FERTILITY EFFECTS OF THE FAMILY TAX BREAK EXTENSION IN HUNGARY

By

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Abstract

This thesis examines the short-run effects of the 2011 family tax break extension on fertility outcomes in Hungary, which introduced large-scale tax base deductions for families with children. I identify causal effects by exploiting exogenous variation in the tax break from two sources: the number of children due to the structure of the policy, and the level of family income due to the condition of non-negative taxes, which constrains lower income families from claiming the full amount of the deductions. I construct an aggregate panel dataset of family types grouped by the demographics of the parents, geography and birth order of the child for years 2008-2013, with cells containing the number of births dated back to conception, average family incomes, personal income taxes and family tax breaks. I estimate the fertility effects of the policy in a quasi-experimental design and find that the average increase in the tax break increment for an additional child led to an around 2% increase in the number of births. The effects are heterogeneous across subgroups; the results are mostly driven by third-born children, the highest income quartile and mothers with tertiary education. The results are corroborated by several specifications and other robustness checks. Depending on the specification, around 6,000 to 18,000 additional newborns were conceived in total between 2011 and 2013 due to the policy change.

JEL Classification: J13, H24, I38

Keywords: family tax break, fertility, personal income tax

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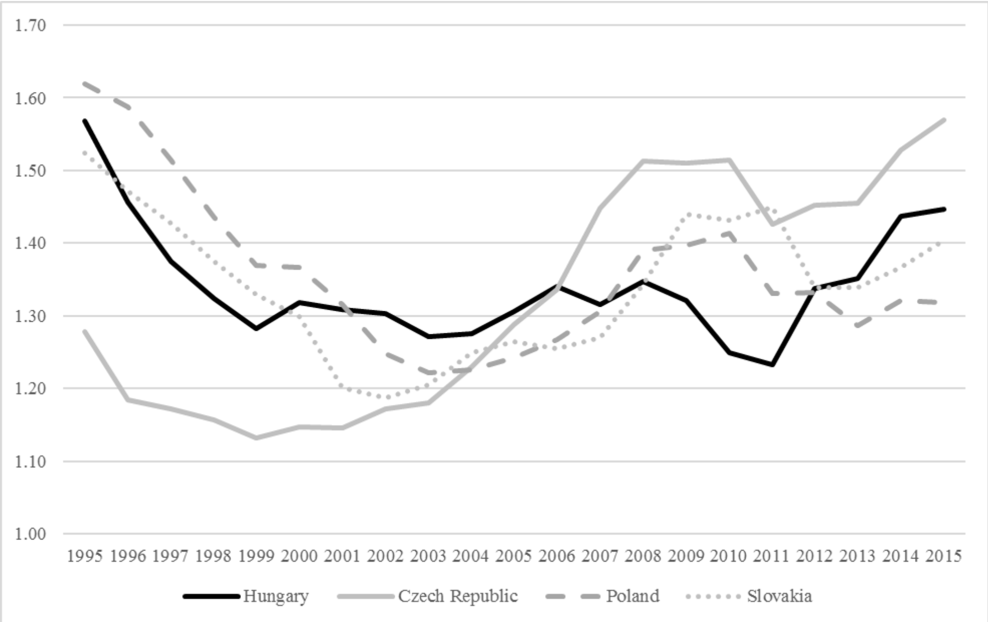
1. Introduction

European societies have faced declining fertility rates over the last two decades. Most European countries have been below the 2.1 total fertility rate per woman necessary to sustain the current size of the population (Eurostat, 2017). Figure 1 shows the total fertility rate in Hungary and other comparable countries in Central Eastern Europe, 1995-2015. We can see the secular decline in Hungarian fertility (Spéder & Kamarás, 2008), which reached its minimum in 2011.

To promote births and help families the Hungarian government introduced a large-scale extension of the family tax break in 2011 (Act CXXIII of 2010), allowing generous tax base deductions based on the number of dependent children. As Figure 1 shows, the total fertility rate of Hungary turned in 2011 while the other countries in the region exhibited different patterns, suggesting that family policies could have influenced fertility (Frejka & Gietel-Basten, 2016).

FIGURE 1 – TOTAL FERTILITY RATE IN CENTRAL EASTERN EUROPE, 1995-2015



Source: Eurostat (2017)

This thesis examines the short-run effects of the 2011 family tax break extension on the number of live births in Hungary. I identify causal effects by exploiting exogenous variation due to the structure of the policy and the condition of non-negative tax bases. The policy has introduced different increments in the family tax break starting at the third child, allowing larger tax base deductions per child; while the condition of non-negative taxes constrain poorer families from claiming the full amount of the financial assistance. This creates exogenous variation amongst families with similar number of children and different levels of income, and amongst families with similar income but different number of children.

I estimate regression difference-in-differences models based on an aggregate panel dataset of family types, with cells grouped by the demographics of the parents, geography and birth order of the child for years 2008-2013. The cells contain the aggregate number of births dated back to conception, average family incomes, personal income taxes and family tax breaks based on the databases of the Live Birth Records and the 2011 Census provided by the Hungarian Central Statistical Office, and the NLO Wage Survey provided by the Databank of the Hungarian Academy of Sciences.[1]

In the main specification I regress the log number of births on the family tax break increment for an additional child, controlling for the base level of the family tax break without an additional child, gross family income and personal income taxes of the family along with individual and time fixed effects. I find that an around 100,000 HUF (≈350 USD)[2] increase in the family tax break increment for an additional child led to an around 2% increase in the expected number of births for the entire population (significant at the 1% level). The fertility effect is heterogeneous across demographic groups: the results are mostly driven by third-born children, higher income families, mothers with tertiary education, and mothers above age thirty. The results pass several robustness checks of different specifications, definitions and samples.

[1] I am grateful to the Hungarian Central Statistical Office, and the Databank of the Centre for Economic and Regional Studies, Hungarian Academy of Sciences for providing the databases, with special thanks to Melinda Tir and Tibor Czeglédi for the administrative assistance.

[2] I also indicate the nominal values in United States Dollars using exchange rates of 1 USD = 284 HUF, as of May 14th, 2017 (Hungarian National Bank http://mnb.hu/arfolyamok, accessed May 14th, 2017).

Depending on the specification, the estimated number of additional newborns due to the policy change ranges from around 6,000 to around 18,000 in total over the three-year period of 2011-2013.

Most papers in the literature studying fertility effects of tax policies tend to assume that the benefits or tax deductions are fully claimed, and calculate their values by taking the product of the tax base and the marginal tax rate (Gauthier, 2007). This thesis takes the tax regulations seriously and accounts for all relevant tax conditions, making the contribution unique in that regard. The change in the level of the tax break was also of considerable size which enables studying different subgroups and magnitudes of the family tax break. However due to recentness of the policy I cannot determine whether the changes affect completed fertility or only the timing of births.

The structure of the thesis is as follows. In Chapter 2 I describe the context of the Hungarian family tax break by briefly reviewing the literature, explaining the structure of the policy, introducing the family support system, and discussing other changes in personal income taxation. In Chapter 3 I describe the data while I argue for the chosen empirical strategy, present the results, test their robustness, and examine different policy scenarios in Chapter 4. In Chapter 5 I summarize my findings and conclude.

2. Context

2.1. The Effect of Taxation and Child Benefits on Birth Outcomes

2.1.1. Theoretical Background

Standard economic theory of the family (Becker & Lewis, 1973, Becker, 1993) models fertility decisions as a utility maximizing family choosing over the number of children, the quality of children (e.g. education and health) and the consumption of market goods, with children "produced" using market goods and time of the mother. Children are considered normal goods and their demand is governed by parental income, relative prices of these factors and the fixed cost of children. Thus, the demand for children is tightly connected to labor supply decisions of women. While in general more income leads to more demand for children, higher salaries for women increase the opportunity cost of rearing children which in turn decreases fertility, so child transfers might only lead to an increase in "quality" not "quantity" amongst middle or higher income women.

As for the exact setting of the Hungarian family tax break, I did not find a theoretical model incorporating simultaneously a jump in the tax break based on the number of children and non-negative tax deductions. Nevertheless, there are relevant studies shedding light on some aspects of the policy, suggesting that the introduced generous tax deductions – at least amongst families with stable income – would encourage fertility. Based on the Beckerian setting, Cigno (1986) builds a model of fertility incorporating different taxes and child benefits. He shows that higher income taxes affecting the wife more, or the parents similarly, encourage fertility; while those which prominently affect the father discourage it. He also points out that even though child benefits increase fertility, they might decrease quality. Fraser (2001) adds stochastic components to the framework and examines children as irreversible but risky commitments. He shows that decreased risk also increases the demand for children, with child transfers being more effective than income taxes for governments to share this risk and help fertility. Finally, the work of Meier and Wrede (2013) imply that joint taxation alone encourages fertility.

2.1.2. General Lessons of the Empirical Literature

Review articles surveying empirical studies about the effects of family policies on fertility report mostly positive or neutral effects with varying magnitude across studies and methodologies, emphasizing that the impact is heterogeneous and potentially affects only timing (Gauthier, 2007, Thévenon & Gauthier, 2011). Timing however can also lead to higher fertility in the long-run according to Kalwij (2010), although he finds that it is maternity-leave benefits and childcare subsidies that drive these effects rather than family allowances.

For the purpose of this thesis I group the studies by the type of policy they examine, such as family allowances and child subsidies, tax credits or tax exemptions for dependents; the newly introduced Hungarian policy resembles tax exemptions the most. These policies all provide different incentives for families regarding the fixed cost and opportunity cost of children. Family allowances do not alter net labor incomes directly, affecting only the fixed cost of children, while tax credits and tax exemptions encourage employment by increasing also the opportunity cost of additional children.

