



## ORIGINAL ARTICLE


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## Fiscal and redistributive impacts of the introduction of dynamic components in maternity benefits

**JEL Classification:** H53; H55; C63

**Keywords:** *maternity benefits; Social policy; work-life balance; redistribution impacts; fiscal impacts; microsimulation*

### Abstract

**Research background:** Social security systems combine several subsystems aimed at addressing the risks of temporary or permanent loss of an individual's income. The subject of the research are parametric changes of alternative public policy aimed at addressing the temporary loss of income caused by the dropout from the labour market due to childcare. The effects of public policies may be fiscally neutral from the entire system, but not from the point of view of the individual.

**Purpose of the article:** The purpose of this study is to examine the fiscal and redistributive effects of parametric changes in social insurance subsystem with an accent on maternity benefits in the conditions of the Slovak Republic by using a modified microsimulation model.

**Methods:** Using a microsimulation model, we investigate the impacts of the alternative policy setting. Microsimulation model contains four basic modules (i) macroeconomic module, (ii) demographic module simulating future population structure from 2017 to 2080 (iii) status module modelling particular attributes (characteristics), (iv) social policy module. The model is applied to

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maternity benefits in two scenarios in the Slovak Republic: scenario 1 — the current legislative setting of maternity benefit policy parameters and scenario 2 — dynamic maternity benefit.

**Findings & value added:** Results in the area of redistributive impacts in social insurance focused on maternity benefits show that dynamic policy parameters can positively affect work-life balance, especially for individuals with higher education. The results in the area of fiscal impacts show that the dynamic model of maternity benefits increases the efficiency of public spending and stimulates the faster return on the labour market. The results indicate the direction of possible government interventions and provide valuable information for policy makers in areas public policies that are associated with temporary labour market dropouts in the case of maternity.

## Introduction

Changes in lifestyle affect the composition of families, the way how children are raised, the distribution of roles among household members, and the strengthening of incentives to enter and remain in the labour market. Modern public policies often include aspects that shift more responsibility to individuals and are also focused on increasing the work-life balance. Research works in this area focus on the specific conditions of work-life balance in selected countries (Hidas & Horváthová, 2018; European Commission, 2021). These policies encourage the employment of women after maternity leave, contributing to reducing inequalities in the allocation of paid and unpaid work between mothers and fathers (Kinoshita & Guo, 2015; Dančíková, 2020). An important element in economies with a skilled labour force is to increase employment through flexible public policy parameters for short-term labour market shortfalls. These modern public policies are mainly implemented in the Nordic and Western European countries (Müller & Wrohlich, 2020; Sobotka *et al.*, 2020). Focus is also given to the evaluation of the effects of family policy and women's employment by an individual's socio-economic characteristics such as education, income, ethnicity and marital status (Stadelmann-Steffen, 2011, pp. 331–357; Liechti, 2017, pp. 91–112; Ferragina, 2019, pp. 65–80). Women's labour market behaviour and dropout times are often conditioned by existing social norms, which are also translated into policies which signals the type of behaviour is desired and encouraged (Neyer & Andersson, 2008, pp. 699–724).

Approaches to work-life balance are the subject of many discussions in the context of policy-making (Hegewisch & Gornick, 2011, pp. 119–138; Geyer *et al.*, 2014, pp. 84–98). The relationship between two different dimensions of family policy (supporting work-life balance and supporting mothers who stay at home) and fertility rates was analyzed in more detail by Wesolowski and Ferrarini, 2018 (pp. 1058–1080). Supporters of family policies emphasise their contribution to gender equality and child develop-

ment in the context of reconciling careers, motherhood and changing social norms around gender roles. However, opponents often point that family policies can cause long-term barriers to women's careers due to the loss of job skills and experiences and the subsequent higher costs to employers (Olivetti & Petrongolo, 2017, pp. 205–230). The authors Olivetti and Petrongolo (2017) distinguish main challenges that family-focused policies face. Family policies are a complex issue, in terms of varying lengths of maternity leave, employment protection, financial support (replacement rates), availability of benefits and public services, and access to pre-school educational institutions. Based on research and international comparisons of public policies aimed at improving the work-life balance of individuals caring for a child, it is the shorter duration of maternity benefits that can increase both employment and fertility rates (Luci-Greulich & Thévenon, 2013, pp. 387–416; Sobotka *et al.*, 2020).

Research findings (Kreyenfeld *et al.*, 2012; Rossin-Slater, 2017; Mas-selot *et al.*, 2018) have motivated us to formulate an alternative policy in social insurance subsystems targeting maternity benefits, reflecting the expected and demonstrated benefits as well as the limitations of this public policy. The subject of the research are parametric changes of alternative public policy aimed at addressing the temporary loss of income caused by the dropout from the labour market due to childcare. An important task of research in these areas is to find an optimal system of financial security for the working-age population, taking into account their preferences and the financial possibilities of the social insurance funds. The aim of the paper is to examine the fiscal and redistributive impacts of parametric changes in the social insurance system, with a focus on temporary dropouts from the labour market in the case of maternity in the conditions of the Slovak Republic.

By the fiscal impacts (Leers *et al.*, 2001) of parametric policy changes in the social insurance subsystems we mean changes in the total amount of resources allocated to the policies over time under different policy settings relative to the no-policy-change scenario. By redistributive effects (see Moene & Wallerstein, 2001, pp. 859–874) of parametric changes in the policies of social insurance subsystems we understand the impact on the disposable income of individuals within cohorts with different status parameters, assuming that they are contributors to the system on one hand and that they are recipients of the benefit on the other in the event of the occurrence of a life situation with which entitlement to the benefit is associated. Given that the public policy of the social insurance subsystems focuses on the productive part of the population, we examine the redistribution associated with intra-generational solidarity.

To investigate this topic, we used a microsimulation agent-based stochastic model which incorporates the effect of the business cycle on fertility rates.

The studies realized so far have mostly focused on the functioning of specific conditions in the areas of family and maternity leave policy in the European context or from the perspective of selected countries. The authors see the added value of the topic addressed in the alternative public policy settings of maternity social insurance schemes and in the introduction of dynamic elements into a microsimulation model through which the redistributive and fiscal effects of alternative public policy settings for maternity can be examined. The topic is applied to the conditions of the Slovak Republic, however, it may be inspiring for other countries with rigid maternity leave benefit systems.

