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The Effect of Low Corporate Tax Rate on Payroll Tax Evasion

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Abstract

That the widespread policy of cutting profit tax can have a positive effect on taxable income through decreasing firms' profit evasion is a common view. However, this policy can trigger more evasion in another tax base–social security. We develop a model in which employers and employees cooperate in declaring lower wages to the tax authorities in order to evade the payroll tax. Since wages and payroll tax are deductible expenses, a lower wage on paper translates into higher corporate profits and hence, higher taxable income in the corporate tax base. Therefore, a low corporate income tax relative to the social security burden can further enhance contribution evasion, especially in economies with weak tax administration. Using firm-level panel data for Bulgaria where the problem of contribution evasion is especially severe, we find that firms facing greater disparity between the contribution rate and the corporate tax rate are more responsive in adjusting their labour expenditure compared to firms for which these rates are similar. Furthermore, we find that while the relationship between taxable income and the corporate tax rate is positive, this relationship reverses when the effect of the payroll tax is taken into account. In other words, a decrease in the corporate rate can increase taxable income due to less evasion of profit, but also because of more payroll tax evasion.

JEL Classification: H25; H26; J31

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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 show 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 as estimated by the International Labour Office in the mid-1990s (Gillion et al. (2000)). In 2002, for example, according to a number of surveys, approximately 34% of all employed in Bulgaria understated their true wages and 25% worked without an official labour contract (Dimitrov et al. (2004)). 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 Turkey, however, the underreporting of earnings has reached such proportions that an earnings-related benefit system has turned into a virtually flat one (Bailey and Turner (2001)).

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 (Pashev (2005)). 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, 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 underreporting of 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 underreporting earnings (McGillivray (2001), Bailey and Turner (2001)). Given that in many countries in the absence of other personal income but the labour contract, it is the employer's responsibility to file a tax return on behalf of his employees, all of the above schemes can be executed with or without the collusion of the employee. According to Gillion et al. (2000), even though methods for combatting evasion differ between DB and DC schemes, one system does not have a clear advantage over the other due to a significant overlap in the incentives for evasion. The most prominent examples are Chile and Uruguay who both switched from DB to DC with little effect on contribution evasion.

Studying evasion is especially difficult due to its illegality and hence, lack of consistent data. Nevertheless, various theoretical and empirical studies predominantly on individual income tax evasion have emerged, primarily after 1972 when Allingham and Sandmo positioned evasion in a specific theoretical framework. Contribution evasion, however, remains largely unexplored in the economic literature.

In this article, I consider contribution evasion in conjunction with tax evasion accomplished

through massive underreporting of earnings in Bulgaria over the 1998-2002 period. Throughout this time, direct taxes have been steadily falling with the corporate income tax (CIT) going down from 40.2 to 28% for big companies and from 28 to 23.5% for smaller businesses. At the same time the heavy social security burden persisted from 46% in 1998 almost entirely covered by employers to 42.6% in 2002 divided between employers and workers in the ratio 75:25. Yet, the reduction in direct taxes in Bulgaria did not translate into narrower compliance gap, a fact largely attributed to the excessive burden of compulsory contributions (Pashev (2005)). The most widespread way of evading contributions was the understatement of real earnings, which triggered evasion in the PIT base too (Dimitrov et al. (2004)). Since firms understated wages, they necessarily ended up reporting higher corporate profits as labour costs are a deductible expense. Thus, they faced a trade-off between overpaying CIT or paying full contributions. For the period 1998-2002, the shifting of tax liability out of the payroll tax base into the corporate base was profitable as the CIT rate was always lower than the payroll tax rate. Other firms, however, underreported sales thereby keeping profits at their true level, or reported zero profits (Pashev (2005)). In either case, the CIT costs of contribution evasion were eliminated, hence avoiding the shift of liability between the two bases.

I develop a theoretical framework in which the employer and employees cooperate in underreporting actual wages for tax purposes. As a result, employers decrease their payroll tax payments, while employees receive higher net wages. The workers' decision of foregoing future pension benefits for current income and the employers' choice to evade are discussed in the context of Bulgaria and the specificities of its economy, although to a large extent such analysis is applicable to any country with a weak tax administration, significant payroll tax rates relative to the corporate burden and strong public mistrust in authorities. The declaration of lower wage payments than incurred in reality increases the firm's taxable income (TI) and hence, profit tax. The employer, therefore, can decide to decrease TI through the manipulation of sales, for example, in order to bring profit down to its actual level or to overpay corporate income tax, fully or partially. I then derive the relationships between the magnitude of fraud, the payroll and the CIT rates.

I use Bureau Van Dijk's AMADEUS dataset to test the main hypotheses generated by the model. In particular, I test if firms for whom the CIT rate is close to the payroll tax rate are less responsive to adjusting their labour expenditure as compared to companies facing a significant difference in these tax rates. I find that firms who have reported zero taxable income for the whole duration of the panel are most responsive to the difference between the payroll tax and the CIT rates, followed by smaller companies with CIT rates considerably below the payroll tax rate. To check what happens in the corporate tax base as a result of income shifting, I run a pooled Tobit regression with taxable income as the explanatory variable.

The paper is structured as follows: Section 2 summarizes past evidence on contribution evasion. Section 3 provides an overview of the Bulgarian social security system and the major reforms over the period of interest and sketches the main features of the CIT law. The theoretical framework of analysis is developed in Section 4, while in Section 5 I discuss the data,

the empirical specification, and test the main hypotheses generated by the model. Section 5 concludes.

2 Literature on Contribution Evasion

The economic literature on contribution evasion is scant even though there has been a significant discussion on the reasons, consequences and the possible strategies for fighting payroll tax evasion (Gillion et al. (2000), McGillivray (2001), Bailey and Turner (2001), Manchester (1999)). Theoretically, the issue of wage underreporting has been tackled in considerable detail by Gideon Yaniv in a series of papers in the context of the personal income tax (Yaniv (1988) and Yaniv (1992)). Yaniv (1988) studies the the advantages of withholding versus self-declaration for income taxation by exploring the possibilities of tax evasion in a withholding system, in which the employer remits employees' withheld income taxes to the authorities. The employer may choose not to comply by understating his total wage payments without the knowledge of his employees. Yaniv assumes that the firm always overpays profit tax due to wage underreporting and if caught, will be either reimbursed or not. Therefore, the author imposes full shifting of tax liability from the personal to the corporate tax base, abstracting from other taxes, such as the payroll tax. He goes on to derive the relationship between the level of wage understatement, the CIT rate and the personal income tax rate under alternative penalty schemes in a framework with a risk-averse employer maximizing his expected utility.

The collaborated employer-employee contribution evasion is explored in Yaniv (1992) again in the context of the PIT. The mechanism of cooperation is the following: The employer understates his wage payments and as a consequence overpays profit tax. Because less tax is withheld from employees, they agree to work for lower than the market wage in order to compensate their employer for the risk of being detected and the overstatement of his profit liability. Thus, savings for the employer stem from the payment of lower wages, while workers' tax savings due to wage underreporting outweigh net income losses.

