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Has Equity Lost Ground?

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Abstract

The Netherlands witnessed major reforms in the taxation of (potential) secondary earners over the past decade. Using the inverse-optimal method of optimal taxation we recover the implicit social welfare weights of single- and dual-earner couples over time. The social welfare weights are grosso modo well-behaved before the reforms. However, after the reforms, they are no longer monotonically declining in income and sometimes negative, suggesting that Pareto-improving reforms are possible. Taken at face value, these results suggest an imbalance between equity and efficiency. However, other considerations may rationalize these findings, like differences in preferences over formal income and informal care.

JEL codes: C63, H21, H31
Keywords: Optimal taxation, revealed social preferences, secondary earners

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1 Introduction

Many OECD countries have implemented tax-benefit reforms, to promote labor force participation, in particular of women. Prominent examples are in-work tax credits and subsidies for child care. As a result, effective marginal tax rates and participation tax rates for secondary earners have declined in many OECD countries (OECD, 2014). However, at the same time, governments want to maintain an equitable distribution of disposable income over single- and dual-earner couples, using various benefits targeted at low-income families, in particular at low-income families with children. Indeed, policymakers face the dilemma of providing sufficient income support for the needy on the one hand and providing sufficient incentives to work on the other. The theory of optimal taxation, pioneered by Mirrlees (1971), studies this trade-off between equity and efficiency. Using optimal tax theory we can derive the optimal income support system for a given set of social welfare weights, behavioral responses and ability distribution. Saez (2002) has extended the optimal tax model of Mirrlees (1971) to include an extensive margin decision for labor supply. A number of recent papers invert the optimal tax model of Saez (2002), using the so-called inverse-optimal method of optimal taxation to reveal the implicit social welfare weights for a given system of income support (Haan and Navarro, 2008; Blundell et al., 2009; Bargain and Keane, 2011; Bourguignon and Spadaro, 2012; Bargain et al., 2014a; Jacobs et al., 2017). Anomalies in the implicit social welfare weights, like weights that are declining in disposable income or weights that are negative, may indicate suboptimal elements in the system of income support. In this way, the inverse-optimal method of optimal taxation can be a powerful tool to help policymakers to optimize the tax-benefit system.

In this paper we study the implicit social welfare weights of single- and dual-earner couples in the Netherlands. Over the past decade, a series of reforms has reduced tax rates on dual-earner couples and has increased tax rates on single-earner couples. Furthermore, due to proposed reforms, these trends will continue in the future. These reforms have stimulated formal labor participation, but have also increased the inequality in disposable income between single- and dual-earner couples. We study how these reforms have affected the trade-off between equity and efficiency, using the inverse-optimal method of optimal taxation, and whether the implicit social welfare weights are becoming more 'well behaved' or not.

Following Haan and Navarro (2008), we invert the optimal tax model of Saez (2002) where women in couples (typically secondary earners) can make both an extensive margin decision (participation) and an intensive margin decision (hours worked per week), while keeping the labor supply of men in couples (typically primary earners) fixed.[1] For this model we need three inputs: i) the income (ability) distribution, ii) net taxes by income, and iii) the behavioral responses to taxes at the extensive and the intensive margin. For the income distribution we take data from the Labor Market Panel of Statistics Netherlands (2012), a large representative administrative dataset for the period 2006–2009. To calculate the net taxes by income we use the advanced tax-benefit calculator MIMOSI (Koot et al., 2016). Finally, we determine the extensive and intensive behavioral responses to taxes by estimating a (static[2]) unitary discrete-choice model for labor supply and child care use for women in couples in the Netherlands. We consider results for the whole

[1]This can be considered a reasonable approximation, as most men in couples work full-time and are relatively unresponsive to changes in financial incentives (Jongen et al., 2014).

[2]We discuss the potential implications of using a static instead of a dynamic (life-cycle) model in the Discussion section.

group of couples, and for subgroups of couples based on the age of the youngest child. We also present a large number of robustness checks.

Our main findings are as follows. First, the implicit social welfare weights in the initial tax-benefit system (of the year 2005) are grosso modo well-behaved for the whole group of couples: monotonically declining in income and positive. However, for couples with a youngest child 0–3 years of age, the social welfare weight for single-earner couples is lower than the social welfare weight of dual-earner couples, despite the higher net income of dual-earner couples. Second, after the reforms over the period 2005–2017, the social welfare weights are no longer well-behaved: they are not monotonically declining in income and are sometimes negative. The social welfare weights of single-earner couples drop below the social welfare weights of dual-earner couples. The drop in social welfare weight is most pronounced for single-earner couples with a youngest child 0–3 years of age and even becomes negative for this group. Taken at face value, this implies that (at the margin) a reduction in taxes on single-earner couples with a youngest child 0–3 years of age is a Pareto-improvement. Furthermore, a simulation of the long-run tax-benefit system, including the proposed policy reforms in the recent Coalition Agreement of Rutte-III, shows that future policy changes will further reduce the social welfare weights of single-earner couples and increase the social welfare weights of dual-earner couples. Third, an optimal tax analysis suggests that for a wide range of preferences for redistribution, it would actually be optimal to reverse some of the recent policy changes and lower taxes on single-earner households and increase taxes on dual-earner couples. These findings are robust across a large number of robustness checks, in the context of our static unitary household model. However, the static unitary household model ignores a number of additional considerations that can potentially rationalize the 'anomalies'

we find. Indeed, amongst others, our model ignores the potential social welfare gains of a more equitable distribution of work and care over men and women in couples, and also what this implies in case their relationship ends. Furthermore, differences in income may not adequately capture the differences in household utility, as single-earner couples may have a stronger preference for 'leisure' or informal care than dual-earner couples.

Our contribution to the literature is twofold. First, we use the inverse-optimal method to evaluate whether a series of tax-benefit reforms, targeted at secondary earners, improves the trade-off between efficiency and equity. We show that the inverse-optimal method can be a powerful tool to assist policymakers in thinking about whether a particular reform will move the system closer to an 'optimal' system, for given preferences for redistribution. Also, we use the inverse-optimal method not only for an ex-post evaluation of past reforms, but also for an ex-ante evaluation of proposed policy reforms in the future. Second, we extend the analysis of optimal taxation of single- and dual-earner couples for Germany in Haan and Navarro (2008) to the Netherlands. Haan and Navarro (2008) study the implicit social welfare weights for single- and dual-earner couples for the joint taxation system in Germany and for a counterfactual individual taxation system (like in the Netherlands). They find that individual taxation implies a lower weight for single-earner couples relative to dual-earner couples than a system with joint taxation. The Netherlands has already made the transition to individual taxation (several decades ago), and we consider whether, starting from an individualized tax system, further reductions in the taxation of secondary earners will move the tax-benefit system closer to what could be considered 'optimal'.

The outline of the paper is as follows. In Section 2 we outline the inverse-optimal

method. Section 3 considers the changes in income support for single- and dual-earner couples in the Netherlands over the past decade and the proposed changes for the future, and also gives descriptive statistics for couples in the dataset. In Section 4 we then recover the implicit social welfare weights at different points in time. Subsequently, in Section 5 we calculate the optimal tax system, for different preferences for redistribution. Section 6 discusses a number of limitations of our analysis and how these may affect our findings. Section 7 concludes. An appendix contains supplementary material.

2 The inverse-optimal model

Our theoretical framework follows the discrete optimal-tax model of Saez (2002). Starting point of the analysis is a household maximization problem, where the household maximizes a static unitary household utility function over consumption and leisure (or hours of work), where for simplicity the labor supply and income of the man fixed:

$$U^h = U(c^h, L_f(h_f), L_m(\bar{h_m})). \tag{1}$$

c^h denotes consumption, $L_f(.)$ is leisure of the woman which is a function of her labor supply h_f, and $L_m(.)$ is the leisure of the man which is a function of his (fixed) labor supply $\bar{h_m}$. Households face the following budget constraint:

$$c^h = \bar{w_f} h_f + \bar{w_m} \bar{h_m} - T(\bar{w_f}, h_f, \bar{w_m}, \bar{h_m}; q), \tag{2}$$

where $\bar{w_f}$ and $\bar{w_m}$ denote gross hourly wage of women and men respectively,[3] $T(.)$ denotes taxes and employees' premiums and q denotes individual and household characteristics. Maximization of the utility function with respect to hours worked by the woman gives the indirect utility function:

$$V^h = U^h(h_f*), \tag{3}$$

where h_f* is the utility-maximizing choice.

The social planner maximizes a social welfare function (SW), which is a weighted sum of the indirect utilities:

$$SW = \int \mu V^h f(z_f) dz_f, \tag{4}$$

where μ measures the preferences for inequality aversion by the social planner, and $f(z_f)$ denotes the density of women's earnings. Income is determined by ability and effort (hours worked). Individuals differ in their earnings ability, but the social planner only observes income. When the social planner redistributes income from high- to low-income households it levies a marginal tax on both innate ability and effort. The latter creates an efficiency loss. Hence, the social planner faces a trade-off between equity and efficiency.

Following Saez (2002), we assume that there are $I+1$ groups on the labor market, with I dual-earner groups and 1 single-earner group. In the single-earner couples, gross household income equals $\bar{w_m}\bar{h_m}$. Gross household income for the dual-earner couples is increasing in the group number i. The social planner sets taxes T_i for

[3]For simplicity we assume that the gross hourly wage does not depend on the hours worked.

all groups so as to maximize the social welfare function, while taking the following government budget constraint into account:

$$\sum_{i=0}^{I} T_i s_i = B, \tag{5}$$

where s_i are the population shares of the groups i, and we normalize the overall total number of single- and dual-earner couples to one: $\sum_i s_i = 1$.

The solution of the optimal tax problem can be characterized by women in couples choosing between option i and option $i-1$ (Saez, 2002). Specifically, the resulting optimal tax system is characterized by the following system of equations. First, we have the expressions for the optimal level of taxes in labor supply choice i relative to labor supply choice $i-1$:

$$\frac{T_i - T_{i-1}}{c_i - c_{i-1}} = \frac{1}{\zeta_i s_i} \sum_{j=i}^{J} s_j \left[1 - g_j - \eta_j \frac{T_j - T_0}{c_j - c_0} \right], \tag{6}$$

where ζ_i is the intensive elasticity of labor supply at i, s_i is the share of women in couples that chooses discrete labor supply option i, η_j is the extensive elasticity at choice j and g_j is the so-called social welfare weight of couples at choice j (the social value of one more euro for couples in option j). Saez (2002) defines the marginal social welfare weight for households in earnings point i as follows[4]:

$$g_i = \frac{1}{\lambda s_i} \int_{S_i} \mu \frac{\partial V^h}{\partial c_i} f(z_f) dz_f, \tag{7}$$

where S_i is the set of couples belonging to s_i. Furthermore, the intensive and

[4]Where λ is the Lagrange multiplier of the government budget constraint.

extensive elasticity of labor supply are defined respectively as:

$$\zeta_i = \frac{c_i - c_{i-1}}{s_i} \frac{ds_i}{d(c_i - c_{i-1})}, \tag{8}$$

and:

$$\eta_j = \frac{c_j - c_0}{s_j} \frac{ds_j}{d(c_j - c_0)}. \tag{9}$$

Next, we invert the optimality conditions to 'free' the social welfare weights. Following the numerical implementation in Blundell et al. (2009), we solve for 6 discrete labor supply choices, $i \in (0, 1, 2, 3, 4, 5)$, where option $i = 0$ is the option reflecting a single-earner couple (the woman does not work). For the highest income group $i = I = 5$ we have a social welfare weight:

$$g_I = 1 - \zeta_I \frac{T_I - T_{I-1}}{c_I - c_{I-1}} - \eta_I \frac{T_I - T_0}{c_I - c_0}, \tag{10}$$

and for the income groups with less income but working $0 < i < I$ (also dual-earner couples) we have:

$$g_i = 1 - \zeta_I \frac{T_i - T_{i-1}}{c_i - c_{i-1}} - \eta_i \frac{T_i - T_0}{c_i - c_0} + \frac{1}{s_i} \sum_{j=i+1}^{J} s_j \left[1 - g_j - \eta_j \frac{T_j - T_0}{c_j - c_0} \right]. \tag{11}$$

The system of equations (10) and (11) gives the solution for the work options T_1–T_5. The social welfare weight for the couples that do not work follows from the normalization:

$$\sum_{i=0}^{I} s_i g_i = 1, \tag{12}$$

the weighted average of the g_i's for the relevant group of couples equals one.[5]

[5]In the absence of income effects, the weighted average of the social welfare weights equals 1,

The system of equations (10)-(12) give the social welfare weights implicit in the tax system, given the elasticity parameters η_i and ζ_i, and the share of couples in each of the 6 options s_i. A complication is that these shares are endogenous to the tax-benefit system. The s_i's in the baseline correspond to averages for the period 2006–2009. Hence, there is no need to adjust the s_i's for 2006–2009. However, when calculating the social welfare weights in other years, and for the optimal tax analysis, we need to take into account that the shares respond to the changes in financial incentives. Here we follow Saez (2002) and assume that the density of options 1 to 5 (the work options) change according to the following rule:[6]

$$s_i = s_i^0 \left(\frac{c_i - c_0}{c_i^0 - c_0^0} \right)^{\eta_i}, \tag{13}$$

where the superscript 0 indicates baseline values.[7]

3 The tax-benefit system and descriptive statistics of couples in the Netherlands

In this section we consider the tax-benefit system for couples in the Netherlands in 2017, the changes in this system between 2005 and 2017, and the proposed changes between 2017 and the 'long run'.[8] Furthermore, we consider how these changes have

see Saez (2002). Following Saez (2002) and Blundell et al. (2009), we ignore income effects for simplicity. Empirical studies suggest that this is a good approximation, see e.g. Bargain et al. (2014b).

[6]The share in option 0 is then the residual.

[7]In a robustness check, we also consider the social welfare weights when the extensive and intensive elasticities are endogenous (the elasticities depend on net income and hence taxes).

[8]Table A.1 in the Supplementary Material gives a detailed overview of the parameters of the tax-benefit system for 2005, 2006–2009, 2017 and the long run. The long run includes the policy proposals of the Rutte-III coalition (Ministry of General Affairs, 2017). The earliest year we

affected the budget constraint faced by couples. Finally, we consider the dataset we use for the quantitative analysis, present some descriptive statistics of this dataset and briefly discuss how we estimate the extensive and intensive margin elasticities (further details are given in the Supplementary Material).

3.1 Changes in the tax-benefit system

We focus on a number of large reforms that have affected single-earner and dual-earner couples differently. On the one hand, more generous in-work tax credits and childcare subsidies have benefitted dual-earner couples. On the other hand, more generous child benefits and health-care benefits targeted at low-income families have benefitted single-earner couples. However, single-earner couples have suffered from the reduction in the transferability of the general tax credit between partners in couples. Below we explain these reforms in more detail, along with a brief general introduction to the Dutch tax-benefit system.

