Taxation, Intrafamily Distribution, and Dynamic Family Bargaining

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Abstract

I examine the effects of changes in the personal income tax system on spousal welfare and household efficiency under different assumptions of family bargaining. Spouses work in employment and household production in each of two periods, and a spouse's first-period labour supply influences his or her second period wage rate. A change in a couple's tax rates changes the couple's utility possibility set. If the threat point is non-cooperative marriage then the tax treatment of couples is the relevant tax factor in the determination of that threat point. Conversely, if the threat point is divorce, then the tax treatment of singles is the key tax-related determinant of that threat point. A change from bargaining over life-time utility to period-by-period bargaining or a change from a divorce threat point to a threat point determined by non-cooperative marriage change the assessment of efficiency and intrafamily distributional effects of personal income taxation.

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1 Introduction

Personal income taxes are a key determinant of intrafamily distribution and the efficiency of household choices. Taxes have an obvious direct impact on welfare within the household but the influence of tax policy on family outcomes runs much deeper than that. In particular, tax policy shapes the family bargaining environment. Family bargaining models are becoming increasingly common in the analysis of household decision making, and these models have shed valuable new light on a wide range of issues including human capital accumulation, labour supply, marriage and divorce, child welfare, and gender inequality. The impact of public policy on the family bargaining environment has therefore become an increasingly important issue.[1]

There are two key ways in which personal income taxes influence family bargaining outcomes. First, taxes affect the utility possibility set of the family. The most crucial aspect of tax policy in this respect is the manner in which personal income is treated *within* marriage. Most OECD countries - including Canada - have adopted individual taxation: a married individual is treated no differently from a single individual for tax purposes (although a low-income spouse can often be claimed as a dependent by the higher income spouse). In contrast, countries such as the US, Ireland and Germany apply personal income tax schedules that depend on marital status. In Germany, couples are taxed according to the income splitting method: the couple pays twice the amount of taxes that a single person would pay if she earned half the couple's income. In the US, a couple's tax liability is also based on joint income but the total tax payable is typically more than twice the amount of tax payable by a single person earning half as much as the couple as a whole.[2]

[1] See e.g. Konrad and Lummerud (2000), Wrede (2003), Pavoni (2000), Chiappori et al. (2002), Manser and Brown (1980), McElroy (1990), Lundberg and Pollak (1993), Lundberg et al. (1997), Lundberg (2002), Saku (2001), Basu (2001), and Pollak (2005).

[2] This leads to some couples paying more than their combined tax liabilities as singles (a so-called "marriage penalty"), and other couples paying less in combined taxes than their single counterparts (a

These differences in tax policy regimes have important implications for utility possibilities within the family, and hence, for family bargaining outcomes.

The second way in which personal income taxes affect bargaining outcomes is through the impact on threat points. Family bargaining models typically focus on one of two natural threat points: divorce, and non-cooperative marriage. In non-cooperative marriage, spouses rely on their own sources of income and provide household public goods non-cooperatively (see Woolley (1988) and Konrad and Lommerud (2000)). If the threat point is non-cooperative marriage then the tax treatment of own income *within* marriage is the relevant tax factor in the determination of that threat point. Conversely, if the threat point is divorce, then the tax treatment of singles is the key tax-related determinant of that threat point.[3] This means that a tax reform - even within a given policy regime with respect to the tax treatment of families - can have very different impacts on family bargaining outcomes depending on the threat point specification.[4]

My paper makes four main contributions to the analysis of tax policy and family bargaining. First, I examine how changes to the tax treatment of singles can affect bargaining outcomes, through the impact on the divorce threat point. To my knowledge, my paper is the first analysis to make this connection between tax rates for singles and family bargaining outcomes. I analyze the impact of such a change in tax rates on bargaining outcomes in the context of a general two-period model of labour supply and household production that allows a comparison of a divorce threat point with a non-cooperative marriage threat point. The modeling choice with respect to threat points turns out to be very important

"marriage bonus").

