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ABSTRACT

'Klin'-ing Up: Effects of Polish Tax Reforms on Those In and on Those Out*

In 2007 and 2008 Polish governments introduced a series of reforms which led to a substantial reduction in the tax "wedge" (in Polish: "klin") on labour. We show that when considered together the package of introduced reforms brought much greater reductions in the tax burden compared to a widely discussed 15% "flat tax". In the analysis we show the effects of the reforms both for the employed and for the non-employed populations. The latter analysis is done in such a way as to account for the entire (simulated) distribution of wages of the non-employed and shows interesting differences between the effects of reforms on employed and non-employed individuals. We argue that to fully appreciate the effect of reductions in labour taxation it is important to bear in mind that one of the reasons for introducing them is to make employment more likely for those who currently do not work. Given the extent of the reductions in the "klin" it is somewhat surprising that so far so little attention has been given to the recent Polish reforms.

JEL Classification: H24, J21, J31

Keywords: work incentives, tax wedge, labour costs, employment

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1 Introduction

Compared to the attention received by the "flat tax" reforms in countries such as Estonia, Lithuania or Russia, the coverage of the recent reforms of the labour costs in Poland has been modest to say the least. This may be puzzling given the significant extent of these reforms and demonstrates that it is often not the content but the form that matters for drawing attention. The high tax "wedge" (in Polish: "klin") on labour has been long identified as one of the major concerns of economic policy in Poland but until recently reducing it was either a low priority for governments or could not get through the full legislative process because of the presidential veto. It is to some extent surprising that the most significant reduction in the "klin" in Poland since the economic transition begun has been proposed and largely implemented by a government which could hardly be described as one with a market-oriented economic agenda.

The tax wedge on labour is a potentially important determinant of economic activity. It has been found to be one of the significant factors behind the rapidly growing unemployment levels in Europe since the 1960s, and one of important reasons why reducing unemployment has proved so difficult.[1] At the same time reduction in taxes on labour has been found to be an important element of recent successful reform packages in Europe (see Nickell (2001) and Annett (2007)). Somewhat surprisingly, given the role assigned to the tax wedge, there is not much detailed analysis of the level and distribution of the tax burden on labour in the countries of Central and Eastern Europe. The issue of the tax wedge is often discussed in the context of an aggregate tax burden and an overall mix of government revenues from different sources. More recent analysis focuses on the implications of introducing the "flat tax", but also in this strand of the literature it is difficult to find detailed analysis of changes in the distribution of the tax rates following the reforms, and even more so some comparative analysis of consequences of potential counterfactual policy options.[2] One of the impor-

[1] See for example the discussions in Layard and Nickell (1986), Lockwood and Manning (1993), Nickell (1997), Sieberst (1997), Nickell (1998) Fiorito and Padrini (2001), and Saint-Paull (2004). In Nickell, Nunziata, and Ochel (2005) the authors estimate that institutional changes contributed to about half of the increase in unemployment in Europe between 1960s and 1990s. Of this half about a fifth has been estimated to relate to taxes on labour. For an interesting analysis of changes in marginal tax rates in Canada see Davies and Zhang (1996).

[2] An early interesting survey of tax policy and unemployment with policy implications for transition countries can be found in Zee (1996). For a recent paper on the comparison of sources of government

tant roles assigned to the reforms reducing the tax burden on labour is their potential effect of stimulating employment demand and increasing incentives to take up jobs. However, to the best of our knowledge there are no studies which would attempt to demonstrate the difference in the tax wedge between those in and out of employment, and analyse implications of tax reforms on those out of work.

In this paper we demonstrate the extent of the change in the cost of labour which resulted from two sets of reforms announced by the J. Kaczyński government in 2007, and introduced in July 2007 and January 2008 (already by the next government who confirmed the preannounced changes). These reforms on the one hand reduced the employee and employer rate of disability social insurance, and on the other hand introduced an income tax credit for families with children. We contrast the extent of these two reforms with the reduction in labour costs which would result from an introduction of a single rate income tax proposed at the time by the liberal "Civic Platform" party (Platforma Obywatelska, PO). The analysis is implemented using the Polish micro-simulation model, SIMPL, applied on the data of the Household Budgets' Survey 2005. The SIMPL model allows us to take account of the distribution of labour incomes and to combine this with households' demographic characteristics. The package of reforms introduced in 2007/2008 proves to reduce the tax burden on those observed as working significantly more than the simulated version of the "flat tax" and we find very interesting differences in the effects of the reforms between the employed and the non-employed populations. The latter effects of tax reforms usually go unnoticed and as such are in our view insufficiently appreciated. As we demonstrate different wage distributions and demographics of those out of the labour market imply very different distributions of the tax burden and significantly different consequences of the reforms in comparison to the employed population. The exercise is conducted in such a way so as to be able to account for the entire (simulated) wage distribution of the non-employed population, and to the best of our knowledge it is the first such application.

The paper is structured as follows. In Section 2 we present a discussion of the different elements of the tax wedge in Poland in the baseline scenario and discuss the implemented reforms. Four broad components of labour costs constitute this tax

revenue between different groups of countries see for example Mitra and Stern (2003). For interesting discussion of the "flat tax" reforms in Central and Eastern Europe see for example Stepanyan (2003) and Keen, Kim, and Varsano (2007).

wedge: employer social security contributions (SSCs), employee SSCs, health insurance and income tax.[3] In section 3 we present the details of the computation of the marginal and average rates of the "klin", and describe our approach to the analysis of the non-employed. The data used in the analysis from the Polish Household Budgets' Survey (2005) and the subsets of the data we use are presented in detail in Section 4. In Section 5 we put the systemic elements together with wage distributions and demographic characteristics and present the distributions of the average and marginal taxes on labour in Poland under the baseline scenario and under the reformed systems. On top of that we compute the distribution of tax rates under the hypothetical 15% "flat tax" scenario, the introduction of which has been proposed in Poland in 2005. Our analysis is first conducted for the sample of employed individuals (5.1) and subsequently on the sample of the non-employed (5.2). Section 6 concludes.

2 Taxes on labour in Poland

Lets consider the simplest case of a single individual whose only source of income is income from employee work. Then under the Polish system the net income from work Ψ of individual i can be expressed as:

$$\Psi_i = \Omega_i - SSC_{1i} - SSC_{2i} - HI_i^{NFZ} - IT_i^F. \tag{1}$$

Net earnings,Ψ_i, is a function of the individual total labour cost Ω_i reduced by the amounts of employer's SSCs (SSC_{1i}), employee's SSCs (SSC_{2i}), health insurance (HI_i^{NFZ}) paid to the National Health Fund (NFZ) and income tax paid to the fiscal authorities (IT_i^F). All these elements are a function of the total labour cost, although the rates and schedules are applied to its different components. The rates of the SSCs (both employer and employee) apply to the "gross earnings" (labelled ω for the rest of the paper), defined as: $\Omega_i - SSC_{1i}$. The Health Insurance and the Income Tax schedules are applied on the so-called taxable income (which we shall label as ψ), defined as $(\Omega_i - SSC_{1i} - SSC_{2i})$.

[3] In the analysis we consider the entire difference between the total labour cost and net earnings to constitute the tax wedge, which is the most common definition in the literature. Note, however, that as rightly pointed out by Disney (2004) the matter is more complicated than that with some elements of the wedge representing future rights to benefits of the contributors in the form of PAYG or funded pensions. Moreover, in some studies at the aggregate level the tax wedge is considered to be the difference between the total labour cost and real consumption, i.e. accounts also for indirect taxation (see for example Nunziata (2005)).