The Netherlands has a progressive individualized income tax system, with targeted benefits that depend on household income. The statutory tax rate in the first tax bracket in 2017 is 36.55%, payable over a taxable income up to 19,982 euros. The second and third tax bracket rate is 40.8%, these brackets cover taxable income from 19,982 to 67,072 euros. The fourth (open) tax bracket has a statutory rate of 52%. Figure 1(a) shows that the first bracket rate is higher in 2017 than in 2005, and the tax rates in the second and third bracket are also slightly higher in 2017 than in 2005. The top rate is the same in both years, although the third tax bracket

consider is 2005 because this is the year in which the Law on Child Care was introduced. Including child care subsidies is potentially important for our analysis. Before 2005, the income support for child care was different and we cannot use the tax-benefit calculator to determine the child care subsidy. We use the CPI to convert all income levels and tax credits to 2017 prices.

is 'longer' in 2017. In the long run, statutory rates will be reduced, and the number of tax brackets goes down from 4 to 2.[9]

The maximum general tax credit (*Algemene Heffingskorting* in Dutch) is 2,254 euros in 2017. This 'general' tax credit is phased out to zero at a rate of 4.79%, starting from an income of 19,982 euros. In 2005, the general tax credit was still independent of income, as illustrated in Figure 1(b). In the long run, the general tax credit will be higher for individuals with a lower income. In 2007, the government decided to limit the transferability of the general tax credit, to stimulate labor force participation (Ministry of General Affairs, 2007). Before 2009, non-working individuals, or secondary earners who do not pay enough taxes, can fully transfer the tax credit to their partners. In this way, single-earner couples were still able to claim the general tax credit twice.[10] In 2009, the transferability was first reduced for individuals born after 1971 and without young children (0–6 years of age). In 2012, the government decided to reduce the transferability further, for individuals born after 1963 and by abolishing the exemption for individuals with young children in annual steps. In 2017, a single-earner couple can still claim 40 percent of the general tax credit for the non-working partner. From 2023 onwards, the general tax credit will no longer be transferable, reducing disposable income of single-earner couples.

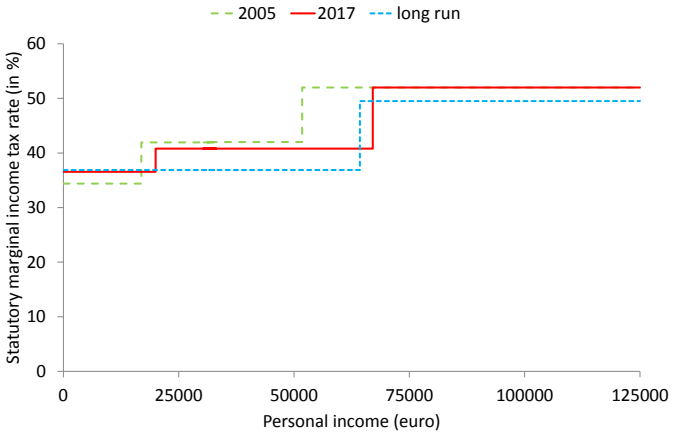
The Netherlands has a general individual in-work tax credit for all workers (*Arbeidskorting* in Dutch). In 2017, over the first 9,309 euros, the phase-in rate is a modest 1.8%. However, between 9,309 and 20,108 euros (approximately the full-time minimum wage) the phase-in rate is much higher: 28.3%. The maximum amount is

[9]The individual progressive tax system leads to a more favorable tax treatment of dual-earners. For the same level of household income, single-earner couples pay more statutory taxes than dual-earner couples.

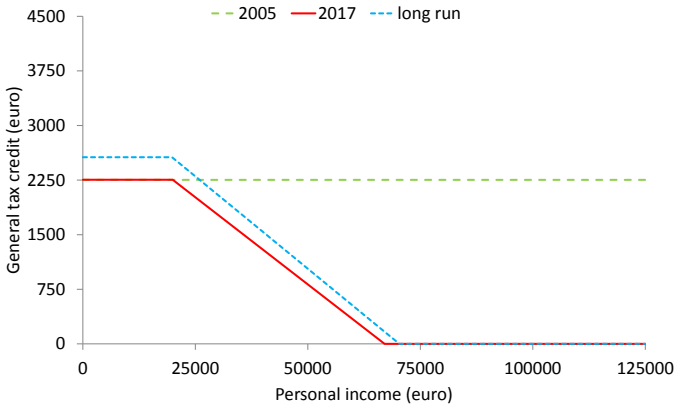
[10]In the Dutch vernacular, this scheme is called the 'kitchen sink subsidy' (*Aanrechtsubsidie* in Dutch), as it gives an incentive for non-working partners to stay at home.

Figure 1: Tax-benefit system 2005, 2017 and long run (1)

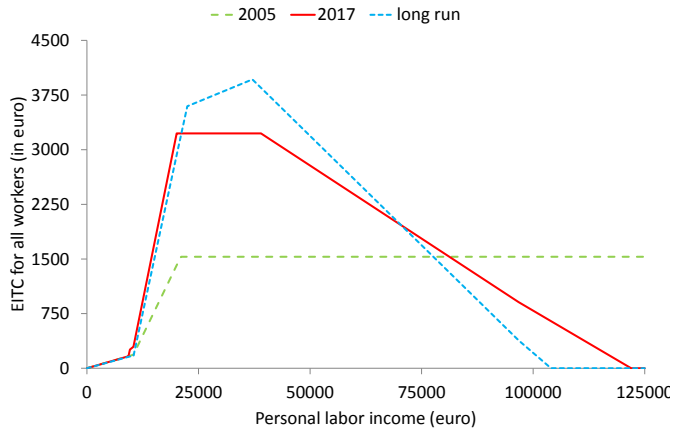
(a) Statutory marginal tax rates



(b) General tax credit



(c) EITC all workers



(d) EITC working parents

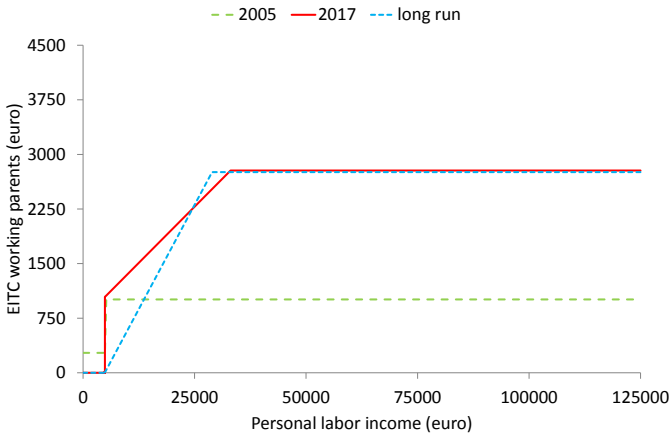
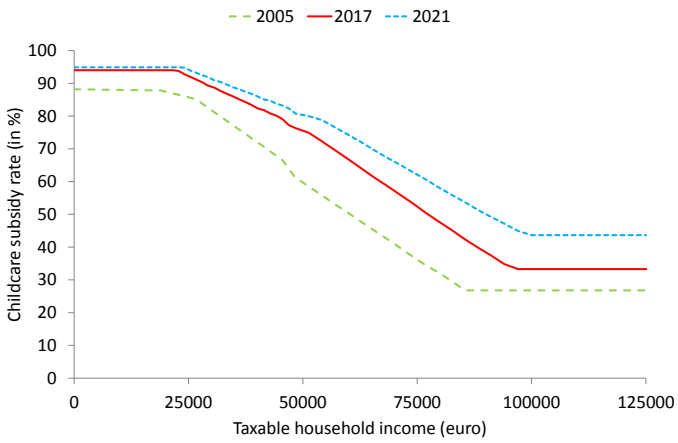
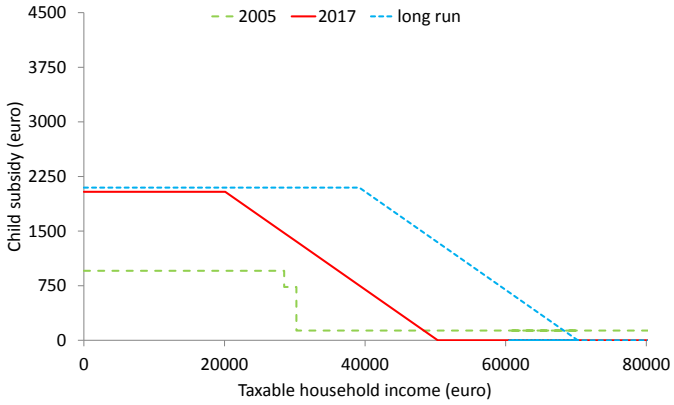


Figure 2: Tax-benefit system 2005 and 2017 (2)

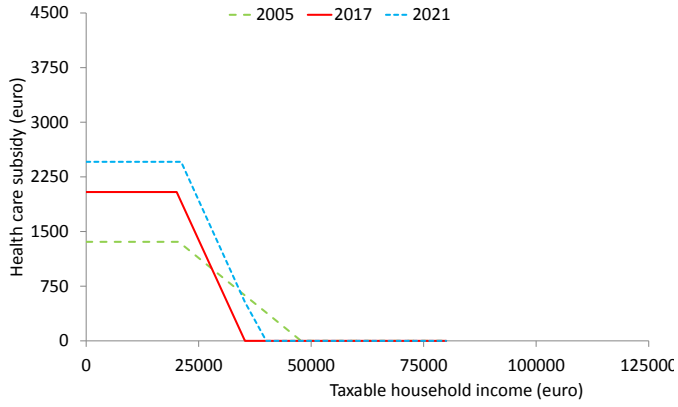
(a) Child care subsidy



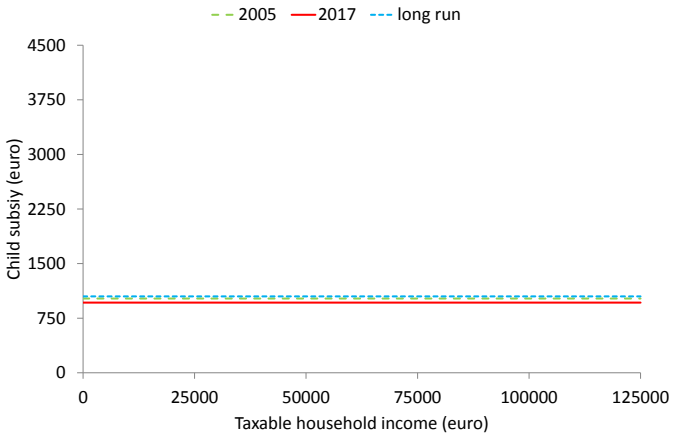
(b) Income-dependent child subsidy



(c) Health care subsidy



(d) General child subsidy per child



3,223 euros. This amount then remains constant between 20,108 and 32,444 euros, and is subsequently phased-out at a rate of 3.6%, until it reaches 0 at an income of 121,972 euros. The level and structure of this tax credit have changed substantially over the period 2005–2017, see Figure 1(c). In 2005, both the level and phase-in were lower than in 2017, and the tax credit was not phased out in 2005. In the long run, the maximum increases to 3,719 euros (in prices 2017), but the phase-out becomes steeper with 6%. The changes in the general in-work tax credit are favorable for dual-earner couples, as secondary earners typically have a low individual income.

Secondary earners with young children (0-11 years of age) also benefit from the income-dependent combination tax credit (*Inkomensafhankelijke Combinatiekorting* in Dutch). In 2017, the base amount is 1,043 euros.[11] Figure 1(d) shows how this tax credit increases with income, at a phase-in rate of 6,159%, until a maximum of 2,778 euros is reached. There is no phase-out. In 2005, this tax credit was still a fixed amount of 617 euros.[12] In the long run, the base amount is abolished, and the phase-in becomes steeper, with a phase-in rate of 11.45%. The maximum amount will be 2,939 euros (in prices 2017). The changes in the combination tax credit have also been favorable to dual-earner couples.

Finally, dual-earner couples have also benefitted from more generous child care subsidies. To qualify for child care subsidies, both partners in the household need to work. The child care subsidy is a subsidy per hour of formal child care.[13] The

[11] Provided that the labor income of the secondary earner exceeds the minimum income level of 4,895 euros, which is approximately 25% of the annual minimum wage.

[12] In 2005, primary earners with young children also received a fixed (lower) tax credit of 228 euros. However, as of 2009, only secondary earners and single parents are entitled to the combination tax credit.

[13] Children in the Netherlands go to primary school when they turn 4, and most children are 12 years old when they go to secondary school. Young children at the age of 0–3 years may go to daycare centers, and older children (4–11 years of age) may go to out-of-school care.

subsidy makes a distinction between the first child and any subsequent children.[14] In 2017, the maximum subsidy rate is 94.0% for the first child, and the minimum subsidy rate is 33.3%. Figure 2(a) shows the child care subsidy rate for the first child.[15] The subsidy rate decreases with income (but higher incomes use more hours of formal child care). We see in Figure 2(a) that the child care subsidy rate in 2005 was lower, in particular for middle and higher incomes. In the long run, child care subsidies rates will become more generous.

However, there were also some reforms that favored single-earner couples. Single-earner couples are more likely to benefit from the income-dependent child benefit (*Kindgebonden Budget* in Dutch) because they have a relatively low household income. This is a subsidy for households with a youngest child of up to 18 years of age that depends on household income and the number of children. In 2017, households with one child receive a maximum amount of 1,142 euros, and households with two children receive a maximum amount of 2,040 euros. This amount increases by 285 euros for each subsequent children. The subsidy is phased-out at 6.75%, starting from an income of 20,109 euros. Figure 2(b) shows the income-dependent child benefit for households with two children (8 years of age). In 2005, the maximum level of the income-dependent child benefit was much lower (802 euros), and was phased out at three kink points. In 2017 it was much more generous, and in the long run this subsidy will be increased further. Figure 2(b) shows that the phase-out of the subsidy will start at a higher income, and consequently more single-earner couples will receive the subsidy (and some dual-earner couples).

[14] The first child is the child with the highest number of hours formal child care.

[15] The maximum subsidy rate for a second child is higher, with 95.0%, and the phase-out of the subsidy is less steep than for the first child. The minimum subsidy rate for the second child is 64.0%.