While PIT evasion is incorporated into the model developed in the current paper, it only arises as a consequence of payroll tax evasion. I consider a mechanism, in which the market wage remains unchanged in reality, but is underreported for tax purposes. Accordingly, benefits to the employer and to workers accrue from lowering their payroll tax liability at the expense of the government, resulting in lower cost to the employer and higher net wages. Higher net wages for the worker further follow from the fact that lower wage stated in the labour contract translates into lower PIT payment as well.

Last but not least, Yaniv (1993) regards the hiring of workers without a labour contract, which is yet another possible channel for payroll tax evasion. In this case the choice variable is the number of employees declared rather than their wage level. In this article I will not take into account this option but will focus entirely on wage understatement.

Recently, there have been a number of empirical papers on contribution evasion in Asia, and in particular, China. Nyland et al. (2006) make use of firm-level data of audited businesses in Shanghai who either payed their contributions in full, underpaid or overpaid. They set out to

determine the characteristics of firms who tend to underpay contributions and find that firm size plays a role in evasion. Their results show that in Shanghai big companies tend to evade more contributions relative to smaller firms.

To my knowledge, the effects of contribution evasion on the revenue outcomes in other tax bases or on the incidence of the payroll tax have not been researched. In the presence of evasion, the incidence of contributions can be very different compared to the current analysis in the literature. Gruber (1997), for example, studies the incidence of payroll taxation in Chile right after the privatization of the country's social security system and estimates that employers shift the incidence fully on wages. With contribution evasion, however, both the employer and the employee can illegally alleviate the burden of the tax at the expense of government revenue, which in turn affects everyone entitled to benefits.

Although not focusing on evasion, Gordon and Slemrod (2000) provide some empirical evidence on income shifting between the corporate and personal tax bases triggered by differences in the PIT and CIT rates. Using aggregated cross-sectional data, the authors estimate the effect of the difference in tax rates both on corporate rates of return and labour compensation of individuals. Their regressions yield a positive statistically significant relationship between the PIT rate and the corporate rates of return, while this relationship reverses for the CIT rate, signalling a strong case for income shifting. Due to time dummies, the tax effect is identified solely by the within-year variation in the tax rates difference.

If tax liability is shifted out of one base into another, then the decrease of income into the first base should be accompanied by an equal increase in income in the second base. Checking if this is indeed the case, Gordon and Slemrod (2000) find that one percentage point increase in the difference between the CIT and PIT rates leads to a 3.4% rise in reported labour income in a pooled 2SLS regression. Surprisingly, the effect of the tax variable on the top one percent of the population is found to be almost the same as for the rest of the population.

The present article considers the shifting of income from the social security system to the corporate tax base through the mechanism of wage underreporting. This shift may not be complete, in the sense that employers may choose not to report all sales and hence, avoid overpaying profit. Therefore, I do not take into account the legal ways of taking advantage of tax differences.

3 Institutional background

3.1 Social Security System: Reform and Characteristics

The economic conditions in Bulgaria in the late 1990s provide a good opportunity for assessing the level of evasion and income shifting for the taxes under consideration. Until 1997 the social insurance system in Bulgaria was typical of any centrally planned economy. In particular, it was a standard pay-as-you-go (PAYGO) DB plan characterized with loose linkage between benefits and contributions, too liberal conditions for access to the pension system, and an insurance burden solely born by employers. While experts admit that a radical pension reform should

have been undertaken as early as the beginning of the 1990s, by 1997 it became clear that this reform could no longer be postponed if the financial sustainability of the system was to be preserved (Shopov et al. (2005)). The chronic financial deficit, low collection compliance rate and high social burden on the working generation triggered an unanimous support for the reform, which was initiated in 1997 and implemented at the beginning of 2000 (Shopov et al. (2005)).

The changes led to the establishment of a three-pillar pension system, 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 people paying voluntary contributions into individual accounts. For couple of years the 2nd pillar was restricted to workers from the so-called first and second labour categories who payed contributions at occupational funds for supplementary pension and early retirement. People in these two categories are employed in hazardous conditions, for instance, minors, underground geologists, hydrologists and others (see Appendix for detailed classification). Despite its fully funded structure, contributions to the second pillar are made only by employers. Later on everyone born after 1959 irrespective of labour category was able to contribute towards a universal pension fund under the second pillar.

Previous to 2000, the system did not distinguish between separate insurance risks (Table 1). Unemployment insurance was paid at a Pre-qualification and Unemployment Fund that was not part of the pension legislation, but which was subsequently incorporated into pension insurance in 2002. From 2000 onwards differentiated amount of the insurance contributions for pension, sickness and maternity, and work injury were introduced, with the employer and the employee sharing the contributions in a given ratio (Table 2). Therefore, it was attempted to alleviate the insurance burden on employers, while increasing that on employees. However, the government encouraged employees by cuts in the PIT rate. The payroll contributions payable by employers in 1997 amounted to 42% of gross salary. In 2002, this percent was still very high– 32.2%. The combined employer-employee contribution rate decreased by only 1.3 percentage points for five years, from 44% in 1997 to 42.7% in 2002 (Table 1). Both the employer and the employee pay contributions to a maximum insured income equal to ten minimum wages. At the same time the personal pension for years of service and old age was restricted to no more than four social pensions and no less than 115% of the old age social pension (Tafradjiyski et al. (2002)).

The reform resulted in a more efficient if more restrictive pension system. A new pension formula was adopted, which aimed at establishing a closer link between contributions and benefits. Before 1997, the amount of personal pension for length of service and old age was calculated on the average gross income on which contributions were paid for a period of three consecutive years, chosen by the person from the last 15 years of service before January 1st, 1997 (Tafradjiyski et al. (2002)). This provision provided no incentives for contribution compliance in the years other than the chosen three (Bailey and Turner (2001)). For a person retiring after 1997, the new formula calculated pensions on the income, on which contributions were made for

the three selected years before 1997 and for the full period after this date until retirement and on length of service. For someone who has not worked before 1997, the pension is calculated on average monthly insurance income for the whole duration of insurance (Tafradjiyski et al. (2002)).

Simultaneously with changes in the formula, the legal retirement age was increased for both men and women from 60 and 55 years of age in 1997 to 61.5 and 56.5 years in 2002, respectively. This tendency continues in 2009. The retirement age for men is currently 63 years and for women it is 60 with a possibility for the equalization of the two in future.[1] The opportunity for an early retirement was also more limited after the reform. A major factor behind the rise in retirement age is the unfavorable dependency ratio over the years as shown in Table 2. Due to the very low replacement rate of the pension system, many pensioners keep on working well after retirement.

3.2 Corporate Income Tax

Unlike the persistently high payroll tax rates, the tax rate on profit in Bulgaria has been lowered substantially over the years from as high as 42.4% in 1997 to 23.5% in 2002 (Table 3). For the whole period 1997-2002 firms paid tax on profits for the republican budget and a tax on profit for municipalities–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. From 1997 to 2001 inclusive, the corporate income tax was progressive with firms above a certain threshold of TI paying higher CIT than firms below that threshold. Starting in 2002, the tax was no longer progressive with a single rate imposed on firms irrespective of their TI. Table 3 summarizes the tax rates for the two income brackets and shows the effective rate taking into account the municipality tax.