In Tables 1 and 2 we present a summary of the rates of respectively the Social Security Contributions and Income Taxes which applied in Poland in 2005. The 2005 system, i.e. the system that was in place in the year the data was collected, is taken to be the baseline scenario for our analysis. The SSCs are divided into the employer and employee components and the rates are presented with reference to gross earnings, ω. The SSCs retirement and disability rates applied to all employee earnings up to a threshold of 72,690.[4] In 2005 the retirement and disability pension insurance was divided equally between the employer and the employee, but some other elements of the insurance were paid entirely by the employer (Work Accident Insurance, Labour Fund contributions, and the Fund of Guaranteed Employee Benefits) or entirely by the employee (Sickness Insurance).

Table 1: Social Security Contributions in Poland, 2005

Employee SSCs	
- retirement insurance	9.76%
- disability insurance	6.50%
- sickness insurance	2.45%
Employer SSCs	
- retirement insurance	9.76%
- disability insurance	6.50%
- work accident insurance	1.93%
- Labour Fund	2.45%
- FGEB	0.15%
Annual threshold for retirement and disability SSCs	72,690 PLN

Notes: FGEB stands for the Fund of Guaranteed Employee Benefits.

Taxable income, i.e. earnings net of the SSCs are subject to health insurance, charged at the rate of 8.5%, most of which (7.75 percentage points of taxable income) can then be deducted from income tax liability. Health insurance is levied individually and there is no upper threshold where the contributions stop to be paid. There are three rates at which individuals pay income tax in Poland: 19%, 30% and 40%. The income bounds on which these rates apply are detailed in Table 2. Each tax payer is granted a universal tax credit of 530.08 PLN per year, and all those employed on a standard work contract receive an extra revenue costs allowance, which in most cases is 1227.00 PLN.

[4]This is determined as a multiple of 30 of the expected average monthly gross earnings in the economy for a given year.

One of the most important elements of the system is the possibility of income splitting available to lone parents and married couples (either with or without children). The system implies that the annual family income before being taxed is divided by two, following which the tax liability is applied according to the standard rates and then the computed liability is multiplied by two (a similar system operates in Germany, see Steiner and Wrohlich (2004)).

Table 2: Income Tax in Poland, 2005

Income tax:		Bounds (PLN per year)
Rate I	19%	0-37,024
Rate II	30%	37,025-74,048
Rate III	40%	74,049 +
Credits (PLN per year):		
Universal credit:	530.08	
Revenue costs:	1,227.00	

2.1 The 2007/2008 reforms

The J. Kaczyński government announced two major reforms of the tax system on labour for introduction in several steps in 2007 and 2008. The first element of the package was a child tax credit at the value of 120 PLN for every dependent child which became effective in January 2007. Secondly, the government reduced the employee rate of SSC disability insurance by 2 percentage points from 6.5% to 4.5%. This came into effect in July 2007. At the same time the government announced the introduction of further reductions in disability insurance levels to take effect in January 2008. In autumn 2007 the government announced that the child tax credit would be extended and the extension would be effective already in 2007. An early parliamentary election, which took place in October 2007, was most likely one of the factors behind this extension. The value of the child tax credit increased from 120 per child to double the value of the universal tax credit (i.e. to 1145.08 PLN at the time).

Despite this significant electoral "giveaway" the coalition parties of the J. Kaczyński government lost the elections with the opposition Civic Platform (PO) forming the government in coalition with the Polish Peasants' Party (PSL). Unable, or perhaps no longer willing, to introduce the "flat tax", with which the PO is often identified in

Poland and which it strongly advocated during the 2005 election, the new government took up the pre-announced reforms of the SSC disability rates and implemented further reductions. As of January 2008 the employee disability SSC rate was 1.5% (down from 6.5% before July 2007), while the employer disability SSC rate was reduced from 6.5% to 4.5%. The Tusk government also upheld the decision concerning the child tax credit which has since been implemented at the value of two times the universal tax credit for every child.[5]

In Figure 1A we present the specific marginal tax rates implied by the the four elements of the Polish system of taxes on labour in the baseline 2005 scenario for a single adult without children (on total labour cost, Ω_i). Payments of the HI start only once the level of income is high enough to exhaust the limits of the the revenue costs allowance and the universal tax credit. After that the rates are applied on the entire taxable income and over the range of labour costs from 507 PLN to 917 PLN per month the health insurance contribution is equal to the income tax due. This explains why initially the marginal rate of the HI is 12.8%. Above 917 PLN per month the marginal rate of HI rate is 5.73% of total labour costs up to the SSC threshold (total labour cost = 7,321 PLN per month), and 7.94% on labour cost beyond this threshold.

On Figure 1A we can also see the changes in the marginal rates of IT and the change in SSCs once individuals are not longer liable to pay retirement and disability insurance.[6] Figure 1B shows the total marginal tax rate (again conditional on Ω_i) for a single adult without children in the baseline 2005 scenario (below referred to as the"base system") and for the first earner in a couple with two dependent children. In the latter case we show the total MTRs under the base system and in three reform scenarios. The MTRs are computed in scenarios with reduced SSC disability rates (hereafter labelled as "ZUS Reform"), with the entire 2007/2008 reform package, i.e. including the child tax credit ("ZUS+CTC Reform"), and in the hypothetical scenario of introducing a 15% "flat tax" reform with other elements of the 2005 system kept unchanged ("15% flat tax Reform").[7] In Section 5 we use the same three reform sys-

[5]Note that the child tax credit is implemented slightly differently than the universal tax credit. It becomes effective only if there is any income tax remaining after the application of the universal tax credit and deduction of the deductible part of health insurance. After that it operates as a standard non-refundable tax credit.

[6]Note that the change in the rate of income tax at the SSC threshold relates only to the fact that for levels of total labour cost beyond 7,321 PLN per month (corresponding to the SSC threshold) the level of taxable income increases.

[7]The "flat tax" reform we consider is a straightforward unification of the tax rates in the Polish

tems to present the influence of the scenarios on the actual changes in taxes of the Polish population.

Several interesting points can be noted with reference to Figure 1B. First of all the difference between the MTRs of the single person without children and the first earner in a couple under the base system is a result of the joint taxation system for couples. Secondly, we can see how strongly the ZUS and the ZUS+CTC reforms affect the MTRs relative to the base system and how differently they change the marginal rates relative to the 15% flat tax reform. The introduction of the child tax credit for the one earner family with two children we consider in Figure 1B affects the marginal tax rate in the range of the total labour cost from 1387 PLN per month (below which the family is not liable to pay any tax) to 3399 PLN per month (above which the entire credit is exhausted).[8] Interestingly, relative to the ZUS and the ZUS+CTC reforms, the MTR under the 15% "flat tax" is lower only for incomes above the SSC threshold, where the effects of changes in the rates of disability insurance no longer apply.

3 Calculating individual-level tax wedge

The calculations presented in this paper are conducted using the Polish micro-simulation model SIMPL.[9] In the analysis presented here we aim to show the level of the overall tax on labour conditional on total labour cost at individual level. In other words we want to answer the question - what the difference is between how much it costs to employ an individual and how much he/she receives "in the pocket". Because of the joint system of taxation, and because individuals can combine employee work (which is the focus of our study) with other forms of income subject to income taxation, identifying the amount of tax which relates only to employee work at individual level requires several assumptions. This problem does not relate to SSCs which are subtracted at individual level, but there are also consequences of joint taxation for the computation of Health Insurance. The way we allocate the specific elements of the Income Tax and Health Insurance to individuals is discussed in detail in Appendix A. As we explain

income tax system. The universal tax credit is maintained in the system. Removing it would naturally increase average tax rates for all individuals and marginal tax rates for some relative to the "flat tax" reform we model.

[8]The two values correspond respectively to about the 25th and 85th centile of the entire distribution of monthly total labour cost among the employed sample.