Single-earner households are also more likely to benefit from the income-dependent health-care benefit. Low-income households receive a benefit to (partly) cover insurance premiums. In 2017, the maximum health care benefit is 2,043 euros for couples. This benefit is phased out to zero at a rate of 13.4% to zero. Figure 2(c) highlights two major changes in the health care subsidy. The maximum level of the health care subsidy has increased since 2005. However, the phase-out rate has become steeper as well (5% in the 'initial' system.[16]). In the long run, the maximum level of the health care benefit increases to 2,457 euros.[17,18]

Figure 3 shows what all this means in terms of the budget constraint for couples in 2005, 2017 and the long run (all in prices 2017), separately for couples (a) without children and (b) with children. On the horizontal axis we have the 6 income groups, where single-earner couples are in group 0 and groups 1 to 5 are the dual-earner couples, with household income increasing from group 1 to group 5. On the vertical axis we have net income. For single-earner couples without children, net income decreases between 2005 and 2017, and between 2017 and the long run. For dual-earner couples without children, net income does not change much between 2005

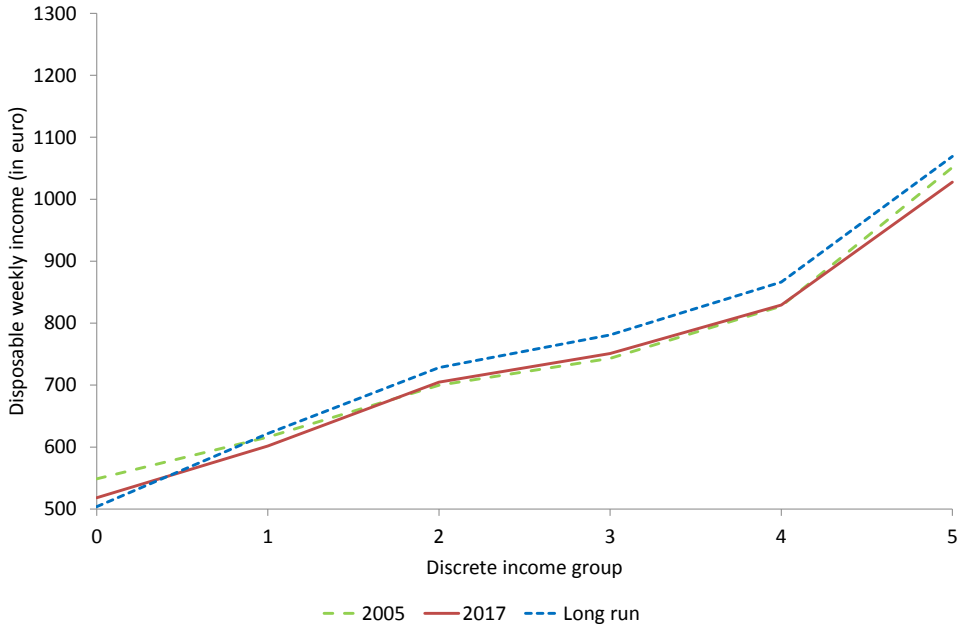
[16]The health care subsidy has been introduced in 2006, and we simulate the health care subsidy of 2006 (in prices 2017) and apply it to the year 2005. The reason for this is that we have insufficient data in our data set to simulate the old health care system from before 2006. Therefore we simulate the health care subsidy based on the parameters of 2006 to be as close as possible to our starting year of 2005.

[17]Single-earner couples and dual-earner couples with children also receive the general child benefit (*Kinderbijslag* in Dutch), which has not changed much over time in real terms, see Figure 2(d). The child benefit does not depend on household income and equals 794 euros for a child 0–5 years of age, 964 euros for a child 6–11 years of age, and 1,134 euros for a child aged 12–17 in 2017. In real terms, the general child benefit was somewhat higher in 2005. The general child benefit in 2005 was 840, 1,021 and 1,200 euros (in prices 2017) for a child aged 0–5, aged 6–11 and aged 12-17 years, respectively. In the long run, the general child benefit will be somewhat higher than in 2017. That is, 865 euros for a child 0–5 years of age, 1,050 euros for a child 6–11 years of age, and 1,235 euros for a child aged 12–17 (in prices 2017).

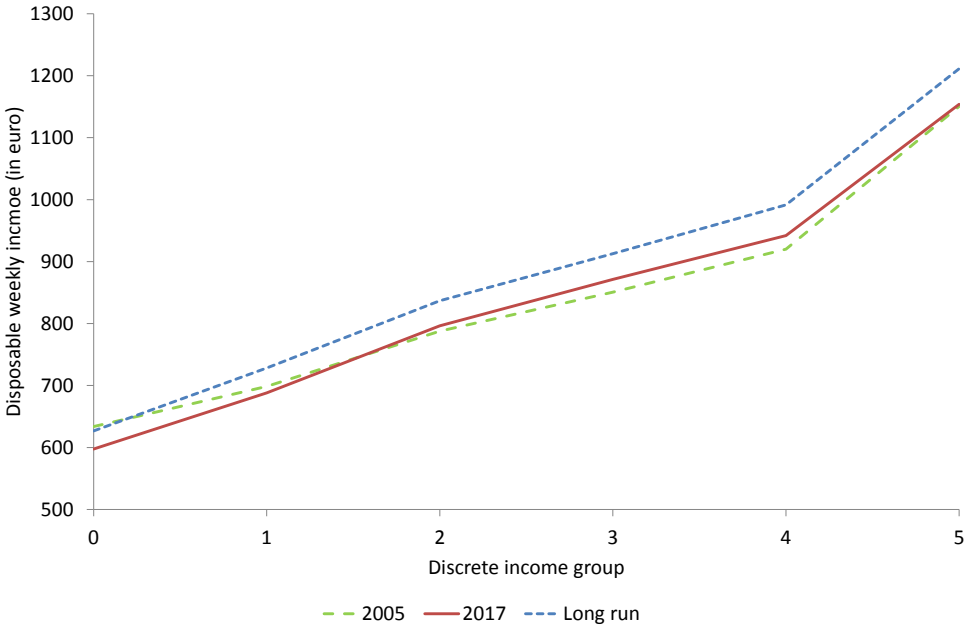
[18]We ignore the rent subsidy in our analysis. The rent subsidy is a means-tested benefit that compensates lower income households for rent costs. It depends on household income, household composition and the rent level. However, we do not observe the rent level in our dataset.

Figure 3: Budget constraint 2005, 2007, long run

(a) Couples without children



(b) Couples with children



and 2017 (though these is some decrease for group 1), but increases between 2017 and the long run. For single-earner couples with children, net income drops between 2005 and 2017, but then returns to the 2005 level in the long run. For dual-earner couples with children, net income typically increases somewhat between 2005 and 2017, and then increases more substantially between 2017 and the long run. In the end, both for couples with and without children, net income of dual-earner couples has increased relative to single-earner couples.

3.2 Dataset, descriptive statistics and estimation of elasticities

For the data on the gross income distribution, employment rates and household characteristics in the baseline we use the Labor Market Panel (LMP) of Statistics Netherlands (2012). The LMP is a large administrative household panel data set. We use data for the period 2006–2009, because the child care data are only available from 2006 onwards and 2009 is the last year in the dataset. The LMP contains a rich set of individual and household characteristics, including gender, year of birth, the highest completed level of education and ethnicity for all adult members of the household, the ages of the children and the area of residence. The LMP also contains administrative data on hours worked and gross income from different sources (wages, benefits etc.).

Table 1 gives descriptive statistics of the 2006–2009 sample we use as the baseline in the inverse-optimal and optimal tax analyses, and in the estimation of the extensive and intensive margin elasticities.[19] We first consider the descriptive statistics

[19] Appendix B gives descriptive statistics for the full set of demographic characteristics in the dataset.

Table 1: Descriptive statistics women in couples: averages for 2006–2009

	Share	Employment rate (in %)	Working hours (conditional on working)	Low education share (in %)	Age
All couples	100.0	72.9	25.1	27.8	44.2
Subgroups:					
– Without children	43.8	0.69	28.6	0.34	47.2
– With children, youngest 0–3	14.5	0.81	22.5	0.15	34.6
– With children, youngest 4–11	21.3	0.76	21.2	0.22	41.1
– With children, youngest 12–17	17.0	0.74	24.0	0.28	46.7
– With children 18 years or older	3.5	0.64	24.3	0.40	52.7

Notes: Includes couples where the women are aged between 18 and 63 years of age. We exclude students, self-employed and women who are on disability or unemployment benefits.

for the whole group of couples. The first row of Table 1 shows that 73% of these women in couples participate on the labor market, and the average number of hours worked (conditional on working) is 25 hours per week. We next distinguish between subgroups based on the age of the youngest child: without children, pre-primary school age 0–3, primary school age 4–11, secondary school age 12–17 years of age, and adult children (living at home). Couples without children are the largest group (44%), couples with adult children living at home are the smallest group (4%). The average age of women in couples increases with the age of the youngest child. However, the participation rate decreases with the age of the youngest child, which is due to a cohort effect. Cohorts of younger women are higher educated than their predecessors. Indeed, Table 1 shows that only 15% of the women with a youngest child 0–3 years of age have a low education level, whereas this share is much higher for women with adult children living at home (40%). Working mothers of young children prefer smaller part-time jobs than working mothers with older children.

To determine the extensive and intensive labor supply elasticities, we estimate preferences over consumption, leisure and child care using a structural discrete-choice model (Aaberge et al., 1995; Van Soest, 1995; Keane and Moffitt, 1998; Haan

and Navarro, 2008; Bargain et al., 2014b). Discrete-choice models have the advantage of being able to take into account all the complexities in the budget set that result from the tax-benefit system (such as kinks and non-convexities). Section C in the Supplementary Material outlines the setup of the discrete-choice model and gives the estimated parameters of the utility function and the fit of the model. The corresponding extensive and intensive elasticities are discussed below.

4 Implicit social welfare weights over time

We derive the implicit social welfare weights for the income support system over time. Specifically, we first calculate the implicit social welfare weights for the data period 2006–2009, using averages for this period, and subsequently for 2005, 2017 and the long run. Note that the shares of (potential) secondary earners in the 6 different options are endogenous, hence we account for e.g. the change in the participation rate by secondary earners when simulating the 2005, 2017 and long-run tax-benefit systems.[20]

The inputs for the calculations for the tax-benefit system of 2006–2009 are given in Table 2. In the top panel we have the inputs for all couples and in the subsequent panels we have the inputs for subgroups that differ by age of the youngest child.[21] For all groups we observe that net income increases as gross income increases (as required for incentive compatibility). Furthermore, extensive elasticities are larger than intensive elasticities.[22] Also, elasticities are higher for couples with younger

[20]The gross incomes for each option are averages for quintiles based on gross weekly earnings of secondary earners to which we add the respective gross income of their primary earners.

[21]The method used in this paper does not readily allow us to study the optimal redistribution between these subgroups, or between couples and other groups on the labor market.

[22]Except for group 1, for which these elasticities are the same by definition, since option $i-1$ is

Table 2: Implicit social welfare weights: 2006–2009

Group	Gross earnings	Net income	Net tax	Intensive elasticity	Extensive elasticity	Share	Social welfare weights
Panel A: All couples							
0	857	609	248	–	–	0.24	1.12
1	903	688	215	0.40	0.40	0.15	1.35
2	1017	785	231	0.13	0.53	0.15	1.11
3	1099	839	260	0.14	0.60	0.15	1.01
4	1203	889	315	0.11	0.55	0.15	1.01
5	1627	1110	518	0.28	0.75	0.15	0.34
Panel B: Couples without dependent children							
0	854	554	300	–	–	0.25	1.39
1	927	623	304	0.25	0.25	0.15	0.99
2	1031	708	323	0.11	0.38	0.15	0.96
3	1102	752	350	0.08	0.34	0.15	0.93
4	1254	837	417	0.07	0.32	0.15	0.97
5	1668	1060	607	0.20	0.54	0.15	0.51
Panel C: Couples with a child 0–17 years of age							
0	859	640	219	–	–	0.23	0.97
1	898	708	190	0.37	0.37	0.15	1.33
2	1000	801	199	0.11	0.49	0.15	1.09
3	1081	866	215	0.15	0.61	0.15	1.03
4	1191	940	251	0.11	0.57	0.15	1.10
5	1607	1175	432	0.28	0.70	0.15	0.50
Panel D: Lone parents with a youngest child 0–3 years of age							
0	804	623	181	–	–	0.21	0.07
1	831	713	117	0.59	0.59	0.16	1.82
2	938	839	99	0.13	0.68	0.16	1.33
3	1022	906	116	0.23	0.87	0.16	1.16
4	1127	1000	127	0.15	0.80	0.16	1.32
5	1569	1275	294	0.38	1.10	0.16	0.58
Panel E: Lone parents with a youngest child 4–11 years of age							
0	868	662	206	–	–	0.26	1.39
1	902	706	196	0.42	0.42	0.15	1.23
2	994	779	216	0.16	0.61	0.15	0.96
3	1076	840	236	0.17	0.73	0.15	0.91
4	1190	916	274	0.17	0.79	0.15	1.03
5	1584	1144	440	0.45	1.00	0.15	0.19
Panel F: Lone parents with a youngest child 12–17 years of age							
0	899	617	282	–	–	0.22	1.35
1	964	711	253	0.32	0.32	0.16	1.25
2	1083	793	290	0.10	0.40	0.16	0.99
3	1170	853	317	0.12	0.52	0.16	0.94
4	1269	909	360	0.09	0.57	0.16	1.05
5	1671	1116	555	0.28	0.83	0.16	0.28

children, and are the lowest for couples without dependent children.

The last column in Table 2 gives the resulting implicit social welfare weights, using the system of equations (10)–(12). We see that for couples without a child and for couples with a youngest child 4–11 or 12–17 years of age, the social welfare weights are grosso modo well-behaved, decreasing in net income and positive (although we observe a moderate increase going from group 3 to 4). However, for couples with a youngest child 0–3 years of age the social welfare weights are not monotonically declining in net household income. In particular, social welfare weights increase when we go from single-earner couples (option 0) to dual-earner couples with a relatively low household income (option 1). This also shows up in the social welfare weights for the larger group with a youngest child 0–17 years of age and for all couples overall.[23]

Table 3 and Figure 4 give the changes in the implicit social welfare weights over time. In Figure 4, the dashed green lines give the social welfare weights for 2005, the solid red lines give the results for 2017 and the dotted blue lines give the results for long-run.[24] The reforms increased net taxes for single-earner couples (option 0) and reduced net taxes for dual-earner couples. This stimulated the participation of secondary earners, as we can see from the drop in the share of (potential) secondary earners in option 0. However, on the flipside, the difference in net income between single-earner couples and dual-earner couples increased (except at the top). Indeed, we observe a drop in the social welfare weights of single-earner couples and a rise

option 0 for $i = 1$.

[23]Haan and Navarro (2008) employ the inverse-optimal method of optimal taxation to derive the implicit social welfare weights for couples in Germany. First they derive the social welfare weights for the actual system of joint taxation. Next, they compare this with the social welfare weights for a hypothetical scenario of individual taxation. They find that social welfare weights are higher for single-earner couples relative to dual-earner couples under the system of joint taxation than under the system of individual taxation.

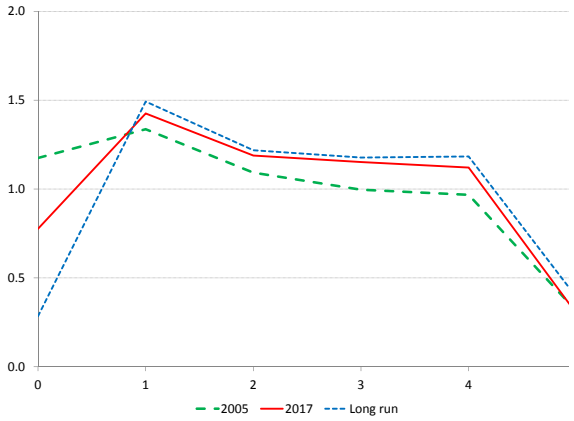
[24]Note that the points on the horizontal axis are not evenly spaced in gross income, see Table 3 for the gross incomes corresponding to points 0–5 in Figure 4.