[3]Empirical evidence suggests that divorce and non-cooperative marriage are both important threat points in family bargaining. (See Rubalcava and Thomas (2000) and Chiappori et al. (2002) for evidence on divorce as a threat point, and Lundberg et al. (1997) and Ward-Batts (2003) for evidence on the role of non-cooperative marriage).

[4]In the US tax reforms sometimes changed either the tax schedule for singles (e.g. Tax Reform Act of 1969) or the tax schedule for married couples (e.g. Tax Reform Act of 1981) without changing the principle of joint taxation of married couples.

in terms of the predicted impacts of changes to the tax treatment of singles on intrafamily distribution as well as efficiency of household decisions.

Second, I analyze the impact of changes to the tax treatment of married couples on bargaining outcomes. My paper is the first to point out the role tax rates within marriage play in determining the threat-point utilities in non-cooperative marriage. Again, the modeling choice with respect to threat points turns out to be very important in terms of the predicted impacts of changes in tax rates within marriage on intrafamily distribution as well as efficiency of household decisions.

The third contribution of my paper is ancillary to the first and second. I demonstrate in a formal context that changes in public policy which alter the relative appeal of divorce versus non-cooperative marriage as the threat point in family bargaining are likely to have substantial impacts on behaviour *within* marriage via the link between threat points and bargaining outcomes. The particular aspect of this behaviour on which I focus is female labour supply. Recent empirical evidence from the US suggests that married women's labour supply elasticities have decreased over time.[5] One explanation is that women have become more concerned about the prospect of divorce - in view of higher divorce rates generally - and therefore prefer to have steady employment throughout their marriage (Heim (2005), p. 41). My paper offers a new possible explanation: the divorce threat point has become increasingly important relative to non-cooperative marriage in family bargaining as divorce costs have fallen. I show that if women are taxed under joint taxation in marriage a switch from a non-cooperative marriage to divorce as the threat point makes the wife's labour supply within marriage less elastic as the lower marginal tax rate in the divorce threat point creates more incentive for the wife to increase her labour supply within

[5]Empirical studies have found differences between married women and men in how responsive they are to changes in their net wage rates (for a survey see for example Hausman (1985)). However, more recent empirical studies on US data find that these differences have dramatically decreased (e.g. Heim (2005)).

marriage.

The fourth contribution of my paper is methodological. The existing literature on family bargaining sometimes assumes a bargaining environment in which spouses can make a binding agreement at the beginning of marriage with respect to intrafamily distribution, and sometimes assumes that commitment is not possible and that spouses therefore renegotiate the marriage contract in each period.[6] [7] In this paper I consider both environments within the context of the same basic model. I show that the choice of modeling environment is pivotal in terms of the predicted impacts of tax reform. Moreover, the sensitivity of tax reform impacts to the bargaining threat point (divorce versus non-cooperative marriage) is itself dependent upon the modeling assumptions with respect to commitment versus renegotiation. My paper investigates these linkages with respect to modeling methodologies in a formal and systematic way. My analysis highlights the importance of methodological choice and points to a need for more careful consideration in this literature on the question of which bargaining environment is most realistic.

The rest of the paper is structured as follows. Section two places my analysis in the context of the existing literature. Section three presents the model and discusses assumptions on the bargaining environment and the threat points. Section four presents bargaining outcomes holding the tax environment fixed. Section five then examines the impact of tax reform on bargaining outcomes, with and without binding agreements. Section six concludes.

[6] For binding agreements see e.g. Konrad and Lummerud (2000), and Wrede (2003); for renegotiation see e.g. Wells and Maher (1996), Aura (2001), Basu (2001), Lich-Tyler (2001), Lundberg (2002), and Lundberg and Pollak (2003)).

[7] A third alternative in family bargaining models is the assumption that families bargain each period but achieve efficiency nonetheless, because the bargaining problem is exactly the same (repeated game) in every period. See e.g. Manser and Brown (1980), McElroy and Horney (1981), Lundberg and Pollak (1993), and Chiappori et al. (2002). Since actions in one period alter the bargaining problem in the next period in my model, this interpretation does not apply here.