[9]For more details see www.simpl.pl.

the expression for net income from equation 1 can be made more specific to refer only to income from permanent employment as:

$$\Psi_{i,e} = \Omega_{i,e} - SSC_{1i,e} - SSC_{2i,e} - HI_{i,e}^{NFZ} - IT_{i,e}^{F}. \tag{2}$$

where:

- $\Psi_{i,e}$ is individual net income resulting from employment,
- $\Omega_{i,e}$ is the total employment labour cost,
- $SSC_{1i,e}$ and $SSC_{2i,e}$ are social security contributions paid on employment income,
- $HI_{i,e}^{NFZ}$ is total health insurance paid to the NFZ on employment income,
- $IT_{i,e}^{F}$ is total individual level income tax paid to fiscal authorities on employment income.

The important thing to bear in mind from the point of view of the analysis presented below is that the tax rates we calculate relate only to taxes on reported permanent earnings, and that in case both partners in couples have taxable incomes the burden is allocated in accordance with the general accounting rules governing their allocation (see Appendix A for details).

3.1 Marginal and average tax rates

The analysis in this paper focuses on average and marginal tax rates as implied by the system described in Section 2 and the effects on these resulting from several policy reforms. Given the expression for net income presented above, the marginal and average tax rates on employment can be computed in the following way.

The average tax rate (ATR), $\kappa_{i,e}$, on employment is computed as

$$\kappa_{i,e} = \frac{\Omega_{i,e} - \Psi_{i,e}}{\Omega_{i,e}}. \tag{3}$$

The marginal tax rate (MTR) on employment income $\mu_{i,e}$ is computed as:

$$\mu_{i,e} = 1 - \frac{\Psi_{i,e}^{*} - \Psi_{i,e}}{\Omega_{i,e}^{*} - \Omega_{i,e}}. \tag{4}$$

where $\Psi_{i,e}$ and $\Omega_{i,e}$ are defined as in equation 2, $\Omega^*_{i,e}$ is total labour cost increased by a fraction, and $\Psi^*_{i,e}$ the net income computed following this fractional increase of the total labour cost.[10] Because of the interdependencies in income taxation among partners in couples, especially when they both have employment incomes, in these cases we only increase the earnings of the partner with higher earnings and the resulting marginal tax rate is assumed to be the same for both partners.[11]

4 Data

The data used in our analysis come from the Polish Household Budgets' Survey 2005 (Badanie Budżetów Gospodarstw Domowych, below referred to as BBGD). The BBGD is an annual survey of household incomes and expenditures and contains detailed demographic and incomes information on about 35,000 Polish households. As Bargain et al. (2007) demonstrated the quality of the BBGD incomes data - especially with reference to earnings information is very high and very closely reflects administrative data.[12]

The analysis is presented in two parts, one showing the effect of the reforms on those reporting positive employment earnings (the employed sample), and the other focusing on the effect of those out of employment (the non-employed sample). In both samples we identify individuals whom we define as "labour market flexible", i.e. actually working (with employment earnings) or potentially working. From the sample of "labour market flexible" individuals we exclude individuals aged less than 18 and over the pension age (65 for men, 60 for women), the self-employed, recipients of retirement or disability pension, full-time students and dependent children. Our analysis focuses on the "tax units" of these labour market (LM) flexible individuals, where a tax unit is an adult single individual or a married couple (with or without dependent children).

[10] In our calculations we increase the total labour cost by 0.01%.

[11] It is important to note also that in computing the value of the "klin" for the simulated reforms we make an assumption that what remains unchanged is the value of "gross earnings" (ω), and the net wage and the total labour cost is computed with reference to this value. Naturally in the post-reform "equilibrium" the value of gross earnings may change and the way it changes will be a function of the relative elasticities of demand for and supply of labour. In the short run however, keeping the gross wage constant seems to be the most natural assumption to make, since labour contracts are written with reference to the gross wage.

[12] For example Bargain et al. (2007) demonstrate that although there is an underrepresentation of top incomes in the BBGD, in terms of employment incomes this applies essentially only to the top centile of the distribution.

Couples where only one person is LM flexible will also be included. In the case of a married couple where one of the partners is employed and the other is not but is classified as LM flexible, this family will enter the analysis twice. First we shall consider the marginal and average taxes which are paid by the employed partner (in Section 5.1), and then will analyse the tax burden of the non-employed partner. The case of tax burden on non-employed "second earners" in couples is in fact a rather special one, and we treat it separately in the analysis of the effect of the reforms on the non-employed in Section 5.2. We focus our analysis of labour taxes on reported (and simulated) permanent earnings and assume that temporary earnings, if such are reported in the data, remain unchanged.[13]

Table 3: Sample characteristics: labour market flexible individuals

	Employed sample			Non-employed sample		
	Men	Women	All	Men	Women	All
All	13117	11868	24985	5505	10052	15557
Age group (column percentages)						
18-24	0.092	0.091	0.091	0.283	0.177	0.214
25-34	0.299	0.278	0.289	0.261	0.297	0.285
35-44	0.273	0.290	0.281	0.177	0.233	0.213
45-54	0.272	0.311	0.291	0.217	0.245	0.235
55+	0.063	0.031	0.047	0.063	0.048	0.053
Education: (column percentages)						
Primary or none	0.072	0.056	0.065	0.219	0.199	0.206
Vocational	0.437	0.212	0.330	0.462	0.361	0.397
Secondary	0.336	0.457	0.394	0.270	0.373	0.337
Higher	0.154	0.273	0.211	0.049	0.066	0.060
Children: (column percentages)						
No children	0.373	0.387	0.380	0.673	0.342	0.459
One child	0.277	0.296	0.286	0.138	0.265	0.220
Two children	0.249	0.240	0.245	0.120	0.240	0.198
More than two children	0.102	0.076	0.090	0.069	0.153	0.123
Married	0.785	0.688	0.739	0.432	0.702	0.607

Source: Authors' calculations using BBGD-2005 data.

These criteria leave us with 24,985 individuals in the employed sample (living in 19,949 tax units/families), and with 15,557 individuals in the non-employed sample (living in 14,651 tax units/families).[14] Some basic descriptive statistics concerning

[13]The BBGD survey only records if an income source from employment received in the month of the interview is "permanent" or "temporary" - temporary jobs are those that last or are expected to last for up to three months. In the microsimulation we assume that all temporary earnings are received for three months, and permanent earnings for the whole calendar year.

[14]Note that some of these families overlap between the samples, since an employed individual in a one earner couple lives in the same family as his/her non-employed partner.

Table 4: Sample characteristics - family types of labour market flexible individuals

	Employed sample			Non-employed sample		
	Men	Women	All	Men	Women	All
All	13117	11868	24985	5505	10052	15557
Family type:						
Singles (number), of which:	2824	3710	6534	3128	2996	6124
- Without children	0.938	0.692	0.798	0.970	0.659	0.817
- With one child	0.037	0.201	0.130	0.017	0.187	0.100
- With 2+ children	0.025	0.107	0.071	0.013	0.155	0.082
Couples with one LM flexible partner (number)	1892	2245	4137	594	2785	3379
of which:						
- Without children	0.396	0.338	0.365	0.429	0.296	0.320
- With one child	0.274	0.298	0.287	0.274	0.238	0.245
- With 2+ children	0.330	0.364	0.348	0.296	0.465	0.436
Couples with two LM flexible partners:						
One earner couples (number), of which:	3365	877	4242	877	3365	4242
- Without children	0.129	0.245	0.153	0.245	0.129	0.153
- With one child	0.347	0.301	0.338	0.301	0.347	0.338
- With 2+ children	0.524	0.454	0.509	0.454	0.524	0.509
Two earner couples (number), of which:	5036	5036	10072	—	—	—
- Without children	0.209	0.209	0.209	—	—	—
- With one child	0.365	0.365	0.365	—	—	—
- With 2+ children	0.425	0.425	0.425	—	—	—
No earner couples (number), of which:	—	—	—	906	906	1812
- Without children	—	—	—	0.223	0.223	0.223
- With one child	—	—	—	0.305	0.305	0.305
- With 2+ children	—	—	—	0.472	0.472	0.472
Total number of families			19949			14651