Table 3: Social welfare weights over time

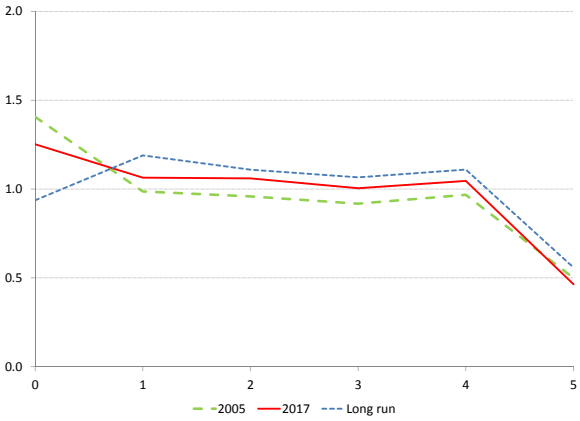
		2005			2017			Long run		
Group	Gross earnings	Net tax	Share	Social welfare weights	Net tax	Share	Social welfare weights	Net tax	Share	Social welfare weights
Panel A: All couples										
0	857	254	0.25	1.17	288	0.18	0.78	275	0.13	0.28
1	903	224	0.15	1.34	235	0.17	1.43	200	0.18	1.49
2	1017	243	0.15	1.09	235	0.17	1.19	199	0.18	1.22
3	1099	274	0.15	1.00	257	0.17	1.15	219	0.18	1.18
4	1203	331	0.15	0.97	316	0.16	1.12	272	0.17	1.18
5	1627	534	0.15	0.31	544	0.16	0.30	495	0.16	0.39
Panel B: Couples without dependent children										
0	854	305	0.25	1.41	336	0.21	1.25	350	0.16	0.94
1	927	311	0.15	0.99	325	0.16	1.06	305	0.17	1.19
2	1031	331	0.15	0.96	326	0.16	1.06	303	0.17	1.11
3	1102	358	0.15	0.92	351	0.16	1.00	321	0.17	1.07
4	1254	426	0.15	0.97	425	0.16	1.05	387	0.16	1.11
5	1668	616	0.15	0.50	640	0.15	0.46	599	0.16	0.56
Panel C: Couples with a child 0–17 years of age										
0	859	225	0.25	1.05	261	0.16	0.51	232	0.14	0.21
1	898	199	0.15	1.31	209	0.17	1.41	169	0.18	1.45
2	1000	212	0.15	1.07	203	0.17	1.16	163	0.17	1.18
3	1081	230	0.15	1.01	210	0.17	1.16	168	0.18	1.17
4	1191	271	0.15	1.07	249	0.17	1.21	200	0.17	1.24
5	1607	457	0.15	0.46	453	0.16	0.49	396	0.16	0.55
Panel D: Lone parents with a youngest child 0–3 years of age										
0	804	190	0.28	0.59	228	0.11	-1.66	188	0.09	-2.40
1	831	140	0.14	1.77	134	0.19	1.90	94	0.19	1.90
2	938	134	0.15	1.29	100	0.18	1.39	58	0.18	1.39
3	1022	155	0.14	1.08	109	0.18	1.31	65	0.19	1.30
4	1127	181	0.14	1.23	127	0.17	1.44	71	0.18	1.46
5	1569	359	0.14	0.44	323	0.16	0.54	252	0.17	0.64
Panel E: Lone parents with a youngest child 4–11 years of age										
0	868	211	0.27	1.42	251	0.13	0.69	217	0.11	0.69
1	902	203	0.15	1.20	217	0.18	1.43	180	0.18	1.43
2	994	222	0.15	0.95	221	0.18	1.13	182	0.18	1.13
3	1076	242	0.15	0.90	228	0.18	1.13	190	0.18	1.13
4	1190	282	0.15	1.03	266	0.17	1.24	219	0.18	1.24
5	1584	453	0.15	0.15	450	0.16	0.23	396	0.17	0.23
Panel F: Lone parents with a youngest child 12–17 years of age										
0	899	288	0.21	1.30	316	0.19	1.20	307	0.13	0.80
1	964	254	0.16	1.26	274	0.16	1.28	229	0.18	1.38
2	1083	288	0.16	1.01	298	0.16	1.05	256	0.17	1.09
3	1170	314	0.16	0.97	318	0.17	1.04	275	0.18	1.09
4	1269	358	0.16	1.07	365	0.16	1.15	319	0.17	1.22
5	1671	554	0.16	0.29	581	0.16	0.23	532	0.17	0.34

Figure 4: Social welfare weights over time

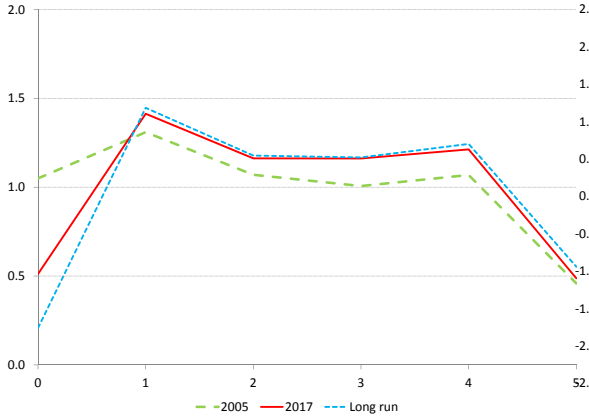
(a) All couples



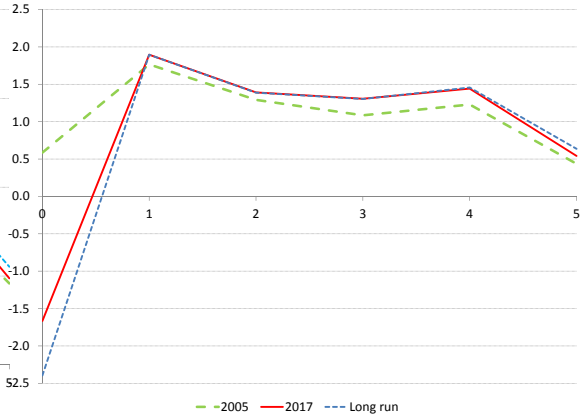
(b) Couples without dependent children



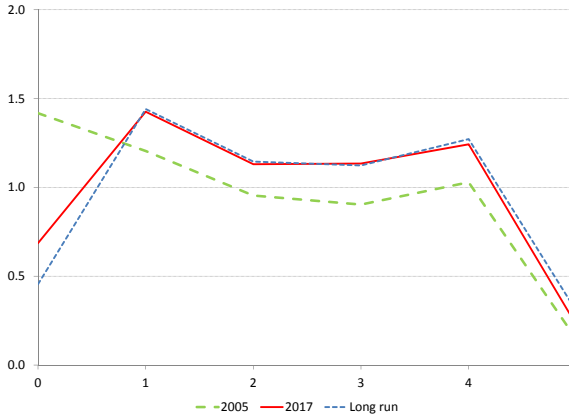
(c) Couples with child 0–17



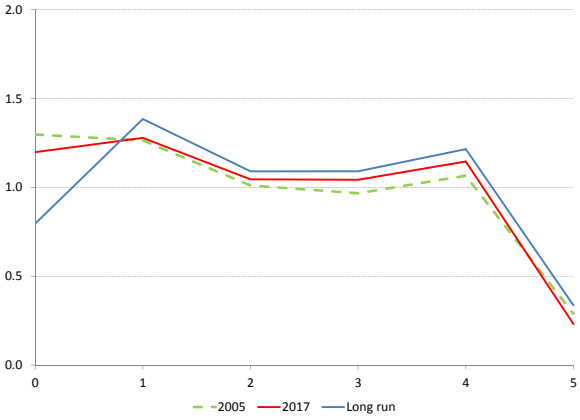
(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17



in the social welfare weights of dual-earner couples. The drop is particularly strong for couples with children. For couples with a youngest child 0–3 years of age the social welfare weights even turn negative. This suggests that, starting out of the tax system of 2017, reducing tax rates on single-earner couples with a youngest child 0–3 years of age leads to a Pareto-improvement (Lorenz and Sachs, 2016). Indeed, this would make these single-earner couples better off, but would also improve public finances, because secondary earners that stop working actually save the government (enough) tax credits and (child care) subsidies to make up for the initial loss in tax receipts.

In the Supplementary Material we present a number of robustness checks of the social welfare weights. Figure D.1 gives the social welfare weights when we allow for endogenous elasticities, e.g. extensive and intensive elasticities that depend on the tax-benefit system through net incomes. The results are qualitatively similar to the baseline with exogenous elasticities, although the changes in the social welfare weights become somewhat more pronounced. Figure D.2 and Figure D.3 give the social welfare weights over time when the intensive and extensive margin elasticities are 50% lower and higher than the baseline, respectively. The changes in the social welfare weights become more (less) pronounced when the elasticities are higher (lower) (see also Jacobs et al., 2017). Figure D.4 gives the social welfare weights when we include the costs of child care in net taxes (in the baseline we only include the child care subsidy in net taxes). The results are qualitatively similar, although the social welfare weights of single-earner couples are then higher and the social welfare weights of dual-earner couples are then lower, as including childcare costs increases net taxes for dual-earner couples with young children in all periods. However, the social welfare weights for single-earner couples with a youngest child

0–3 years of age still turn negative in 2017 and in the long run. Figure D.5 shows that we obtain qualitatively similar results when we use a discrete choice model with 9 instead of 6 options. Finally, Figure D.6 give the social welfare weights when we split the households in three groups by income of the man, to account for the heterogeneity in household income among single- and dual-earner couples due to variation in the income of the man. For all subgroups, we observe a decline in the social welfare weight of single-earner couples, and an increase in the social welfare weight of dual-earner couples. The changes are the most pronounced for couples where the man has a relatively high income.

5 Optimal income support for different degrees of inequality aversion

The analysis above suggests that a decade of reforms favoring dual-earner couples over single-earner couples has resulted in implicit social welfare weights for single-earner couples that are relatively low compared to dual-earner couples, and the weights of single-earner couples will drop further relative to dual-earner couples in the future due to proposed policy reforms. In this section we consider changes in the tax-benefit system that would be considered optimal for different degrees of inequality aversion. Note that this is still in the context of our static unitary household model. We discuss the limitations of this setup and how this may affect the results in the next section.

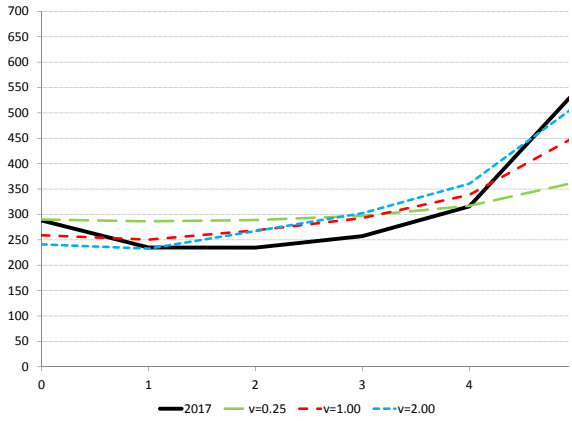
Following Saez (2002) and Blundell et al. (2009), we consider the optimal system of income support for different sets of social welfare weights that are the following

Table 4: Optimal income support for different tastes for redistribution

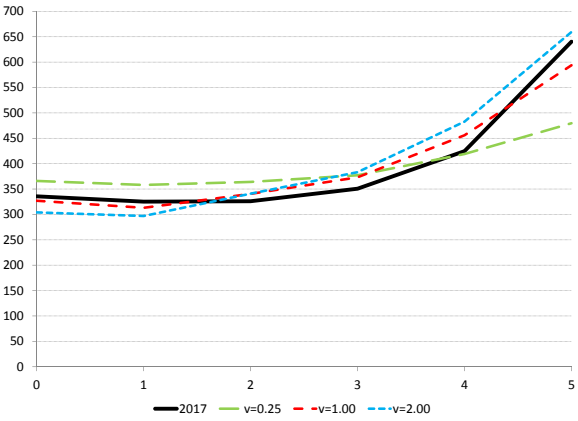
	2017				v=0.25			v=1.00			v=2.00		
Group	Gross earn.	Net tax	Share	Social welfare weights	Net tax	Share	Social welfare weights	Net tax	Share	Social welfare weights	Net tax	Share	Social welfare weights
Panel A: All couples													
0	857	288	0.18	0.78	290	0.21	1.08	259	0.27	1.26	241	0.32	1.40
1	903	235	0.17	1.43	286	0.13	1.06	250	0.13	1.15	233	0.13	1.18
2	1017	235	0.17	1.19	289	0.15	1.02	268	0.14	1.00	267	0.13	0.94
3	1099	257	0.17	1.15	297	0.15	0.99	293	0.14	0.93	302	0.13	0.84
4	1203	316	0.16	1.12	317	0.16	0.97	339	0.15	0.87	361	0.14	0.75
5	1627	544	0.16	0.30	364	0.20	0.89	454	0.17	0.64	515	0.15	0.43
Panel B: Couples without dependent children													
0	854	336	0.21	1.25	366	0.18	1.10	327	0.23	1.30	304	0.27	1.47
1	927	325	0.16	1.06	358	0.16	1.06	313	0.16	1.12	297	0.16	1.12
2	1031	326	0.16	1.06	364	0.16	1.02	341	0.15	0.99	341	0.15	0.93
3	1102	351	0.16	1.00	377	0.16	0.99	373	0.15	0.94	383	0.14	0.86
4	1254	425	0.16	1.05	419	0.16	0.96	456	0.15	0.86	483	0.14	0.75
5	1668	640	0.15	0.46	480	0.18	0.88	594	0.16	0.64	659	0.14	0.44
Panel C: Couples with a child 0–17 years of age													
0	859	261	0.16	0.51	244	0.24	1.07	217	0.29	1.22	201	0.34	1.34
1	898	209	0.17	1.41	241	0.13	1.05	210	0.13	1.13	193	0.13	1.17
2	1000	203	0.17	1.16	243	0.14	1.02	225	0.14	1.01	223	0.13	0.96
3	1081	210	0.17	1.16	251	0.15	0.99	247	0.14	0.94	255	0.13	0.85
4	1191	249	0.17	1.21	271	0.15	0.97	293	0.14	0.87	314	0.13	0.75
5	1607	453	0.16	0.49	317	0.18	0.89	408	0.16	0.65	468	0.14	0.45
Panel D: Lone parents with a youngest child 0–3 years of age													
0	804	228	0.11	-1.66	151	0.38	1.06	130	0.43	1.17	118	0.48	1.26
1	831	134	0.19	1.90	150	0.08	1.05	127	0.08	1.13	115	0.08	1.16
2	938	100	0.18	1.39	152	0.11	1.01	139	0.11	0.99	140	0.10	0.93
3	1022	109	0.18	1.31	157	0.12	0.99	156	0.11	0.91	164	0.10	0.80
4	1127	127	0.17	1.44	172	0.13	0.96	193	0.12	0.85	215	0.11	0.71
5	1569	323	0.16	0.54	207	0.17	0.88	287	0.15	0.62	342	0.13	0.39
Panel E: Lone parents with a youngest child 4–11 years of age													
0	868	251	0.13	0.69	258	0.16	1.08	236	0.21	1.25	221	0.26	1.41
1	902	217	0.18	1.43	255	0.14	1.06	228	0.15	1.17	211	0.15	1.23
2	994	221	0.18	1.13	255	0.16	1.03	235	0.16	1.04	230	0.15	1.00
3	1076	228	0.18	1.13	261	0.16	1.00	254	0.16	0.96	259	0.14	0.88
4	1190	266	0.17	1.24	275	0.17	0.97	292	0.15	0.88	310	0.14	0.76
5	1584	450	0.16	0.23	304	0.21	0.90	372	0.18	0.65	422	0.16	0.44
Panel F: Lone parents with a youngest child 12–17 years of age													
0	899	316	0.19	1.20	338	0.16	1.10	307	0.21	1.31	285	0.26	1.49
1	964	274	0.16	1.28	331	0.14	1.06	291	0.15	1.15	272	0.15	1.17
2	1083	298	0.16	1.05	335	0.16	1.02	315	0.16	1.01	316	0.15	0.95
3	1170	318	0.17	1.04	345	0.16	0.99	343	0.15	0.94	354	0.14	0.84
4	1269	365	0.16	1.15	364	0.17	0.97	387	0.15	0.88	409	0.14	0.76
5	1671	581	0.16	0.23	403	0.21	0.89	486	0.18	0.66	543	0.16	0.44