2.1.3. Evidence on Family Allowances and Subsidies

Family allowances and subsidies generally provide financial assistance which is not dependent on employment status, although they mostly target poorer households with children. Gábos, Gál and Kézdi (2009) use Hungarian time series data and estimate that an around 1% increase in child benefits increase leads to an around 0.2% increase in total fertility, with increasing magnitude by birth order. Cohen, Dehejia and Romanov (2013) study child subsidies in Israel based on micro panel data and find that an around 1% increase in child benefits raises the probability of being pregnant similarly by around 0.2% with heterogenous effects across religious and ethnic groups. Studying a child transfer program in Québec, Milligan (2005) uses a quasi-experimental approach and finds that an extra 1000 Canadian Dollars leads to a 17% increase in the probability of having a child; however, Parent and Wang (2007) argue based on Census data that the Québec policy affected only timing rather than completed fertility as the cohorts responding more to the incentives had a smaller fertility rate later on.

Some studies present evidence on both fertility and infant health effects. The effects of the 1960's and 1970's Food Stamp Program in the United States are examined by Almond, Schanzenbach and Hoynes (2011) who find no significant effects on natality but do document increased birth weights leading to significant decrease in metabolic syndrome as adults, and better economic self-sufficiency for women (Hoynes, Schanzenbach & Almond 2016).

2.1.4. Evidence on Tax Credits and Tax Deductions

The Earned Income Tax Credit in the United States is one of the most studied regulations concerning effects on fertility, infant health and women's employment. It started in 1975 with the goal of helping poor working families, and has grown to be one of the largest cash antipoverty programs (Hotz & Scholz 2003). Since its establishment it went through several expansions providing researchers opportunities to evaluate its impact (Eissa & Hoynes 2006). Baughman and Dickert-Conlin (2009) study its fertility effects with a quasi-experimental approach and find no statistically significant effects for higher order births and a negative effect for white first births. Hoynes, Miller and Simon (2015) also use quasi-experimental variation to examine infant health outcomes and fertility changes amongst single women, and find significantly lower incidence of low weight births but no effects on the number of births. Brewer, Ratcliffe and Smith (2012) study a similar policy in the United Kingdom and their results suggest that there was no significant effect on single women but an around 15% effect on women in couples.

The closest counterpart in the United States and Canada to the newly introduced Hungarian family tax break is personal exemption for dependents, which earlier papers examined using time series data. In the United States the dependent tax exemption can be used to reduce income tax liabilities by $4,000 (≈1,150,000 HUF) for each dependent (U.S. Tax Center, 2017); this is comparable to the family tax break in Hungary. Whittington, Alm and Peters (1990) find a positive and significant fertility effect of around 2% as a response to a 10% increase in the real tax value of the exemption. Gohmann and Ohsfeldt (1994) find similar results while accounting for abortion availability, but they add that their results vary significantly with the specifications. Zhang, Quan and van Meerbergen (1994) study personal exemption, family allowance and tax credit in Canada; their results show that a 10% increase in total benefits is associated with a small, around 0.5% increase in total fertility rate but ratios between the types of family support are not stable across specifications. Several studies of the earlier time series literature suffer from issues such as inappropriate treatment of non-stationarity or endogeneity of female labor market control variables (Ridao-Cano & McNown, 2005). Crump, Goda and Mumford (2011) revisits Whittington et al. (1990) and points out that those results are especially sensitive to specification and not robust to other benefits.

Microeconometric evidence on personal exemption policies is scarce. Huang (2002) presents evidence from Taiwan based on regional panel data in a fixed effects framework and finds that an around 1000 Taiwan New Dollars (≈35 USD) increase in personal exemptions leads to 1.2-1.4 births per a thousand women. Azmat and González (2010) examine the 2003 Spanish tax reform which introduced tax base deductions and find significant fertility effects of around three births per a thousand women, with less educated and younger women driving the results. In a recent working paper Riphahn and Wiynck (2017) study the 1996 German reforms introducing tax base deduction type child benefits. They do not find any evidence either for less educated couples or first births; however, for second births they detect an around 4.5 percentage points decrease for the less educated, and an around 3.7 percentage points increase for the more educated, implying an around 10-23% effect for the latter.

2.2.Structure of the Family Tax Break in Hungary

Extending the family tax break was a central part of the personal income tax changes in 2011 with the explicit goal of redistributing money towards families who raise children. Public opinion surveys from 2016 show that although only 32% of the 18-50 age group mentioned it spontaneously amongst child benefit policies, 91% claimed to have heard about it after the interviewer had named it (Kapitány, 2015). Since the introduction of the policy the government has also provided information leaflets explaining the regulation (Ministry of National Resources, 2011). These circumstances suggest that the family tax break can be considered well-known to the public, so assuming perfect compliance throughout the thesis should not influence the results meaningfully.

Before 2011 the family tax break was a relatively small allowance with an amount of 48,000 HUF (≈170 USD) a year for each child, accessible only to families with three or more children. The 2011 policy change in Hungary extended the family tax break such that every family became eligible with two main categories (Act CXXIII of 2010):

1. For one and two dependent children, the income tax base can be reduced by 750,000 HUF (≈2,640 USD) a year for each child who is eligible for the family allowance[3].
2. For three or more dependent children, the income tax base can be reduced by 2,475,000 HUF (≈8,710 USD) a year for each child who is eligible for the family allowance.

There is the possibility for a joint claim by the parents; married couples or life partners with common children are eligible for the family tax break together. This means that the tax base deductions apply to the family level income: if one parent does not earn enough to claim the full amount, the rest can be used on behalf of the other parent. It is also worth noting that parents

[3] Family allowance eligibility lasts until the end of the child's education with an upper limit of 20 years of age.

with a fetus at least 3 months old are already eligible for the tax break, so the policy could potentially affect the health of the newborns via this channel as well.

A key characteristic of the new policy is that it decreases the personal income *tax base* of the family unit, which in Hungary cannot be negative. This general rule has far-reaching consequences regarding the actual size of the benefit to families with different levels of income. I call family tax break the amount of money not paid in taxes due to the policy for a given year. Before 2011 it is the value of the smaller allowance, and since 2011 it can be calculated as the product of the actual tax base deductions and the marginal tax break, taking the non-negativity constraint and tax credits also into account.

Table 1 displays some examples of the family tax break at different income levels representing lower, middle and higher income families. The regulation creates a large jump at the third child to the point that families with three children even with an average income do not pay personal income taxes at all. The largest tax break appears in absolute terms for the higher income families; the birth of the third child would result in a total increment of 948,000 HUF (≈3,340 USD) a year. Compared to gross incomes the largest the family tax break increment can be seen for the third child of middle-income families at 15%, but even for high income families the gain is around 11%.

TABLE 1 – EXAMPLES OF THE FAMILY TAX BREAK BY THE NUMBER OF CHILDREN AND INCOME

	Number of children	Gross income of the parents in 2011: 2 400 000	4 800 000	9 000 000
		Tax base of the parents in 2011: 3 048 000	6 096 000	11 430 000
Personal income tax in 2011	0	487 680	975 360	1 828 800
	1	367 680	855 360	1 708 800
	2	247 680	735 360	1 588 800
	3	0	0	640 800
	4	0	0	244 800
The family tax break	1	120 000	120 000	120 000
	2	240 000	240 000	240 000
	3	487 680	975 360	1 188 000
	4	487 680	975 360	1 584 000
The family tax break increment for an additional child	1	120 000	120 000	120 000
	2	120 000	120 000	120 000
	3	247 680	735 360	948 000
	4	0	0	396 000
The family tax break increment for an additional child, as a % of gross income	1	5.00%	2.50%	1.33%
	2	5.00%	2.50%	1.33%
	3	10.32%	15.32%	10.53%
	4	0.00%	0.00%	4.40%

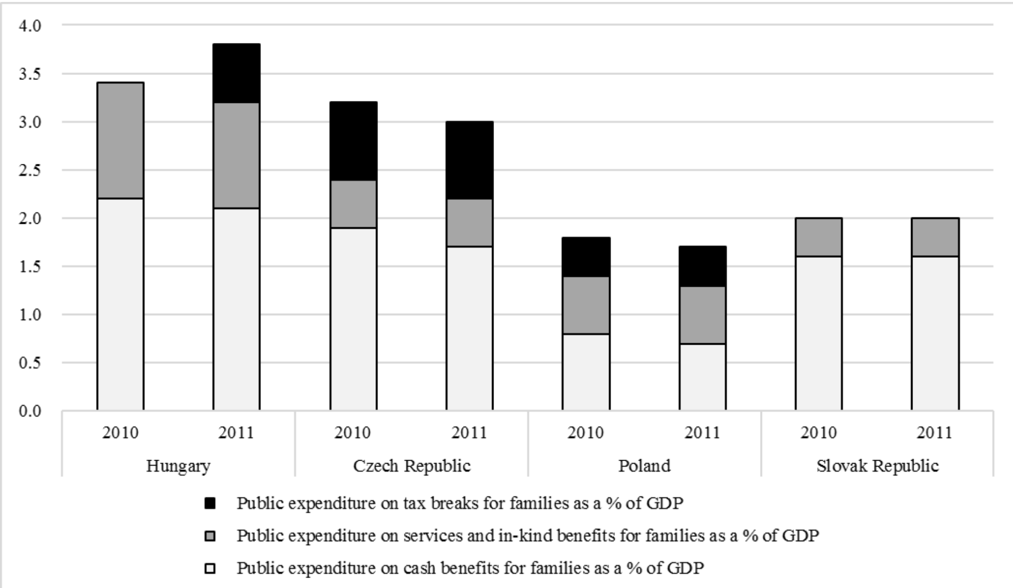
Notes: the author's calculations. The tax base for personal income tax in 2011 was 1.27 times the gross income while the marginal tax break was 16% at all income levels. The family tax break is decreases the tax base of the family unit with a possible joint claim. The actual amount break can be calculated as the money not paid in personal income taxes, taking the non-negativity constraint of tax bases into consideration.

The change in the family tax break introduces exogenous variation along two lines. On the one hand, the tax base cannot turn negative, so not everyone can realize the whole amount of the potential tax deduction. This results in richer families with the same number of children benefitting more in absolute terms than poorer families, as they can claim a larger fraction of the potential tax break. This is especially pronounced from the third child as illustrated by Table 1. On the other hand, the regulation creates differences in the amount of tax break within income groups across families with different number of children, meaning that having a third child compared to a second one has significantly larger incentives.