Source: Authors' calculations using BBGD-2005 data.

the two sample are presented in Tables 3 and 4. Individuals in the non-employed sample, especially men, are much more likely to be young and have significantly lower levels of education (Table 3). As many as 28% of men in the non-employed sample are aged 18-24, compared to 9.2% in the employed sample. 21.9% of non-employed men have only primary education or none, compared to 7.2% in of those who are employed. Employed men are more likely to have at least one child (62.7% relative to 32.7% among the non-employed men), and are almost twice as likely to be married as those observed as non-employed. With regard to children, the differences are much smaller for women, although the proportion of women with more than two children is only 7.6% in the employed sample and 15.3% in the non-employed sample. As

we can see in Table 4 a substantial proportion of single individuals have at least one child (respectively 20.0% and 18.2% in the employed and non-employed sample), and the proportions are still higher in the case of couples. For those with one LM flexible partner 63.5% and 68.0% of couples have at least one child respectively in the employed and the non-employed sample. Among one earner couples as many as 84.7% have at least one child, and the proportion is almost as high for two earner couples (79.1%). Couples with two LM flexible partners where none of them works are not very common, though the proportion of those having at last one child among these is also very high (77.7%). The differences in characteristics of the employed and non-employed samples, especially with regard to age and education will be reflected in the level of wages, as will differences in family composition between the employed and non-employed samples. The latter will also find a reflexion in the different way the child tax credit will affect the tax burden on those with children.

5 "Klin"-ing up: reforming taxes on labour in Poland

Below we present the distributions of marginal and average taxes in Poland under the base 2005 system and compare them to those resulting from the two introduced reforms described in Section 2.1 and to the 15% "flat tax" scenario. In Section 5.1 we present the distributions for the employed sample, while in Section 5.2 for the non-employed sample.

5.1 Distribution of the "klin": the employed population

Results of the calculations for the employed sample are presented in Figure 2 and in Table 5. Panels A and B of Figure 2 show the cumulative distributions of the total marginal and average tax rates for the entire employed population, while in Panels C and D we show the distributions separately for the sub-sample of employed individuals with children. The figures confirm the basic conclusion we drew on the basis of Figure 1B, but complete the picture with demonstrating the effect of the reforms taking account of the composition of the population and the full observed distribution of wages. The results show a very significant reduction in the level of the tax burden on wages following the 2007/2008 reform package. The mean value of the total average

rate of labour tax has fallen by 7.6 percentage points for all employed individuals, and by 8.6 percentage points for those with children. This corresponds to reductions of, respectively, 18% and 21%, and represents the most significant reduction in the "klin" since the beginning of the economic reforms in Poland in 1989.

The ZUS reforms on their own have reduced the level of the "klin" for a large proportion of the employed population by much more compared to the hypothetical 15% "flat tax" reform. The "flat tax" reform does result in some MTR falling to levels which are not achieved by the other reforms considered. For example, the 1st percentile of the post "flat tax" reform MTR distribution is as low as 21.3%, compared to 25.4% under the ZUS reform and ZUS+CTC package (see Table 5), and down from 32.6% under the baseline system. However, for a great majority of working individuals the latter two reforms reduce the MTR by much more than the simulated "flat tax". For example the 25th percentile of the distribution is 40.1% under the ZUS reform, 35.3% under the joint ZUS+CTC package and 43.2% under the "flat tax" regime - down only by 2.7 percentage points relative to the baseline. Figure 2B shows the values for average tax rates and we can now clearly see the effects of the introduced reforms. The average ATR falls from 41.6% in the baseline system to 35.6% after the ZUS reform and 34.0% when we add the child tax credit. The reduction is much higher compared to the average ATR at the level of 39.6% resulting from the introduction of the "flat tax". The picture is of course even more striking when we consider only those with children. The median ATR falls from 42.3% to 31.7% under the ZUS+CTC reform, and only to 40.3% under the "flat tax" scenario.

Table 5: Total marginal and average tax rates, base and reformed systems: employed sample

	Marginal tax rate						Average tax rate	
	1st perc.	25th perc.	median	75th perc.	99th perc.	mean	median	mean
All:								
Base system	0.326	0.459	0.459	0.459	0.533	0.455	0.423	0.416
ZUS Reform	0.254	0.401	0.401	0.401	0.483	0.401	0.363	0.356
ZUS+CTC Reform	0.254	0.353	0.401	0.401	0.483	0.382	0.340	0.340
15% flat tax Reform	0.213	0.432	0.432	0.432	0.476	0.424	0.403	0.396
With children:								
Base system	0.326	0.459	0.459	0.459	0.533	0.455	0.423	0.415
ZUS Reform	0.254	0.401	0.401	0.401	0.483	0.400	0.363	0.356
ZUS+CTC Reform	0.254	0.317	0.401	0.401	0.483	0.369	0.317	0.329
15% flat tax Reform	0.213	0.432	0.432	0.432	0.476	0.423	0.403	0.396

Source: Authors' calculations on BBGD-2005 data using SIMPL microsimulation model.

5.2 Distribution of the "klin": the non-employed population

Results presented in this section demonstrate how different the consequences of tax reforms can be on those who are non-employed, and who potentially could be working. One of the justification for reducing the "klin" is that high taxes on labour lead to lower employment through, on the one hand, high employer costs and, on the other, lower net remuneration thus affecting supply of labour. From this point of view the effect of tax reforms on those who are out of employment is extremely important. We saw in Section 4 how different the non-employed sample is with respect to such characteristics as education, age, the presence of children, etc. These differences in characteristics will translate into different (on average lower) wage levels, while the differences in family structure will affect net earnings directly through the tax system.

In Section 5.2.1 we first outline the way we propose to deal with the fact that we do not observe the wages of the non-employed individuals. Subsequently our analysis of the distribution of tax rates for the non-employed is divided into two parts. In Section 5.2.2 we examine the tax rates of "first earners". These are either single non-working individuals in the non-employed sample, or non-employed individuals in couples where only one of the partners is labour market flexible, or - in cases where both partners belong to the non-employed sample - the partner with higher expected wage. For these first earners we analyse the distributions of marginal and average tax rates under different scenarios. In Section 5.2.3 we analyse the tax burden on "second earners", i.e. on labour market flexible partners of employed individuals.

5.2.1 Accounting for the distribution of wages of the non-employed

As in all studies on the position of the non-employed on the labour market the crucial piece of information we miss is information on their wage level. Because of much lower variance of the distribution of expected wages compared to the distribution of observed wages, and because of significant non-linearity of the Polish tax system (especially the post-reform system including the child tax credit), using a simple expected wage distribution would mistakenly represent the level of taxes and changes in it. The method we propose to adopt relies on simulating an entire distribution of earnings for the non-employed sample by drawing from the distribution of the residual in the wage equation. This means that for every individual i in the non-employed sample we

generate the gross monthly wage as:

$$\widehat{W}_i = exp(\hat{w}_i + \varepsilon_i), \tag{5}$$

where $\hat{w}_i$ is the expected (log) gross wage of individual i, and ε_i is drawn from the distribution of the residuals in the wage equation.[15] In most applications where one accounts for the entire distribution of wages for the non-employed the final results, such as for example labour supply response, are integrated over the distribution of the residual (see e.g. Myck and Reed (2006)). Since generally it is impossible to find an algebraic solution for the integral, the results are generated as some form of the average over a number of draws from the distribution of ε. In our case we can generate a number (S) of wage measures for each individual by drawing from the distribution of ε. This means that we produce S measures of gross wage for each non-employed individual, each taking the form of:

$$\widehat{W}_i^s = exp(\hat{w}_i + \varepsilon_i^s). \tag{6}$$

In our analysis integrating the results over the distribution of the residuals for each individual, would imply producing average rates out of the marginal and average rates computed for each individual for the S wages. This averaging process would imply that, first of all, it would be very likely that the averaged marginal rates would not correspond to the marginal rates implied by the system, and secondly, that there would be an unclear relationship between the distributions of the marginal and the average rates, and the results would be difficult to interpret.