Figure 5: Optimal tax profiles for different degrees of inequality aversion

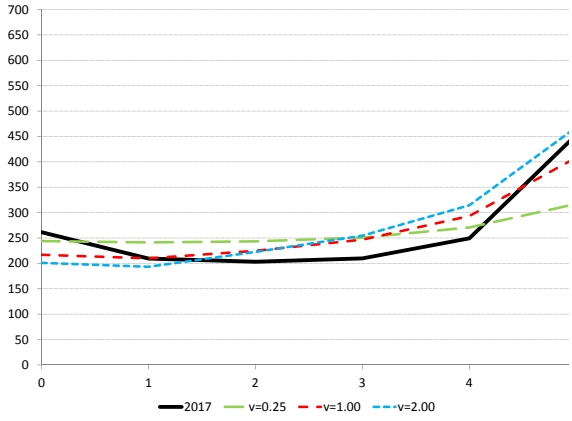
(a) All couples



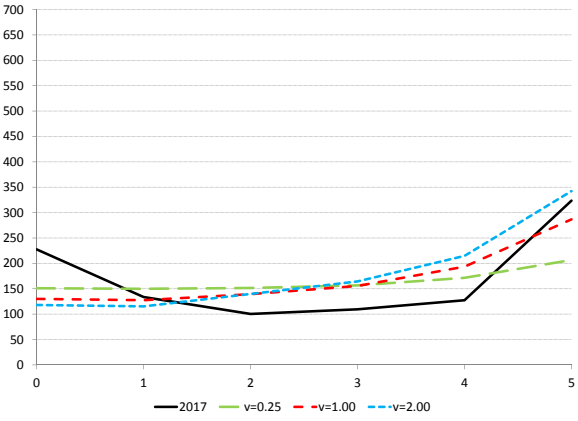
(b) Couples without dependent children



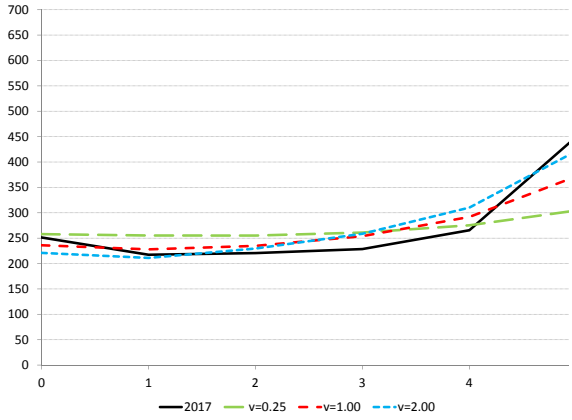
(c) Couples with child 0–17



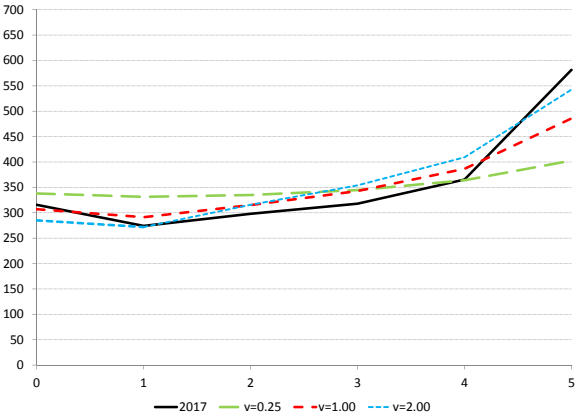
(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17



function of net household income: $g_i = 1/(pC_i^v)$, where p is a scaling variable that we use to normalize the weighted sum of social welfare weights to 1 and v measures the preferences for inequality aversion. Specifically, the higher is v, the higher is the aversion to inequality. Following Blundell et al. (2009), we consider values for v of 0.25, 1.00 and 2.00. We compare the outcomes for the different sets of social welfare weights using the outcomes for 2017 as the base. Specifically, the endogenous shares in the different options for the alternative income support systems are calculated using equation (6) and 2017 as the base, and we require the total net transfer to couples (for the whole group and for all subgroups) to be the same as in 2017.

The results are given in Table 4 and illustrated in Figure 5. In Figure 5, the solid black lines give the income support in the 2017 system, the dashed green lines give the income support for the set of social welfare weights with a relatively low taste for redistribution (v=0.25), the dotted red lines for the set of social welfare weights with an intermediate taste for redistribution (v=1.00) and the dotted blue lines for the set of social welfare weights with a relatively high taste for redistribution (v=2.00).

For couples with dependent children (0–17 years of age), we find that optimal net taxes are always lower for single-earner couples than in the 2017 system, in particular when there is a high taste for redistribution. For single-earner couples with a youngest child 0–3 years of age, optimal net taxes on single-earner couples are much lower. Optimal net taxes are typically higher for dual-earner couples with dependent children, although in option 1 and 5 (couples with a secondary earner that has a relatively low or a relatively high income, respectively) this depends on the taste for redistribution. For couples without dependent children, optimal net taxes for single-earner couples are lower than in the 2017 system for an intermediate or high taste for redistribution, but higher for a low taste for redistribution, and

the same holds for dual-earner couples where the secondary earner has a relatively low income. For dual-earner couples where the secondary earner earns somewhat more (options 2 to 4), optimal net taxes are typically higher than the 2017 system. Optimal net taxes for dual-earner couples with the highest income can be higher or lower than the 2017 system, depending on the taste for redistribution. Finally, also note that for all demographic groups, it is always optimal to have slightly negative marginal tax rates going from option 0 (single-earner couples) to option 1 (a dual-earner couple where the income of the secondary earners is relatively low). This result is also found by Saez (2002). However, actual marginal tax rates in 2017 going from group 0 to group 1 were more negative than that.

6 Discussion

We find that after the reforms of the past decade, social welfare weights are lower for single-earner couples than for dual-earner couples, even though single-earner couples have a lower net income than dual-earner couples. We also show that efficiency considerations alone cannot explain the relatively high net taxes we find for single-earner couples. Below we consider a number of other reasons that can potentially rationalize these findings.

Governments may want to reduce net taxes on dual-earner couples and increase net taxes on single-earner couples to stimulate a more equitable distribution of work and care over men and women in couples (emancipation). Indeed, the Dutch Ministry of Education, Culture and Science explicitly states that independence of women, from an economic perspective, is an important policy goal of the government (Ministry of Education, Culture and Science, 2017). Alesina et al. (2011) formulate

an optimal tax model with bargaining between spouses in a collective household setting, and study optimal gender-based taxation. They argue that it may be optimal to have lower taxes for secondary earners for a number of reasons. In our model we implicitly assume a unitary household model, by focusing on household income, and ignore intra-household bargaining.[25] Modelling intra-household bargaining would require data on consumption patterns. With intra-household bargaining, overall welfare can increase when work and care are divided more equally among men and women in couples, which can potentially rationalize the relatively low taxes on dual-earner couples we observe.

Relatedly, dynamic aspects may favor lower net taxes on dual-earner couples. About one third of relations ends in a separation in the Netherlands, which leads to an average drop in disposable income of 21% for women (SCP and CBS, 2016). A more equal division of income from work in couples may reduce the changes in income following a separation, leading to a more equitable income distribution. Furthermore, a more equal division of income from work in couples may also give women more equal opportunities to reach better career paths (that require e.g. a minimum number of days at work per week). However, dynamic discrete lifecycle models are hard to solve (Keane, 2011; Haan and Prowse, 2013), and require data on consumption and savings, which is not in our dataset.

We further ignore differences in preferences about leisure and consumption in the model. Indeed, households are assumed to differ only in their productivity on the formal labor market, while preferences for leisure and consumption are the same.

[25]The unitary model predicts that households pool income, where the source of the income is irrelevant. Several empirical studies reject the pooling hypothesis (Thomas, 1990; Schultz, 1990). Estimated labor supply elasticities may not differ much between so-called collective and unitary household models (Vermeulen, 2005), but the difference between both models can be important for evaluating policy reforms (Beninger et al., 2006; Myck et al., 2006).

Fleurbaey and Maniquet (2006) consider fairness concerns in an optimal-tax setting. In their model, individuals differ in two aspects, their earnings ability and their preferences over consumption and leisure. They show that it can be optimal to give higher subsidies to the 'working poor' relative to the 'non-working poor'. Indeed, we can think of single-earner couples as having a higher preference for 'leisure' to e.g. raise the children at home. In this case, net household income differences are an imperfect measure of differences in household utility, and lower net taxes for dual-earner couples can be optimal. Along similar lines, we may think of non-working women in single-earner couples being more productive at home than women in dual-earner couples would be if they would stay at home (Apps and Rees, 2009). Also in this case, the difference in income between single- and dual-earner couples is an insufficient measure of the difference in household utility.

The literature on optimal taxation also considers 'behavioral' (non-welfarist) motives for the anomaly of rising social welfare weights (Kanbur et al., 2006). Gerritsen (2016) combines the theory of optimal taxation with empirical data on the well-being of individuals. He uses stated preferences on overall well-being of respondents from the British Household Panel. A substantial share of the respondents declare that they prefer to work less hours, and this share is increasing with gross earnings. Gerritsen (2016) uses this information to estimate the determinants of overall well-being, with (among others) income and hours of work as explanatory variables. Next, he incorporates this information in a model of optimal taxation, and concludes that low-income workers work too little, whereas high-income workers work too much. This implies that the social welfare weights of the working poor are underestimated in the 'standard' model. This too could offer a rationale for the social welfare weights we find after the reforms.

Finally, we should consider the possibility that policymakers do not actually try to maximize a social welfare function, and may be driven by opportunistic or behavioral motives, resulting in social welfare weights that may appear anomalous (Jacobs et al., 2017).

7 Conclusion

In this paper we have studied how a series of reforms has affected the implicit social welfare weights of single- and dual-earner couples, using the inverse-optimal method of optimal taxation, own estimates for extensive and intensive labor supply responses and an advanced tax-benefit calculator. Our results suggest that for the initial tax-benefit system in 2005, the social welfare weight of single-earner couples is on average higher than the social welfare weight of dual-earner couples. After the reforms, in 2017, the social welfare weight of single-earner couples is typically lower than for dual-earner couples, in particular for single-earner couples with young children. Furthermore, single-earner couples with a youngest child 0–3 years of age even get a negative social welfare weight, which suggests that reducing net taxes for this group leads to a Pareto-improvement. Due to proposed policy changes, net taxes on single-earner couples will increase further, and as a result the social welfare weight of single-earner couples will drop further. An optimal tax analysis suggests that, for a wide range of preferences for redistribution, it would actually be optimal to reduce rather than increase net taxes for single-earner couples relative to dual-earner couples. However, there are a number of important limitations of the optimal-tax model that we use, which may explain the anomalies we find, such as a emancipation, fairness and behavioral considerations that are not included in the

model that we use.

Future research could consider a number of extensions to the analysis outlined here. It would be interesting to include some of the mechanisms of the Discussion section in the formal analysis, using e.g. a collective household model and allowing for emancipation effects more generally (Alesina et al., 2011), allow for differences in preferences and/or productivity at home (Fleurbaey and Maniquet, 2006; Apps and Rees, 2009) or account for misoptimizing agents (Kanbur et al., 2006; Gerritsen, 2016). Furthermore, in the analysis we use a set of social welfare weights that is not linked directly to the estimated preferences used for the calculation of the extensive and intensive labor supply responses. An optimal tax analysis using the estimated preferences directly, along the lines of Blundell and Shephard (2012), also seems an interesting avenue for future research. Finally, we do not model the labor supply decision of men. An interesting next step would be to jointly model the decision of both partners, and recover the social welfare weights and determine the optimal taxation of both primary and secondary earners (Boskin and Sheshinski, 1983; Apps and Rees, 1998; Kleven et al., 2009; Alesina et al., 2011).