The decrease in the CIT rate, however, was not accompanied by an extensive expansion of the tax base to make the reform revenue-neutral. Depreciation rates and loss carryforwards remained unchanged throughout the 1997-2002 period, although the different categories of assets subject to different rates of depreciation were described in more detail in the Corporate Income Tax Law of 1997 (Table 3). Most importantly, while the definition of taxable income changed, its core elements remained the same. 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 then 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 in these provisions, alters the definition of TI.

Table 4 shows how the number of provisions varied over the period of interest. In particular it shows how many provisions were abolished, how many new ones were introduced and whether they increased or decreased TI. It is clear from Table 4 that the main change in the definition of TI occurred between 1997 and 1998 and since then the definition has mostly been altered with respect to the provisions that decrease TI. For example, in 1999 four new provisions were

[1] For III labour category. People in I and II labour category retire earlier.

introduced allowing the subtraction of donations to cultural organizations or stipend funds for students in art schools from the accounting financial result. Expenditure for the acquisition of renewable energy equipment also became deductible. In 2000, these provisions were abolished. Furthermore, starting 1998-1999 tax relief was provided for firms that operated in regions with unemployment rate higher than the average for the country.

Currently, there is no theoretical framework comparing the costs and benefits of the welfare state to firms. In particular, what benefits, if any, do firms derive from social policies? The only answer offered in the literature thus far is by Isabela Mares who argues that a policy of social protection induces workers to acquire specific skills and thus, protects employers' investment in their workers' skills (Mares, 2003). While this argument may hold for high-skill dependent firms, for the majority of companies the burden of social insurance combined with the perception of massive evasion by other employers in the economy is likely to outweigh any other benefits. In that sense, contributions underpayment, although illegal, is not irrational. The motivation of employees for participating in evasion schemes, however, requires more detailed discussion.

3.3 Why employees cooperate

By agreeing to work for a lower gross wage on paper, a worker puts more money in his pocket today, but forgoes higher pension in the future. If put in context, this otherwise "myopic" behavior has its logic. First and foremost, the complexity of the Bulgarian pension system makes it almost impossible to obtain an estimate of the expected future pension. Worse, frequent changes in rules and the pension formula create a sense of uncertainty even in the most diligent taxpayer. Pension uncertainty aside, the average lifespan of the population is very close to the full retirement age, especially when it comes to men. For example, a Bulgarian man retiring in 2005 at the age of 63 is going to live six more years on average, in which he is going to receive a pension. This fact alone creates strong incentives for intertemporal shifting of income from the future to the present. The general low level of wages further enhances preferences for present consumption.

Regarding healthcare, lower contributions do not mean that a person will not be treated. In a comprehensive survey conducted in 1997, Balabanova and McKee (2002) find that "under-the-counter" payments and various gifts before or after treatment have become entrenched into the health sector. People pay to ensure a better service and access to specialized facilities. The authors note that informal payments are "universal" for surgery, childbirth and any complicated medial procedures. In other words, the healthcare system has long ceased to be "free" with people overcoming its deficiencies by out-of-pocket payments. It is not surprising, therefore that workers would prefer money at hand to contributions given their expectations to pay for quality treatment. Since free medical care is a public good, an increased uncertainty about the contributions of others to the public good is likely to lower an individual's own contributions as concluded by Sandler et al. (1987) and Alm et al. (1992). And when free-riders are not easily punished, people resort to evasion (in our model through their consent to jointly evade contributions with the employer).

3.4 Overall attitude towards government officials: Are tax rates irrelevant?

Undoubtedly tax system parameters like tax rates, penalties and government's enforcement capacity influence taxpayers' behavior. There is, however, one factor, which is difficult to measure but invariably affects tax compliance–tax morale. The research on this topic has surged in recent years with particular emphasis on how different social norms, values and attitudes lead to various willingness to pay taxes across countries (e.g. Torgler (2002); Alm and Torgler (2006); Cummings et al. (2005)). We argue that the tax morale in Bulgaria is particularly low because of perceptions of widespread corruption in the government and the tax administration. A 2004 survey by Coalition 2000 showed that 64.3% of people believed that almost all or most politicians and political party leaders are involved in corruption. These perceptions are not unfounded. Only in 2008 and the beginning of 2009 the media has covered at least three major scandals that, if anything, entrenched perceptions of "universal" corruption.[2] Ignoring people's impression of how their taxes are used and the morale of the officials who make use of it, would mean neglecting a major driver of tax compliance. Given the economic and political environment in which taxpayers make decisions to evade or not, it is not unreasonable to ask if there is a point beyond which the tax structure does not influence choice.

4 The Model

4.1 Perfect enforcement

Below I present a model in which the firm underreports its wage bill 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. For now we assume that the government has the capacity to detect and punish contribution evasion. Later on, we relax this assumption.

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 and t_s is the payroll tax rate faced by the employer. The value of output $Y(L)$ is produced by labour input only, where $Y'(L) > 0$ and $Y''(L) < 0$. 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 underreports 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 $t_p(1 - t_e)uL$. According to the law, if a worker derives his income solely from

[2]Some of these scandals are the European Union's temporary suspension of millions of Euros under the pre-accession programs PHARE and SAPARD because of "mismanagement" and "inadequate control" of funds. In July a report by the European Commission's anti-fraud office implicating major government officials in having ties to organized crime, leaked to the media causing anger and frustration among the public. And in the beginning of 2009, the general director of the National Revenue Agency responsible for the collection of VAT, social security and CIT among others, quit after allegations of syphoning millions of VAT.

employment, he is not obliged to file a tax return. It is the employer's responsibility to withhold the personal income tax and remit it to the tax collecting agency. Due to the progressivity of the PIT, wage understatement will move some workers to a lower tax bracket. At minimum, no PIT is remitted. This happens when $w^R - u = w_{min}$. Until 2007 when Bulgaria introduced a flat tax PIT, w_{min} was not taxed.[3]

An important question is how these gains are redistributed between the employer and the employee as contribution evasion becomes difficult without the cooperation of workers. Before a person is hired, she needs to sign an employment contract stipulating her exact gross remuneration to be $w^R - u$, with the mutual understanding that she will actually receive w^R. The worker's net wage increases by $t_p u + t_e u L(1 - t_p)$, i.e. we assume that the savings realized due to evaded employee's contributions go back to the employee in the form of higher compensation. Since what the worker gets is not enforced by contract, she takes a risk–trusting the employer to deliver on their non-official agreement. We presume that the employee is neither compensated for this risk, nor for expected lower pension in the future. The diagram below summarizes the benefits from evasion to both parties:

No evasion:

$$\underbrace{w^R(t_s+1)}_{\text{cost to employer}} \longleftarrow w^R \longrightarrow \underbrace{(1-t_p)(1-t_e)w^R}_{\text{no-evasion net wage}}$$

Evasion (What is seen by authorities):

$$\underbrace{(w^R-u)(1+t_s)}_{\text{cost to employer}} \longleftarrow \underbrace{w^R-u}_{\text{authorities}} \longrightarrow \underbrace{(1-t_p)(1-t_e)(w^R-u)}_{\text{official net wage}}$$

Evasion (What happens in reality):

$$\underbrace{w^R+(w^R-u)t_s}_{\text{cost to employer}} \longleftarrow \underbrace{w^R}_{\text{real}} \longrightarrow \underbrace{w^R-(w^R-u)(t_e-t_p(1-t_e))}_{\text{true net wage}}$$

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

$$\pi^{real,evasion} = Y(L) - w^R L - (w^R - u)Lt_s > \pi^{real} \tag{1}$$

The difference $\pi^{reported} - \pi^{real} = (1+t_s)uL$ constitutes an evasion-driven increase in profit that is taxed at the corporate tax rate t_c. It is at this point that social security evasion creates incentives for further evasion in the corporate income tax base. In particular, knowing by how much its profit rises on paper, a firm can choose to hide part of its sales in order not to pay corporate income tax in excess of its true liability.[4] Suppose that the firm subtracts a fraction

[3] An alternative mechanism of evasion is to hire workers without a labour contract, i.e. understate the true employment level. In this case, the employer may choose to report the true wage of the people he employs legally, while evading all contributions for the illegal ones. Yaniv (1993) develops such model.