Because our analysis focuses on the examination of entire distributions of tax rates, the solution we propose is to compute the corresponding marginal and average tax rates under each of the examined systems for each measure of $\widehat{W}_i^s$, and then to analyse the resulting S distributions of tax rates jointly. This approach will correctly reflect the entire distribution of gross wages and the tax rates implied by the different systems, and will not suffer from the shortcoming of averaging the rates mentioned above.[16]

[15]The wage equation is estimated separately for men and women using the Heckman two-step model to account for labour market selection. Simulated out of work incomes are used as instruments for selection. Details are available from the authors on request.

[16]In the application we use ten draws from the distribution of the residual for every non-employed individual, i.e. $S = 10$. This is usually considered sufficient to correctly reconstruct the entire wage distribution (see e.g. Myck and Reed (2006)).

5.2.2 Marginal and average taxes rates on non-employed first earners

We begin the analysis of the effects of the reforms on the non-employed sample by looking at the changes in distributions of marginal and average taxes of "first earners" in the non-employed sample. The first earners include single non-employed individuals, the non-employed LM flexible partner in couples with only one LM flexible person, and the partner with higher expected wage ($exp(\hat{w}_i)$) in no earner couples. Two interesting points are worth noting with respect to the differences in composition of this part of the non-employed sample relative to the employed sample. First of all the proportion of men and women with children is similar among the employed and the non-employed, though in the latter sample families are more likely to have more than one child. For example among singles 20.1% of employed and 18.2% of non-employed individuals have at least one child, but only 10.7% of working single women have more than one child compared to 15.5% among non-working single women (see Table 4). Similarly about 79% of two earner couples and 78% of no earner couples have children, but the proportion of those with more than one child is again greater for the sample of no earner couples. Secondly however, despite these similarities in terms of family structure, as we pointed out earlier, there are important differences in other characteristics between the employed and the non-employed sample, especially age and education. These differences will play a crucial role in determining the way the simulated reforms affect changes in the value of the tax wedge.

Table 6: Total marginal and average tax rates, base and reformed systems: non-employed sample, first earners

	Marginal tax rate						Average tax rate	
	1st perc.	25th perc.	median	75th perc.	99th perc.	mean	median	mean
All:								
Base system	0.326	0.454	0.459	0.459	0.530	0.442	0.399	0.390
ZUS Reform	0.254	0.396	0.401	0.401	0.480	0.385	0.338	0.328
ZUS+CTC Reform	0.254	0.396	0.401	0.401	0.480	0.375	0.326	0.323
15% flat tax Reform	0.326	0.427	0.432	0.432	0.476	0.417	0.380	0.376
With children:								
Base system	0.326	0.454	0.459	0.459	0.530	0.429	0.385	0.381
ZUS Reform	0.254	0.396	0.401	0.401	0.480	0.371	0.326	0.318
ZUS+CTC Reform	0.254	0.317	0.317	0.396	0.401	0.338	0.317	0.302
15% flat tax Reform	0.326	0.427	0.427	0.432	0.476	0.407	0.370	0.369

Source: Authors' calculations on BBGD-2005 data using SIMPL microsimulation model.

Similar to the results presented for the employed sample, the cumulative distrib-

utions of total marginal and average tax rates with respect to the total labour cost are presented graphically (Figure 3) and summarised in Table 6. The first thing that distinguishes the non-employed sample is a much higher proportion of low wage individuals who as a result of the low wage pay very low marginal and average tax. The marginal rate of 32.6% applies to about 15% of the entire non-employed sample, and over 20% of the non-employed sample of first earners with children. As a result of lower wages in comparison to the employed population, the non-employed first earners pay less income tax (or do not pay any tax at all) and consequently the effect of the child tax credit reform is much less pronounced in comparison to the employed sample. For example while the mean ATR in the employed sample falls by 1.6 percentage point following the CTC reform (i.e. when we compare the ZUS reform with the ZUS+CTC reform), it falls by only 0.5 percentage points in the sample of non-employed first earners. When we look only at those with children the difference in the means is 2.7 vs. 1.6 percentage points, while the median ATR falls by 4.6 percentage points for the employed sample and by only 0.9 percentage points among the non-employed first earners.

Despite the difference in the effect of the CTC the general pattern of the effects of the simulated reforms is similar to what we saw for the employed sample. The ZUS reform produces a very significant reduction in the level of the tax burden on labour, and the child tax credit contributes to a further sizeable reduction. One important point which distinguishes the effect on the non-employed first earners is that, due to lower wage levels of the non-employed sample relative to the employed, the number of those whose marginal tax rate is 21.3% following the 15% "flat tax" reform is very low, and the 1st percentile MTR is already above that level. This is despite the fact that the entire distribution of wages is accounted for in the process. Also, because on average the non-employed pay less tax than the employed sample the reduction in the average level of taxes resulting from the "flat tax" reform in slightly higher in the case of the latter sample. The simulated reform reduces the tax burden on average by 2.0 percentage points for the employed individuals and only by 1.4 percentage points among the non-employed. These are much lower reductions in comparison to the effects of the entire ZUS+CTC package, namely 6.7 percentage point (17.2%) for the non-employed first earners, and 7.6 percentage points (18.3%) for the employed sample.

5.2.3 Average taxes rates on non-employed second earners

The problem of the tax burden on second earners has been frequently discussed in the labour supply literature, and has been shown to be especially severe in cases of systems with joint income taxation like Poland or Germany, or with in-work benefits means-tested at family-level like the UK's Working Tax Credit.[17] In the analysis we focus only on the average tax rates of these second earners. The rates are computed differently than in the case of couples where both partners are employed (as described in details in Appendix A), as otherwise we would have to account for the effect of entry into employment on the average tax rate of the already employed partner.[18] Such an analysis would then imply sharing of the advantages of the tax system (such as universal tax credit or the child tax credit) between partners and would wrongly represent the actual rate of tax that the family has to pay on the earnings of the second earner.

The average tax rate on employment income of the second earner, $\kappa_{j,e}$, is thus computed as:

$$\kappa_{j,e} = \frac{\Omega_{j,e} - (\Psi^f_{i+j,e} - \Psi^f_{i,e})}{\Omega_{j,e}}. \tag{7}$$

where $\Omega_{j,e}$ is total labour cost of employing the second earner j, $\Psi^f_{i+j,e}$ is the total net family income resulting from the joint employment of both partners, and $\Psi^f_{i,e}$ is the total net family income resulting from the employment of the partner observed as employed.

Table 7: Total average tax rates, base and reformed systems: non-employed second earners

	All		With children	
	median	mean	median	mean
Base system	0.445	0.442	0.444	0.441
ZUS Reform	0.386	0.383	0.386	0.383
ZUS+CTC Reform	0.353	0.351	0.342	0.345
15% flat tax Reform	0.421	0.418	0.421	0.417

Source: Authors' calculations on BBGD-2005 data using SIMPL microsimulation model.

[17] For discussion of the consequences of the German system see e.g. Steiner and Wrohlich (2004). For analysis of consequences of means testing of in-work support see Blundell et al. (2000), while for a comparative discussion of the issue in Germany, Poland and the UK see Haan et al. (2008).

[18] The same argument applies of course to the issue of the marginal tax rates of the second earner and the working partner, which is why we leave the analysis of marginal tax rates out.