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Supplementary Material

A Parameters tax-benefit system: 2005–long run

Table A.1: Tax-benefit system couples: 2005–long run

	2005	2006	2007	2008	2009	2017	Long run
Welfare benefits couples	13,883	14,451	14,897	15,206	15,480	16,874	18,744
Tax bracket rates (in %)							
Income bracket 1	34.40	34.15	33.65	33.60	33.50	36.55	36.89
Income bracket 2	41.95	41.45	41.40	41.85	42.00	40.80	36.89
Income bracket 3	42.00	42.00	42.00	42.00	42.00	40.80	36.89
Income bracket 4	52.00	52.00	52.00	52.00	52.00	52.00	49.50
Top of the tax bracket (in €)							
Income bracket 1	16,893	17,046	17,319	17,579	17,878	19,982	21,129
Income bracket 2	30,357	30,631	31,122	31,589	32,127	33,791	35,238
Income bracket 3	51,762	52,228	53,064	53,860	54,776	67,072	68,516
Income bracket 4	∞	∞	∞	∞	∞	∞	∞
General tax credit (in €)							
Maximum	1,894	1,990	2,043	2,074	2,007	2,254	2,734
Start phase-out	–	–	–	–	–	19,982	21,129
End phase-out	–	–	–	–	–	67,068	75,001
Level at end of phase-out	–	–	–	–	–	0	0
phase-out-rate						4.787	5.075
Earned income tax credit (in €)							
Maximum	1,287	1,357	1,392	1,443	1,504	3,223	3,964
Level at start of phase-in	144	146	148	151	154	165	176
Start phase-in	8,101	8,132	8,312	8,587	8,859	9,309	10,414
End phase-in	17,733	17,883	18,382	18,981	19,763	20,108	22,495
Start phase-out	–	–	–	–	42,509	32,444	37,084
End phase-out	–	–	–	–	44,429	121,972	103,151
Level at end of phase-out	–	–	–	–	1,480	0	0
phase-out-rate						3.6	6.0
Combination credit (in €)							
Maximum	617	754	849	858	1,765	2,778	2,939
Level at start of phase-in	–	–	–	–	770	1,043	0
Start phase-in	–	–	–	–	4,619	4,895	5,174
End phase-in	–	–	–	–	30,803	33,065	30,842
phase-in-rate	–	–	–	–	3.8	6	11.45
Child care subsidy							
Maximum first child (% of hourly price)	96.5	96.5	96.5	96.5	95.5	94.0	94.9
Max. 2nd (3rd etc.) child (% of hourly price)	96.5	96.5	96.5	96.5	96.5	95.0	95.8
Start phase-out, all children (in €)	16000	16,119	16,493	16,925	17,553	23,408	27,676
End phase-out, first child (in €)	79068	96,543	132,551	134,311	113,016	99,999	115,680
End phase-out, second (3rd etc.) child (in €)	79068	96,543	100,649	101,376	162,936	180,419	202,675
Minimum first child (% of hourly price)	26.8	25	33.3	33.3	33.3	33.3	43.65
Min. 2nd (3rd etc.) child (% of hourly price)	72.1	82.4	90.7	90.7	85.0	64	69.63
Maximum hourly price daycare (in €)	pm	5.72	5.86	6.10	6.10	7.18	7.46
Max. hourly price out-of-school care (in €)	pm	6.03	6.02	6.10	6.10	6.69	6.96
Income-dependent child benefit							
Maximum for 1 child	802	924	939	994	1,011	1,142	1,209
Maximum for 2 children	802	924	939	994	1,322	2,040	2,236
Maximum for 3 children	802	924	939	994	1,505	2,325	2,539
Maximum for 4 children	802	924	939	994	1,611	2,610	2,842
Maximum for 5 children	802	924	939	994	1,662	2,895	3,145
Additional amount per child > 2 chld	65	–	–	–	–	–	–
Additional amount per child > 5 chld	–	–	–	–	51	285	303
Additional amount child aged 12–15[a]	–	–	–	–	–	234	249
Additional amount child aged 16–17[a]	–	–	–	–	–	417	443
Level at income 28,491–30,225 euro	616	–	–	–	–	–	–
Level at income 30,225–60,447 euro	112	–	–	–	–	–	–
Start phase-out	–	28,521	28,978	29,413	29,914	20,109	22,496
Phase-out rate (in %)	–	5.75	5.75	5.75	6.5	6.75	6.75
Minimum level	0	0	0	0	0	0	0
General child benefit (in €)							
Per child 0–5 years of age	706	722	755	768	780	794	922
Per child 6–11 years of age	858	877	917	933	947	964	1,119
Per child 12–17 years of age	1,009	1,032	1,079	1,097	1,114	1,134	1,317
Health care benefit (in €)							
Maximum level	–	pm	pm	pm	pm	2,044	2,619
Start phase-out	–	17,487	17,905	18,493	19,135	20,109	22,496
Phase-out rate (in %)	–	5	5	5	5	13.46	14.15
Minimum level	–	0	0	0	0	0	0

B Demographic characteristics couples in the dataset

Table B.1: Descriptive statistics couples: averages for 2006–2009

	All Couples		Without children		Youngest child 0–3 yrs		Youngest child 4–11 yrs		Youngest child 12–17 yrs		Youngest child 18+	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Age	44.20	9.64	47.23	11.67	34.63	4.22	41.10	4.39	46.71	4.25	52.71	4.47
Native	0.88	0.33	0.88	0.32	0.87	0.34	0.87	0.33	0.87	0.33	0.87	0.33
Western immigrant	0.08	0.28	0.09	0.28	0.07	0.26	0.08	0.27	0.08	0.28	0.09	0.29
Non-Western immigrant	0.04	0.20	0.03	0.17	0.06	0.24	0.05	0.22	0.04	0.21	0.04	0.19
Lower educated	0.28	0.45	0.34	0.47	0.15	0.35	0.22	0.41	0.28	0.45	0.40	0.49
Middle educated	0.45	0.50	0.40	0.49	0.49	0.50	0.53	0.50	0.46	0.50	0.41	0.49
Higher educated	0.27	0.44	0.26	0.44	0.36	0.48	0.25	0.44	0.25	0.43	0.19	0.39
Large city	0.14	0.35	0.15	0.36	0.15	0.35	0.13	0.33	0.13	0.33	0.13	0.33
Small city	0.86	0.35	0.85	0.36	0.85	0.35	0.87	0.33	0.87	0.33	0.87	0.33
Hourly gross wage	16.02	6.97	15.78	6.74	16.37	6.77	16.27	7.23	16.04	7.41	15.42	6.57
Participation rate	0.73	0.44	0.69	0.46	0.81	0.39	0.76	0.43	0.74	0.44	0.64	0.48
Hours worked per week	25.06	9.68	28.65	9.83	22.55	7.97	21.16	8.45	23.96	9.28	24.31	9.62
Using formal child care	0.09	0.29			0.47	0.50	0.13	0.33				
Hours formal child care per week	16.78	11.45			19.99	11.40	8.72	6.56				
Observations	414,645		181,466		59,947		88,429		70,515		14,288	

Notes: Includes couples where the women are aged between 18 and 63 years of age. We exclude students, self-employed or women who are on disability or unemployment benefits.

We start by pooling all couples, without and with children. For the empirical analysis, we model the labor supply decision for employed women and women without personal income. We exclude women in couples who are either self-employed or have multiple sources of income, because we cannot determine their budget constraint. Furthermore, we exclude women who are on disability or unemployment benefits, assuming that they are constrained in their labor supply choice. After these selections are made, we further drop women with missing information on individual or household characteristics. This leaves us with 414,645 observations.

Column (1) in Table B.1 shows descriptive statistics for this whole group. Next, we distinguish subgroups based on the age of the youngest child: no children, pre-primary school age 0–3, primary school age 4–11, secondary school age 12–17 years of age, and adult children living at home.

C Discrete choice model for labor supply

We use a structural model for labor supply, where couples are assumed to maximize a unitary utility function. Households maximize utility over consumption, leisure and the use of child care. The model has a static framework and we abstract from savings, hence consumption equals disposable income. Then, the systematic part of utility, U^s, depends on disposable income y, hours of leisure $(1 - h/T)$ and hours of formal child care k. For the functional form of U^s we use the flexible translog specification:

$$\begin{aligned} U^s(\nu) &= \nu'\mathbf{A}\nu + \mathbf{b}'\nu + \mathbf{d}'\mathbf{1}[\mu > \mathbf{0}], \\ & \quad \nu = (\log(y), \log(1 - h/T), \log(k)), \\ & \quad \mu = (h, k), \end{aligned} \tag{C.1}$$

with $\mathbf{A}$ being a symmetric matrix of quadratic coefficients and $\mathbf{b}$ being a vector of linear coefficients corresponding to the vector of the aforementioned variables ν. The hours worked variable h in the vector ν has been transformed into an indicator of leisure utilization, representing the fraction of weekly time endowment T which is spent on activities unrelated to work (including household production). The vector $\mathbf{d}$ captures fixed costs of work and using formal child care. Since these fixed costs are specified in the utility metric, they represent an amalgamation of different factors such as intrinsic disutility from work, or market frictions and other costs related to job search. Above we present the most extensive specification of the utility function with formal child care. However, only couples with a youngest child 0–11 years of age use formal child care. Older children (12–17 years of age) go to secondary school

and their parents do not use formal child care, and therefore the child care terms in the utility function drop out.

We allow for preference variation through observed individual and household characteristics $\mathbf{x}_2$, $\mathbf{x}_3$ in parameters b_2 and b_3:

$$\begin{aligned} &\mathbf{b} = (b_1, b_2, b_3), \\ &b_1 = \beta_1, \quad b_2 = \mathbf{x'}_2\beta_2 + \psi_2, \quad b_3 = \mathbf{x'}_3\beta_3 + \psi_3 \end{aligned} \tag{C.2}$$

which are the linear utility terms in leisure and hours of formal child care. The same variation is also allowed for the fixed costs parameters $\mathbf{d}$ (for a full list of the covariates used, see Table C.1). We start by estimating a random parameters model where we allow for unobserved preference heterogeneity in the preference parameters for leisure (ψ_2) and child care (ψ_3).[26] As it turns out, the results of the random parameters models are very similar to the homogeneous model without unobserved heterogeneity. For simplicity we therefore use the homogeneous model as our baseline specification.

The full translog specification did not result in a significant share of households with negative marginal utility of income in the observed choices. Negative marginal utility of income in the observed choice is not consistent with utility maximization and drives down the labor supply elasticities to implausible values.[27]. We obtained an 'inverted' pattern for the marginal utility of income for all couples, with a negative (log) linear term and a positive (log) quadratic term. This results in implausible (positive) income effects, and therefore we dropped the quadratic term in income.

[26] We use Halton sequences to draw the random terms as they provide a better coverage of the distribution than pseudo-random draws for finite samples (Train, 2003).

[27] We only encountered a small share of households with negative marginal utility of income for couples with a youngest child 0–3 yrs (0.12%) and couples with a youngest child 4–11 yrs (0.02%)

Finally, the translog specification was still not flexible enough for couples without children, and couples with a youngest child 12–17 and 18 years and older. In particular, we do not capture the distribution of hours worked at the top very well, and we introduce a third-order term for (log) leisure, which then improves the fit at the top.

Disposable household income is given by:

$$y = \bar{w_f} h_f \bar{w_m} \bar{h_m} - T(w_f, h_f, w_m, h_m; q) - TC(p_k, k; q) + S(p_k, k, y_t; q), , \qquad \text{(C.3)}$$

where w_f and w_m denote gross hourly wage of women and men respectively,[28] $T(.)$ denotes taxes and employees' premiums, q denotes individual and household characteristics, $TC(.)$ is the total cost of formal child care, with p_k denoting its price per hour, and $S(.)$ is the child care subsidy, which depends on the hourly price of formal child care, the hours of formal child care, taxable income y_t and household characteristics (e.g. the ages of the children).

For workers, we observe gross hourly wages which are used to compute the work-related part of income for each alternative in the choice set. For non-workers, we simulate wages using estimates from a model that accounts for selection (Heckman, 1979)[29], and we account for wage heterogeneity by taking multiple draws from the estimated wage error distribution. Similarly, for households that use formal child care we use observed hourly prices of formal child care, and for non-users we simulate hourly prices using estimates from a model that accounts for selection and we account for price heterogeneity by taking multiple draws from the estimated gross hourly price error distribution.

[28] For simplicity we assume that the gross hourly wage does not depend on the hours worked.
[29] Here we follow e.g. Blundell et al. (2007) and Bargain et al. (2014b).

For our empirical specification we use a discrete-choice model. Here, men are 'inflexible' with respect to labor supply and we keep their labor supply fixed. Hence, only women are able to adjust their labor supply. However we account for the 'inflexible' partner's income when calculating the budget constraint of the 'flexible' partner. Households choose their preferred combination of hours of work from a finite set of alternatives $j \in \{1, ..., J\}$. Next to the systematic part $U^s(\nu_j)$, the utility function contains alternative-specific stochastic terms ε_j:

$$U(\nu_j) = U^s(\nu_j) + \varepsilon_j. \tag{C.4}$$

These stochastic terms are assumed to be independent and identically distributed across alternatives, and to be drawn from a Type 1 Extreme-Value distribution. This leads to a multinomial logit specification of the discrete-choice model (McFadden, 1978).

We discretize the data for the discrete-choice model. Women in couples are able to choose from 6 labor supply options: working 0, 1, 2, 3, 4 or 5 days per week, each day equaling 8 hours.[30] For child care, we allow for 0, 1, 2 and 3 days,[31] with data showing a typical child care day to equal 10 hours,[32] and a typical out-of-school-care day equals 5 hours.[33] Couples with a youngest child aged 0 to 3 or 4 to 11 have the largest choice set: $6 \cdot 4 = 24$ alternatives. Couples without children or older children (12–17 years of age, and 18 years or older) do not use formal child care, and their budget set has 6 alternatives.

[30] Classified as: $0 \in [0, 5), 8 \in [5, 13), 16 \in [13, 21), 24 \in [21, 29), 32 \in [29, 37), 40 \in [37, \infty)$.

[31] The data show that using formal child care for more than 3 days per week is rare in the Netherlands. The remaining child care needs are usually met by informal care or parents themselves.

[32] Classified as: $0 \in [0, 0], 10 \in [0, 15), 20 \in [15, 25), 30 \in [25, \infty)$.

[33] Classified as: $0 \in [0, 0], 5 \in [0, 7.5), 10 \in [7.5, 12.5), 15 \in [12.5, \infty)$.

To determine disposable household income in each discrete option we use the advanced tax-benefit calculator MIMOSI (Koot et al., 2016). MIMOSI is the official tax-benefit calculator of the Dutch government for the (non-behavioral) analysis of the impact of reform proposals on the disposable income distribution and the government budget. MIMOSI allows for a very accurate calculation of the budget constraints. Indeed, it takes into account all (national[34]) taxes, social security premiums, and income independent subsidies and tax credits. In accordance with the law, we ensure that household disposable income can not drop below the welfare level.

Random preference heterogeneity, together with the draws from the estimated wage for non-workers and estimated price for non-users of child care, complicate the estimation of the likelihood function. We use R draws from the wage distribution for non-workers, the price distribution for non-users of child care and the random terms for unobserved heterogeneity.[35] The likelihood function has no closed-form solution and therefore we use simulated maximum likelihood. For each draw r we calculate the likelihood and then take the average of the likelihood over R draws. Hence, the resulting likelihood function has the following form:

$$L = \prod_{i=1}^{N} \frac{1}{R} \sum_{r=1}^{R} \left(\exp(U_k^{ir}) / \sum_{j=1}^{J} \exp(U_j^{ir}) \right)^{D_{ki}} \tag{C.5}$$

with D_{ki} being an indicator function taking the value 1 for the observed choice, and zero otherwise.

[34]Local taxes account for only a small portion of total taxes in the Netherlands (3.3% in 2007, European Union, 2014).

[35]The number of draws in our specification is 50, and it is kept relatively low to limit the computational complexity of the model. Increasing the number of draws did not change the predictions of our model.

Table C.1: Estimated preferences

Parameters	Without children	Youngest child 0–3	Youngest child 4–11	Youngest child 12–17	Youngest child 18+
Income	2.322***	8.149***	5.401***	3.749***	1.333***
Income^2	0.551***	-0.275***	0.560***	0.452***	0.404***
Leisure	-3.262***	-21.860***	-12.560***	-38.440***	-28.860***
X (age-38)/10	4.536***	3.444***	0.014	0.383	0.499
X (age-38)^2/100	1.256***	3.174***	0.486***	1.193***	1.984***
Leisure^2	92.980***	-153.100***	-111.500***	-225.700***	-103.300***
Leisure^3	357.900***			-270.700***	-24.100***
Fixed costs of work	-1.823***	-2.615***	-1.768***	-3.078***	-2.235***
X 1(low educated)	-0.730***	-0.285***	-0.533***	-0.744***	-1.033***
X 1(medium educated)	-0.151***	0.217***	-0.046*	-0.193***	-0.379***
X 1(non-Western allochtonous)	-0.944***	-1.050***	-0.493***	-0.570***	-0.285***
X 1(Western allochtonous)	-0.177***	-0.434***	-0.185***	-0.143***	-0.294***
X 1(>=150,000 inhabitants)		-0.144***	0.058**		
Hours of formal child care		-1.435***	-0.820***		
X 1(non-Western allochtonous)		0.685***	0.330***		
X 1(Western allochtonous)		0.503***	0.213***		
X 1(>=150,000 inhabitants)		0.337***	0.275***		
Hours of formal child care^2		-0.159***	-0.571***		
Fixed costs of child care		0.063	-2.281***		
X 1(low educated)		-1.394***	-1.393***		
X 1(medium educated)		-0.833***	-0.749***		
X 1(non-Western allochtonous)		-1.537***	-0.146		
X 1(Western allochtonous)		-0.774***	-0.133		
Income X hours of formal child care		0.411***	0.424***		
Leisure X hours of formal child care		-6.397***	-6.391***		
Observations	181,466	59,947	88,429	70,515	14,288

Notes: Includes couples where the women are aged between 18 and 63 years of age. We exclude students, self-employed or women who are on disability or unemployment benefits.