The study is structured into six parts. In the introduction, the topic of maternity benefits is described in the broader context of public policies related to short-term labour market outcomes. The second section includes a review of the literature in the examined area. In the methodology part, the microsimulation approach is described and the model is presented. The fourth part presents the results of redistributive and fiscal impacts of introducing dynamic components into maternity benefits in the conditions of Slovak Republic. In the discussion, the results are confronted with the findings of other authors. The last section is the conclusion, which provides the main results obtained and several suggestions for future research.

## **Literature review**

During a temporary dropout from the labour market and income loss due to childcare, the maternity benefit as a social insurance benefit is aimed to provide temporary cash liquidity to smooth the consumption over time. However, we can assume that income shocks will affect individuals differently depending on their education and age defining the value of human capital. Understanding the impacts on individuals by age-education cohort is what can contribute to the design of targeted and effective public policies (Cygan-Rehm, 2016, pp. 73–103; Billingsley *et al.*, 2018). Existing literature suggests to take into account individual attributes of insured persons when designing the maternity leave benefits.

The differential impact of the economic recession on fertility rates across the EU is also caused by differences in public policies and in the level of work-life balance as well as the availability of formal childcare facilities (Neels, 2010; Hofmann & Hohmeyer, 2012, pp. 503–521;

Comolli, 2017, pp. 1549–1600). In addition to reconciling work-life balance, other factors (economic uncertainty, culturally determined patterns of behavior) also play a role in influencing the relationship between fertility and unemployment (Kreyenfeld *et al.*, 2012; Pailhé & Solaz, 2012, pp. 1–40; Currie & Schwandt, 2014, pp. 14734–14739). The relationship between unemployment and fertility is also examined with a focus on country conditions (e.g. Matysiak & Vignoli, 2013, pp. 273–302; Cazzola *et al.*, 2016, pp. 1–38). The findings in relation to unemployment and fertility by socio-economic group confirm that unemployment is associated with lower fertility among highly educated women (Kreyenfeld & Anderson, 2014, pp. 59–73).

Therefore, appropriately set public policy parameters aimed at achieving work-life balance and making pre-school childcare facilities available help individuals to enter and remain in the labour market. Gerbery (2017, p. 7), notes that family policies should not only consider the situation in families with young children, but they also should be based on the knowledge of the prevailing ideas about what model of childcare prevails in society, what is considered an "appropriate" time to re-enter the labour market, or what division of work between parents is appropriate.

According to Strang and Broeks (2017), in most EU countries, public policies relating to maternity leave are formed by a traditional concept designed for women. However, the trend in recent years points to changes in the design of public policies and the provision of maternity leave also through paternity or family leave. This suggests to have more flexible and individualized set-ups of maternity leave benefits instead of rigid ones, which are currently the case in Slovakia and other countries.

There is significant variation in the way that maternity leave policy is structured across EU countries (Strang & Broeks, 2017). At the same time, maternity benefits vary between EU countries in terms of the length of paid maternity leave (in weeks), the replacement ratio and the level of flexibility allowed in the mode of uptake. According to OECD (2022) data, the European countries with the longest paid maternity leave include Bulgaria (59 weeks), Greece (43 weeks), the Slovak Republic (34 weeks), while the shortest paid maternity leave is in Portugal (6 weeks) and Sweden (13 weeks). The replacement rate for maternity benefits varies (from 27% up to 100%). Ireland (27.3%), Denmark (52.4%) or Greece (61.8%) have the lowest replacement rate for maternity benefits, while some countries, for example Austria, Germany, Portugal, Estonia, have 100% replacement rate for maternity benefits.

Not only the replacement rate, but also the duration of benefit, is one of the important factors that influence women's decision-making itself and has

an impact on their lifetime earnings function. Authors Anderson *et al.* (2003, pp. 273–294); Correll *et al.* (2007, pp. 1297–1339); Fernández-Kranz *et al.* (2013, pp. 169–197) point to the fact that individuals returning to the labour market after maternity leave were penalized in terms of lower wages compared to those who did not face a labour market dropout and did not face the same opportunities for career progression. Experiences from the Slovak Republic in this area are presented e.g. by Dančíková (2020) or Čerman and Dujava (2021). Research from the authors Masselot (2018); Rossin-Slater (2017) confirms that if maternity and following parental leave is shorter than a year, it significantly increases women's (or fathers') employment rates, up to several years after maternity leave is taken. In contrast, if maternity leave lasts longer than a year, it has a negative impact on individuals' lifetime earnings function, employment rates as well as career advancement opportunities. This fact is also illustrated by research works and their findings focused on the conditions of individual countries, specifically from Germany Raute (2019, pp. 203–222) or from the Slovak Republic (Hidas & Hotváthová 2018; Černam & Dujava 2021).

According to Čerman and Dujava (2021), mothers in the Slovak Republic still have 33% lower wages six years after the first birth compared to childless women, where only about one-third of the difference in monthly wages can be explained by the fact that mothers work less hours on average. At the same time, the effect of motherhood on women's earnings depends on the number of children and educational level. In contrast, the effect of parenthood on men's earnings is much less significant, but positive, during the first two years after the birth of the first child.

Adda *et al.* (2017, pp. 293–337) find that the long-term effects of pro-fertility policies are smaller than the short-term effects, especially for women at the beginning of their careers. A typical example is the incorrect expectation that extending the duration of maternity benefits will lead to an increase in fertility rates. Instead, short-term effects are observed i.e. that a woman uses the maximum period of extended maternity leave, but the policy does not affect the incentives to have another child. For example, authors such as Adsera (2005, pp. 189–193) or Kreyenfeld and Anderson (2014) confirm a positive correlation between fertility rates and public policies enabling work-life balance. Their research points to the fact that gender differences in unemployment in a given economy have a negative impact on fertility rates. In the perspective of foreign experience, Seltzer (2019) analysed how changes in labour markets are associated with changes in total fertility rates. The findings suggest that structural changes in the economy have a greater impact on total fertility rates than changes in unemployment rates.

In Central and Eastern European countries, declining fertility rates have been also driven by uncertainty due to the transition process, which has increased the returns from education. This has consequently led to postponement of pregnancies during the transition period as investment in education became more attractive and provided access to more stable employment and higher wages (Kohler *et al.*, 2002, pp. 641–680). The relevance of work-life balance has been pointed out, for example, by Kreyenfeld & Anderson (2014); Sobotka *et al.* (2020), who argue that work-life balance reduces the opportunity cost associated with child raising, which can lead, according to Dančíková (2020) and Čerman and Dujava (2021), to higher fertility rates for all educational (or income) cohorts, as well as to increased future retirement benefits.