In Figure 4 we present the cumulative distributions of the average tax rates computed using formula 7. The results are also summarised in Table 7 for the entire sample of one earner couples and for those with children. As we can see, since a great majority of one earner couples (where the second partner is LM flexible) have children (about 85%, see Table 4) the results for all individuals and for the sub-sample with children are very similar. The simulations confirm what we mentioned above, namely that the tax burden on second earners is generally higher than for first earners. For example, while the mean ATR on labour among non-employed first-earners is 39.0%, that on the second earners is 44.2%.

As we can see in Figure 4 and in Table 7, the 2007/2008 reform package introduced a very significant reduction of taxes on second earners. The tax wedge following the ZUS+CTC reform is not only much lower in comparison to the effects of the 15% "flat tax" reform, but the extent of the reduction for second earners is also much greater in comparison to the non-employed first earners and to those who are employed. The mean ATR for second earners falls by 9.1 percentage points (21%) for all individuals and by 9.6 percentage points (22%) when we consider only one earner couples with children. What is especially important is that for the sample of non-employed second earners we can see the largest effect of the child tax credit reform. For those with children the mean ATR is reduced from 38.3% to 34.5% (3.8 percentage points). This compares to the reduction by 2.7 percentage points for those with children in the employed sample (Table 5), and by 1.6 percentage points for the non-employed first earners with children (Table 6).

6 Conclusion

The "klin" between net earnings and the total labour cost in Poland has been significantly reduced through a reform package that came into effect in 2007 and 2008. As our analysis demonstrates the reduction in the tax wedge resulting from cuts in the disability social security contributions and from an introduction of a generous child tax credit has been much higher compared to a hypothetical, though widely discussed, introduction of a 15% "flat tax". The recent reforms constitute an unprecedented reduction in the level of taxes on labour in the history of the Polish economic transformation. According to our analysis the mean value of the average tax rate on labour

earnings fell from 41.6% to 34.0% among the employed population. If instead of the introduced reforms the government opted for a 15% "flat tax" reform the resulting mean ATR would fall only to 39.6%.

This reduction in the tax wedge is likely to contribute to improvements on the labour market both through the likely increases in labour demand and through the reaction on the supply side as work becomes more financially attractive. From this point of view several interesting conclusions follow from our examination of the effects of the tax reforms on the tax wedge of those who remain out of the labour market. In the analysis we implemented a methodology which allowed us to account for the entire distribution of wages of the non-employed. This is especially important in highly non-linear tax systems, and so particularly relevant for the case of the Polish system after the introduction of the child tax credit. In the analysis we separately examined the effects of the tax reforms on first and second earners, and while in both cases the effects of the implemented reforms are overall much greater in comparison to the simulated 15% "flat tax" reform, there are important differences in the effects between first and second earners. This partly relates to the demographic characteristics of the samples and partly to the different level of wages they could receive. Because of the latter, while the effects of the reductions in social security contributions result in similar reductions in the tax wedge, the effects of the child tax credit are much weaker on the first non-employed earners relative both to those on the second (non-employed) earners and on the employed population.

The reduction in the tax on labour is likely to contribute to increases in employment in Poland. However, compared to the SSC reform, the introduction of the child tax credit is unlikely to play an important role in the case of families where no one is employed. This is despite the fact that a high proportion of these families are families with children, and relates to their low potential level of earnings. On the other hand the child tax credit leads to significant reductions in the level of the tax wedge for non-employed second earners. This is partly because almost 85% of one earner couples have children, and as many as 43% have two children or more, and suggests that the child tax credit reform could provide an important stimulus to an increase in the proportion of two earner families.

The analysis also shows that it is generally important to consider the demographic characteristics of households as well as incomes from sources other than earnings in

the analysis of the tax wedge. In the Polish case, the importance of the first element becomes crucial with the introduction of the child tax credit.

The discussion about the level of tax on labour in Poland has not ended with with the introduction of the 2007/2008 reforms. In fact the government has already introduced further reforms and plans to reduce income tax rates to 18% and 30% as of January 2009. It seems however that these reforms will only have a minor effect on the majority of the working and non-working population compared to the recent reforms, especially that as we saw in this paper a significant proportion of working (and non-working) individuals pay little or no income tax after the introduction of the child tax credit.

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Appendix A: Allocating taxes to individuals

The simple expression for the relationship between net and gross (permanent) earnings gets more complicated in the scenario where the individual receives income from sources other than employee work, for example from rent. Because of the non-linearity of the tax system, and because of the interdependencies of the level of HI and income tax, the level of income tax levied on employment will in general be different from that presented in equation 1. To compute the level of tax relating only to employee employment we first compute the overall level of income tax of the individual, and then the amount of tax the individual would have to pay if his/her employee income were zero. The resulting difference in the level of income tax then identifies the income tax on the individual's earnings. Formally the computation of income tax relating to earnings can be expressed in the following way:

$$IT_i^0(\Omega_i) = \tau(\omega_i + \Phi_i|\omega_i > 0) - \tau(\Phi_i|\omega_i = 0), \tag{8}$$

where Ω_i is total labour cost, ω_i is taxable income from earnings and Φ_i is taxable income from sources other than earnings. Function $\tau(.)$ is the income tax schedule. For the moment we ignore the payment of health insurance which we shall discuss in detail below. This means that $IT_i^0(\Omega_i)$ is the computed income tax due taking into account the elements of the tax system presented in Table **??**, i.e. the revenue costs, the universal tax credit and the child tax credit.

The second difficulty concerning "individualisation" of the tax wedge is the fact that income is taxed jointly for married couples in Poland. This means that in cases where only one person in the couple is working, or if there are high disproportions in gross incomes between partners, the income tax (conditional on gross earnings) for a married person is lower compared to someone who is not married. Since income splitting is available also to lone parents, their income tax bill will also be lower compared to single individuals without children. These features were evident from the analysis of Figure 1. In the case of lone parents and for many couples the computation of the individual net earnings will proceed in the same way as presented in equations 1 and 8. For couples this will be the case when only one partner in couples has income from earnings and the other partner has no other income which is subject to income tax. In these cases the tax schedule will of course take into account the splitting element, but apart from that the allocation of the tax is straightforward. In cases of couples where either both partners have income from earnings, or there are other incomes in the family which are subject to income taxation we "individualise"

income taxation of earnings in the following way.[19] First family level taxable incomes are computed in two scenarios, with and without permanent earnings incomes:

$$\psi^1_{fj} = (\omega_{mj} + \Phi_{mj} + \omega_{wj} + \Phi_{wj}), \tag{9}$$

and

$$\psi^2_{fj} = (\Phi_{mj} + \Phi_{wj} | \omega_{mj} = 0, \omega_{wj} = 0), \tag{10}$$

where ψ^1_{fj}, the overall tax bill of family j, is computed included the reported earnings of the two partners and ψ^2_{fj} assuming the earnings are zero. For each of the two measures of taxable incomes we first subtract the revenue costs for those partners who are employees (conditional on having employment income). Then an appropriate applicable tax rate is chosen by applying the tax schedule to half of the sum of partners' incomes (given the income splitting formula). This tax rate is then applied to each of the taxable incomes (reduced by the value of the individual revenue cost) and in this way the so-called "due tax" is computed. Following this we subtract the universal tax credit from individual "due taxes". In the first step the full value of the universal tax credit is allocated to each of the two partners. In the second step if any of the universal tax credits - due to low levels of taxable income of one of the partners - are left unclaimed, they are transferred to the partner with higher taxable income to be subtracted from the taxable income of that partner. Income tax *on earnings* at individual level is calculated by subtracting individual income taxes using ψ^1_{fj} from individual taxes using ψ^2_{fj}. The values thus calculated ($IT^0_{mj}(\Omega_{mj})$ and $IT^0_{wj}(\Omega_{wj})$) constitute individual incomes taxes before the payment of health insurance, i.e. correspond to $IT^0_i(\Omega_i)$ from equation 8.