2.3. The Family Support System in Hungary

The extension of the family tax break should be viewed in the context of the family support system and personal income taxation. Hungary had one of the most generous family support systems of the OECD countries with respect to total public expenditure or length of paid maternity leaves even before the changes in 2011 (OECD, 2017). Figure 2 compares Hungary's total public expenditure on families as a fraction of the gross domestic product, to similarly developed OECD countries in Central and Eastern Europe in 2010 and 2011. We can see that compared to the Czech Republic, Poland and the Slovak Republic, the Hungarian system redistributed more to families even in 2010, with an additional increase of 0.6 percentage points (around 17%) due to the family tax break in 2011. Regarding the length of paid maternity leave, Hungary is also amongst the most generous countries alongside the Slovak Republic, Finland and Estonia, providing three years of paid maternity leave according to OECD (2017).

FIGURE 2 – PUBLIC EXPENDITURE ON FAMILIES AS % OF GDP IN CENTRAL EASTERN EUROPE



Source: OECD Family Database (2017).

I summarize the relevant information about the family support system outside of the family tax break in Table 2 based on Makay (2015). Changes in other parts of the system were minor in the relevant time frame, so the main purpose of this section is to put the scale of the family tax break into perspective. There are elements concentrating on the years just following childbirth while others accompany families until the child reaches adulthood. The most important parts of the short-run financial assistance are the *baby-care allowance* (abbreviated in Hungarian as CSED), the *childcare benefit* (GYED) and the *childcare allowance* (GYES). The baby-care allowance and the childcare benefit are considerably larger than the childcare allowance. They are available to parents with prior employment and comparable in size to previous earnings; while the childcare allowance is provided to mothers who were unemployed prior to childbirth, and comparable only to the minimum old age pension. The most important part of long-run financial assistance is the *family allowance*, divided into two parts – the *childrearing allowance* and the *schooling support* – depending on the child's age. Families of three of more children are also eligible to claim the *childrearing support* with conditions targeting full-time parents.

TABLE 2 – FINANCIAL ASSISTANCE TO FAMILIES IN HUNGARY APART FROM THE FAMILY TAX BREAK

Name	Age of child	Amount	Eligibility
Baby-care allowance (CSED)	0-6 months	70% of previous earnings	Employment prior to childbirth
Childcare benefit (GYED)	6-24 months	70% of previous earnings with upper limit of 1.4 times the minimum wage (in 2013: 1,646,400 HUF a year)	Employment prior to childbirth
Childcare allowance (GYES)[4]	24-36 months if employed 0-36 months if unemployed	statutory minimum of old age pension (in 2013: 342,000 HUF a year)	Universal
Childrearing support (GYET)	3-8 years old	statutory minimum of old age pension (in 2013: 342,000 HUF a year)	Families of three or more children with a parent working ≤30 hours, or from home
Childrearing allowance	0-6 years old	144,000 HUF a year	Child not yet enrolled in education
Schooling support	6-18/20 years old	144,000 HUF a year	Child enrolled in education

Notes: the table shows the most important types of family assistance in Hungary apart from the family tax break, based on Makay (2015, p.60). Information about the minimum wage is available at National Tax and Customs Administration of Hungary (2016), and about the statutory minimum of old age pension at National Labor Service (2014). CSED and GYED are subject to personal income tax, GYES is only subject to a 10% deduction as pension contribution.

[4] For a brief period May 2010-January 2011 GYES was restricted to 2 years but it was quickly abolished.

The long-run types of financial assistance provide a good baseline to evaluate the size of the family tax break. The amount of 144,000 HUF (≈510 USD) a year per child is comparable to the family tax break with less than three children (120,000 HUF, ≈420 USD); however, it is much lower than the potential tax break per child with three children or more, which amounts to 396,000 HUF (≈1,390 USD) creating major additional incentives towards fertility. But as we have already seen in Table 1, this amount can only be claimed fully by parents with a sufficiently high income.

2.4. Changes in Personal Income Taxation

A large-scale overhaul of Hungarian personal income taxation was introduced by Act CXXIII of 2010: along with the family tax break a 16% flat tax rate was introduced instead of the previous progressive taxation, and the 27% temporary tax base addition from the previous year was retrieved. In 2012 the tax base increase applied only to portion of incomes above 2,424,000 HUF, while in 2013 it was abolished. In 2012 the tax credit was also discontinued, which had aided poorer individuals by greatly decreasing their income taxes. These changes alone created major variation in the after-tax incomes of families parallel to the introduction of the family tax break potentially influencing fertility decisions as well.[5]

Table 3 summarizes the evolution of personal income taxes in Hungary 2008-2013. The implications of the 2011 changes in personal income taxation have been assessed by microsimulations (Benczúr et al., 2011, Tóth & Virovácz, 2013). Both studies claim that the tax changes aided richer households while having increased the tax burden of poorer households. Tóth and Virovácz (2013) find that the top income quintile of the population gained the most with 74% of the total estimated 444 billion HUF annual tax cut; although Baksay and Csomós (2014) argue that the effects for poorer households were balanced by the raised

[5] Contributions (e.g. pension, health) form the other major part of the Hungarian tax system but as their amount did not undergo any remarkable changes in the relevant time frame (National Tax and Customs Administration of Hungary 2014), I do not discuss them in detail.

minimum wage and wage growth. These studies suggest that the changes in personal income taxation parallel to the family tax break extension were sizeable, so it is worth controlling for during the analysis as they could have influenced the fertility decisions of families.

TABLE 3 – EVOLUTION OF PERSONAL INCOME TAXATION IN HUNGARY, 2008-2013

Year	Tax base		Personal income tax		Tax credit
2008	gross income		≤1,700,000 HUF	18%	Under 1,250,000 HUF 18% of income with a max. of 136,080 HUF, above 1,250,000 HUF it decreases by 9% to 0
			≥1,700,001 HUF	306,000 + 36% of income above 1,700,000	
2009	gross income		≤1,900,000 HUF	18%	Under 1,250,000 HUF 18% of income with a max. of 136,080 HUF, above 1,250,000 HUF it decreases by 9% to 0
			≥1,900,001 HUF	342,000 + 36% of income above 1,900,000	
2010	gross income * 1.27		≤5,000,000 HUF	17%	Under 1,065,000 HUF 17% of income with a max. of 181,200 HUF, above 1,065,000 HUF it decreases by 12% to 0
			≥5,000,001 HUF	850,000 + 32% of income above 5,000,000	
2011	gross income * 1.27		16%		Under 2,750,000 HUF 16% of income with a max. of 145,200 HUF, above 2,750,000 HUF it decreases by 12% to 0
2012	≤2,424,000 HUF	gross income	16%		-
	≥2,424,001 HUF	gross income * 1.27			
2013	gross income		16%		-

Notes: based on information available on the website of the National Tax and Customs Administration (2016). Tax credit information was collected from guides of the National Tax and Customs Administration (2008-2011).

3. Data

3.1. Data Sources

The ideal way to evaluate such a policy change would be to construct a panel dataset of families containing information about pregnancies, gross incomes and taxes with other covariates potentially influencing fertility decisions. As data of such quality are not available, I construct an aggregate panel dataset of family types for years 2008-2013, to implement a quasi-experimental design comparable to Baughman and Dickert-Conlin (2009) and Hoynes, Miller and Simon (2015).

The observations are defined by the following set of variables corresponding to demographics of the parents, geography and birth order of the child:

- residence (3): Budapest metropolitan area, cities and environs, villages (according to definitions of Hungarian Central Statistical Office, 2014)
- mother's education (4): 0-8 grades, vocational, high school, tertiary
- mother's sector of employment (3): public, private, other (unemployed, on childcare allowance etc.)
- father's education (4): 0-8 grades, vocational, high school, tertiary
- father's sector of employment (3): public, private, other
- mother's age group (2): 20-29, 30-49
- birth order (4): 1,2,3,4

For each family type defined by these variables, the cells contain the aggregate number of births dated back to conception, the estimated average gross incomes, personal income taxes, and family tax breaks for years 2008-2013, with weights corresponding to the frequencies of the family types in the 2011 population of Hungary. To compute these variables, I use three main data sources: the Live Births Records and the 2011 Census provided by the Hungarian Central

Statistical Office, and the NLO Wage Survey database provided by the Databank of the Hungarian Academy of Sciences.

The Live Births Records database (Hungarian Central Statistical Office, 2015) contains information on all individual live birth events in Hungary for the period of 1970-2014. The data are collected by registrars, health institutions and local municipalities based on personal identification documents and the mother's verbal account. The set of variables includes birth dates of the child and the parents, parents' residence, education, labor force status (employment, occupation, sector of employment), mother's past pregnancies (number of pregnancies, live births, abortions, spontaneous abortions) and characteristics of the current pregnancy and birth (sex, birth weight, length, 5-minute Apgar value, gestation).

The NLO Wage Survey data are collected by the National Labor Office annually with the purpose of providing information on the wage dynamics in Hungary (National Labor Office, 2017, Databank of the Hungarian Academy of Sciences, 2017). Data are supplied by all budgetary institutions, all companies with more than five employees and by a random sample of smaller companies via a questionnaire at each site. Employees of budgetary institutions and larger companies are randomly sampled while all employees of the selected smaller companies participate. The dataset contains information of employees such as age, work experience, education, salaries and hours worked, while on employers size, ownership, sectoral and geographic information is provided. The dataset also contains weights enabling the sample to be representative of the reference population. Throughout the thesis I treat the estimated salary as total income due to lack of information on outside sources of income.

The 2011 Census database was constructed by the Hungarian Central Statistical Office and it enumerates the around 10 million residents of Hungary as of 1st October 2011 (Hungarian Central Statistical Office, 2016). The data were collected based on interviews conducted by census enumerators, and self-reports responding to either paper-based or online questionnaires.

The Census documents age, education, employment status of individuals amongst many other characteristics, while it also maps family structures extensively.

