18th AMSE Applications of Mathematics and Statistics in Economics
International Scientific Conference | Jindřichův Hradec, 2-6 September 2015

LOSSES AND PROFITS ON THE CHILD TAX CREDIT IN THE POLISH TAX SYSTEM

EDYTA MAZUREK
Wrocław University of Economics, Faculty of Management, Computer Science and Finance, Department of Statistics, Komandorska Street 118/120, 53-345 Wrocław, Poland
email: edyta.mazurek@ue.wroc.pl

Abstract
Since 2007 a child tax credit, used by almost 17% of taxpayers, has been in effect in the Polish tax system. It is one of the applicable tax reliefs with the greatest financial impact. It unquestionably represents a considerable aid to families with several children, which is of great importance taking account of the demographic problem faced by Poland. Starting from 2012 the child tax credit has been successively modified. The main purpose of the article is the statistical analysis of the consequences of changes introduced to the child tax credit such as the state budget revenue from personal income tax and the progressivity of the tax system, the level of income redistribution, and the tax fairness consisting in preserving the ranking of taxpayers in terms of their earned income before and after taxation.

Key words: *personal income tax, statutory tax rate, child tax credit, the progressivity index, tax fairness.*

1. Introduction

The demographic problem, which consists not only in unfavourable changes in the population structure in terms of age, but also in the declining fertility rate, currently affects numerous countries, including Poland. As observed since 1992, the fertility rate in Poland has not guaranteed the simple replacement of generations (RocznikDemograficzny, 2013). In the context of demographic threats it is crucial to implement the appropriate pro-family policy, and the more so, since demographers forecast the further escalation of these tendencies, which can lead over time even to the phenomenon of depopulation, with all its adverse consequences for the society (Kochanowski, 2009; Palley andShdaimah, 2011).

Financial issues are pointed out as one of the main reasons for a low or negative population growth rate. The observation of the fertility rate among our emigrants confirms that economic factors cause a reduction in the fertility rate.

In Poland numerous families with several children are exposed to poverty (NaszDziennik, 2014). The President of the Republic of Poland is trying to solve the demographic problem considering the withdrawal of the possibility of joint tax returns for married couples and replacing it with a personal allowance (tax-free income), which depends on the number of children being brought up in the family (gazetaprawna, 2013; wywiad, 2013). However, at present, the demographic problem in Poland, which consists in the declining fertility rate, is solved by the child tax credit, called also the family tax credit. Since its onset the relief is subject to continuous modifications. The purpose of the article is the statistical analysis of the consequences of changes introduced to the family tax credit for the basic characteristics of the system. The analysis will be conducted on the basis of real data concerning the revenue of taxpayers filing a joint tax return in the selected tax office in Wrocław.

2. Family tax credit in the Polish tax system

The demographic problem in Poland inclined the government to introduce a new tax relief, a family tax credit, in 2008, applicable to tax returns filed for 2007. It is the most frequently used relief. In 2013, 16.52% of all taxpayers in Poland were eligible for the child tax credit. In the years 2007-2012 the relief consisted in deducting the relevant amount per child from the income tax already reduced by health insurance contributions. The level of the relief for respective family types in the years 2007-2012 is presented in Table 1.

Table 1.Amount of the family tax credit depending on the number of dependent children.