[4] An accountant we consulted extensively for this paper noted that some firms may deliberately decide to overpay CIT in a given year, especially if they have understated taxable income in previous years in expectation of the lower rate. Regarding strategies for reducing sales, the most common one is not issuing an invoice, which makes a cash transaction untraceable.

$\phi uL(1+t_s)$ 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. In that case, one can easily conclude that higher corporate revenue results from lower CIT rate and less evasion, whereas in reality this rise will be at least partly driven by more evasion in another tax base. Second, if $\phi > 0$ ($\phi = 1$), the cost of contribution evasion is partially (entirely) eliminated. We do not consider the case when $\phi > 1$. In other words, we restrict the firm to not evade corporate tax for its own sake but only in conjunction with social security.[5] As long as the firm engages in fraud in both bases, the total amount evaded is:

$$E = \underbrace{(t_s + t_e + t_p(1-t_e))uL}_{\text{PIT+ total social security}} + \underbrace{t_c\phi(uL + t_s uL)}_{\text{corporate tax}}. \tag{2}$$

The firm's behavior is constrained by probability of audit and severe penalties that make evasion costly. Let the probability of audit be $\bar{p} = p_1(\phi(uL + t_s uL)) + p_2(\frac{u}{w^R})$. p_1 is the probability of being caught for cheating at the corporate tax base. I follow Slemrod and Yitzhaki (2000) and assume an endogenous probability of detection that is an increasing convex function of evaded income in the corporate tax base. p_2, on the other hand, is a function of the ratio of the amount of wage underreported to the total wage and is increasing and convex as well. 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 our previous assumption that there will be no corporate tax evasion without contribution evasion. The firm is risk-neutral. Its after-tax profit if not detected is:

$$\pi^{nd} = Y(L) - w^R L - (w^R - u)t_s L - t_c[Y(L) - (w^R - u)L(1+t_s) - \phi uL(1+t_s)] \tag{3}$$

The penalty scheme in this model environment is complicated. First of all, since I have allowed for a mechanism of detection for payroll tax evasion, I further assume that an audit performed for corporate tax evasion will expose wage understatement and vice versa. I explore the consequences of authorities' inability to expose contribution evasion later on. An important question in this context is whether the firm will be reimbursed for its overpayment of profit, not reimbursed, or penalized 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 understatement. 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. The penalty

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

under these conditions becomes:

$$P = \lambda_1(t_s + t_e + t_p(1 - t_e))uL + \lambda_2 t_c \phi(uL + t_s uL) \tag{4}$$

where $\lambda_1 > 1$ and $\lambda_2 < 1$.[6] In the event of detection, the firm's profit changes to:

$$\begin{aligned} \pi^d &= Y(L) - w^R L - (w^R - u)t_s L \\ &- t_c[Y(L) - (w^R - u)L(1 + t_s)] - \lambda_1(t_s + t_e + t_p(1 - t_e))uL \\ &- \lambda_2 t_c \phi(uL + t_s uL) \\ &= \pi^{nd} - P \end{aligned} \tag{5}$$

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

$$E[\pi] = (1 - \bar{p})\pi^{nd} + \bar{p}\pi^d, \tag{6}$$

The first order conditions for this problem are:

$$\frac{\partial E[\pi]}{\partial \phi} = t_c - p_1' P - (p_1 + p_2)\lambda_2 t_c = 0 \tag{7}$$

$$\frac{\partial E[\pi]}{\partial u} = t_s - t_c(1 + t_s) - (p_1 + p_2)A - p_2' \frac{1}{w^R}\frac{P}{L} = 0 \tag{8}$$

$$\frac{\partial E[\pi]}{\partial L} = (1 - t_c)(Y'(L) - (w^R - u)(1 + t_s)) - u(1 + (p_1 + p_2)A) = 0, \tag{9}$$

where $A = \lambda_1(t_s + t_e + t_p(1 - t_e))$. It can be seen from (8) that the marginal benefit of underreporting wage by one euro, t_s, equals the marginal cost of overreporting profit at the corporate tax base plus the expected penalty. I thus obtain the necessary condition for contribution evasion to be

$$t_s > t_c(1 + t_s), \tag{10}$$

which requires that the CIT is markedly below the payroll rate. An interesting and empirically testable implication of this condition is that firms facing lower CIT rate have a bigger incentive to engage in social security fraud than firms for which the CIT rate is close to their contribution rate. $(p_1 + p_2)A$ is the expected penalty per euro of understated wage and depends on the probability of detection for both social security and corporate tax evasion because the higher the u, the more sales need to be manipulated. The same logic applies to the expected penalty in eq.(7). The additional term, $p_2' \frac{1}{w^R}\frac{P}{L}$ captures the fact that an audit for social security fraud can uncover corporate profit interference. On the other hand, the marginal benefit of sheltering some of the increased profit, $t_c \phi L(1 + t_s)$ cancels out after we plug in (7) into the second FOC to obtain (8). Concerning the optimal number of workers, wage underreporting does distort the

[6] 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 for now we will ignore the fact that workers cooperate willingly.

choice upwards as demonstrated in (9) since the firm is able to decrease the marginal cost per worker by $t_s - (p_1 + p_2)A > 0$.[7]

Particularly interesting is the relationship between the amount of wage understated u and the CIT rate t_c. Using (8) we obtain:

$$\frac{du}{dt_c} = -\frac{(1+t_s)(1+p_2'\frac{1}{w^R}\lambda_2\phi u)}{(p_1'\phi L(1+t_s)+p_2'\frac{1}{w^R})A + p_2''\frac{1}{(w^R)^2}\frac{P}{uL}} < 0 \tag{11}$$

The above equation shows that 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 rise taxable income in the economy through two separate channels: First, smaller rate translates into less corporate tax evasion; second, lower rate triggers more social security evasion through the underreporting of wages with at least some firms overreporting corporate profits. Therefore, unless the government finds a way to decrease the contribution rates, the policy of lowering the corporate tax burden can backfire through more evasion in another base.