3.2. Analysis Dataset

As I described earlier, I create a family type level panel dataset from the Live Birth Records tracking the number of births dated back to the time of conception using the information on gestation, as conception is more tightly connected to the fertility decisions than births. I restricted the analysis dataset to births to mothers between 20 and 49 years of age and to fathers between 20 and 59 years of age or missing, as I cannot gather credible income information on younger parents. I also exclude births for which any of the mother's variables defining the family types in the panel dataset is missing, as for these cases I cannot attach any salaries. I also merge children of fifth or higher birth order into the category of fourth-born because of their limited occurrences. In case the father's variables were missing I considered only the mother's income as tax base treating them as single mothers. I did not use marital information as 48% of children in Hungary are not born into marriages (Kapitány & Spéder, 2015) and life partner relationships are not indicated in the Live Birth Records, while life partners are also eligible for claiming the family tax break jointly.

The number of total births to 20-49-year-old mothers and the number of births used in the analysis dataset are displayed in Table 4 for the two main periods, we can see that almost all initial observations with the age restriction are kept, so missing values did not seriously influence the sample size.

TABLE 4 – NUMBER OF BIRTHS DATED BACK TO CONCEPTION, TOTAL AND THE ANALYSIS DATASET

Period	Total number of births	Total number of births to mothers 20-49, fathers 20-59/missing	Number of births in the analysis sample
2008-2010	277,051	259,442	254,200
2011-2013	269,343	251,083	246,082

Notes: based on the Live Birth Records of Hungary, provided by the Hungarian Central Statistical Office. Number of births are dated back to conception.

I define two main outcome variables: the logarithm of the number of births[6] and the number of births per a thousand women of the family type in the 2011 Census (birth rate). Both measurements of fertility provide meaningful and interpretable estimates. Although the log number of births lacks the denominator to relate it to the size of the population, birth rates are also not based on the precise number of family types exposed to the policy change either, as the information represents the conditions of the middle of the time frame, being necessarily contaminated by measurement errors. As I use fixed effects models to control for the levels of the variables the importance of normalization is lessened, so I choose the log number of births to be my main outcome variable of fertility, while displaying both results for the main equations.

I use the NLO Wage Survey data to estimate the average gross incomes of family types, based on the salaries of 20-49-year-old females and 20-59-year-old males working full-time, which I attach to the to the mother and the father respectively. The family tax break belongs to the group of long-run family assistance, implying that the use of full-time salaries is more appropriate as they proxy the average potential long-run incomes of the family type more accurately. I calculate average family incomes by adding the incomes of the parents; for infants whose parents belong to neither to the public nor the private sector, I attach the average salaries of their respective employed family types defined by the rest of their characteristics, constituting a second-best proxy for their potential long-run incomes. The fathers of these children are mostly unemployed, while the mothers are unemployed or at home with a child.

To calculate personal income taxes, tax credits and the family tax breaks I apply the tax regulations detailed in Chapter 2. My variable of interest is *the family tax break increment for an additional child* (abbreviated as FTBi), which is the amount of additional money the family receives with the newborn. I also calculate the following controls: the amount of the family tax

[6] For the log number of births I calculate ln(1+number of births) to keep observations with 0 births.

break base level without an additional child (FTBb), gross family income (INC) and personal income taxes of the family without the tax break (PIT). Gross incomes and taxes capture the parallel changes in labor market conditions and tax regulations. I measure these variables in one million HUF a year (≈3,520 USD) and in simple nominal terms, as the brief time frame and year fixed effects should render accounting for inflation unnecessary.

Based on the 2011 Census data I create weights for the family types according to their frequencies within around 1.5 million families in the 2011 Census. This ensures that changes in fertility of family types which represent a small fraction of the population would influence the estimates to a smaller extent than changes of groups which are more prevalent. I do not however use information about the number of children in the family as it could have already been affected by the policy itself making the weights endogenous; so I include all family units containing at least one woman and complying with the age restrictions defined for live births.

Table 5 displays the means and standard deviations of the introduced variables for years between 2008 and 2013. We can see that the number of births falls in 2009 according to both definitions, and never returns to the 2008 level. This, however, does not contradict Figure 1 showing an increase in total fertility rate starting from 2011; the latter measure also depends on the number of females in childbearing age, which has been declining for several years (Kapitány & Spéder, 2015). The table also documents the substantial changes in the amount of both the tax break increment due to an additional child and the base level without the child, from 2010 to 2011. Gross family incomes grow steadily on average over the years, while the amount of the family level personal income taxes fluctuate with the changes discussed in Chapter 2.

TABLE 5 – DESCRIPTIVE STATISTICS OF THE MAIN VARIABLES

Year	Log(#births)	Birth rate	FTBi	FTBb	INC	PIT
2008	3.72	14.79	0.05	0.03	3.60	0.67
	(1.85)	(33.21)	(0.06)	(0.06)	(1.84)	(0.63)
2009	3.59	13.85	0.05	0.03	3.79	0.71
	(1.85)	(36.78)	(0.06)	(0.06)	(2.04)	(0.69)
2010	3.56	13.26	0.05	0.03	3.87	0.61
	(1.83)	(36.81)	(0.06)	(0.06)	(2.12)	(0.63)
2011	3.56	13.65	0.15	0.22	4.00	0.62
	(1.86)	(32.20)	(0.20)	(0.26)	(2.13)	(0.48)
2012	3.54	13.29	0.19	0.25	4.31	0.84
	(1.86)	(32.22)	(0.23)	(0.30)	(2.21)	(0.65)
2013	3.55	13.63	0.17	0.25	4.33	0.69
	(1.87)	(30.68)	(0.21)	(0.28)	(2.19)	(0.35)

Notes: the table displays means and standard deviations (in parentheses) for the variables used in the analysis. Abbreviated names of the variables stand for the following. FTBi: the family tax break increment for an additional child, FTBb the family tax break base level without an additional child, INC: gross family income, PIT: personal tax income for the family without the family tax break.

4. Empirical Strategy and Results

4.1. Identification

As mentioned earlier, the identification strategy relies on a quasi-experimental setting comparable to Baughman and Dickert-Conlin (2009) and Hoynes, Miller and Simon (2015). My design assumes that conditional on aggregate dynamics the number of births in a family type is in equilibrium disturbed by the large-scale family tax break change in 2011. Exogenous variation arises from birth orders and family incomes. The non-negativity constraint of tax bases creates differences in the amount of actual money received by families with the same number of children but different levels of income, as lower income families are less able to claim the full amount of benefit. On the other hand, the structure of the regulation itself provides extra incentives towards the third child compared to other birth orders for families with similar income. Other studies normally assume full claim of the tax credits and deductions as they calculate the amount of benefits from tax exemptions as a product of the total tax base and a flat marginal tax rate (Gauthier, 2007). I treat the binding constraint seriously as it introduces meaningful variation in the actual amount of the family tax break.

It is useful to put the situation into a treatment/control framework with considering potential outcomes (Pischke & Angrist, 2009). Potential outcomes are the potential number of births for a given family type with treatment being the average amount of the family tax break increment for an additional child. I use a regression difference-in-differences setup and estimate fixed effect models based on the panel dataset introduced in the previous chapter. The baseline specification has the following form:

$$y_{it} = \beta_1 FTBi_{it} + \beta_2 FTBb_{it} + \beta_3 INC_{it} + \beta_4 PIT_{it} + \alpha_i + \lambda_t + u_{it} \qquad (1)$$

where for family type i in year t: y_{it} denotes the birth outcomes, $FTBi_{it}$ the family tax break increment for an additional child, $FTBb_{it}$ the family tax break base level without an additional child, INC_{it} the gross income proxying exogenous labor market changes potentially affecting both the amount of the family tax break and fertility, and PIT_{it} the personal income tax of the family without the family tax break to account for the contemporary changes in the taxation. The specification allows for different levels of outcomes for each family type (α_i) controlling for unobserved time-independent characteristics, while year fixed effects (λ_t) capture aggregate changes. Family type fixed effects ensure that time-independent heterogeneity in fertility preferences within the family type is also captured; according to survey evidence they remained stable in the relevant time frame (Kapitány, 2016). The average treatment effect on the treated is measured by β_1 which is the short-run difference in the expected number of births if the family tax break increment is larger by one million HUF. In all models throughout the thesis standard errors are clustered at the family type level.

4.2.Main Estimates

In this section I present the most important results of the family tax break's effect on the number of births. Table 6 displays the estimates of the fixed effect regressions based on the whole sample for both definitions of fertility: the log number of births and the number of births per a thousand women (birth rate). Columns 1 and 4 show the estimates without the controls, 2 and 4 with the controls, while 3 and 6 also include linear trends interacted with the types of father's employment to control for differential labor market trends. The first row shows the point estimates of the effect of the family tax break increment for an additional child (FTBi) on fertility. We can see that the results are robust across specifications, although the estimate of the base level of the family tax break's effect (FTBb) is significant for birth rates and has the same magnitude as FTBi. Plugging back in the average FTBi of 0.1 million HUF leads to an around 1.8-2% increase in the expected number of births, or using the other definition an around 1.2-1.75% increase in the expected birth rate, both significant at the 1% level. These results support the exogeneity of the variation as all estimates are remarkably close to each other.

Further results on other subgroups based on parity, family's income quartile, mother's education and age, can be found in Appendix tables A1 and A2.