Tax year	Amount of the relief for families with			
	1 child	2 children	3 children	4 children
2007	$2 \cdot 572.54 = 1145.08$	$2 \cdot 1145.08$ 2290.16	$3 \cdot 1145.08$ 3435.24	$4 \cdot 1145.08$ 4580.32
2008	$2 \cdot 586.85 = 1173.70$	$2 \cdot 1173.70$ 2347.40	$3 \cdot 1173.70$ 3521.10	$4 \cdot 1173.70$ 4694.80
2009-2012	$2 \cdot 556.02 = 1112.04$	$2 \cdot 1112.04$ 2224.08	$3 \cdot 1112{,}04$ 3336.12	$4 \cdot 1112.04$ 4452.16
2013	$2 \cdot 556.02 = 1112.04$	$2 \cdot 1112.04$ 2224.08	2224.08+1668.12 3892.20	3892.20+2224.08 6116.28
	Eligibility: families with one child, if the couple's income is not higher than PLN 112000. families with two or more children, irrespective of the income level.			
2014	$2 \cdot 556.02 = 1112.04$	$2 \cdot 1112.04$ 2224.08	2224.08+2000.04 4224.12	4224.12+2700 6924.12
	Eligibility: families with one child, if the couple's income is not higher than PLN 112000. families with two or more children, irrespective of the income level. right to claim a refund on account of the unused tax relief.			

Source: Own calculations.

In the years 2007-2012, under the family tax credit a taxpayer was entitled to deduct an identical fixed amount per each child, own or adopted one, brought up throughout the tax year. The tax relief is applicable to children below 18 years of age, children, regardless of their age, who, pursuant to separate provisions, were receiving the disability living allowance and children in education below 25 years of age. The child tax credit is a parental relief, i.e. in the case where both parents bring up a child they have one tax relief, in the above-mentioned amount. The amount of the family tax credit is deducted from the computed tax, so this solution is highly favourable for taxpayers. The final amount to be deducted is determined by the number of dependent children of the taxpayer. However, the income earned by the taxpayer had to be high enough to enable the taxpayer to make use of this relief, as in the case of low incomes the major part of tax due is used for the deduction of health insurance contributions.

Changes in the family tax credit started in the year 2013. Since 2013, as a result of amendments to the Act on Personal Income Tax, the rules for making use of the family tax credit have changed significantly. Parents having three or more dependent children have become entitled to a higher amount of the relief, whereas the eligibility of parents having one dependent child has been restricted, by the introduction of the income cap. Parents with one child could make use of the family tax credit if their joint income did not exceed PLN 112000 on an annual basis. The same restriction was applicable to a single parent. In the case of the person who was not married and did not bring a child on his or her own the income cap in the tax year totalled PLN 56000. The amount of the relief for respective families in 2013 is presented in Table 1.

In 2014, in comparison with the preceding year, the amount of the relief for the third and each subsequent independent child raised in the family was increased. In addition, the possibility of claiming a refund for the unused relief was introduced, in the case where the tax due is lower than the amount of the relief. In the previous years the tax relief not used in a given year could not be carried forward and it was not possible to use it when the tax due was lower than the applicable relief.

The changes introduced to the tax system and effective from 2014 are highly favourable for families having dependent children, and with several children in particular. The child tax credit is the most popular relief in the present tax system. In the years 2007-2013 from 16.43 to 18.07% of all taxpayers made use of it (see Table 2).

Table 2.Selecteddata related to the child tax credit in Poland in 2007-2013.

	Tax year						
	2007	2008	2009	2010	2011	2012	2013
Percent of taxpayers making use of the relief [%]	16.43	17.21	17.77	17.52	17.94	18.07	16.52
Average amount deducted per child [PLN]	903	951	898	904	912	924	949
Average amount deducted per taxpayer [PLN]	1367	1437	1299	1321	1315	1315	1374

Source: Own work on the basis of the publication: Informacja dotycząca rozliczenia podatku dochodowego..., Warszawa 2007-2013.

It could be observed that the introduction of the enlarged amount for the third and each subsequent dependent child in 2013 significantly increased the average amount deducted per child. The information about the data in the tax year 2014 is not available yet, but it can be presumed that the average will increase again. The concurrent introduction of the restriction consisting in establishing the income cap for families with one dependent child only resulted in the reduction in the number of taxpayers eligible for the discussed family tax credit, from 18.07 to 16.52% of all taxpayers.