2 Related Literature

My model of the household is most similar to that of Lundberg (2002) and Wrede (2003). Like these authors I use a two-period model in which a spouse's labour force attachment in the first period influences his or her opportunity cost of time in the second period. In contrast to Lundberg (2002) and Wrede (2003), I incorporate household production in both periods, and assume that spouses divide their time between employment and household production in each of the two periods. Allowing for household production in both periods introduces less incentive for the wife to work in employment in the first period. Nonetheless, my model shows that the wife has an incentive to oversupply labour in the first period due to the benefits first-period labour supply has on increasing her second-period utility in the threat point.[8]

The use of divorce as a threat point in cooperative bargaining models of the family was introduced by Manser and Brown (1980) and McElroy and Horney (1981). My specification of divorce as a threat point follows their basic approach. My modeling of non-cooperative marriage is motivated by Lundberg and Pollak (1993). They define non-cooperative marriage as a situation in which spouses retreat to a division of labour sanctioned by gender roles, an environment they call "separate spheres bargaining."

A large volume of literature has examined the question of whether the household or the individual should be the unit of taxation. Most of this work has focused on efficiency implications and impacts on *interhousehold* distribution.[9] More closely related to my

[8] Family bargaining models have not always considered household production. Early models focused on the consumption of household public goods that were purchased in the market. Apps and Rees have criticized this assumption in numerous articles (e.g. Apps and Rees (1999a and b)). Recently household production has been incorporated in family bargaining models (see e.g. Wells and Maher (1996), Lundberg (2002), and Wrede (2003)).

[9] For example, see Apps and Rees (1999a and b) and Pigott and Whalley (1996) for analyses focused on efficiency, and Apps and Rees (1999b) for a treatment of interhousehold distribution issues. Schuetze (forthcoming) puts forth a new argument for joint taxation in a Canadian context, showing that the potential for non-compliance under a system of individual taxation is quite large. In particular, he finds

own analysis are Wrede (2003) and Pollak (2005), both of whom are concerned with the *intra*family distributional effects of family taxation. Pollak (2005) provides a valuable discursive overview of how bargaining models of the family might address the question of whether joint taxation of couples could hurt married women compared to individual taxation. He emphasizes the importance of household production and the possibility of renegotiation within marriage. My paper can be seen partly as an extension of Pollak (2005), by providing a formal framework to analyze the intrafamily distributional impacts of personal income taxation. My paper goes beyond Pollak (2005) by comparing the outcomes of bargaining models using different threat points, and by highlighting the different roles that tax rates play in the different threat point specifications.

Wrede (2003) argues that both spouses always prefer the income splitting method to individual taxation. In contrast, my paper shows that spouses might prefer different forms of family taxation if spouses cannot make a binding agreement at the beginning of their marriage. In particular, a change from individual taxation to income splitting always increases the utility possibility set of the household, but it also changes the threat point of spouses in the second period. This impact on threat points is crucial to the bargaining outcome and can in fact lead the wife to prefer individual taxation if the threat point is non-cooperative marriage; individual taxation raises her net wage in the threat point and can thereby offset the negative impact that individual taxation has on the household's utility possibility set relative to income splitting. This difference between my results and that of Wrede (2003) highlights the importance of tracing the impact of policy on the threat points in family bargaining.

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evidence that a significant portion of the married self-employed in Canada illegally split income in order to reduce their tax liability.

3 The Model

Two individuals, one denoted by $i = w$ for "wife," and another denoted by $i = h$ for "husband," bargain over their utility in marriage. They live for two periods, $k = 1, 2$. I will refer to husband and wife also as "spouses" or "the couple". I focus on two different bargaining regimes: (1) bargaining over life-time utility at the beginning of marriage and (2) renegotiation of the marriage contract (termed period-by-period bargaining).