TABLE 6 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON FERTILITY, MAIN SPECIFICATIONS

	(1)	(2)	(3)	(4)	(5)	(6)
Dependent variable:		Log(#births)			Birth rate	
FTBi	0.208***	0.179***	0.205***	2.391***	1.587**	2.005***
	(0.0619)	(0.0614)	(0.0603)	(0.654)	(0.746)	(0.771)
FTBb		0.00716	0.0250		1.438**	1.719***
		(0.0653)	(0.0658)		(0.560)	(0.602)
INC		0.00391	0.0275		0.757	0.981*
		(0.0239)	(0.0250)		(0.530)	(0.527)
PIT		-0.0927***	-0.0909***		-1.706**	-1.114
		(0.0306)	(0.0303)		(0.790)	(0.813)
Observations	18,702	18,702	18,702	18,702	18,702	18,702
Family types	3,117	3,117	3,117	3,117	3,117	3,117
Adj. R-squared	0.061	0.063	0.067	0.003	0.004	0.013
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Father's emp. trend	No	No	Yes	No	No	Yes
Mean of Outcome		3.59			13.75	
SD of Outcome		1.85			33.66	
Mean of FTBi		0.11			0.11	
SD of FTBi		0.17			0.17	

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variables are natural logarithm of the number of births and number of births per a thousand women in the family type, which are regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. Columns 3 and 6 adds linear trends for types of father's employment categories: private, public, other or missing.
Standard errors clustered at the family type level are in parentheses.
Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Table 7 displays estimates of the main specification for subgroups of the population which drive the overall fertility effects: third-born children, the highest family income quartile (based on the family income distribution weighted by the Census frequencies), mothers above thirty years of age, and mothers with tertiary education. Within other subgroups not shown – such as the fourth child or other income quartiles – the estimates for the effect of the family tax break increment for an additional child (FTBi) are not statistically significant at the 5% level; these results are shown in Appendix tables A12 and A13. For third births (Column 1) the estimate is around the same as we have previously seen for the entire sample (0.19), but the average treatment size for the time frame is significantly higher at 0.27 million HUF due to the structure of the policy, implying an around 5% increase in births within the subgroup. For the highest income quartile, mothers with tertiary education and older than thirty, the estimates are slightly higher at around 0.26. Births to older mothers are also affected not only by an additional child's increment but also by the base level of the family tax break. The largest marginal effect is estimated for third-born children of the fourth income quartile at around 0.57, which by plugging back in the average FTBi of 0.49 million HUF implies a 28% increase in the number of births within the subgroup. This last result suggests that the size of the marginal effect increases with the size of the treatment.

TABLE 7 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON LOG NUMBER OF BIRTHS ACROSS SUBGROUPS

	(1)	(2)	(3)	(4)	(5)
Subgroup:	3rd child	4th quartile	Mother's age ≥30	Mother tertiary educated	4th quartile and 3rd child
FTBi	0.187***	0.264***	0.265***	0.263***	0.571**
	(0.0713)	(0.0757)	(0.0698)	(0.0747)	(0.281)
FTBb	0.128	-0.0761	0.131***	0.00773	-
	(0.577)	(0.0808)	(0.0427)	(0.0937)	
INC	0.0724**	0.00967	0.0316	0.0268	0.0805**
	(0.0325)	(0.0342)	(0.0223)	(0.0366)	(0.0369)
PIT	-0.165***	-0.0307	-0.102***	-0.108**	-0.0347
	(0.0472)	(0.0445)	(0.0265)	(0.0506)	(0.0545)
Observations	4,728	5,682	9,816	4,590	1,438
Family types	788	1,098	1,636	765	276
Adj. R-squared	0.075	0.042	0.043	0.032	0.118
Family type FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Mean of outcome	3.13	3.94	3.90	3.43	3.33
SD of outcome	1.55	2.00	1.71	2.06	1.56
Mean of FTBi	0.27	0.18	0.11	0.16	0.49
SD of FTBi	0.25	0.27	0.18	0.24	0.36

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variable is natural logarithm of the number of births, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups of the population.
Standard errors clustered at the family type level are in parentheses.
Significance levels: *** p<0.01, ** p<0.05, * p<0.1

4.3. Internal Validity and Robustness

The most important assumption for the fixed effects estimator to be consistent is parallel trends (Pischke & Angrist, 2009), meaning that changes in the potential birth outcomes of family types are independent of the size of the family tax break they receive; in other words, family types without the policy change would have had similar fertility trends. If the number of births had been growing more in those groups who received more family tax break regardless of the intervention, the effect is overestimated.

I test this assumption by regressing the fertility outcomes on the 3-year forward values of the family tax break increment for an additional child (F3.FTBi), which should yield positive estimates if the fertility of family types benefitting more had already been increasing at a faster pace in the pre-treatment period of 2008-2010. Table 8 presents the results of this "placebo" exercise without contemporary controls used in the main specification (Columns 1 and 3), and with them (Columns 2 and 4). The estimates are negative for both definitions of fertility, although with controls we can see that they are not statistically significant. The results imply that fertility of family types benefitting more from the future family tax break declined more in the pre-treatment period, suggesting that the previous results might underestimate the real effect.

TABLE 8 – ROBUSTNESS CHECK: REGRESSION ESTIMATES OF FERTILITY ON THE 3-YEAR FORWARD VALUES OF THE FAMILY TAX BREAK, 2008-2010

	(1)	(2)	(3)	(4)
Dependent variable:	Log(#births)		Birth rate	
F3.FTBi	-0.453**	-0.378	-1.393**	-0.113
	(0.209)	(0.230)	(0.676)	(0.797)
Observations	9,351	9,351	9,351	9,351
Family types	3,117	3,117	3,117	3,117
Adj. R-squared	0.099	0.104	0.006	0.007
Family type FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	No	Yes	No	Yes
Mean of outcome	3.62	3.62	13.97	13.97
SD of outcome	1.84	1.84	35.64	35.64
Mean of F3.FTBi	0.17	0.17	0.17	0.17
SD of F3.FTBi	0.21	0.21	0.21	0.21

Notes: the table presents family type / year fixed effect regression results for years 2008-2010. Dependent variables are natural logarithm of the number of births and number of births per a thousand women, which are regressed on the 3-year forward values of the family tax break increment for an additional child (FTBi) in Column 1 and 3, with additional controls of FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break in Column 2 and 4. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Another concern might be that the composition of family type observations have changed during the period, which may be driven by two potential parallel phenomena. One is accelerating emigration – which primarily affects young adults in childbearing age (Kapitány & Spéder, 2015). For instance, Hungarian women in the United Kingdom had a 1.63 total fertility rate in 2011, which is higher than of those staying in Hungary; however, it cannot be excluded that emigration itself causes higher fertility, or that preferences for more children push families to move away. As emigration affects the highly educated disproportionately more (Blaskó & Gödri, 2014), it is likely that emigrants would have received larger amount of the family tax break, introducing downward bias in the estimates.

Fertility might also rebound by itself after the Great Recession as employment would increase due to increase in labor demand. If employment grows more amongst those who would receive more family tax break, and higher employment leads to higher fertility, then the estimates suffer from upward bias. I use several methods to eliminate these concerns. To the unemployed I assign the average income for their respective employed family type, so the inclusion of gross family income as a control would reduce this bias by capturing changes in the labor market. I also include linear trends interacted with the employment sectors of the fathers in the main results (Table 1), and these estimates indicate that the rebound effect is unlikely to be influential and it might even be of negative sign.

Table 9 displays estimates of the the family tax break increment's effect on fertility using different samples, specifications and weights, which corroborate the main results and the design. Columns 1 and 2 present regressions using observations from births only where both parents are employed, or third and fourth-born children respectively. Column 3 displays the estimate of the treatment variable while including the lagged and forward values in the equation, and Column 4 shows the results without using the weights from the 2011 Census. The first two columns suggest that the main results are not affected heaviliy neither by single mothers, unemployment or lower birth orders. We can also observe that neither estimates in Column 1 to 3 differ significantly from the main results of around 0.18, although the unweighted estimate is only around half the size of the weighted estimates. Further results for different specifications are displayed in Appendix tables A15 and A16.

TABLE 9 – ROBUSTNESS CHECKS: THE FAMILY TAX BREAK EXTENSION'S EFFECT ON FERTILITY ACROSS DIFFERENT SAMPLES AND SPECIFICATIONS

	(1)	(2)	(3)	(4)
Sample/specification:	Both parents employed	3rd-4th birth order	Incl. lag and forward of FTBi	Unweighted
FTBi	0.204***	0.176***	0.185	0.0822**
	(0.0615)	(0.0669)	(0.119)	(0.0370)
Observations	7,854	8,484	12,468	19,062
Family types	1,309	1,414	3,117	3,177
Adj. R-squared	0.108	0.045	0.017	0.014
Family type FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
Mean of Outcome	3.92	2.67	3.59	1.74
SD of Outcome	1.93	1.63	1.85	1.56
Mean of FTBi	0.13	0.16	0.11	0.12
SD of FTBi	0.19	0.22	0.17	0.18

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variable is natural logarithm of the number of births, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups or specifications.
Standard errors clustered at the family type level are in parentheses.
Significance levels: *** p<0.01, ** p<0.05, * p<0.1

Finally I also examine the family tax break's effects on the incidence of low weight (<2500g) and pre-term (<37 weeks) births. Tax and benefit policies can affect the health of children via after-tax family income as health outcomes are also closely related to the socioeconomic status of the parents (Currie, 2009). Previous results of this thesis have established that fertility effects could only be detected with confidence amongst the higher income groups of the population, so no meaningful improvement is expected regarding infant health. The results in Table 10 support this statement as no statistically significant point estimates were found for either variable, although the positive signs indicate that it is unlikely that the family tax break would play any meaningful role influencing infant health outcomes. Further estimates are presented in the Appendix tables A17 and A18.

TABLE 10 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON INFANT HEALTH OUTCOMES

	(1)	(2)	(3)	(4)
Dependent variable:	Low birth weight		Pre-term birth	
FTBi	0.0245	0.0335	0.00496	0.0123
	(0.0242)	(0.0270)	(0.0272)	(0.0290)
FTBb		-0.0107		-0.0175
		(0.0294)		(0.0368)
INC		-0.00824		-0.00379
		(0.00665)		(0.00916)
PIT		0.0172		0.0189
		(0.0125)		(0.0131)
Observations	14,464	14,464	14,464	14,464
Family types	3,117	3,117	3,117	3,117
Adj. R-squared	0.002	0.003	0.000	0.001
Family type FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Mean of Outcome	0.10	0.10	0.11	0.11
SD of Outcome	0.12	0.12	0.13	0.13
Mean of FTBi	0.11	0.11	0.11	0.11
SD of FTBi	0.17	0.17	0.17	0.17

Notes: Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variables are the number of low weight (<2500g) and pre-term (<37 weeks) births as a fraction of the total number of births, which are regressed on the family tax break increment for an additional child (FTBi) in Column 1 and 3, with additional controls of FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break in Column 2 and 4.
Standard errors clustered at the family type level are in parentheses.
Significance levels: *** p<0.01, ** p<0.05, * p<0.1

4.4. Policy Scenarios

In this section I examine counterfactual policy scenarios to evaluate the impact of the 2011 family tax break extension. I relate the estimates to the number of births to 20-49-year-old mothers and 20-59-year-old fathers (Table 4). I examine four scenarios with two representing the actual, and two representing hypothetical family tax break extensions, assuming that the marginal effects on fertility only vary with the magnitude of the policy and there is perfect compliance.