The resulting preferences are given in Table C.1. We include a quadratic term for age since we expect that the relationship between age and the preference for leisure is not constant. Indeed, the quadratic term for age is positive indicating that marginal utility of leisure with respect to age is increasing. Younger women

have a higher preference for work as marginal utility of income with respect to age is negative. However, for older women the quadratic term of age dominates and they have a higher preference for leisure.[36] We include fixed costs of work as indicator variables[37] and interact them with observable characteristics such as education, ethnicity and region. The constant term of the fixed costs specification is negative (and significant) for all groups reflecting that there is some disutility from work such as traveling costs or search costs. Furthermore, fixed costs of work are higher for women with a lower education or non-native background. Similarly, we include a fixed costs specification for the use of childcare. Households with a lower educated women or non-native background are more likely to use formal childcare in the Netherlands. Indeed, estimation results show that the interaction terms of education and ethnicity in the fixed costs specification of childcare are negative.

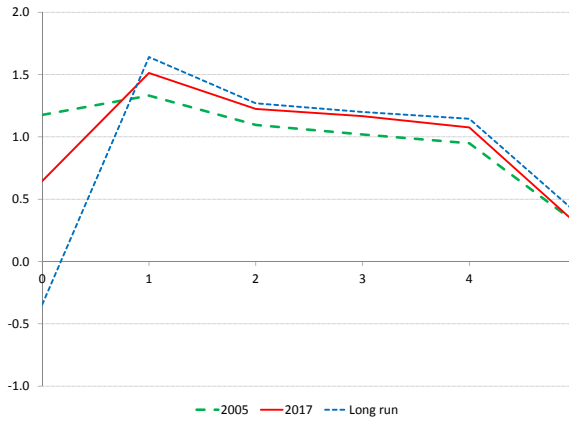
[36] For example, the quadratic term of age dominates for women without children at an age of 21 years ($= exp(4.456/2 * 1.256) * 10 + 38$).

[37] Which equal 0 for the non-working alternative and 1 for the working alternatives

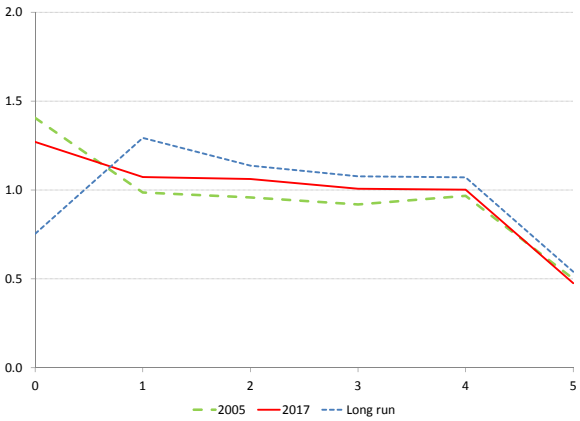
D Robustness checks social welfare weights

Figure D.1: Social welfare weights over time: endogenous elasticities

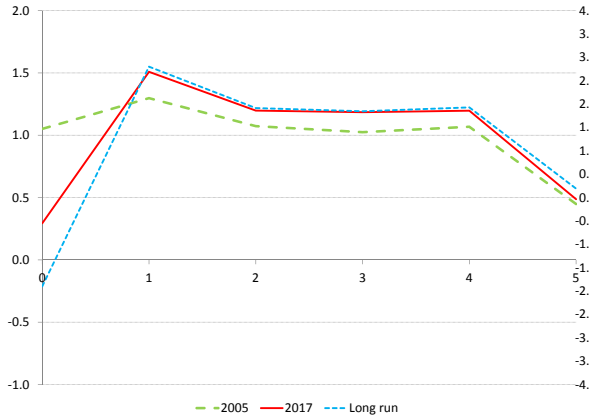
(a) All couples



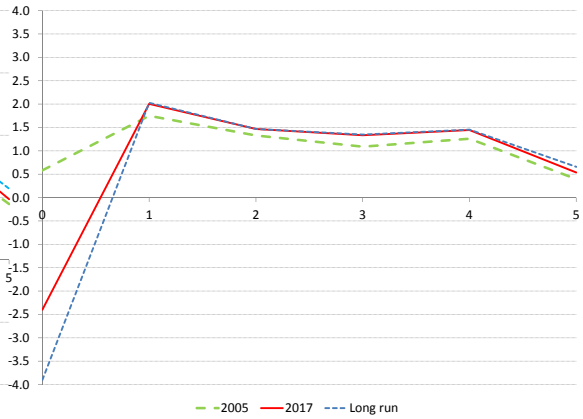
(b) Couples without dependent children



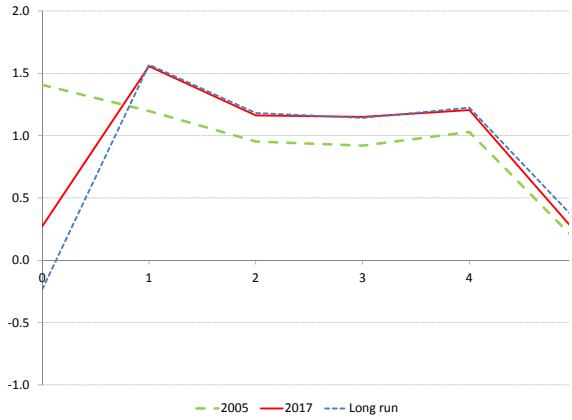
(c) Couples with child 0–17



(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17

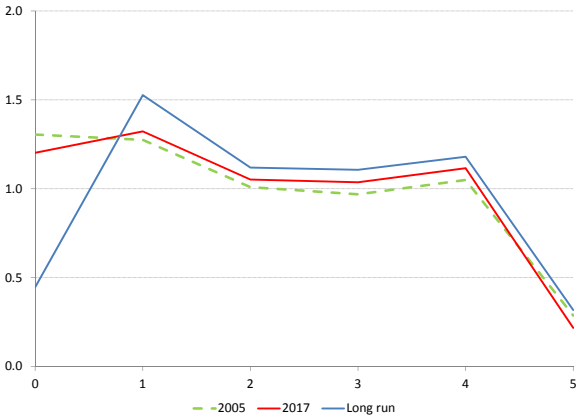
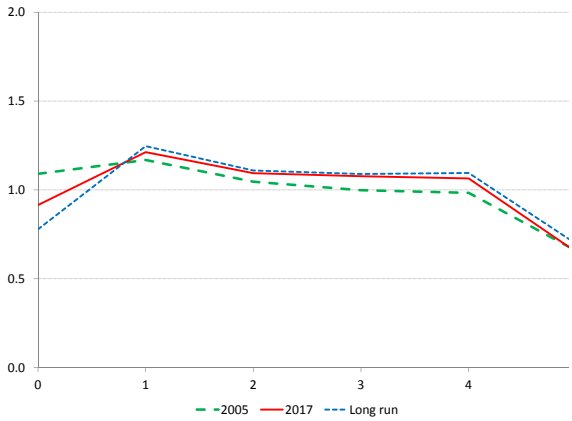
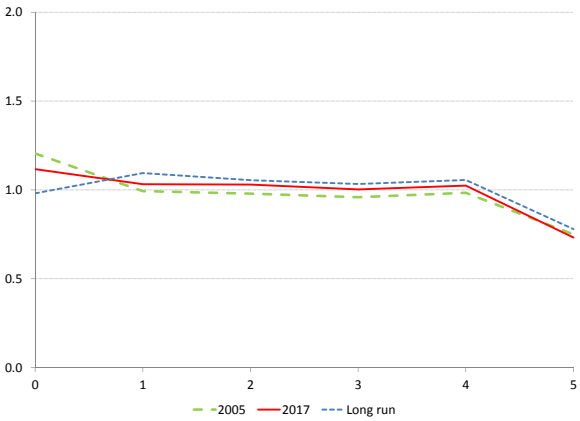


Figure D.2: Social welfare weights over time: elasticities 50% lower

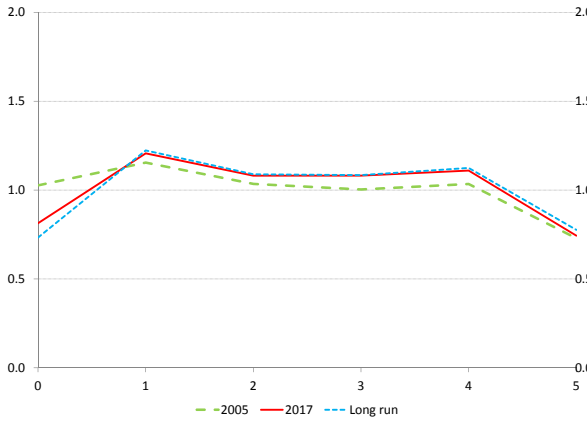
(a) All couples



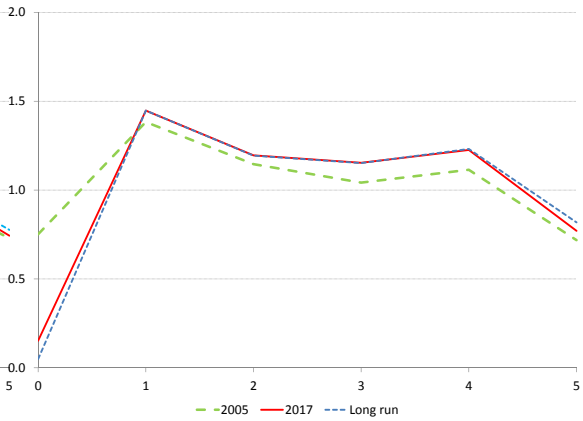
(b) Couples without dependent children



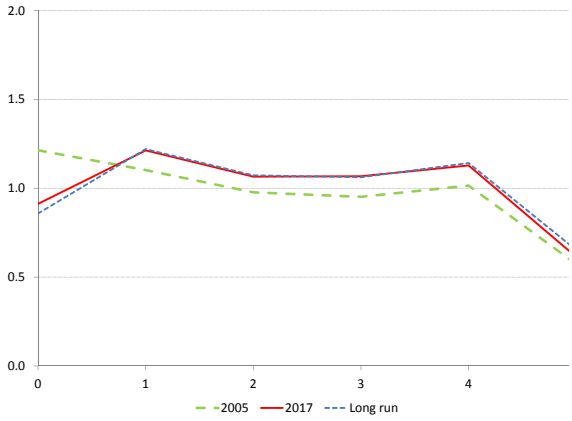
(c) Couples with child 0–17



(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17

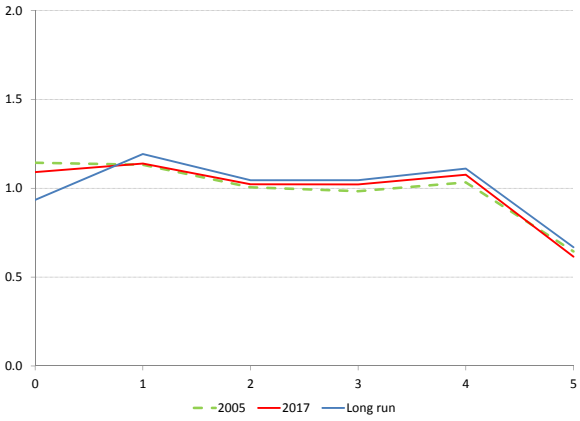
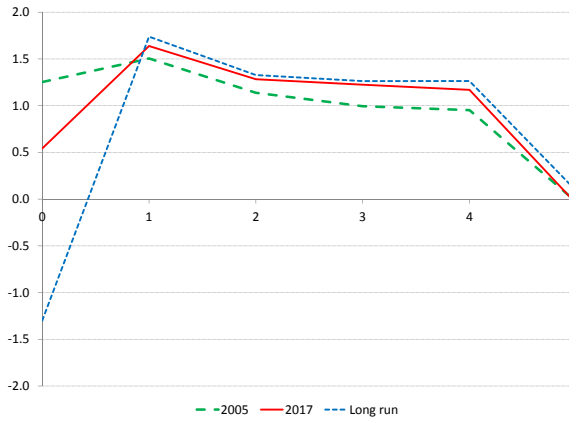
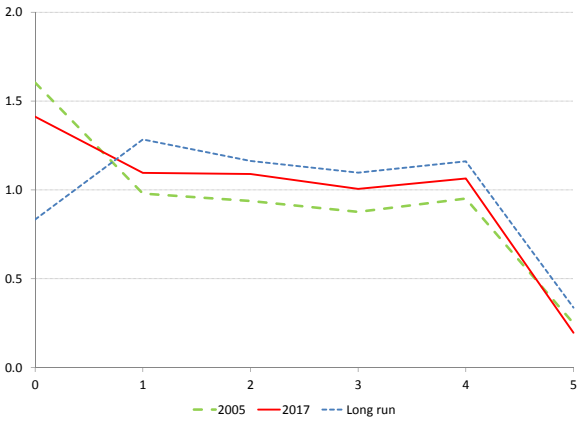