Two main approaches can be identified in the context of examining public policies aimed at supporting the family (Olivetti & Petrongolo, 2017, pp. 205–230). The national approach identifies the impacts of public policies based on a comparative analysis of interventions within and across countries using labour market data. The micro-level approach identifies the causal impact of the public policies under study on individuals, such as the extension/shortening of maternity leave on the willingness to engage in employment (Olivetti & Petrongolo, 2017, pp. 205–230).

The micro approach using the simulation model is what we choose in this paper to shape the methodology of investigation. We focus on designing a maternity policy that, by the nature of its parameters, would increase the flexibility of the behaviour of economic agents (in most cases women) in receiving maternity benefits in the labour market where more skilled female workers enter the market.

## **Research method**

The subject of the research are parametric changes of alternative public policy aimed at addressing the temporary loss of income caused by the dropout from the labour market due to childcare. The aim of this study is to examine the fiscal and redistributive effects of parametric changes in the maternity benefits<sup>1</sup> policy under the conditions of the Slovak Republic where the rigid system is replaced by a flexible one allowing for setting the duration as well as the replacement ratio (level of the benefit). By using a modified microsimulation model incorporating the effect of economic

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<sup>1</sup> Maternity benefit is an insurance based benefit provided by the Social Insurance Agency based on pregnancy or care for a new-born child.



uncertainty on the aggregate fertility rate, we want to verify two research questions (RQs):

*RQ1: Does the implementation of the dynamic components in maternity benefits allows to achieve income smoothing over time?*

*RQ2: Does the implementation of dynamic components in maternity benefits leads to a reduction in public spending?*

For alternative policy modeling and examining the impacts, we use a cohort-based dynamic microsimulation model. According to Spielauer (2016) the strength of dynamic microsimulation models used in policymaking is closely linked to the ability of these models to present policies results at any level of detail. Microsimulation allows to address distributional issues as well as issues of long-term sustainability (fiscal effects). Changes in social policies need for a longitudinal perspective and thus benefit from detailed projections and ability to test environment provided by dynamic microsimulation models.

The model contains four basic modules: (i) macroeconomic module, which simulates future economic development (wage growth, unemployment, asset prices, and inflation) and drives the economic uncertainty for economic agents and their decisions, (ii) demographic module simulating expected fertility rates and future population structure from 2017 to 2080, (iii) status module modelling particular attributes (characteristics) of individuals according to a transition matrices, and (iv) social policy module, where the policy parameters are defined.

Initial attributes of the population living in Slovakia in 2020 were set for each economic agent (age, sex, education, marital status, economic activity) using the Statistical Office of the Slovak Republic (2020) data from 1996 to 2019. We constructed marriages by age of a couple using a transition matrix and estimated probability matrix of marriage by age based on the Statistical Office of the Slovak republic data (2020).

In the demographic module, the model works with the estimation of the size and structure of the Slovak population by 2080. Based on the study of Kocourková *et al.* (2019, pp. 82–104), we have incorporated the relationship between the business cycle and fertility rates. We estimated a regression model that linked macroeconomic parameters to fertility rates and modelled expected number of born children according to the regression model. As the variables GDP per capita and unemployment are significantly correlated with each other, our model works with the unemployment



factor. We used a simple linear regression method to determine the impact of unemployment on the total fertility rates:

$$\text{TFR}_t = \beta_0 + \beta_1 \left( \frac{u_t}{u_{t-1}} - 1 \right) + \varepsilon \quad (1)$$

where:

- $\text{TFR}_t$  change in total fertility rate;
- $\beta_0$  constant;
- $\beta_1$  regression coefficient;
- $\frac{u_t}{u_{t-1}} - 1$  change in the unemployment rate over time  $t$ ;
- $\varepsilon$  random component.

We assume that unemployment will affect fertility rates in line with the results of studies focusing on EU countries, so we set the regression coefficient according to the study by Kocourková *et al.* (2019, pp. 82–104)  $\beta_1 = -0.129$ . Projections of the population using the model compared to the EUROPOP2018 projections are presented in Figure 1.

Based on the recent trend of catch-up pregnancies as well as the change in the distribution of fertility by age cohorts and in particular the increase in the median age of first-borns (Kohler *et al.* 2002, pp. 641–680), we work with the average number of births by age of woman from OECD data for the period 2008 to 2017. Probability of mother's age at child birth is presented in Figure 2. This probability is important for the identification of mother's income and subsequent maternity benefits, which are directly linked to the mother's previous income.

Further, we estimated the probability matrix of live births by legitimacy status and sex of the child born using the data from the Statistical office of Slovak republic (2020). The probability matrix (2 x 2 matrix) is shown in Table 1. The probability matrix is used as a proxy for the stochastic model when moving the population forward. A newborn has 51.5% probability of being a male, 60% probability of being born in marriage and combined probability (a male born in a marriage) at 31%.

When estimating the life-cycle income functions of economic agents with specific age and attained education level, we used the studies of Šebo *et al.* (2020, pp. 271–284) and Balco *et al.* (2018, pp. 64–80), who focused on modeling the age and education specific life-cycle income functions for individuals in the Slovak Republic. Administrative data on age and educational specific wages for the Slovak Republic from the Ministry of Finance of the Slovak Republic (Fodor & Cenker, 2019) were used to estimate the regression coefficients of a polynomial function.

In order to incorporate the uncertainty into the individual income development, the impact of labour market shocks and inflation on the nominal wage ( $w$ ) could be expressed as (Šebo *et al.*, 2020, pp. 271–284).

$$w_{j,t} = \begin{cases} w_{j,t}; t = 1 \\ w_{j,t-1} \times (1 + \tau_t); U_t = 1, t \in \langle 1, T \rangle \\ w_{j,t-1} \times \omega_{j,t}^* \times (1 + \tau_t); U_t = 0, t \in \langle 1, T \rangle \end{cases} \quad (2)$$

Where  $\omega_{j,t}^*$  represents monthly changes in the real wage based on the estimated life-cycle income functions for an individual with education  $j$  and time  $t$ ;  $\tau_t$  represents the inflation in time  $t$ .  $U_t = 1$  means that the economic agent is unemployed at time  $t$ , while  $U_t = 0$  means that the economic agent is employed at time  $t$ . Parameter  $T$  defines the year when an economic agent reaches the retirement age. If an economic agent is employed ( $U_t = 0$ ), his/her income function depends on the development of inflation and the increased labour productivity over time. In the case that the economic agent is unemployed ( $U_t = 1$ ), his/her lifetime income function changes over time only by the impact of inflation and the labour capital remains constant.