Baseline scenario with parallel trends: the effect of family tax break increment for an additional child (FTBi) is compared to the no-extension case, assuming the parallel trend assumption holds. This means that I treat the results of the "placebo" exercise in Column 2 of Table 8 as if it yielded zero results and not the non-significant negative estimates. Corresponding marginal effect: $\hat{\beta}\approx0.18$, $\widehat{SE(\hat{\beta})}\approx0.06$.

Baseline scenario with "placebo": the effect of FTBi is compared to the no-extension case assuming the parallel trend assumption does not hold, so I account for the negative estimates in Column 2 of Table 8. I calculate the marginal effects and standard errors by subtracting the placebo estimate from the baseline. Corresponding marginal effect: $\hat{\beta}\approx0.56$, $\widehat{SE(\hat{\beta})}\approx0.24$.

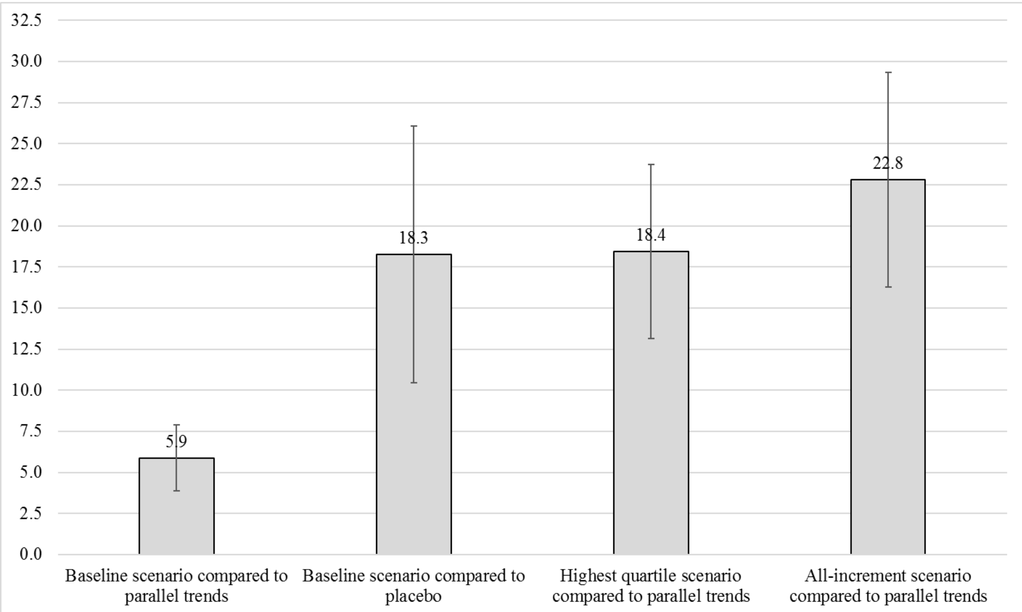
Highest quartile scenario with parallel trends: the effect of FTBi is compared to the no-extension case assuming the parallel trend assumption holds, and using the marginal effect and the average change of FTBi for the highest income quartile. This scenario represents a hypothetical policy where all families would have received the same incentives as the highest family income quartile. Corresponding marginal effect: $\hat{\beta}\approx0.26$, $\widehat{SE(\hat{\beta})}\approx0.08$.

All-increment scenario with parallel trends: I keep the average amount of family tax break base level (FTBb) *unchanged* from 2008-2011 to 2012-2014, and redistribute the left-over towards FTBi such that the sum of the changes in FTBb and FTBi corresponds to the baseline scenario. I use the marginal effect of the highest income quartile ($\hat{\beta}\approx0.26$, $\widehat{SE(\hat{\beta})}\approx0.08$), as this group's average change in FTBi (≈0.27) is the closest to the one used in this scenario (≈0.33).

I estimate the counterfactual total additional births conceived between 2011 and 2013 attributed to the family tax break extension, as the product of $\hat{\beta}$ and the average change in FTBi from the 2008-2010 period to 2011-2013. Figure 4 presents the results with the bars showing the point estimates along with the 95% confidence intervals. We can see that according to the baseline scenario assuming parallel trends, between 2011 and 2013 an additional 4,000-8,000 newborns in total were conceived due to the extension of the family tax break. With the "placebo" scenario the imprecise negative pre-trend is also considered, resulting in a larger point estimate and also a larger standard error. This result implies that depending on the specification, around 18,000 (±8,000) additional newborns were conceived between 2011 and 2013 due to the policy change.

The third and fourth bars represent counterfactual scenarios with different size or structure of the policy, assuming parallel trends. These cases yield larger number of extra births compared to the baseline scenario with parallel trends, due to the larger marginal effects and larger average change in FTBi. The highest quartile scenario shows that if the entire population had faced the financial incentives of the richest quartile, around 12,000 more children would have been born in total compared to the baseline over the three years. Finally, the all-increment scenario demonstrates that a policy of similar costs to the baseline, focusing completely on the incremental element would have led to around 16,000 extra births in total over the three-year period of 2011-2013.

FIGURE 3 – ADDITIONAL TOTAL NUMBER OF BIRTHS DUE TO DIFFERENT FAMILY TAX BREAK EXTENSION SCENARIOS



Notes: the figure shows the additional number of births in different scenarios of the family break extension. The bars display the additional number of births in thousands conceived in the three-year period of 2011-2013, along with the 95% confidence intervals. The figure is based on the age-restricted total number of observations in the Live Birth Records of the Hungarian Central Statistical Office and the author's calculations. The first and second bars compare the estimates from the baseline scenario to counterfactuals considering parallel trends and the estimated (although non-significant) downward trends. The third and fourth bars show results using estimates of the highest quartile with different average changes in the family tax break increment for an additional child.

According to OECD (2017) the extension of the family tax break cost 0.6% of the Hungarian GDP, stable across years 2011-2013. Using this information as the yearly long-run cost of the policy along with the Hungarian GDP of around 28 trillion HUF in 2011 (Hungarian Central Statistical Office, 2017), it is possible to give an estimate for the cost of an additional birth due to the policy change, based on the scenarios presented in this section. Table 11 displays the cost estimates. We can see that the cost per child values range from 85 million HUF (≈300,000 USD) to 30 million HUF (≈105,000 USD) depending on the scenario we choose to accept.

TABLE 11 – COST ESTIMATES FOR AN ADDITIONAL CHILD

Additional number of births conceived between 2011 and 2013	Cost per child
6,000	85,500,000
8,000	63,400,000
10,000	50,700,000
18,000	28,200,000

Notes: the table displays the cost of a child born due to the extension of the family tax break, based on the policy scenarios examined in the subsection. Using the 0.6% of GDP estimate of OECD (2017) and the around 28,166 billion HUF GDP estimate of the Hungarian Central Statistical Office (2017), I calculate the total estimated cost of the policy per child in 2011 HUFs, rounded to 100,000s.

5. Conclusion

This thesis studies the fertility effects of the 2011 family tax break expansion in Hungary taking advantage of the exogenous variation from two sources. On the one hand, a large jump in the tax break increment at the third child creates different incentives by the number of children for families with similar income. On the other hand, the condition of non-negative tax bases constrains poorer families from claiming the full amount of the financial assistance. I present evidence that the policy change led to a statistically significant increase in the number of births with economically meaningful magnitude; the results are corroborated by several robustness checks. The estimated marginal effects are heterogeneous across subgroups and driven mostly by third-born children and higher income families, with an increasing marginal response to the size of the treatment. These estimates are comparable to previous results of Whittington, Alm and Peters (1990) and Riphahn and Wiynck (2017).

I also evaluate the impact of the actual and some counterfactual policy changes on the number of births. These calculations suggest that the extension of the family tax break led to an around 6,000 to around 18,000 extra births depending on the preferred specification, supporting the argument that the policy had economically relevant effects. Other setups with a different scale or structure of the policy show that placing more emphasis on the incremental part or providing larger incentives for a wider segment of the population, the family tax break would have resulted in higher fertility effects potentially keeping the total cost unchanged.

As many European countries are expected to face low fertility rates in the following years, finding ways to turn the trend around is of crucial importance. My results suggest that sufficiently large monetary incentives focusing on the increment for an additional child have the potential to influence the number of births meaningfully. However, due to the recentness of the policy this study cannot differentiate between completed fertility and timing effects. This question should be revisited in the future.