3.1 Household Net Income, Household Consumption, and Household Production

Total time, which is equal to T for each spouse in each period, can be divided between employment and household production.[10] Let l_{ik} denote spouse i's time devoted to employment in period k, and let t_{ik} denote spouse i's time devoted to household production in period k, then a spouse's time constraint in each period is given by

$$l_{ik} + t_{ik} = T. \tag{1}$$

The wage rate of each spouse i in the first period, w_{i1}, is fixed. Continuous human capital investment through training on the job is very important in increasing one's wage rate over time and my model captures this aspect of wage rate increase by assuming that the wage rate in the second period increases linearly (expressed by parameter π) in the

[10] I abstract from leisure in this model. Introducing leisure as a choice variable would further complicate the analysis. If spouses consider leisure a private good, spouses then face different prices for leisure causing the utility possibility frontier to tilt with a change in marginal tax rates during marriage. In the bargaining literature, authors often make a choice between either focussing on household production (e.g. Konrad and Lommerud (2000), Lundberg (2002), Wrede (2003)) or leisure (e.g. Pavoni (2000), Chiappori et al. (2002)), but do not consider both simultaneously.

hours spent in employment in the first period.[11] [12] Let w_{ik} denote spouse i's wage rate in period k then

$$w_{i2} = w_{i1}\left(1 + \pi l_{i1}\right), \tag{2}$$

where $0 < \pi < 1$. I assume that the wife always earns a lower wage rate than the husband, no matter how much she works in the first period, i.e.$w_{h1} > w_{w2}$.[13]

As noted by Myles (1995, p. 141), "the complexity of evaluating a change in the general model of income taxation has led to considerable interest in the restricted case of linear taxation." In analyzing the linear case the tax schedule for a couple is reduced to three parameters: a lump-sum transfer to the household in period k equal to α_k, and the tax rates τ_{hk} and τ_{wk}, the marginal tax rates the spouses face in the general model in period k.[14] That is, the couple's net income in period k is given by $\sum_{i=h,w} w_{ik}\left(1 - \tau_{ik}\right) l_{ik} + \alpha_k$. Under joint taxation, in order to maximize the household budget set the wife is the secondary earner and so her tax rate on her first dollar earned is equal to the husband's tax rate on his last dollar earned. Under individual taxation, the wife's marginal tax rate does not depend on the husband's income. Following Apps and Rees (1999a and b), I will assume a couple faces marginal tax rates when taxed jointly that lie between the marginal tax rates when taxed individually

$$\tau_{wk}^{ind} < \tau_{hk}^{joint} \leq \tau_{wk}^{joint} < \tau_{hk}^{ind}. \tag{3}$$

[11] See Pavoni (2000), Lundberg (2002) and Wrede (2003) for similar treatment.

[12] Konrad and Lummerud (2000) and Wrede (2003) examine the investment decisions in education of men and women prior to marriage. Given that families distribute resources within marriage according to a Nash Bargaining solution, future spouses overinvest in marketable skills/underinvest in skills that would make them more efficient in household production.

[13] In Canada in 1999, women were paid an average of 80 cents for every dollar earned by men, and on average women earned $17.14 per hour while men received $21.54 per hour (The Daily (2002)).

[14] E.g. Apps and Rees (1999a and b) adopt this approach in analyzing joint versus individual taxation of married couples.

I also assume that the tax schedule cannot reverse the ordering of net wage rates compared to the ordering of wage rates before taxes even if the wife is taxed individually in marriage, i.e.

$$w_{h1}\left(1-\tau_{h1}\right) > w_{wk}\left(1-\tau_{wk}\right), \tag{4}$$

for $k = 1, 2$.[15]

A couple uses household income to finance their consumption of a composite private good. Let x_{ik} be the amount of the private good consumed by spouse i in period k and assume that the price of the good is equal to 1. The household budget constraint in period k is given by[16]

$$x_{hk} + x_{wk} = w_{hk}\left(1-\tau_{hk}\right) l_{hk} + w_{wk}\left(1-\tau_{wk}\right) l_{wk} + \alpha_k. \tag{5}$$

Spouses produce a household public good in each period, denoted by y_k, their time inputs.[17] I assume that spouses' time inputs in household production are perfect substitutes and that there are constant returns to scale in household production.[18] Given the time constraint, equation (1), of each spouse in each period k, the level of household production in period k is given by

$$y_k\left(l_{hk}, l_{wk}\right) = \left(T - l_{hk}\right) + \left(T - l_{wk}\right). \tag{6}$$

[15] For example, if the husband earns a wage rate of \$21.54 and the wife earns a wage rate of \$17.14 per hour, the wife's combined provincial and federal marginal tax rate in British Columbia in 2005 is 21.05%, while the husband's is 24.15%. This amounts to a marginal net wage rate of \$16.36 for the husband and to a marginal net wage rate of \$13.53 for the wife.