Secondly, in order to get different labour income process under the unemployment risk (Skrętownicz & Wójcik, 2016, pp. 211–226), we developed transition matrix, that transform general unemployment rates into age and specific ones. In modeling the probability of changes in the employment of an economic agent at age  $x$ , education  $j$  at time  $t$ , the transition matrix has the following form:

$$M_{x,j,t} = \begin{pmatrix} p_{U_t=1 \rightarrow U_t=1, x,j,t} & p_{U_t=1 \rightarrow U_t=0, x,j,t} \\ p_{U_t=0 \rightarrow U_t=1, x,j,t} & p_{U_t=0 \rightarrow U_t=0, x,j,t} \end{pmatrix} \quad (3)$$

For each element of matrix  $M$ , the probability of status change ( $p$ ) applies, where:

$$0 \leq p \leq 1$$

Initial transition matrix with probabilities (odds ratios) has been created using cross-sectional data on age and educational specific unemployment from the Ministry of Finance of the Slovak Republic for the reference period of 2004 until 2018.

Resulting regression parameters for estimating life-cycle income polynomial functions for various age and educational cohorts are presented in the Table 2.

Entire population is moved forward by implying macroeconomic uncertainty onto the micro entities using the resampling method, where the future macroeconomic development is presented via blocks of macro variables (unemployment, total factor productivity, inflation, equity and bond returns) randomly combining the up-trending and down-trending economic cycles using data from the NBER (2018). Altogether, we have 18 up-trending and 18 down-trending cycles forming 100 years of monthly data that can be combined (resampled) into  $n!$  new blocks (more than  $6.4e^{15}$  of new pseudorandom blocks) of which we randomly select 30000 simulations. The simulations are performed for the years 2000–2040. For each simulation block, we start from the first month ( $t = 0$ ), where the initial population is moved using macroeconomic variables that via transition matrixes influence the changes in the status parameters of economic agents.

The results of incorporating macroeconomic uncertainty into the individual income projections depending on the education attained are presented in annex (Figures 3–5). The projections show that the higher the education level, the lower the unemployment risk and the higher the variation of income. In the model, we monitor the development of parameters for analyzed policies and for each economic agent on the annual basis. The data presented in this study represents the 50<sup>th</sup> percentile of all simulations, however the model is also able to present the simulated values for different percentiles.

### *Scenario 1 – no policy change scenario (NPC)*

The NPC scenario represents the current legislative setting of maternity benefit policy parameters (Social Insurance Act) as of 1 July 2020. Level of maternity benefit received is dependent on the contribution base of an insured person. The policy contains the upper limit on the maximum level of contribution base set at the twice the average wage in the economy two years ago ( $2\bar{w}_{t-2}$ ). Monthly maternity benefit is a product of the allowance rate (75%) and average previous monthly income of an insured person, where the minimum is basically the level of parental benefit ( $RP$ ) as defined in the Parental Allowance Act (Article 4(4)). Formula for calculating the level of maternity benefit is than as follows:

$$B_{M;NPC} = \max \left\{ RP; AR_M \times \min \left( \frac{\sum_{m-1}^{m-24} w_m}{24}; 2\bar{w}_{t-2} \right) \right\} \quad (4)$$

The maximum period of maternity leave for which the maternity benefits are paid ( $BP_M$ ) is fixed at 34 weeks for a married mother and 37 weeks for a single mother.

### Scenario 2 – Dynamic maternity benefit

Scenario 2 represents an alternative policy and incorporates the flexibility based on an assumption that an individual with higher education and wage prefers shorter maternity leave accompanied with higher allowance rate compared to an individual with lower education, which was confirmed by the empirical research of Hidas and Horváthová (2018) and Dančíková (2020). Scenario 2 thus present the dynamic maternity benefit model where an individual with a higher income receives the benefit for a shorter period, but at a higher replacement rate determined by the average income of an insured person compared to the average wage in the economy with a maximum set at twice the average wage in the economy two years ago ( $2\bar{w}_{t-2}$ ). On the opposite side, lower income individuals prefer longer maternity leave accompanied with lower replacement ratio with a minimum maternity benefit equal to parental benefit.

We determine the maternity benefit ( $B_{M,dynamic}$ ) according to the following formula:

$$B_{M,dynamic} = \max \left\{ RP; \min \left( 2 \times AR_M; AR_M \times \frac{\sum_{m-1}^{m-24} w_m}{\bar{w}_{t-1}} \right) \times \frac{\sum_{m-1}^{m-24} w_m}{24} \right\} \quad (5)$$

where:

|                 |  |
|-----------------|--|
| $B_{M,dynamic}$ | monthly maternity benefit in Scenario 2;               |
| $RP$            | parental benefit;                                      |
| $AR_M$          | maternity benefit replacement ratio (allowance rate);  |
| $w_m$           | monthly contribution base (wage) of an insured person. |

While the duration of maternity benefit is fixed and dependent on the marital status in the NPC scenario, the duration of maternity benefit ( $BP_{M,dynamic}$ ) in the dynamic maternity benefit scenario depends on the income of an individual and is determined by the following formula:

$$BP_{M,dynamic} = \max \left( \frac{8}{\frac{\sum_{m-1}^{m-24} w_m}{24}}; BP_M \min \right) \quad (6)$$

where:

$BP_{M,dynamic}$  length of receiving the dynamic maternity benefit (benefit period);

$BP_{M min}$  minimum length of maternity period;

$w_m$  monthly contribution base (wage) of an insured person.

Value 8 in formula (6) represents the maximum benefit period in months in the NPC scenario for an individual with the marital status “married”. The dynamic length of the benefit period and allowance rate in the Scenario 2 smooth the consumption over time and reduce the shock from the loss of liquidity. However, we have set the minimum benefit period ( $BP_{M min}$ ) in accordance with the EU Directive no. 92/85/EEC, which sets the minimum period of maternity at 14 weeks, which for modeling purposes we have rounded to 4 months.

## Results

In this part, we present the results of redistributive and fiscal impacts of introducing dynamic components into maternity benefits in the Slovak Republic using a microsimulation model.

### *Redistributive impacts of the dynamic components in maternity benefits*

Research results are presented using three education (income) cohorts of mothers aged 32 who would receive maternity benefits expressed in real terms (2020 year prices) in a given year, regardless of the woman's status (married/unmarried) in a neutral scenario represented by the 50<sup>th</sup> percentile of all simulations.