Appendix

A12 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON THE LOG NUMBER OF BIRTHS, MAIN SPECIFICATIONS FOR ALL SUBGROUPS BY BIRTH ORDER, FAMILY INCOME AND MOTHER'S EDUCATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:						Log(#births)						
FTBi	0.179***	-0.159	0.187***	-0.0584	-0.195	0.0965	-0.0336	0.264***	0.0901	0.126	-0.0638	0.263***
	(0.0614)	(0.369)	(0.0713)	(0.417)	(0.281)	(0.349)	(0.218)	(0.0757)	(0.146)	(0.165)	(0.122)	(0.0747)
FTBb	0.00716	2.794	0.128	0.0484	0.125	0.0799	0.251**	-0.0761	-0.0464	0.0644	-0.0777	0.00773
	(0.0653)	(2.495)	(0.577)	(0.129)	(0.214)	(0.199)	(0.118)	(0.0808)	(0.117)	(0.118)	(0.136)	(0.0937)
INC	0.00391	0.0339	0.0724**	-0.127	-0.0779	-0.112	0.0197	0.00967	-0.106	-0.110*	-0.00664	0.0268
	(0.0239)	(0.0360)	(0.0325)	(0.0843)	(0.146)	(0.138)	(0.114)	(0.0342)	(0.0719)	(0.0649)	(0.0317)	(0.0366)
PIT	-0.0927***	-0.168***	-0.165***	-0.0140	0.354	-0.182	-0.681*	-0.0307	0.0701	-0.0965	-0.110	-0.108**
	(0.0306)	(0.0527)	(0.0472)	(0.106)	(0.272)	(0.410)	(0.399)	(0.0445)	(0.153)	(0.116)	(0.0755)	(0.0506)
Observations	18,702	5,112	4,728	3,756	2,787	4,568	5,665	5,682	4,380	4,632	5,100	4,590
Family types	3,117	852	788	626	637	1,170	1,357	1,098	730	772	850	765
Adj. R-squared	0.063	0.137	0.075	0.038	0.035	0.117	0.085	0.042	0.041	0.201	0.074	0.032
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth order	all	2	3	4	all	all	all	all	all	all	all	all
Inc. quart.	all	all	all	all	1	2	3	4	all	all	all	all
Mother's educ.	all	all	all	all	all	all	all	all	0-8	voc	HS	tert
Mean outcome	3.59	4.20	3.13	2.19	3.01	3.76	3.65	3.94	3.61	3.62	3.68	3.43
SD outcome	1.85	1.60	1.55	1.57	1.53	1.77	1.95	2.00	1.47	1.75	1.90	2.06
Mean FTBi	0.11	0.06	0.27	0.04	0.06	0.09	0.11	0.18	0.07	0.08	0.10	0.16
SD FTBi	0.17	0.06	0.25	0.08	0.07	0.10	0.13	0.27	0.09	0.10	0.15	0.24

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variable is natural logarithm of the number of births, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups of the population indicated in the table. All variance in first births is taken up by the year fixed effects as all family types had enough income to claim the full benefit for the given year. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

A13 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON BIRTH ORDER, MAIN SPECIFICATIONS FOR ALL SUBGROUPS BY BIRTH ORDER, FAMILY INCOME AND MOTHER'S EDUCATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:						Birth order						
FTBi	1.587**	1.992	1.033*	0.698	-0.579	-0.110	3.813***	2.698**	-1.041	0.589	2.495***	2.240*
	(0.746)	(3.826)	(0.559)	(0.647)	(1.332)	(1.492)	(1.237)	(1.163)	(1.769)	(0.943)	(0.748)	(1.263)
FTBb	1.438**	-8.370	-1.122	-0.0494	-1.292	3.123**	5.215***	0.562	-4.774***	5.566***	3.440***	0.501
	(0.560)	(15.01)	(2.678)	(0.297)	(1.400)	(1.389)	(1.352)	(0.787)	(1.299)	(0.838)	(0.819)	(0.856)
INC	0.757	1.563	1.199**	0.225	-1.194*	-2.134**	-0.572	2.044***	0.955	-2.504***	-1.544***	2.003***
	(0.530)	(1.090)	(0.555)	(0.203)	(0.660)	(0.901)	(1.124)	(0.707)	(0.868)	(0.586)	(0.505)	(0.736)
PIT	-1.706**	-2.958**	-2.530***	-0.722**	0.875	-2.960**	-0.592	-2.596**	-9.284***	-2.378**	1.301	-2.645**
	(0.790)	(1.428)	(0.882)	(0.289)	(1.479)	(1.337)	(3.424)	(1.138)	(2.545)	(1.192)	(0.843)	(1.061)
Observations	18,702	5,112	4,728	3,756	2,787	4,568	5,665	5,682	4,380	4,632	5,100	4,590
Family types	3,117	852	788	626	637	1,170	1,357	1,098	730	772	850	765
Adj. R-squared	0.004	0.004	0.006	-0.000	0.011	0.050	0.006	0.002	0.017	0.039	0.004	0.003
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth order	all	2	3	4	all	all	all	all	all	all	all	all
Inc. quart.	all	all	all	all	1	2	3	4	all	all	all	all
Mother's educ.	all	all	all	all	all	all	all	all	0-8	voc	HS	tert
Mean of outcome	13.75	18.03	7.37	4.90	7.39	10.58	14.11	23.08	14.21	9.28	13.08	17.94
SD of outcome	33.66	44.77	19.02	16.94	16.18	15.98	30.63	54.49	20.56	17.72	34.47	45.83
Mean of FTBi	0.11	0.06	0.27	0.04	0.06	0.09	0.11	0.18	0.07	0.08	0.10	0.16
SD of FTBi	0.17	0.06	0.25	0.08	0.07	0.10	0.13	0.27	0.09	0.10	0.15	0.24

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variable is birth order defined as number of births per a thousand women in the family type, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups of the population indicated in the table. All variance in first births is taken up by the year fixed effects as all family types had enough income to claim the full benefit for the given year. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

A14 – ROBUSTNESS CHECK: REGRESSION ESTIMATES OF FERTILITY ON THE 3-YEAR FORWARD VALUES OF THE FAMILY TAX BREAK, 2008-2010 ACROSS DIFFERENT SAMPLES AND SPECIFICATIONS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:	Log(#births)		Birth rate		Log(#births)		Birth rate		Log(#births)		Birth rate	
F3.FTBi	-0.453**	-0.378	-1.393**	-0.113	-0.255	-0.112	0.559	2.062**	-0.392*	-0.305	-3.048***	-2.113***
	(0.209)	(0.230)	(0.676)	(0.797)	(0.259)	(0.286)	(0.832)	(1.011)	(0.233)	(0.279)	(0.615)	(0.644)
FTBb		3.739		22.87		-56.07***		-466.5***		3.378		7.277
		(3.598)		(17.51)		(3.037)		(23.19)		(3.661)		(12.69)
INC		0.0365		1.399**		0.117**		1.179		0.0199		1.101***
		(0.0435)		(0.627)		(0.0496)		(0.731)		(0.0820)		(0.394)
PIT		-0.254**		-3.156**		-0.370***		-4.012**		-0.300		-2.280***
		(0.108)		(1.362)		(0.133)		(1.609)		(0.208)		(0.851)
Observations	9,351	9,351	9,351	9,351	3,927	3,927	3,927	3,927	4,242	4,242	4,242	4,242
Family types	3,117	3,117	3,117	3,117	1,309	1,309	1,309	1,309	1,414	1,414	1,414	1,414
Adj. R-squared	0.099	0.104	0.006	0.007	0.156	0.164	0.124	0.133	0.075	0.080	0.003	0.003
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	all	all	all	all	employed	employed	employed	employed	3-4 births	3-4 births	3-4 births	3-4 births
Mean of outcome	3.62	3.62	13.97	13.97	3.96	3.96	14.44	14.44	2.70	2.70	6.09	6.09
SD of outcome	1.84	1.84	35.64	35.64	1.91	1.91	17.39	17.39	1.60	1.60	18.48	18.48
Mean of FTBi	0.17	0.17	0.17	0.17	0.20	0.20	0.20	0.20	0.23	0.23	0.23	0.23
SD of FTBi	0.21	0.21	0.21	0.21	0.24	0.24	0.24	0.24	0.29	0.29	0.29	0.29

Notes: the table presents family type / year fixed effect regression results for years 2008-2010. Dependent variables are natural logarithm of the number of births and number of births per a thousand women, which are regressed on the 3-year forward values of the family tax break increment for an additional child (FTBi) in Column 1 and 3, with additional controls of FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break in Column 2 and 4. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

A15 – ROBUSTNESS CHECKS: THE FAMILY TAX BREAK EXTENSION'S EFFECT ON FERTILITY ACROSS DIFFERENT SAMPLES, SPECIFICATIONS AND WEIGHTING

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:	Log(#births)		Log(#births)		Log(#births)		Log(#births)		Log(#births)		Birth rate	
FTBi	0.239***	0.204***	0.240***	0.216***	0.204***	0.176***	0.105***	0.0760*	0.218**	0.185	1.850***	1.283**
	(0.0650)	(0.0615)	(0.0493)	(0.0512)	(0.0616)	(0.0669)	(0.0359)	(0.0425)	(0.109)	(0.119)	(0.515)	(0.568)
L.FTBi									-0.0218	0.00600	-0.433	0.107
									(0.0915)	(0.0988)	(0.359)	(0.407)
F.FTBi									0.0409	0.0214	0.605**	0.315
									(0.102)	(0.0989)	(0.299)	(0.352)
FTBb		0.0264		0.125***		-0.0547		0.0130		-0.0149		0.939***
		(0.0738)		(0.0368)		(0.0828)		(0.0393)		(0.0649)		(0.331)
INC		0.0277		0.0244		-0.0196		0.0217		0.0265		0.728
		(0.0255)		(0.0165)		(0.0456)		(0.0212)		(0.0288)		(0.460)
PIT		-0.0805**		-0.120***		-0.102*		-0.114***		-0.103*		-1.282
		(0.0324)		(0.0311)		(0.0552)		(0.0370)		(0.0563)		(0.877)
Observations	7,854	7,854	7,854	7,854	8,484	8,484	8,652	8,652	12,468	12,468	12,468	12,468
Family types	1,309	1,309	1,309	1,309	1,414	1,414	1,442	1,442	3,117	3,117	3,117	3,117
Adj. R-squared	0.105	0.108	0.026	0.030	0.043	0.045	0.009	0.010	0.016	0.017	0.001	0.001
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sample	Parents employed	Parents employed	Parents employed unweighted	Parents employed unweighted	3-4 births	3-4 births	3-4 births unweighted	3-4 births unweighted	all	all	all	all
Mean outcome	3.92	3.92	1.95	1.95	2.67	2.67	1.35	1.35	3.59	3.59	13.75	13.75
SD outcome	1.93	1.93	1.79	1.79	1.63	1.63	1.35	1.35	1.85	1.85	33.66	33.66
Mean FTBi	0.13	0.13	0.12	0.12	0.16	0.16	0.19	0.19	0.11	0.11	0.11	0.11
SD FTBi	0.19	0.19	0.18	0.18	0.22	0.22	0.24	0.24	0.17	0.17	0.17	0.17