As expected $w^R - u$ is decreasing with the payroll rate again pointing to the fact that increasing the contribution burden will cause more wage underreporting:[8]

$$\frac{du}{dt_s} = \frac{1 - t_c - (p_1+p_2)\lambda_1 - p_1'\phi uLA - p_2'\frac{u}{w^R}(\lambda_1 + \lambda_2 t_c\phi)}{(p_1'\phi L(1+t_s)+p_2'\frac{1}{w^R})A + p_2''\frac{1}{(w^R)^2}\frac{P}{uL}} > 0 \tag{12}$$

The relationships between the tax rates and ϕ and L are derived below:

$$\frac{d\phi}{dt_c} = \frac{1 - p_1'\lambda_2\phi uL(1+t_s) - \bar{p}\lambda_2}{uL(1+t_s)(p_1''P + 2p_1'\lambda_2 t_c)} > 0 \tag{13}$$

$$\frac{d\phi}{dt_s} = -\frac{p_1''P\phi + p_1'\lambda_1 + 2p_1'\lambda_2 t_c\phi}{(1+t_s)(p_1''P + 2p_1'\lambda_2 t_c)} < 0 \tag{14}$$

$$\frac{dL}{dt_c} = \frac{Y'(L) - (w^R - u)(1+t_s)}{Y''(L)(1-t_c) - Ap_1'\phi u^2(1+t_s)} < 0 \tag{15}$$

$$\frac{dL}{dt_s} = \frac{(w^R - u)(1-t_c) + \bar{p}u\lambda_1 + p_1'u^2A\phi L}{Y''(L)(1-t_c) - Ap_1'\phi u^2(1+t_s)} < 0 \tag{16}$$

A decrease in t_c leads to lower ϕ and more workers, while a fall in t_s rises ϕ and again, increases the number of employees. Since p_1, the probability of being caught for payroll tax evasion, depends on t_s and at the same time p_1 can result in uncovering profit manipulation, a fall in t_s decreases the expected penalty of cheating, and hence, ϕ goes up.

[7] The positive sign is clear from (8).

[8] We have plugged (7) and (8) into the numerator to show that it is positive.

We next turn to exploring the effect of tax rates on taxable income. The TI that is going to be taxed at the corporate base is:

$$TI = Y(L) - (w^R - u)L(1 + t_s) - \phi u L(1 + t_s) \tag{17}$$

We ignore proceeds to the government from fines as we are interested only in changes in revenue stemming from changes in taxable income.

$$\frac{dTI}{dt_c} = \underbrace{\frac{\partial TI}{\partial L}}_{+}\underbrace{\frac{dL}{dt_c}}_{-} + \underbrace{\frac{\partial TI}{\partial \phi}}_{-}\underbrace{\frac{d\phi}{dt_c}}_{+} + \underbrace{\frac{\partial TI}{\partial u}}_{+}\underbrace{\frac{du}{dt_c}}_{-} < 0 \tag{18}$$

Keeping all else constant, a lower CIT rate increases TI because more labour is hired, ϕ goes down and it is more profitable for the firm to overpay CIT, which leads to higher u. 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. The sign of $\frac{dTI}{dt_s}$, however, is ambiguous. On the one hand, decreasing t_s rises taxable income because less payroll tax expense is deducted and more labor is employed. On the other hand, ϕ increases, while u goes down, both shifting TI downwards.

$$\frac{dTI}{dt_s} = \underbrace{\frac{\partial TI}{\partial t_s}}_{-} + \underbrace{\frac{\partial TI}{\partial L}}_{+}\underbrace{\frac{dL}{dt_s}}_{-} + \underbrace{\frac{\partial TI}{\partial \phi}}_{-}\underbrace{\frac{d\phi}{dt_s}}_{-} + \underbrace{\frac{\partial TI}{\partial u}}_{+}\underbrace{\frac{du}{dt_s}}_{+} \tag{19}$$

4.2 Imperfect enforcement

The above model relies on the assumption that social security evasion can in fact be detected and punished. In practice, tax authorities have limited capacity for the conduct of audits, especially if evasion is widespread. Furthermore, when the incentives of the employer and his workers are aligned so that they cooperate, it is extremely difficult to prove underpayment of contributions. In what follows, we consider the case when the government is unable to adequately enforce social security compliance.

What can be ascertained by an audit of a firm suspected in payroll evasion? As already mentioned, the labor contract signed by the worker states $w^R - u$ as the true gross wage. Besides, once employed, a worker has to sign monthly payslips, which again list the amount of the salary to be $w^R - u$. As a consequence, a person who is not willing to participate in an evasion scheme, will simply not find employment with a company that underpays its workers' social security. Provided that an employee decided to become a whistle-blower after being hired, her signature on the contract and the payslips will officially invalidate her claim. In other words, in the presence of collaborative payroll tax evasion an auditor cannot go much further than establishing that the employees of a given company work for lower wages (usually the minimum wage) than the market wages for their respective professions.

In the case of Bulgaria, this fraudulent behavior is so endemic that in 2004 the government introduced so-called "minimum social security thresholds" for each industry and type of oc-

cupation, on which employers are obliged to pay social security. Since their implementation, thresholds have been raised annually with the increase reflecting the authorities' perception of what the true salaries in the economy are (Slavova et al., 2007). This policy strongly suggests that the tax administration cannot sufficiently combat or prevent social security evasion and has attempted to mechanically control contributions instead of relying on agents' discretion. Thus, the government compensates for the virtually zero probability of detecting social security evasion by managing $w^R - u$. Despite bringing in more revenue from non-compliant taxpayers, this policy can introduce substantial distortions due to the ad-hoc setting of wages, which may not be optimal for many businesses. A survey of the structure of wages performed by the Bulgarian National Statistical Institute in 2006 showed that out of 2.2 million labor force, 20% earned the minimum monthly untaxable income, while 50% of all employed worked for twice the minimum wage or less.

If the government cannot enforce social security compliance, the probability of detection reduces to $p(\phi uL(1 + t_s))$. Thus, if a firm is caught cheating, ironically it will be for the overpayment of corporate tax, but from an auditor's perspective, there is profit tax evasion. The penalty decreases too:[9]

$$t_c \lambda \phi u L(1 + t_s), \tag{20}$$

where this time $\lambda > 1$ ($\lambda_2 < 1$ under perfect enforcement).

The penalty structure assumed here, while corresponding to the penalties specified by law, may not reflect the practice.[10] In particular, in the event that a firm is caught cheating, the auditor who prepares the penalty report may be induced to accept a bribe, which is usually less than the amount of the punishment itself. If the auditor is not susceptible to bribery, the firm can appeal his decision in a court of law and succeed in paying off the judge, although this scenario is much more complicated and risky. An evading company certainly takes these possibilities into consideration when evaluating the risks it is exposed to.

According to a survey conducted by Vitosha Research (2004), 43% of the general public and 51% of businesses believed that tax officers are involved in corrupt activities. In a different survey, the public ranked judges higher than tax officers in terms of corruptibility (Coalition 2000, 2005). Even if public perceptions are incorrect, businesses act upon them. While we will not account for these prospects in our model, it is important to bear in mind that the penalty structure may not provide the right incentives to prevent tax fraud and that the problem of evasion is manyfold. Chander (1992), for instance, develops a game theoretic model with corrupt tax administration showing that an increase in the tax rate can lead to more bribing of auditors and hence, less revenue collected. The tax system's parameters, therefore, are not entirely

[9] We do not consider the effect of the social security thresholds. In any case, the conclusion that if facing no probability of detection for contribution evasion, the firm will set $w^R - u = w_{min}$ will hold for the thresholds as well.