As the setting of the dynamic maternity benefit scenario changes the replacement rate and duration of maternity benefit depending on the education (income) of the individual, we can assume that the maternity benefit will be higher for higher education (income) and, on the other hand, will be lower for lower education (income) compared to the NPC scenario.

The dynamic maternity benefit model in higher education cohorts increases the amount of the benefits (by 24.4%) and decreases the duration time of receiving benefits (by 9.4%). The model confirms the behavior of economic agents similar to the Slovak empirical data, where the preference for shorter maternity leave is obvious. This could reduce the opportunity cost for higher educated (higher income) mothers, that would prefer shorter maternity leave periods with higher replacement rates. We could expect

also some positive effects on increased fertility rate in this cohort. On the other hand, for the lower-educated cohorts, the replacement rate is lower (by 25.9%) and the duration of receiving the benefit is longer (by 23.8%), reflecting the higher risk of unemployment and the liquidity trap just after the maternity leave period. There are no significant changes in the replacement rate nor the duration of receiving the benefit for secondary educational (income) cohort (see Figure 6 and 7 for more details).

In reality, once an individual has reached the maximum legal duration of maternity leave, he or she usually starts receiving parental allowance (as a subsequent benefit in the form of social assistance), to which he or she is entitled until the child reaches the age of three. The model allows individuals with lower education to receive the benefit for a longer period and reduce the risk of a liquidity trap, as individuals with lower education (most often women) face a higher risk of unemployment in the post-maternity leave period. By contrast, individuals with higher education do not face high risks of unemployment after maternity leave; on the contrary, maternity leave is ended before the child reaches the age of three, which is reflected in the duration of the benefit in the dynamic maternity benefit model. These dynamic policy parameters may have the effect of increasing work-life balance, particularly among higher-educated cohorts, which in turn may also lead to higher fertility rates even in times of economic recession.

### *Fiscal impact of the implementation of dynamic components in maternity benefits*

Effective contribution rate is a typical indicator explaining the fiscal impact of policy change. When examining the effective contribution rate indicator (Figure 8), we can identify that the dynamic maternity benefit scenario achieves lower contribution rates across all analyzed years 2020–2040 when compared to the NPC scenario. The relative difference among the scenarios is more than 10%. One could note the overall declining trend in the effective contribution rate for both policies, which is caused by low fertility rates and correspondingly declining numbers of children born in future periods.

As in the case of the effective contribution rate, when examining the balance of the sickness fund and the impact of the implementation of the dynamic maternity benefit scenario (Figure 9), we can conclude that the dynamic maternity benefit policy improves the performance of the sickness insurance fund by 16.7%. Increasing positive balances of the sickness insurance fund are caused by decreasing trend of births in future periods, which influences the lower number of paid benefits.

## Discussion

Using stochastic modelling to simulate the maternity benefit policy on the whole population, we tested two research questions, focusing on the redistributive impacts of changing the static parameters of maternity policy into the dynamic ones in order to reflect the preferences of the individuals receiving the benefit, and the fiscal impacts of changing the parameters of the maternity policy. The limitation of microsimulation lies in the fact that the degree of model detail does not go hand in hand with overall prediction power. The reason is the randomness, partly caused by the stochastic nature of microsimulation models, and partly due to accumulated errors and biases of variable values. There is a trade-off between the randomness introduced by additional variables and misspecification errors caused by models that are too simplified. This means that the feature that makes microsimulation especially attractive, namely the large number of variables that models can include, comes at the price of randomness and the resulting prediction power that weakens or decreases as the number of variables increases. A limitation of our research is that we have only focused on examining maternity benefits and we have not examined parental allowance, which is a subsequent benefit during the maternity leave period, motivating us for future research.

In our research on redistributive impacts, the examined research question (RQ1) was "*Does the implementation of the dynamic components in maternity benefits allow to achieve income smoothing over time?*". Assessing the designed alternative dynamic maternity benefit policy suggested that the policy could increase the flexibility of maternity benefits, reflect individuals' preferences in the amount and duration of benefits, and at the same time reduce the risk of poverty in families with young children, which is particularly specific to cohorts with lower education. For this reason, we related the parameters of the designed policy to an individual's education (significant determinant of income), which dynamically changes the replacement ratio and the duration of paid maternity benefit. Based on the results from a macroeconomic perspective, dynamic maternity benefit policy increases the positive balance of the sickness insurance fund.

Authors Anderson *et al.* (2003, pp. 273–294); Correll *et al.* (2007, pp. 1297–1339) and Fernández-Kranz *et al.* (2013, pp. 169–197) point to the fact that individuals returning to the labour market after maternity leave were penalized in terms of lower wages compared to individuals who did not face a labour market dropout and did not face the same opportunities for career progression. So, the decision to have a child has a strong signal-



ing role for the employer in the form of the mother's expressed career preferences and willingness to accept lower wages.

Our research has shown that a dynamic maternity benefit model reflects this signaling role and provides a signal to the mother to reduce the risk of income loss after the end of maternity benefit period and an acceptable wage level when returning to the labour market. Based on our findings, we can answer the research question (RQ1) positively (YES).

Following the analyses made by Hidas and Horváthová (2018) or Dančíková (2020), the results in the conditions of the Slovak Republic show that the behavior of individuals with different education (or income) during the time spent out of the labour market as a result of childbirth is dependent on the education (or income) of the individual. The different preferences of individuals for being out of the labour market due to childcare (maternity and parental leave) were taken into account in the dynamic maternity benefit scenario. The parameters of dynamic maternity leave allow individuals with lower education to receive the benefit for a longer period and, to reduce the risk of a liquidity trap because individuals with lower education (most often women) face a higher risk of unemployment in the period after maternity leave (Hidas & Horváthová, 2018), which is followed by a 5-year childcare gap in the market after the parent has stopped receiving the benefit. It is during this period where the poverty risk increases for families with young children. The authors Čerman and Dujava (2021, p. 8) point out that measures in the areas of public and social policy should focus on supporting the return of mothers to employment, in particular by increasing the availability of pre-school care, promoting the use of maternity and parental leave by fathers and flexible employment. According to Čerman and Dujava (2021, p. 8) or Kleven *et al.* (2019), gaps in these areas mean that women cannot optimally combine work and childcare and re-enter the workforce too late. This amplifies the negative income effect of parenthood, leads to lower retirement pensions for mothers at older ages and increases their economic dependence on their partners' income.