Health insurance is computed on individual level and separately on each source of taxable income.[20] Generally the HI is computed in the following way. Focusing for the moment on income from earnings, if the amount of income tax due ($IT^0_i(\Omega_i)$, i.e. prior to subtracting the HI credit) is less than 7.75% of taxable income, then the individual pays health insurance (to the National Health Fund) at the level equivalent to the total amount of income tax due, and as a result pays no income tax to the fiscal authorities (i.e. $HI^{NFZ} = IT^0_i(\Omega_i)$ and $IT^F_i = 0$). Once income tax due exceeds 7.75% of taxable income, then any income tax above that needs to be paid to the fiscal authorities ($IT^F_i > 0$), and at the same time individuals pay the part of HI which does not count as a tax credit (up to the value of 8.5% of taxable income).

[19] We are grateful to Lidia Kuleta for clarifying to us the practical details of income tax calculation.
[20] The only exceptions are income from rent and investment incomes.

In most cases the amount of income tax $IT_i^0(\Omega_i)$ will exceed the 8.5% of taxable income from earnings, and in the case of two earner couples this holds in general for both partners (once we allocate individual incomes taxes, $IT_{mj}^0(\Omega_{mj})$, and $IT_{wj}^0(\Omega_{wj})$).

It is only after health insurance payments are deducted and there is still income tax to pay that the child tax credit (in the simulation of the reform) affects the amount of tax paid. For couples we proceed with the application of the child tax credit in the same way as int he case of the universal tax credit, i.e. first divide the total tax credit available to a couple by two, and then if some of it remains unclaimed by one of the partners it is "transferred" to the other.

The expression for net income from equation 1 can be generalised to refer only to income from permanent employment as:

$$\Psi_{i,e} = \Omega_{i,e} - SSC_{1i,e} - SSC_{2i,e} - HI_{i,e}^{NFZ} - IT_{i,e}^{F}. \tag{11}$$

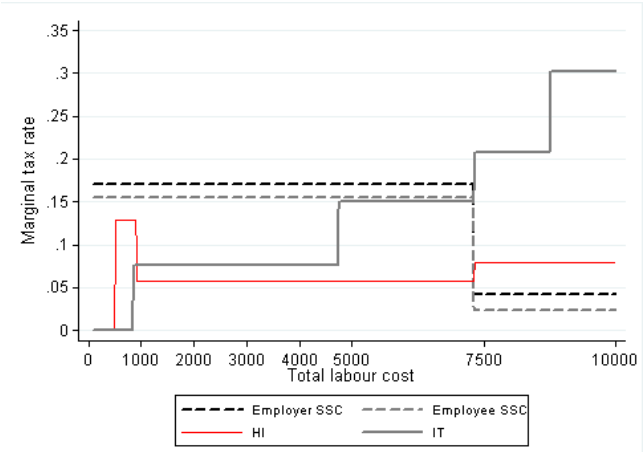
where:

- $\Psi_{i,e}$ is additional net income resulting from employment,
- $\Omega_{i,e}$ is the total employment labour cost,
- $SSC_{1i,e}$ and $SSC_{2i,e}$ are social security contributions paid on employment income,
- $HI_{i,e}^{NFZ}$ is total health insurance paid to the NFZ on employment income,
- $IT_{i,e}^{F}$ is total individual level income tax paid to fiscal authorities on employment income.

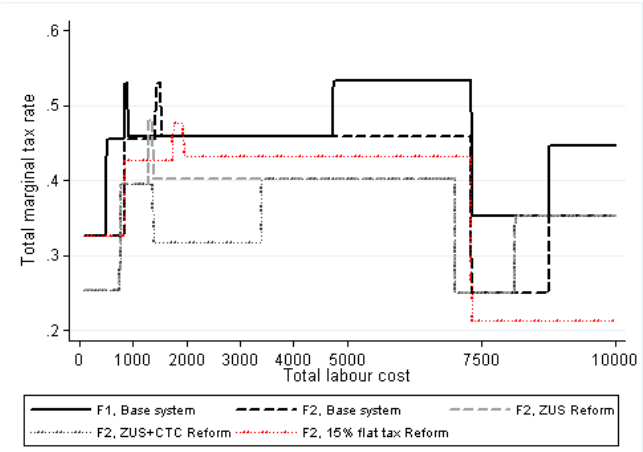
Appendix B - Figures and Tables

Figure 1: Marginal tax rates implied by the Polish tax system

1A - Specific MTRs: single, no children



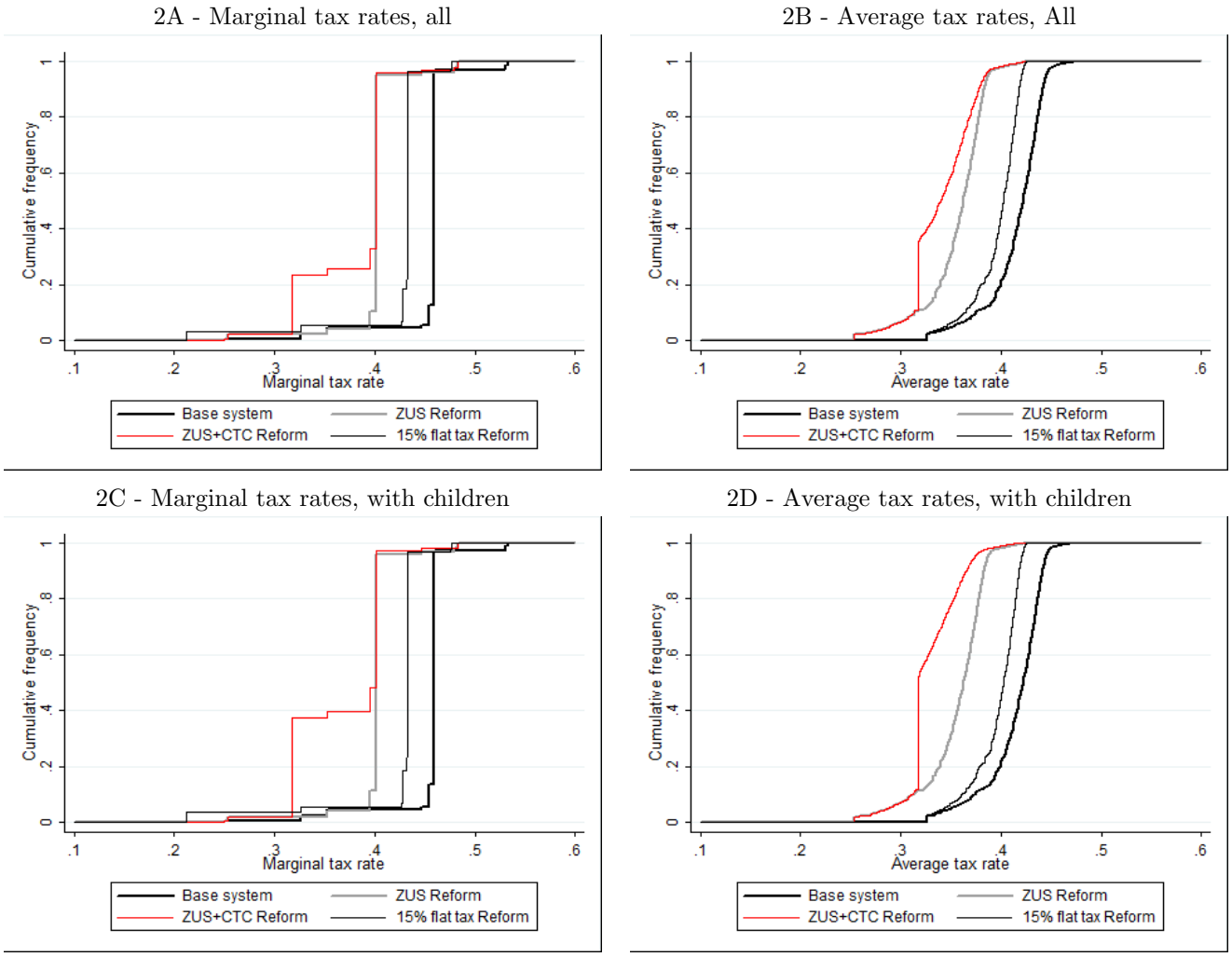
1B - Total MTRs: by family type



Note: In Figure 1B, F1 refers to single person without children, and F2 to one earner couple with two children (second partner assumed to have no income subject to SSCs or income tax).