[10] In the case of an intentional evasion of taxes, a firm owes the evaded tax, interest on it as well as a fixed fine. This type of evasion is also considered a criminal offense. If evasion is unintentional, however, only the tax and the interest are payable.

exogenous from a taxpayer's point of view, as given corruption in the tax administration, these parameters can be manipulated to the taxpayer's (and auditor's) advantage.

Given that the firm takes no risks when understating wages, its decision will be entirely based upon whether $t_s > t_c(1+t_s)$ holds or not. If the condition is satisfied, it pays off to set $w_R - u = w_{min}(w_{minthreshold})$.[11] An auditor can only verify $\pi^{reported}$ but not $\pi^{real,evasion}$. As a consequence, π^d becomes:

$$\begin{aligned} \pi_1^d &= Y(L) - w^R L - w_{min} t_s L \\ &- t_c[Y(L) - w_{min} L(1+t_s)] - (\lambda - \phi) t_c u L(1+t_s) \end{aligned} \tag{21}$$

The firm is then choosing L and ϕ to maximize expected profit:

$$E(\pi)_1 = p(V)\pi_1^d + (1 - p(V))\pi^{nd}, \tag{22}$$

where $V = \phi u L(1+t_s)$. Below, we derive the first order conditions:

$$\frac{\partial E(\pi)_1}{\partial \phi} = 1 - \lambda[p'(V)V + p(V)] = 0 \tag{23}$$

$$\frac{\partial E(\pi)_1}{\partial L} = (1-t_c)(Y'(L) - w^R - w_{min}(t_s - t_c(1+t_s)) = 0 \tag{24}$$

Because $(1-t_c)(1+t_s)w^R > w^R + w_{min}(t_s - t_c(1+t_s))$, again, more labor is hired compared to the no-evasion optimum. A decrease of t_c in this case will not have any effect on u as the firm has already set it at its maximum possible value but it will lead to a higher ϕ since the expected penalty for corporate evasion goes down.

5 Empirical analysis

5.1 Data description

We use firm-level data for Bulgaria from the AMADEUS dataset provided by Bureau Van Dijk, a European electronic publishing firm. The data is a panel of firms' main financial statements' variables and contains more than 800,000 firm-year observations for the period 1997-2006. Two thirds of these firms have missing values for almost all entries in their income statement, so we end up with 258,000 firm-year observations. Firm coverage is especially good from 1999 to 2004, with fewer firms observed for 1997-1998 and particularly 2006. Our main variables of interest are the firm's total cost of employment, which includes salaries and social security expenses, taxable income according to which we will assign each firm into its respective tax bracket, and the number of employees. Other characteristics of interest are firm size, measured by number of employees and tangible fixed assets, degree of indebtedness, which we capture by the amount of current liabilities, the number of internal auditors and earnings before interest

[11] To explain why there are enterprises that pay contributions on true wages, we will have to include tax morale in the form of cost (disutility) of evading taxes that will serve as a deterrent to full evasion.

and tax among others. Because the corporate tax is progressive only until 2002, our period of interest is 1997-2002 for our first proposition, whereas we use the complete period 1997-2006 when estimating the relationship between taxable income and the corporate tax rate.

Since we want to differentiate between firms based on their TI, we first need to recover TI from the data. 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, our 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 can neither be used in place of TI, nor is it a good indicator of it. One peculiarity and major advantage of the Bulgarian tax code is that the tax liability stated on the firm's financial statement is the same as in the firm's tax return, which is not publicly available. We are, therefore, able to recover TI by dividing the tax liability by the respective tax rate.[12]

To allocate firms within brackets, we multiply the taxable income threshold by the lower CIT rate for a given year and assign firms that pay less than that amount in tax to the low tax bracket, while those paying more go into the high bracket. Although we manage to allocate firms into their tax brackets for each year, we do not know to what extent firms will self-select into a particular bracket across years. We discuss how to deal with this problem later.

The AMADEUS database provides firms' total cost of employment *coste*, which includes wages and payroll tax. We divide *coste* by $1+t_s$ in order to obtain the wage bill only, $w^R - u$. To ensure results are not driven by changes in the minimum wage, we include minimum wage as an explanatory variable in the regression specification.

To capture the effect of tax rates on $w^R - -u$ we do not consider t_s and t_c separately, but employ two separate specifications. In the first one we take the difference between the tax rates, $t_{st} - t_{cit}$ and in the second, the ratio $\frac{t_{st}}{t_{cit}}$. Both specifications take into account the fact that besides expected penalty, firms base their decision of evading payroll tax on how high t_s is relative to t_c. From the theoretical framework developed above, we know that the necessary condition for evasion is $\frac{t_{st}}{t_{cit}} > 1 + t_s$. We, therefore, expect that firms for which the $\frac{t_{st}}{t_{cit}}$ ratio is significantly different from one to be more aggressive in managing their wage bill compared to firms with a ratio close to one. Similarly, the bigger the difference $t_{st} - t_{cit}$, the more likely a firm is to evade payroll contributions. The difference $t_{st} - t_{cit}$ is greatest for firms that report zero taxable income in a given year, i.e. they do not pay CIT. The AMADEUS database contains many firms that have reported zero profit for the whole duration of our panel. We expect that contributions evasion is most profitable precisely for these firms.

5.2 Empirical strategy

To differentiate between the responses of the three categories of firms that are of interest, we employ the following two specifications:

$$ln((w^R - u)_{it}) = \alpha_i + \beta ln(t_{st} - t_{cit}) + \beta_1 ln(t_{st} - t_{cit})H + \beta_2 ln(t_{st}) * Z + X'_{it}\Gamma + \epsilon_{it}, \quad (25)$$

[12] Hanlon (2003) provides an excellent analysis of the caveats in inferring taxable income from firms' financial statements.

$$ln((w^R - u)_{it}) \quad = \quad \alpha_i + \beta ln(\frac{t_{st}}{t_{cit}}) + \beta_1 ln(\frac{t_{st}}{t_{cit}})H + X'_{it}\Gamma + \epsilon_{it}, \tag{26}$$

where t_{st} is the payroll tax rate, which is not firm specific, t_{cit} is the corporate tax rate faced by firm i in year t and the X's are other controls that can vary by firm-year (such as total assets, current liabilities) or just by year (such as year dummies). H is a dummy, which equals one if the firm is in the high tax bracket. Z equals one if a given firm has reported zero taxable income for every year it appears in the panel. α_i is a firm-specific fixed effect. A regression using fixed effects eliminates time-invariable explanatory variables and as a result we cannot account for the firm's industry, region or ownership. We control for changes in the number of employees by adding interaction terms of number of employees and the year dummies. Our expectation is that β, β_1 and β_2 will have negative signs and that $\beta_2 > \beta > \beta_1$ in absolute value. Again, the rationale for this reasoning is that the bigger the difference between the payroll and the CIT rates, the more likely it is that a firm will be involved in hiding contributions, which is manifested by a bigger downward impact of $t_{st} - t_{cit}$ on reported wages.