Notes: the table presents family type / year fixed effect regression results for years 2008-2013 for employed and 3-4 births samples with and without weighting and thw whole sample including lagged and forward treatment with weights. Dependent variables are the natural logarithm of the number of births and the number of births per a thousand women in tha family type (column 11, 12), which are regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

A16 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON THE LOG NUMBER OF BIRTHS WITHOUT WEIGHTING, MAIN SPECIFICATIONS FOR ALL SUBGROUPS BY BIRTH ORDER, FAMILY INCOME AND MOTHER'S EDUCATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:	Log(#births)											
FTBi	0.0822**	0.271	0.124**	0.0131	-0.0369	-0.0983	-0.113	0.123***	0.0786	0.0805	-0.0330	0.138**
	(0.0370)	(0.424)	(0.0608)	(0.128)	(0.251)	(0.185)	(0.113)	(0.0459)	(0.0840)	(0.0761)	(0.0777)	(0.0615)
FTBb	0.0462*	1.161	0.461	-0.0112	0.166	0.0549	0.0587	0.0229	-0.116*	0.0522	0.0106	0.120***
	(0.0257)	(3.712)	(0.456)	(0.0601)	(0.214)	(0.117)	(0.0740)	(0.0304)	(0.0675)	(0.0612)	(0.0500)	(0.0398)
INC	0.0414***	0.0697***	0.0216	0.0138	0.165	0.0232	-0.0214	0.0408**	0.0813**	0.0291	0.0407	0.0314*
	(0.0119)	(0.0212)	(0.0289)	(0.0313)	(0.128)	(0.0922)	(0.0687)	(0.0162)	(0.0331)	(0.0303)	(0.0249)	(0.0178)
PIT	-0.0941***	-0.126***	-0.105**	-0.106*	-0.740**	-0.405	-0.123	-0.0371	-0.184***	-0.174***	-0.0225	-0.0441
	(0.0220)	(0.0396)	(0.0493)	(0.0574)	(0.294)	(0.268)	(0.200)	(0.0367)	(0.0682)	(0.0543)	(0.0477)	(0.0388)
Observations	19,062	5,214	4,806	3,846	2,787	4,568	5,738	5,969	4,458	4,770	5,172	4,662
Family types	3,177	869	801	641	637	1,170	1,370	1,150	743	795	862	777
Adj. R-squared	0.014	0.032	0.013	0.007	0.023	0.028	0.014	0.004	0.011	0.041	0.013	0.007
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth order	all	2	3	4	all	all	all	all	all	all	all	all
Inc. quart.	all	all	all	all	1	2	3	4	all	all	all	all
Mother's educ.	all	all	all	all	all	all	all	all	0-8	voc	HS	tert
Mean outcome	1.74	2.00	1.47	1.21	1.82	1.71	1.68	1.79	1.44	1.49	2.08	1.92
SD outcome	1.56	1.60	1.38	1.31	1.60	1.51	1.47	1.66	1.55	1.39	1.54	1.66
Mean FTBi	0.12	0.06	0.30	0.04	0.06	0.09	0.11	0.17	0.10	0.10	0.12	0.15
SD FTBi	0.18	0.06	0.26	0.08	0.07	0.10	0.13	0.26	0.14	0.15	0.17	0.23

Notes: the table presents family type / year fixed effect regression results for years 2008-2013 without the family type weights of the 2011 Census. Dependent variable is natural logarithm of the number of births, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups of the population indicated in the table. All variance in first births is taken up by the year fixed effects as all family types had enough income to claim the full benefit for the given year. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

A17 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON THE FRACTION OF LOW WEIGHT BIRTHS, MAIN SPECIFICATIONS FOR ALL SUBGROUPS BY BIRTH ORDER, FAMILY INCOME AND MOTHER'S EDUCATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:	Fraction of low weight births											
FTBi	0.0335	-0.150	0.0622*	0.166	0.0601	0.196**	0.0394	0.0478*	0.105*	0.00394	0.0183	0.0302
	(0.0270)	(0.281)	(0.0329)	(0.260)	(0.151)	(0.0975)	(0.0798)	(0.0275)	(0.0539)	(0.0588)	(0.0474)	(0.0399)
FTBb	-0.0107	6.524*	0.228	-0.0492	-0.116	0.0653	0.172**	-0.0504	-0.0363	0.0835**	-0.0292	-0.0187
	(0.0294)	(3.405)	(0.204)	(0.0698)	(0.140)	(0.0425)	(0.0680)	(0.0356)	(0.0390)	(0.0409)	(0.0302)	(0.0472)
INC	-0.00824	0.000692	-0.0182	-0.0282	-0.0709	0.0515	0.0734*	0.000791	-0.00511	-0.0220	0.00563	-0.0111
	(0.00665)	(0.00825)	(0.0152)	(0.0309)	(0.0985)	(0.0593)	(0.0437)	(0.00755)	(0.0253)	(0.0244)	(0.0106)	(0.00863)
PIT	0.0172	0.00311	0.0441**	0.0417	0.246	-0.189	-0.331**	0.0299*	-0.0944	-0.000735	0.0214	-0.00550
	(0.0125)	(0.00973)	(0.0223)	(0.0626)	(0.249)	(0.239)	(0.155)	(0.0176)	(0.0699)	(0.0404)	(0.0306)	(0.0221)
Observations	14,464	4,226	3,458	2,524	2,158	3,504	4,421	4,381	2,985	3,455	4,347	3,677
Family types	3,117	852	788	626	594	1,074	1,273	1,055	730	772	850	765
Adj. R-squared	0.003	0.004	0.006	0.018	0.009	0.023	0.052	0.017	0.007	0.010	0.003	0.013
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth order	all	2	3	4	all	all	all	all	all	all	all	all
Inc. quart.	all	all	all	all	1	2	3	4	all	all	all	all
Mother's educ.	all	all	all	all	all	all	all	all	0-8	voc	HS	tert
Mean of outcome	0.10	0.09	0.10	0.12	0.17	0.09	0.08	0.07	0.13	0.11	0.10	0.09
SD of outcome	0.12	0.09	0.12	0.19	0.15	0.11	0.11	0.11	0.10	0.11	0.12	0.15
Mean of FTBi	0.11	0.06	0.27	0.04	0.06	0.09	0.11	0.18	0.07	0.08	0.10	0.16
SD of FTBi	0.17	0.06	0.25	0.08	0.07	0.10	0.13	0.27	0.09	0.10	0.15	0.24

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variable is the fraction of low weight births (<2500g) in the family type, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups of the population indicated in the table. All variance in first births is taken up by the year fixed effects as all family types had enough income to claim the full benefit for the given year. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

A18 – THE FAMILY TAX BREAK EXTENSION'S EFFECT ON THE FRACTION OF PRE-TERM BIRTHS, MAIN SPECIFICATIONS FOR ALL SUBGROUPS BY BIRTH ORDER, FAMILY INCOME AND MOTHER'S EDUCATION

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dependent var.:						Fraction of pre-term births						
FTBi	0.0123	-0.117	0.0308	0.114	0.0914	-0.0364	0.0320	0.0576*	0.115**	-0.0512	-0.0139	0.0300
	(0.0290)	(0.192)	(0.0319)	(0.267)	(0.120)	(0.111)	(0.104)	(0.0296)	(0.0543)	(0.0525)	(0.0494)	(0.0390)
FTBb	-0.0175	-16.93***	0.320*	-0.0581	0.0661	-0.00249	0.179**	-0.0663	0.0162	0.0757*	-0.0383	-0.0285
	(0.0368)	(4.475)	(0.192)	(0.0698)	(0.0986)	(0.0439)	(0.0823)	(0.0462)	(0.0356)	(0.0419)	(0.0478)	(0.0577)
INC	-0.00379	0.000481	-0.00441	-0.0189	-0.0215	0.100*	0.159**	-0.00101	-0.0278	0.00639	0.00955	-0.0134
	(0.00916)	(0.00918)	(0.0212)	(0.0389)	(0.0917)	(0.0549)	(0.0620)	(0.0114)	(0.0260)	(0.0264)	(0.0115)	(0.0135)
PIT	0.0189	0.00849	0.0257	0.0614	-0.0123	-0.420*	-0.438**	0.0279*	-0.00577	-0.0329	0.00447	0.0215
	(0.0131)	(0.0119)	(0.0226)	(0.0659)	(0.193)	(0.253)	(0.207)	(0.0164)	(0.0669)	(0.0622)	(0.0321)	(0.0237)
Observations	14,464	4,226	3,458	2,524	2,158	3,504	4,421	4,381	2,985	3,455	4,347	3,677
Family types	3,117	852	788	626	594	1,074	1,273	1,055	730	772	850	765
Adj. R-squared	0.001	0.012	0.003	0.009	0.007	0.028	0.044	0.025	0.006	0.008	0.005	0.009
Family type FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth order	all	2	3	4	all	all	all	all	all	all	all	all
Inc. quart.	all	all	all	all	1	2	3	4	all	all	all	all
Mother's educ.	all	all	all	all	all	all	all	all	0-8	voc	HS	tert
Mean of outcome	0.11	0.10	0.12	0.14	0.17	0.09	0.10	0.09	0.11	0.11	0.12	0.11
SD of outcome	0.13	0.10	0.13	0.20	0.15	0.11	0.13	0.12	0.10	0.12	0.13	0.15
Mean of FTBi	0.11	0.06	0.27	0.04	0.06	0.09	0.11	0.18	0.07	0.08	0.10	0.16
SD of FTBi	0.17	0.06	0.25	0.08	0.07	0.10	0.13	0.27	0.09	0.10	0.15	0.24

Notes: the table presents family type / year fixed effect regression results for years 2008-2013. Dependent variable is the fraction of pre-term births (<37 weeks) in the family type, which is regressed on the following independent variables. FTBi: the family tax break increment for an additional child, FTBb: the family tax break base without an additional child, INC: gross family income, PIT: personal income tax of the family without the family tax break. The columns show results for different subgroups of the population indicated in the table. All variance in first births is taken up by the year fixed effects as all family types had enough income to claim the full benefit for the given year. Standard errors clustered at the family type level are in parentheses. Significance levels: *** p<0.01, ** p<0.05, * p<0.1

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