The research question (RQ2) was tested in the context of fiscal impacts: "*Does the implementation of dynamic components in maternity benefits leads to a reduction in public spending?*"

Both the European Commission (2008, 2018, 2019) and the European Parliament (2015) point out that countries with higher female employment rates are also countries with higher fertility rates, which is also an important element in dealing with demography and population ageing. At the same time, Kinoshita and Guo (2015) highlight the importance of women's labour force, which can be the key to unlocking growth potential in economies, especially in those economies that have a skilled female labour force.

In comparison to the existing policy, the dynamic model reflects the demand for labour and gives a signal on the cost of labour to the mother when returning to the labour market.

The lower effective contribution rate of the dynamic maternity allowance demonstrates a higher efficiency in spending the public resources needed to pay maternity benefits. Therefore, based on the findings, we can answer YES to RQ2.

In the context of other developments that would enable women to return to the labour market faster Esping-Andersen (2009) illustrated that the lack of formal childcare services to help women achieve work-life balance will lead to two equilibria, namely (i) an equilibrium characterized by childlessness and low fertility or (ii) an equilibrium characterized by low income and low employment. That is why we consider that it is important to set public policies in a way that allows women to return to work earlier with minimal penalties. However, in order to increase the employment of women with young children, and thus to increase work-life balance, it is necessary to achieve the Barcelona targets, which set the availability of childcare facilities at least 33% for children under 3 years of age and at least 90% for children up to school age. The European Commission (2019) reports that state-run childcare facilities for children under 3 years of age in the Slovak Republic are not in the government's focus.

Ayllón (2019, p. 1322), on the other hand, notes that if labour market effects prevail, where supply is very low, women may trade low pay and low labour market prospects for the opportunity to provide for their own children. In this case, we can find a positive relationship between worsening economic conditions and the number of children born. Since women's earnings are usually lower than men's, a bad economic situation can be seen as a good time to leave the labour market (especially if women's unemployment rate is rising more than men's). This situation can arise where the welfare state is generous and benefits provide a high replacement rate (specifically in the Nordic countries of Europe). At the same time, in European countries where women are more likely to provide childcare themselves rather than relying on a variety of childcare options, these substitution effects can be strong.

In general, we can conclude that dynamically set maternity policy parameters can increase work-life balance, especially for higher-educated cohorts (Kohler *et al.*, 2002, pp. 641–680; Adsera, 2005, pp. 189–193; Kreyenfeld & Anderson, 2014, pp. 59–73), which can also lead to higher fertility rates in times of economic recession. Referring to the European experience and research in this area, Ayllón (2019, pp. 1321–1347) or Matysiak *et al.* (2021, pp. 29–64) examined to what extent changes in la-

bour market conditions caused by the Great Recession were associated with reduced fertility rates. Results from European countries suggest that the main indicators which are strongly associated with reduced fertility include unemployment, inability to find full-time work and perceived job insecurity. However, the findings vary by country group, age group and, in particular, by income and educational attainment.

We consider the limitation of our research is 1) the fact that the used simulation model does not reflect other factors that influence a mother's willingness to return to the labour market. 2) The implementation of dynamic elements in maternity benefit policy using a microsimulation model is a less explored topic, not only in the Slovak Republic. Although available studies, e.g. Baroni *et al.* (2009) explain the simulation model in different areas (Demographic, Labour Market, Human Capital Production module) or discuss the advantages and disadvantages of the model. However, given the alternative public policy topic addressed, we have referred to appropriate papers with empirical results in order to make a more detailed comparison of our research with other authors.

## **Conclusions**

Modern public policies should reflect economic and social changes. Flexible maternity leave, together with increased flexibility in working hours, is one of the main aspects of achieving work-life balance.

The main objective was to examine the fiscal and redistributive impacts of parametric changes in the social insurance subsystem with a focus on maternity benefits in the Slovak Republic. By modifying the microsimulation model and supplementing the relationship between mother and child, father and child and father and mother, we opened a completely new perspective on the formation of public policies in this area. By examining the current knowledge of public policies in the areas of maternity benefits we came to the conclusion that the practice in most developed countries motivates mothers (parents) to the earlier return to the labour market with aim to fully utilize the human capital.

Results based on redistributive impacts in social insurance focused on maternity benefits, show that dynamic policy parameters can positively affect work-life balance, especially for individuals with higher education. In the area of fiscal impacts, implementing dynamic parameters into maternity benefits indicate that the dynamic model reflects labour market demand and gives a signal on the cost of work to the mother when returning to the labour market, compared to the existing policy. At the same time, the

dynamic model of maternity benefits increases the efficiency of spending the public resources needed to pay these benefits.

The methodology of our research, where the stochastic microsimulation model was used, provided the ability to test the alternative policy set-ups but, on the other hand, did not allow to directly compare the results with other studies. As the microsimulation techniques gain on the importance in the research and applied policy making, more studies will occur that would allow to compare the models at least in the no-policy settings and modeling results.

The findings in the conditions of the Slovak Republic indicate the direction of possible government interventions in the analyzed areas of public policies. Our findings also support further research on incorporating dynamic factors into the public policies that would support work-life balance and thus help to close the gap between the intended and revealed preferences on the number of children.

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### **Acknowledgments**

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## Annex

**Table 1.** Probability matrix of the distribution of live births by legitimacy and sex

| Legitimacy / Sex | Male  | Female | Total |
|------------------|-------|--------|-------|
| In marriage      | 0.31  | 0.29   | 0.60  |
| Outside marriage | 0.205 | 0.195  | 0.40  |
| <b>Total</b>     | 0.515 | 0.485  | 1     |

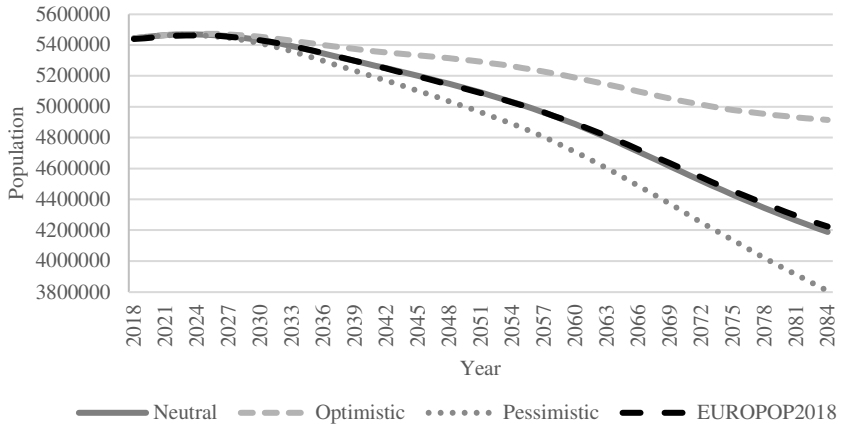
Source: own elaboration based on data from the Statistical Office of the Slovak Republic (2021).