The difference between the two specifications above is that eq. (25) includes firms that have reported zero taxable income in a given year, while eq. (26) includes only firms with positive reported TI and can be considered as a special case and a robustness check. Besides distinguishing between tax brackets, we also sort the sample based on tangible fixed assets (TFA), which we use as a measure of firm size. Thus, firms with TFA greater than the average of the whole sample in a given year are defined as big (dummy B=1). We will run the above regression for $B = 1$ and $B = 0$ to estimate the effect of $t_{st} - t_{cit}$ and $\frac{t_{st}}{t_{cit}}$ on $w^R - u$ separately for big and small firms.

Since current year level of labor expenditure is likely to be affected by last year's level, we estimate eq.(26) by both simple fixed effects and Arellano-Bond linear dynamic panel-data estimation, in which we include one lag of the dependent variable.

$$ln((w^R - u)_{it}) \quad = \quad \beta_0 ln((w^R - u)_{it-1}) + \beta ln(\frac{t_{st}}{t_{cit}}) + \beta_1 ln(\frac{t_{st}}{t_{cit}})H + X'_{it}\Gamma + \epsilon_{it}, \tag{27}$$

A limitation of Arellano-Bond's GMM estimator is that it requires that firms' idiosyncratic errors are not autocorrelated. In addition, we show that potential bracket creep is not an issue by repeating the estimation with firms that have never switched between brackets from 1997 to 2002 (to be added).

Column 3 of Table 5 shows the results of estimating eq.(25). As expected, wage elasticity with respect to $t_{st} - t_{cit}$ is negative for all three groups and greatest for those companies with zero profits (-.146) who have nothing to lose by reporting lower wages since they do not overpay profit tax. Firms in the low tax bracket follow with an elasticity of -.08. Lastly, companies in the high tax bracket, which do not face a major difference between t_{st} and t_{cit} and hence have the least incentive to evade, indeed are least responsive with an elasticity of -.047. All estimates are statistically significant. Column 4 displays the results of a regression where the tax rates are included separately. Since t_{st} only varies across time, its coefficient can only be estimated when t_{st} is interacted with H. This coefficient is negative suggesting that an increase in the

payroll rate results in lower wages to employees, however, we do not know, whether this decline is due to shifting of the burden to employees or due to underreporting of wages with the goal of evading contributions.

In Table 6 we have estimated eq.(26) where instead of the difference, we have the ratio of the tax rates as an explanatory variable. Columns 3 and 4 show the fixed effects model, while Columns 5 and 6 the Arellano-Bond linear dynamic panel-data estimation. As expected, if in the low tax bracket firms adjust the declared cost of employment downwards by 0.39% for each percent increase in the $\frac{t_{st}}{t_{cit}}$ ratio in the fixed effects specification (Column 3). This elasticity is -0.18 and insignificant for the firms facing higher CIT implying that a decrease in t_s and t_c or t_c would not have a major imapct on the reported wage bill in these firms. After controlling for number of employees over the years, falling taxes would imply anything but falling wages, so for the low bracket firms, this observation can be explained with their involvement in payroll tax evasion. We also account for firm size by including $\frac{t_{st}}{t_{cit}} * B$ as an explanatory variable in the fixed effects specification. The coefficients remain similar to those discussed above with the elasticity of the low -bracket firms increasing to -.428 as shown in Column 4. For big firms, the elasticity is still negative (-.036) albeit not statistically significant.

We next consider the dynamic specification of the model estimated by Arellano-Bond GMM with one lag of the dependent variable (Columns 4 and 5). The elasticity for the H group becomes positive and insignificant, while the elasticity of the low-bracket group remains negative at -.34, which supports the validity our previous specification.

When it comes to estimating the relationship between TI and the CIT rate, we face the problem of censored dependent variable. To see this, note that when taxable income is positive, taxes are paid immediately, but if TI is negative, losses can be carried forward (for 5 years in Bulgaria). In other words, there is no refund of CIT when TI is negative. The company pays zero tax, which means that TI is censored at zero. Fixed effects and random effects specifications are usually used to analyze pooled cross-section and time-series data, but when it comes to extending these methods to censored panel data, the estimation gets complicated. We follow Kim and Maddala (1992) and Shum (1996) and start with pooled Tobit specification. The model is defined as follows:

$$TI_{it} = \begin{cases} TI^*_{it} = \theta' Z_{it} + u_{it} & \text{if } TI^*_{it} > 0 \text{ (realized profit)} \\ 0 & \text{if } TI^*_{it} \leq 0 \text{ (loss)} \end{cases}$$

The vector Z_{it} includes the following variables: $(t_c)_{it}$, $(t_c)_{it} * (t_s)_t$, $(t_c)_{it} * B$, depreciation, number of employees, profit before income and tax, time dummies and ten dummies capturing industry-specific tax effects. The interaction term $(t_c)_{it} * (t_s)_t$ is intended to capture the effect of the CIT rate on TI given the value of t_s. Under the assumption that $u_{it} \sim N(0, \sigma^2)$, the Tobit likelihood function is:

$$L = \prod_0 [1 - F(\theta' Z_{it})] \prod_1 \frac{1}{(2\pi\sigma^2)^{-1/2}} e^{-(T_{it} - \theta' Z_{it})^2 / 2\sigma^2}, \tag{28}$$

where F is cumulative normal. After we have estimated the Tobit model, we report the elasticities of interest using:

$$TI^*_{it} = \theta_1 t_{cit} + \theta_2 t_{st} + \theta_3 t_{cit} t_{st} + \theta' \Gamma_{it} + u_{it} \tag{29}$$

In addition to the above specification, we are able to estimate random effects dynamic Tobit model if we assume that the error term u_{it} can be decomposed into two components as done by Kim and Maddala (1992)

$$u_{it} = v_{it} + w_{it}, \tag{30}$$

where v_{it} and w_{it} are iid with $var(v_{it}) = \sigma_i^2$ and $var(w_{it}) = \theta_t^2$ so that $var(u_{it}) = \sigma_i^2 + \theta_t^2$. Thus, we are able to allow for heteroskedastic errors with a firm-specific component and time-specific component. We are also able to include a lag of the dependent variable as an explanatory variable.

We now turn to the results of the pooled Tobit regression, in which we are interested how the CIT and social security rates affect firms' taxable income. The elasticities of taxable income with respect to t_c, t_s and $t_s * t_c$ are presented in Table 7. It is the interaction term $t_s * t_c$ that is of particular interest since it captures the influence of both tax rates on TI. In column 1 we consider exclusively the effect of taxes and the time trend on TI. We find that one percentage point decrease in the CIT rate will decrease taxable income by 1.63. The positive relationship between TI and CIT is surprising. The interaction term, however, offers a different story. Even if lower payroll tax by itself induces more truthful reporting of wages and a lower CIT rate can indeed lower TI, when firms consider both tax rates jointly, a decrease in either of them can actually rise TI through the overpayment of profit by at least part of the firms involved in contribution evasion. In Column 2 we have included interactions of $t_{st} t_{cit}$ with H and B, which moves all elasticities downwards but they remain close to their value in Column 1 and still significant. Column 3 further adds dummies for the ten major industries in the data, but results remain unchanged.