Source: Authors' calculations using SIMPL microsimulation model.

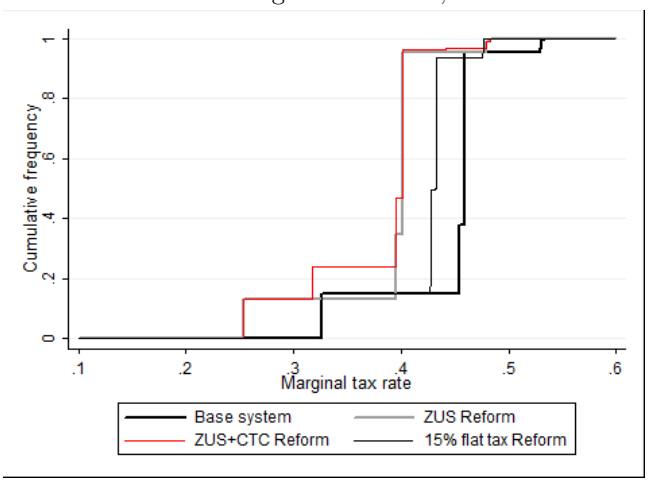
Figure 2: Marginal and average tax rates of working individuals - base and reform systems



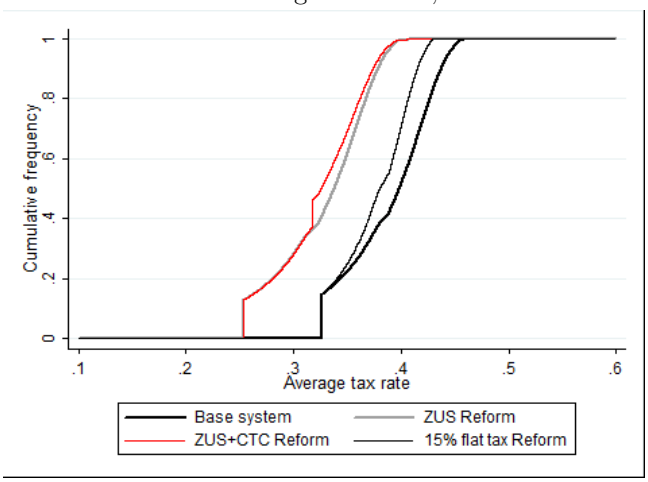
Source: Authors' calculations on the basis of BBGD 2005 data using the SIMPL micro-simulation model.

Figure 3: Marginal and average tax rates of non working "first earners" - base and reform systems

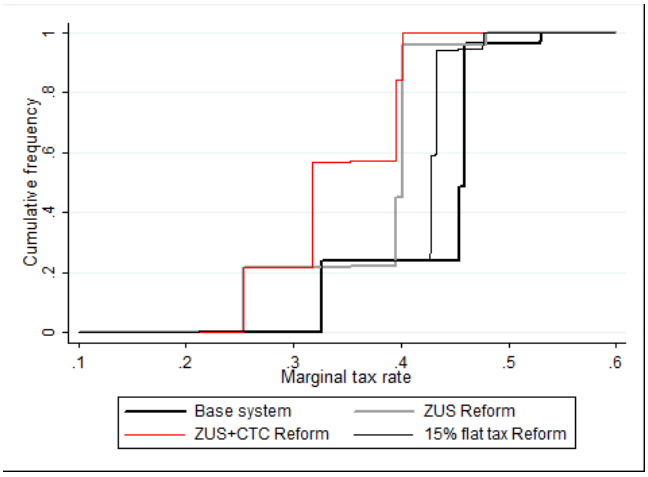
3A - Marginal tax rates, all



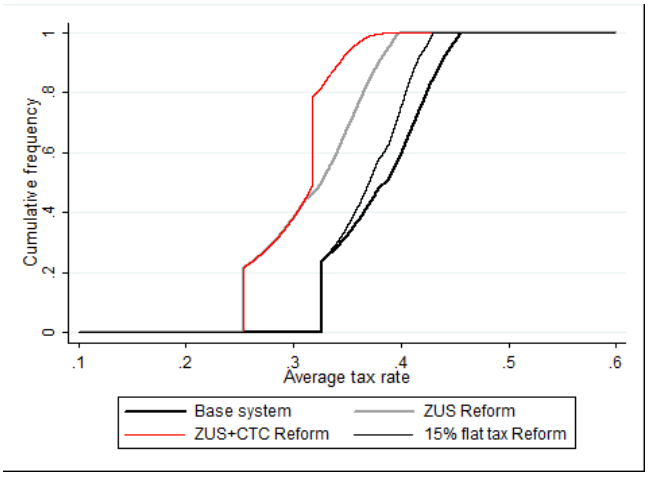
3B - Average tax rates, All



3C - Marginal tax rates, with children



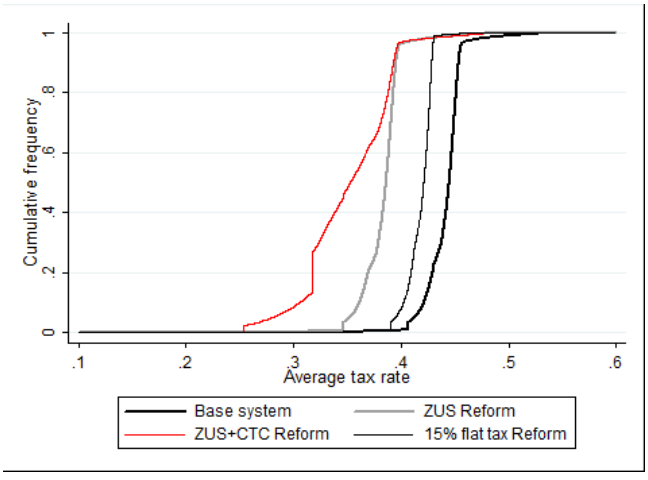
3D - Average tax rates, with children



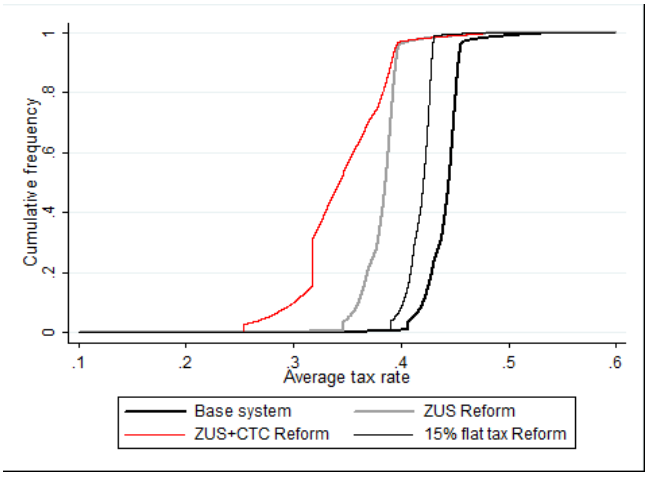
Source: Authors' calculations on the basis of BBGD 2005 data using the SIMPL micro-simulation model.

Figure 4: Average tax rates of non working "second earners" - base and reform systems

4A - Average tax rates, all



4B - Average tax rates, with children



Source: Authors' calculations on the basis of BBGD 2005 data using the SIMPL micro-simulation model.