**Table 2.** Estimation of regression parameters for life-cycle income polynomial function

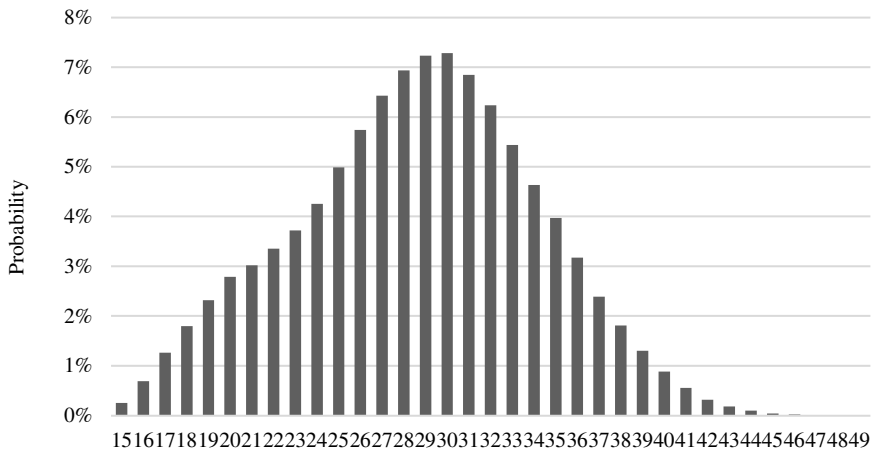
| Regressors:                           | <i>Education level</i> |            |            |
|---------------------------------------|------------------------|------------|------------|
|                                       | Primary                | Secondary  | Tertiary   |
| a                                     | 0.2242                 | 0.0006     | -0.9978    |
| b                                     | 0.0009                 | 0.0027     | 0.0085     |
| c                                     | -0.0000006             | -0.0000021 | -0.0000065 |
| <b>Standard Error</b>                 | 0.0086                 | 0.0095     | 0.0702     |
| <b>R<sup>2</sup></b>                  | 0.96                   | 0.993      | 0.96       |
| <b>Correlation</b>                    | 0.98                   | 0.99       | 0.98       |
| <b>Parameter Standard Deviations:</b> |                        |            |            |
| <i>a_stddev</i>                       | 0.0392                 | 0.0431     | 0.32       |
| <i>b_stddev</i>                       | 0.0002                 | 0.0002     | 0.0012     |
| <i>c_stddev</i>                       | 0.00000014             | 0.00000015 | 0.00000114 |
| <b>Parameter Uncertainties, 95%</b>   |                        |            |            |
| <i>a_unc</i>                          | 0.1009                 | 0.1109     | 0.8226     |
| <i>b_unc</i>                          | 0.0004                 | 0.0004     | 0.0032     |
| <i>c_unc</i>                          | 0.0000004              | 0.0000004  | 0.000003   |

Source: own elaboration based on Sebo *et al.* (2020).

**Figure 1. Population projections - model vs. EUROPOP2018**

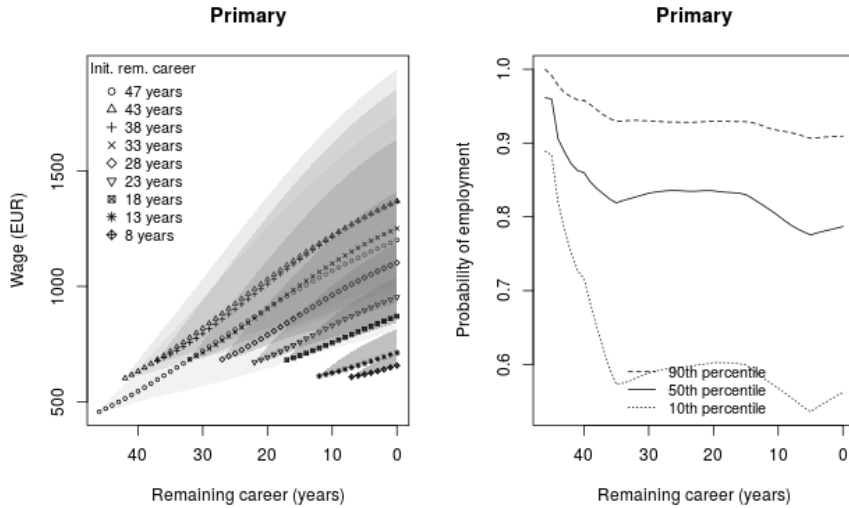


**Figure 2. Probability distribution of mother's age at childbirth**

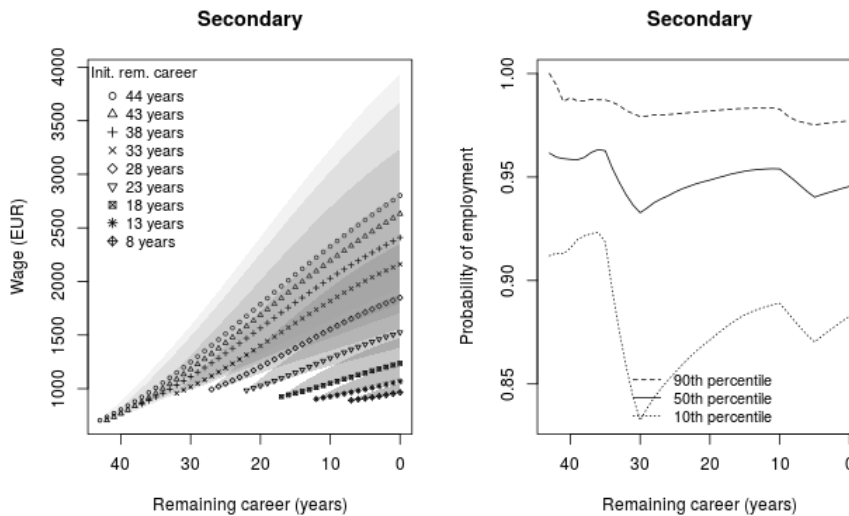


Note: Figures 3–5 below present education specific life-cycle income projections for different remaining career/working years (left chart) complemented with the estimated probability of being employed until achieving the standard retirement age (right chart). Grey shaded areas around 50<sup>th</sup> percentile within left charts represent 10<sup>th</sup> and 90<sup>th</sup> percentile of all simulations.