Figure D.3: Social welfare weights over time: elasticities 50% higher

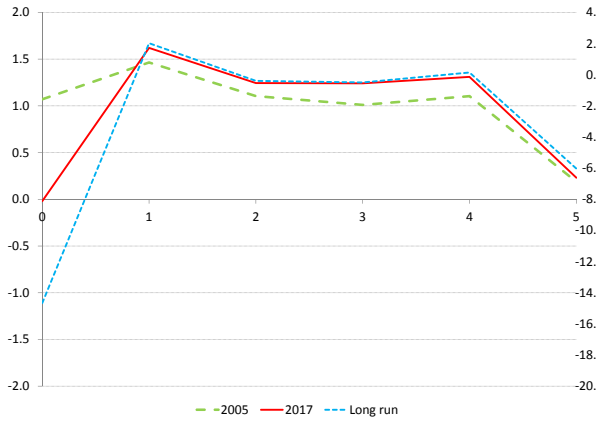
(a) All couples



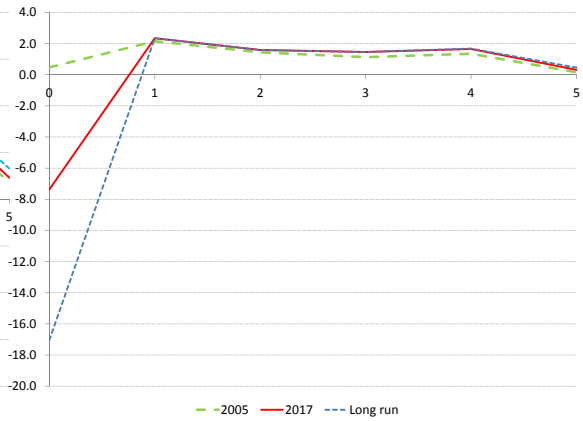
(b) Couples without dependent children



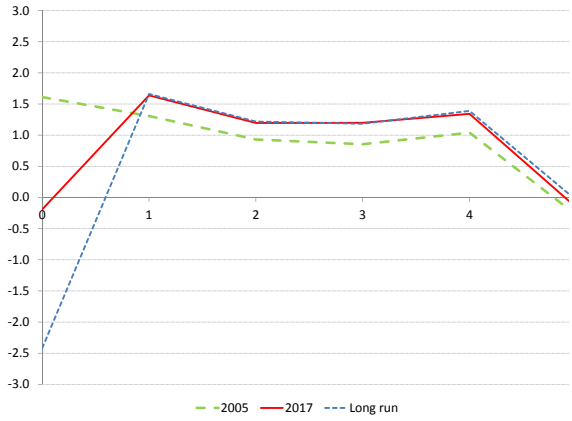
(c) Couples with child 0–17



(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17

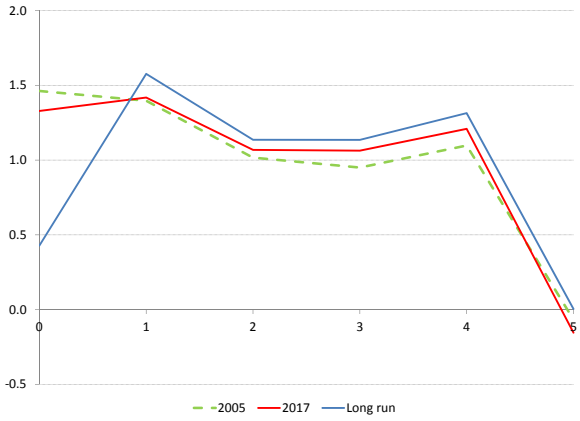
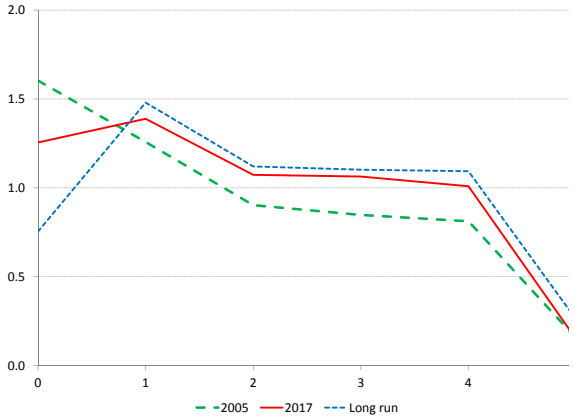
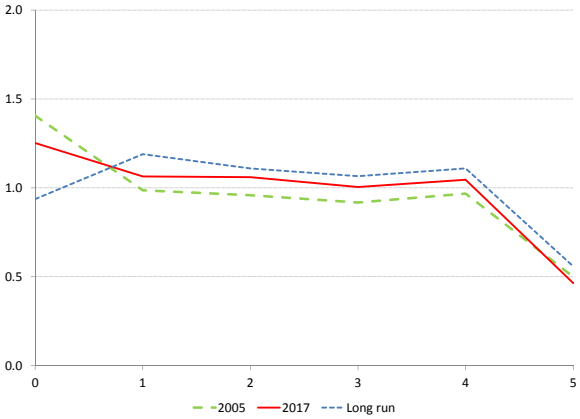


Figure D.4: Social welfare weights over time: using net incomes where child care costs are deducted from disposable income

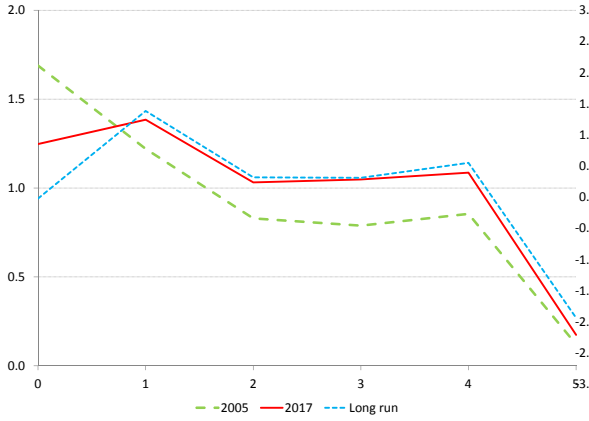
(a) All couples



(b) Couples without dependent children

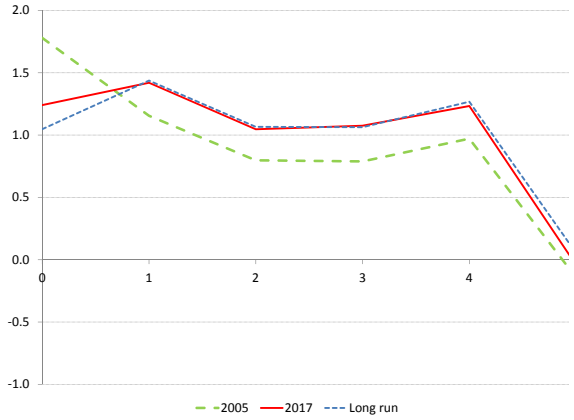


(c) Couples with child 0–17



(d) Couples with youngest child 0–3

(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17

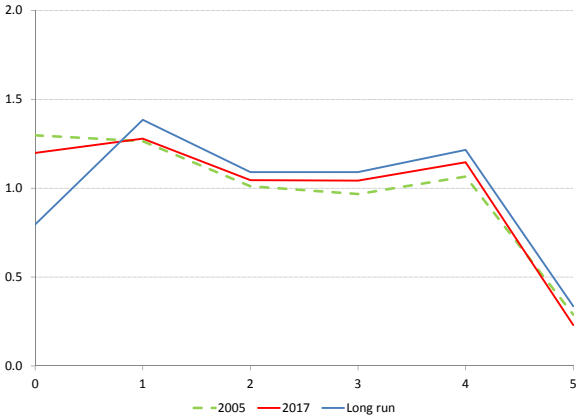
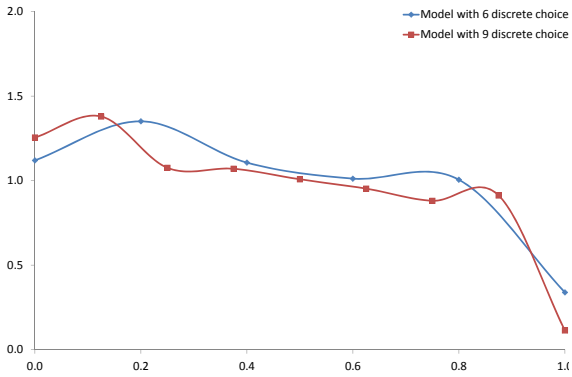
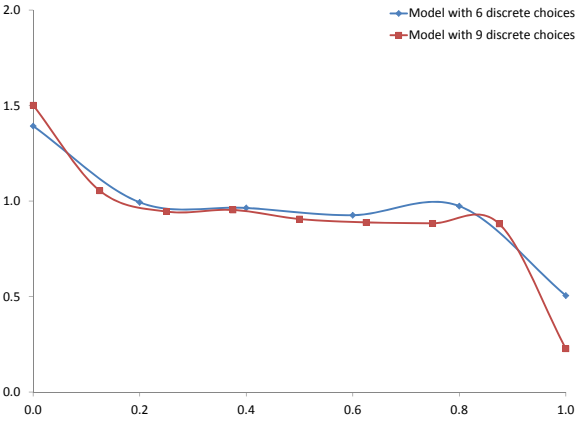


Figure D.5: Social welfare weights: comparison model with 6 and 9 discrete choices in 2006–2009

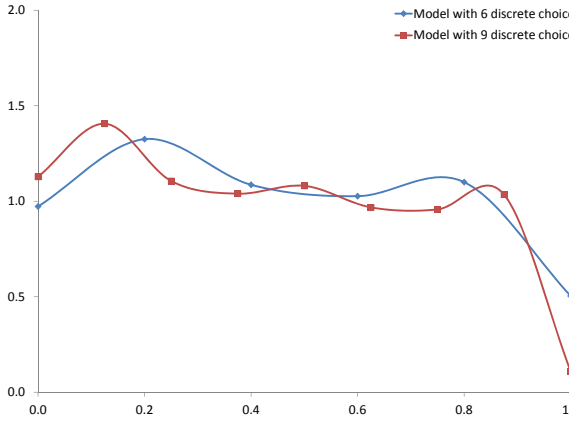
(a) All couples



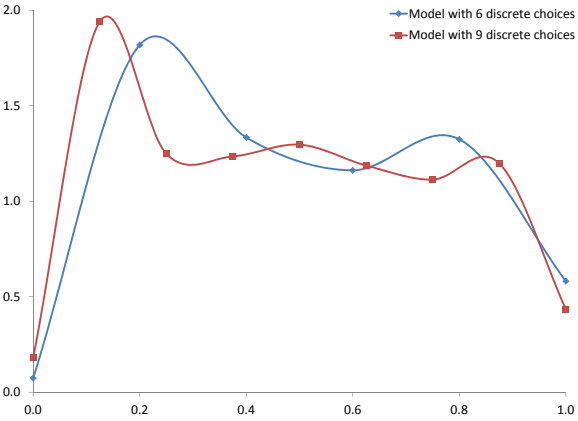
(b) Couples without dependent children



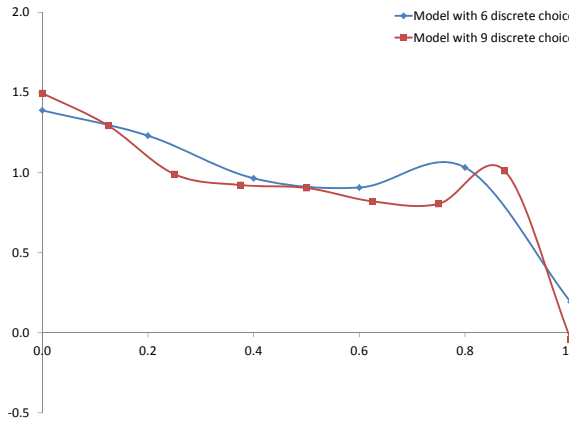
(c) Couples with child 0–17



(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11



(f) Couples with youngest child 12–17

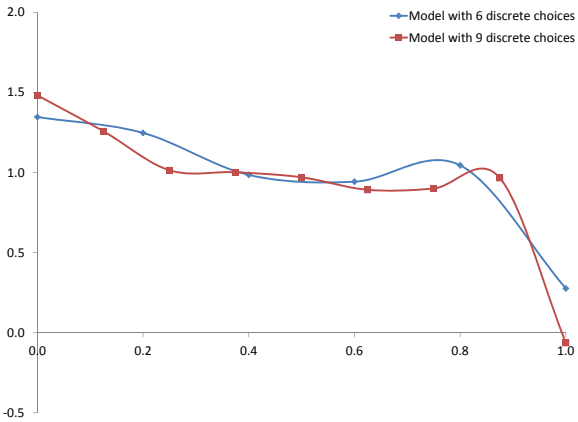
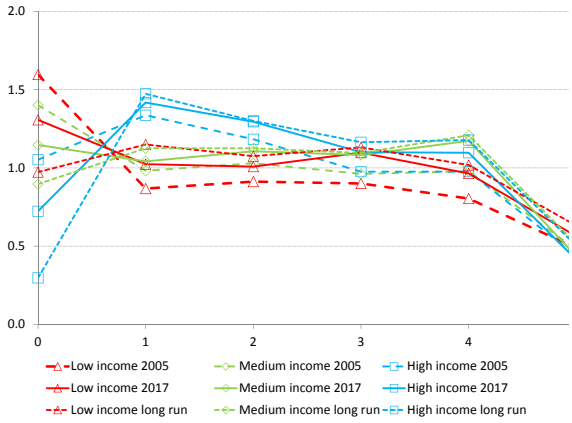
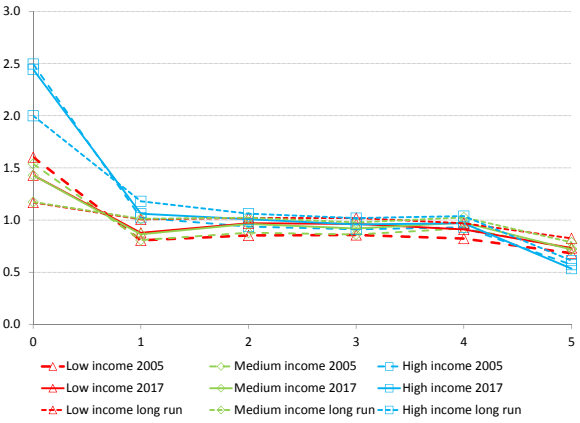


Figure D.6: Social welfare weights over time: by income of the man

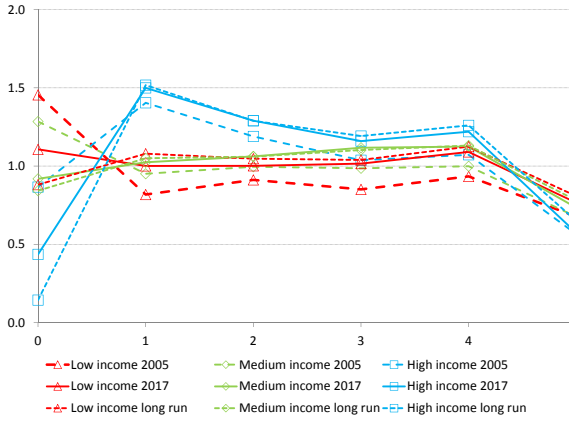
(a) All couples



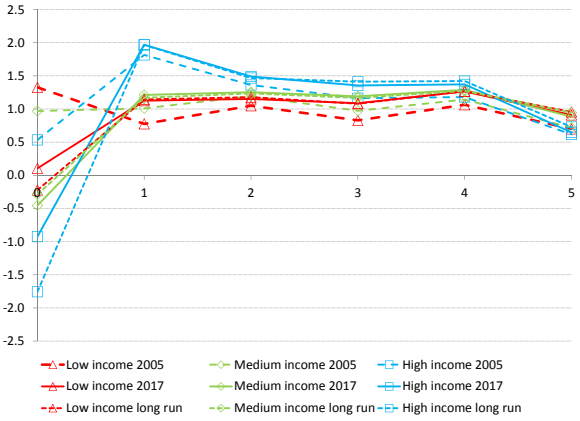
(b) Couples without dependent children



(c) Couples with child 0–17



(d) Couples with youngest child 0–3



(e) Couples with young. child 4–11

(f) Couples with youngest child 12–17

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