6 Tax Policy Implications

In the last decade many developing and developed economies have resorted to cutting their CIT rates in order to attract foreign direct investment and stimulate businesses at home. While such policy clearly generates incentives towards the honest disclosure of corporate profits, it would be hasty to consider its effects in isolation of other tax bases within the economy. The main goal of our paper is to point out at the risk that a too low CIT can exacerbate social security evasion if the contribution burden on employers is significant. With the collaboration of employees, such fraudulent behavior becomes virtually undetectable and as a consequence it may be more beneficial for a firm to overpay profit tax than to pay its full contributions expense. Thus, unless the government is able to somehow balance the corporate and social

security burden, such possibility certainly exists and should not be neglected. Given Europe's rapidly aging 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. Governments should, therefore, carefully consider not only the advantages of a low CIT rate, but also its potential side-effects in relation to other tax bases.

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Table 1: Social Insurance Financing in Bulgaria

	1997		1998		1999**		2000		2001		2002	
	Employer	Employee	Employer	Employee	Employer	Employee	Employer	Employee	Employer	Employee	Employer	Employee
III Labour Category												
	37	2	37	2	35.85	1.5						
Pension							25.6	6.4	23.2	5.8	20.25	6.75
Sickness/Maternity							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 fund											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
II Labour Category												
	47	2	47	2	45.85	1.5						
Pension							28.6	6.4	26.2	5.8	23.25	6.75
Sickness/Maternity							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 Occupational fund							7	0	7	0	7	0
2nd Pillar Universal fund											1.5	0.5
Total	52	2	50.8	2.95	52.4	5.2	46.7	9	44.3	8.4	42.2	10.5
I Labour Category												
	52	2	52	2	50.85	1.5						
Pension							28.6	6.4	26.2	5.8	23.25	6.75
Sickness/Maternity							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 Occupational fund							12	0	12	0	12	0
2nd Pillar Universal fund											1.5	0.5
Total	57	2	55.8	2.95	57.4	5.2	51.7	9	49.3	8.4	47.2	10.5

SOURCE.--Law on State Social Security Insurance, Law on Health Insurance (various years)

NOTE.--Figures are percentage of payroll.

**

Table 2: Social Insurance: Main Characteristics

	1997	1998	1999	2000	2001	2002
Dependency ratio (pensioners to insured persons)	69.17%	71.84%	83.26%	103.19%	107.59%	108.02%
Replacement ratio (avg. pension to avg. insurable income)	32.20%	36.95%	36.79%	39.80%	38.02%	39.38%
Legal retirement age *						
Men		60	60	60.5	61	61.5
Women		55	55	55.5	56	56.5
Contributions share ratio	-	-	-	80:20	80:20	75:25
Payroll taxes % GDP						

SOURCE.-- Bulletins of the National Social Security Institute for various years; National Statistical Institute
NOTE.--For III labour category

Table 3: Corporate Income Tax Financing and Characteristics

	1997	1998	1999	2000	2001	2002
CIT rate central budget						
TI> Treshhold* (1)	36	30	27	25	20	15
TI<Treshhold (2)	26	20	20	20	15	-
CIT rate municipalities	6.5	10	10	10	10	10
Total CIT (1)	42.4	37	34.3	32.5	28	23.5
Total CIT (2)	33.4	28	28	28	23.5	-
Depreciation rates **						
I	4	4	4	4	4	4
II	20	20	20	20	20	20
III	8	8	8	8	8	8
IV	15	15	15	15	15	15
Loss carryforward (years)	5	5	5	5	5	5
CIT % GDP	823,107	3.18%	2.60%	2.52%	2.92%	2.74%

Table 4: Changes in the Definition of Taxable Income

	1997	1998	1999	2000	2001	2002
No. of Provisions in 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

Table 5: Response of labor expenditure for firms with positive and zero TI to payroll tax/CIT ratio 1997-2002

	Fixed Effects		
log(SS-CIT)	-0.192 (.006)	-.080 (.004)	
log(SS-CIT)*H		-.047 (.018)	
log(SS)*Z		-.146 (.050)	
log(SS-CIT)*B		.032 (.008)	
B		.194 (.021)	
H		.005 (.050)	
logCIT			.590(.097)
logCIT*H			.0007(.096)
logSS*H			-.063 (.115)
log(minwage*empl)	.764 (.006)	.758 (.006)	.739 (.012)
Year Dummies	Yes	Yes	
Number of employees* year dummies	Yes	Yes	
Observations	42 349	42 349	42 349

All standard errors are robust and reported in parentheses. H equals one when a firm is in the high tax bracket , B equals one when the firm has more tangible fixed assets than the average firm in year t, and Z is one whenever a firm's taxable income is zero. In all regressions, five year dummies are included as well as interactions between the year dummies and the number of employees. All regressions also include total assets, current liabilities, turnover, earnings before interest and tax and capital. With the exception of turnover, the coefficients on the other variables are insignificant and therefore, not reported.

Table 6: Response of labor expenditure for firms with positive TI to payroll tax/CIT ratio 1997-2002

	Pooled OLS		Fixed Effects		Arellano-Bond GMM	
Lag wR-u					.254 (.008)	.254(.008)
log(SS/CIT)	-1.26 (.072)	-1.28 (.075)	-.399 (.113)	-.428 (.115)	-.342 (.079)	-.309 (.083)
log(SS/CIT)*H	1.41 (.081)	1.26 (.078)	-.186 (.105)	-.175(.109)	.095 (.077)	.100 (.077)
log(SS/CIT)*B		.609 (.082)		-.036(.071)		-.111 (.080)
B		.113 (.025)		.131 (.026)		.058 (.027)
H			.136 (.032)	.124 (.033)		
log(minwage*empl)	1.07 (.003)	1.04 (.003)	.739 (.012)	.735 (.012)	.476 (.008)	.476 (.008)
Year Dummies	Yes		Yes		Yes	
Number of employees* year dummies	Yes		Yes		Yes	
Observations	23 681				10 645	

All standard errors are robust and reported in parentheses. H equals one when a firm is in the high tax bracket and B equals one when the firm has more tangible fixed assets than the average firm in year t. In all regressions, five year dummies are included as well as interactions between the year dummies and the number of employees. All regressions also include total assets, current liabilities, turnover, earnings before interest and tax and capital. With the exception of turnover, the coefficients on the other variables are insignificant and therefore, not reported.

Table 7: Response of taxable income to CIT and social security rates 1997-2002 (elasticities)

	Pooled Tobit (1)	Pooled Tobit (2)	Pooled Tobit (3)
Corporate tax rate (CIT)	1.63 (.016)	1.43 (.010)	1.51 (.010)
CIT*SS	-1.09 (.014)	-.438 (.010)	-.520 (.010)
CIT*SS*H		-.082 (.001)	-.080 (.001)
CIT*SS*B		.019 (.000)	.018 (.000)
H		.028 (.001)	.025 (.001)
B		-.031 (.000)	-.031 (.000)
Year Dummies	Yes	Yes	Yes
Industry dummies	No	No	Yes

Standard errors are reported in parentheses. All coefficients represent elasticities obtained after the Tobit estimation. The period under consideration ends at 2002. The number of uncensored observations is 45, 974. The number of left-censored observations is 44, 886.