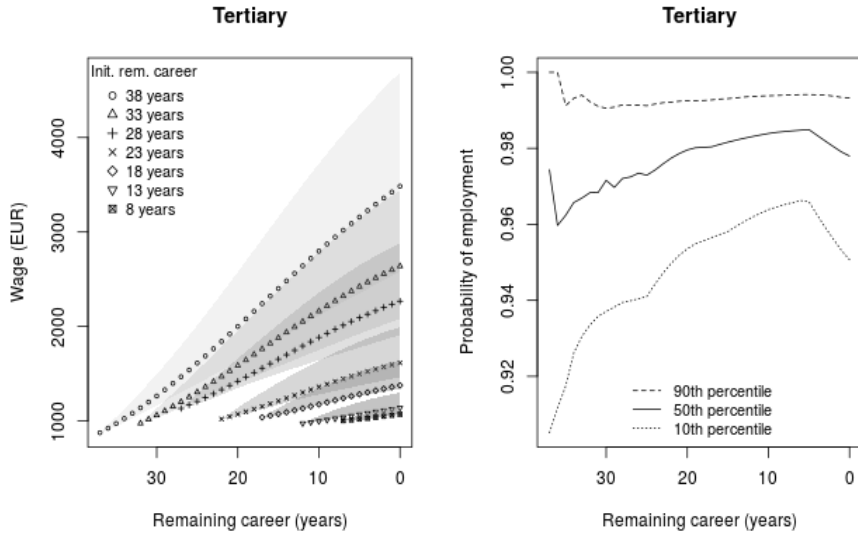
**Figure 3.** Life-cycle income projections with unemployment risk for primary education level



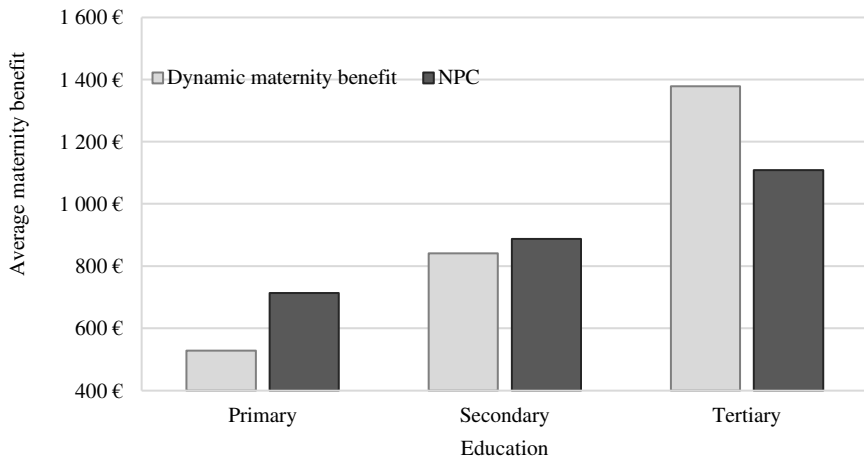
**Figure 4.** Life-cycle income projections with unemployment risk for secondary education level



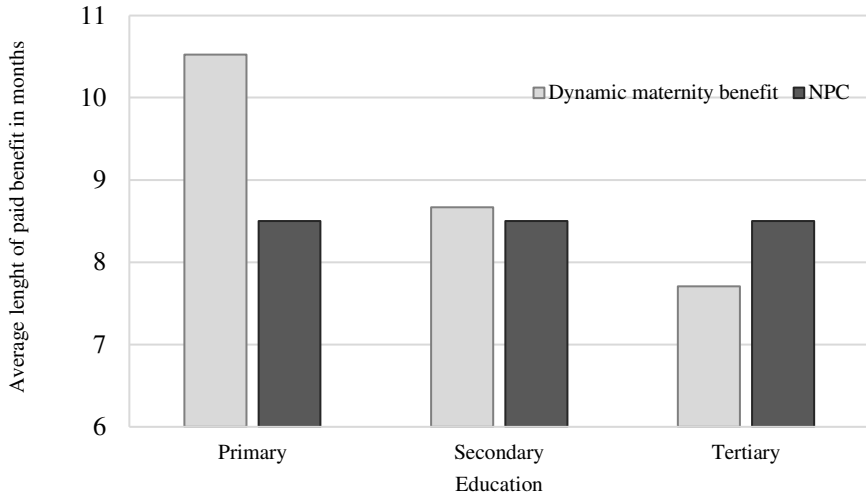
**Figure 5.** Life-cycle income projections with unemployment risk for tertiary education level



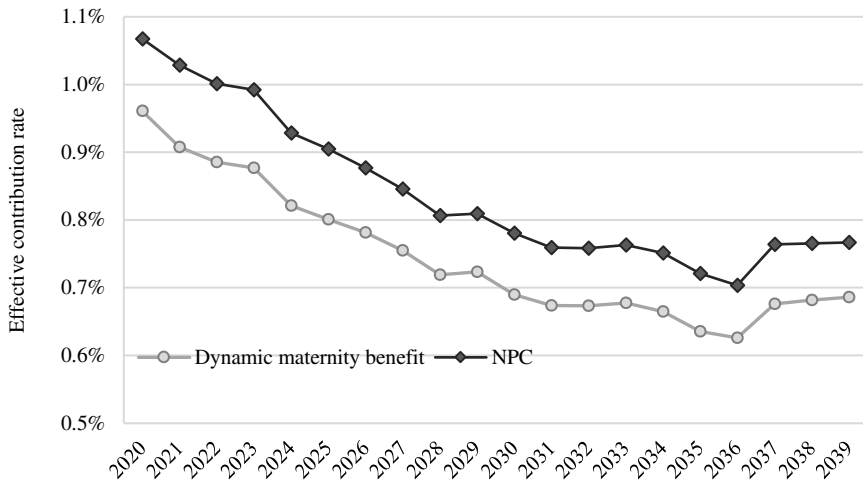
**Figure 6.** Average maternity benefit by education



**Figure 7.** Average duration of maternity benefit by education



**Figure 8.** Effective contribution rate of the sickness fund



**Figure 9.** Balance of sickness fund