3. The Methodology

The comparison of child tax credits consisted in the assessment of predefined scenarios with respect to the state budget revenue from personal income tax, the progressivity of the tax system, the level of income redistribution through the tax system and the tax fairness, which consists in retaining the ranking of taxpayers in terms of their income before and after taxation. For the above purpose, apart from basic descriptive statistics, the following were used: the Kakwani progressivity index, the redistribution index and the Atkinson-Plotnick index.

3.1. The Kakwani progressivity index

The Kakwani progressivity index (Kakwani, 1977, 1987) is defined as the difference between the concentration coefficient for taxes $(D_T)$and the Gini coefficient for gross income (G_X):

$$\Pi^K = D_T - G_X \,. \tag{1}$$

The values of this index fall within the range $\Pi^K \in [-1-G_X, 1-G_X]$. Positive values of the index, $\Pi^K > 0$, represent the progressive tax system. For the proportional system the value is $\Pi^K = 0$. The regressive tax system is described by negative values of the index, $\Pi^K < 0$. The values of the Π^K index can be interpreted as the percentage of overall tax burden that has been transferred from low-income groups to high-income groups, as a result of the progression of the tax system.

3.2. The redistribution index

The redistribution index, *RE*, is defined as follows:

$$RE = G_X - G_Y \,, \tag{2}$$

where G_X is the Gini coefficient for income distribution before taxation, while G_Y stands for the Gini coefficient for income distribution after taxation.

The Gini coefficient is reduced by modest income transfers from the wealthiest individuals to the poorest ones. Furthermore, the Gini coefficient is not sensitive to the size of incomes of individuals between whom the transfer is made, whereas it is sensitive to the difference in the ranks of individuals between whom the transfer is made. Owing to this property, the Gini coefficient can be used as a measure for levelling out inequalities in the society, resulting from the progressive income taxation. Taking into account that the Gini coefficient measures the inequality of incomes resulting from the progressive taxation in relation to the proportional taxation of the same incomes, the *RE* index is a measure of the effect of redistribution of the progressive taxation as opposed to the proportional taxation. Its role it to assess the extent to which a relatively equal income after proportional taxation is redistributed from the rich to the poor as a result of progressive taxation.

3.3. TheAtkinson-Plotnick index

When the progression of the tax system is too strong, unfair taxation can occur, consisting in the changed ranking of taxpayers, with respect to their affluence, before and after taxation. The change in the ranking of taxpayers can be quantified by means of the following Atkinson-Plotnick measure (Atkinson, 1980;Plotnick, 1981):

$$R^{AP} = G_Y - D_Y \,. \tag{3}$$

The Atkinson-Plotnick index assumes the values in the range $[0,2G_Y]$. If every taxpayer holding the r position in the ranking, with respect to income before taxation, retains this position also after taxation, the value of R^{AP} index will be zero. The more changes are caused by the progressivity of the system in the taxpayers' ranking with respect to income before and after taxation, the larger is the value of R^{AP} index.

4. Results of the analysis

It was mentioned earlier, the main purpose of the article is to analyse the impact of amendments to the Act on Personal Income concerning the child tax credit on the state budget revenue from personal income tax and on the basic characteristics of the tax system. The research was conducted on real data concerning the gross income of the taxpayers who filed joint tax returns with one of the tax offices in Wrocław. Three income tax scenarios were applied to real data. Each scenario was based on the thresholds and social insurance contributions applicable for tax returns for the year 2014. The scenarios differed by the application of three child tax credits, being in effect in 2012, 2013 and 2014, respectively.

The studied population comprised 17165 married couples, i.e. 34330 taxpayers. The structure of married couples filing joint tax returns with respect to the number of children for whom the tax relief was claimed is presented in Table 3.

Table 3. Structure of taxpayers having dependent children and filing joint tax returns.

Number of dependent children	Number of married couples	Percentage
0	9324	54.32
1	4862	28.32
	4098 (eligible for the child tax credit in 2013 and 2014)	
2	2597	15.13
3	332	1.93
4	41	0.24
5	8	0.05
10	1	0.01
Total	17165	100%

Source: Own calculations on the basis of the data obtained from the Tax Office.

Taking account of investigated issues, the conducted research is limited to married couples filing joint tax returns with the selected tax office. The number of dependent children means the number of children for whom taxpayers are eligible for the tax relief on account of their up-bringing. The family thus defined will be referred to as a tax family. It does not mean that the analysed couples do not have more children. However, this information is irrelevant for the results of the conducted analysis.

Among the analysed taxpayers bringing up children families with one child only are prevalent. Such families represent over 28% of the studied population. Two dependent children are raised in 15.13% of the studied families and as little as 2.23% of the tax families bring up three or more children.

In 2013 the income cap was introduced for the first time. When the cap is exceeded, tax families having one dependent child are no longer eligible for the child tax credit.

Therefore, the number of taxpayers eligible for this relief totalled 34330 in 2012, whereas in the years 2013-2014 it was 32802.

Table 4 presents the reduction in tax, as a percentage, resulting from the applicable child tax credit.

Table 4. Comparison of tax losses due to the applicable child tax credit.

Year when the child tax credit was in effect	Tax due as a percentage of tax computed without relief [%]	Effective tax rate for tax computed without the relief [%]	Effective tax rate for tax computed with the relief [%]
2012	92.8	13.83	12.84
2013	93.0	13.83	12.86
2014	92.7	13.83	12.83

Source: Own work on the basis of the adopted scenarios of the applicable child tax credit.

The tax relief in effect in 2012 caused a reduction in the theoretical tax, computed without the applicable tax relief, by 7.2 %. The introduction of the income cap in 2013, with the concurrent increase in the child tax credit for the third and each subsequent dependent child raised in the family, reduced the computed tax without the applicable tax benefit by only 7%. The possibility of claiming a refund of the tax relief not used because of the low computed tax, introduced in 2014, with the concurrent increase in the tax relief for the third and each subsequent dependent child reduced the state budget revenue to the level of 92.7% of the tax computed without the tax relief. The lowest effective tax rate was also recorded in the case of the tax relief in effect in 2014.

Table 5. Selected characteristics of the tax system as a function of the applicable child tax credit.

Year when the child tax credit was in effect	Π^K	$RE \times 100$	R^{AP}
2012	2.87	1.44	1.46
2013	2.94	1.48	1.50
2014	3.04	1.53	1.55

Source: Own work on the basis of the adopted scenarios of the applicable child tax credit.

The further changes in the Act on Personal Income Tax, related to the child tax credit, had a favourable impact on the characteristics of the tax system. Year by year the social stratification was increasingly levelled out (see Table 5). Inequalities in the income distribution were reduced by 0.0144 with the child tax credit effective in 2012, whereas the changes in this tax relief introduced in 2014 reduced income inequalities in the society by 0.0155. The Kakwani progressivity index also evidences the favourable influence exerted by tax relief modifications on the progression of the tax system. The value of Π^K index means that as a result of modifications to the tax relief an increasing percentage of overall tax burden was transferred from low-income taxpayers to the high-income ones. However, an increase in progression has translated into an increase in the Atkinson-Plotnick index, informing about the level of tax unfairness, caused by the re-ranking of taxpayers, with respect to their income before and after taxation.

5. Conclusions

The income cap introduced in 2013, above which the taxpayers with one dependent child lose their entitlement to the tax relief, caused that 15.7% of the studied married couples with one dependent child ceased to be eligible. These changes, in comparison with the preceding year, caused a slight increase in the state budget revenue, despite the fact that the amount of the child tax credit for the third and each subsequent dependent child was higher. After the changes introduced in 2013 the state budget revenue increased from 92.8% of the tax computed without the tax relief to 93%. With the child tax credit in effect in 2014, when the possibility of claiming a refund for the tax relief not used because of the low computed tax was introduced, concurrently with an increase in the amount of the tax relief for the third and each subsequent child, the state budget revenue recorded the lowest level and represented 92.7% of the tax computed without the tax relief. Subsequent modifications to the child tax credit had a favourable impact on the levelling out of the income stratification in the society and on the progression of the tax system. The changes implemented in 2014 reduced income inequalities by 0.0155%. However, the strengthened progression has led to the occurrence of a higher level of tax unfairness, consisting in the re-ranking of taxpayers with respect to their affluence before and after taxation. On the basis of the drawn conclusions it is planned to conduct further research using the method proposed by Monti, Pellegrino and Vernizzi (Monti et al. 2015)to identify in detail the issue of taxation unfairness, in order to propose modifications to the tax relief aimed at making the tax system more fair. It is also planned to test changes in tax progressivity before and after tax reform using the method proposed by Bishop (Bishop et al., 1998).

Acknowledgements

The author is grateful to an anonymous referee for their constructive comments and suggestions. Any errors are solely those of the author.

References

1. ATKINSON, A.B. 1980. Horizontal Equity and the Distribution of the Tax Burden.In: AARON H.J. AND BOSKINS M.J. 1980. (eds.) The Economics of Taxation, Washington D.C., Brookings, 1980, pp. 3-18.
2. BISHOP, J.A., FORMBY, J.P., ZHENG, B. 1998. Inference tests for Gini-Based Tax Progressivity Indexes. In Journal of Busines& Economic Statitics, 1998, vol. 16, iss. 3, pp. 322-330.
3. http://www.gazetaprawna.pl/artykuly/707451,prorodzinna_propozycja_komorowskiego_ mozna_zlikwidowac_ulge_podatkowa_malzenstw.html. [cit.01-12-2013].
4. http://www.radio.opole.pl/2013/wrzesien/wiadomosci/bronislaw-komorowski-o-wsparciu-rodziny-wywiad-dla-radiaopole.html.[cit.06-12-2013].
5. Informacja dotycząca rozliczenia podatku dochodowego od osób fizycznych za rok 2007-2013, Ministerstwo Finansów, Department Podatków Dochodowych, Warszawa 2008-2014.
6. KAKWANI, N. C. 1977. Measurement of Tax Progressivity: An International Comparison. In The Economic Journal, 1977, vol. 87, pp. 71-80.
7. KAKWANI, N. C. 1987. Measures of tax progressivity and redistribution effect-A comment. Public Finanse-Finances Publiques, 1978, vol. 42, pp. 431-437.

8. KOCHANOWSKI J. 2009.Przesłanki Tworzenia strategii polityki rodzinnej, w: B.Balcerzak- Paradowska, J.Szymborski (red.), Polityka rodzinna w krajach Unii Europejskiej - wnioski dla Polski, Biuletyn RPO- MAT. Nr 67 Zeszyty Naukowe, Biuro Rzecznika Praw Obywatelskich, Warszawa 2009.
9. MONTI M. G., PELLEGRINO S., VERNIZZI A. 2015. On Measuring inequality in Taxation Among Groups of Income Units, Review on Income and Wealth, 2015, vol. 61, iss. 1, pp. 43-58.
10. Nasz Dziennik, środa 4 czerwca 2014, Nr 128. http://www.naszdziennik.pl/wp/79232,wielodzietni-za-burta.html [cit. 04-06-2014].
11. PALLEY E., SHDAIMAH C. 2011. Child care policy: A need for greater advocacy. Children and Youth Services Review, 2011, 33, pp. 1159-1165.
12. PLOTNICK R. 1981. A measure of horizontal of inequity. Review of Economics and Statistics, 1981, vol. 63, pp. 283-288.
13. RocznikDemograficzny 2013, GłównyUrządStatystyczny, Warszawa 2013.
14. Ustawaz dnia 26 lipca 1991 r. o podatku dochodowym od osób fizycznych – tekst jedn. Dz. U. z 2000 r. Nr 14, poz. 176 z późn. zm.