[16] It is quite common in dynamic bargaining models of the family (e.g. Wells and Maher (1996), Pavoni (2000), Lundberg (2002), and Wrede (2003)) to rule out saving and borrowing and I also do that here.

[17] One can think of household production as cleaning the house, gardening, redecorating the living room, etc.

[18] The assumption of constant returns to scale is not crucial to my results.

3.2 Quasilinear Utility

In order to examine the intrafamily distributional effects of changes in the personal income tax schedule, I explicitly account for the utility of each spouse. I assume that both spouses have identical utility functions, so that the results are not driven by any difference in tastes. Each spouse i has quasilinear preferences in each period and a linear intertemporal utility function.[19] The utility function in period k for spouse i is given by

$$u_{ik}(x_{ik}, y_k) = x_{ik} + v(y_k)$$

where $v(y_k)$ is an increasing, strictly concave, and twice differentiable function. A spouse's intertemporal utility, U_i, is given by the sum of the spouse's utilities in both periods[20]

$$U_i(u_{i1}, u_{i2}) = u_{i1} + u_{i2}.$$

These assumptions lead to transferable utility and therefore the intertemporal utility possibility frontier and the utility possibility frontier in each period are both linear. To be specific, the equation for the intertemporal utility possibility frontier is given by

$$U_h + U_w = U,$$

where $U = \max_{x_{h1}x_{,w1},y_1,x_{h2}x_{w2},y_2} \sum_{k=1,2}(x_{hk} + x_{wk} + 2v(y_k))$ subject to the constraints given by equations (5) and (6) for $k = 1, 2$. Given labour supplies in period k, l_{hk} and l_{wk},

[19] This simplification is quite common in the family bargaining literature (e.g. Wells and Maher (1996), Lundberg (2002), Lundberg and Pollak (2003), and Wrede (2003)).

[20] A discount factor does not change the results qualitatively and is therefore omitted.

the utility possibility frontier in period k is given by

$$u_{hk} + u_{wk} = u_k$$

where $u_k = w_{hk}(1 - \tau_{hk}) l_{hk} + w_{wk}(1 - \tau_{wk}) l_{wk} + \alpha_k + 2v((T - l_{hk}) + (T - l_{wk}))$.

The most serious limitation of these assumptions is that a change in the net wage rates leading to a change in the opportunity cost of the household public good will not have an income effect, only a substitution effect. My results will therefore overstate the increase in labour supply as the wife's net wage rate increases. However, there are two advantages to this particular type of transferable utility. First, it makes it easier to compare results in the different bargaining regimes discussed below. Second, with a linear UPF the Nash Bargaining solution and the Kalai-Smorodinsky solution coincide, and have a nice interpretation: they split utility above the threat point equally between spouses.[21]

3.3 Bargaining Regimes

3.3.1 Bargaining over Life-Time Utility

In bargaining over life-time utility, spouses make a binding agreement at the beginning of marriage about the utility they will receive in marriage. Denote the utility spouse i has in the intertemporal threat point by D_i. Utility gains from life-time marriage are equal to $U - D_h - D_w$. Spouses individually choose their labour supply in marriage knowing that they split the utility gains from life-time marriage equally. Each spouse's utility from

[21] Both the Nash-Bargaining solution (see e.g. McElroy and Horney (1981), Lundberg and Pollak (1993), Pavoni (2000) and Wrede (2003)) and - to a lesser extent - the Kalai-Smorodinsky solution (see e.g. Manser and Brown (1980), and Konrad and Lummerud (2000)) have been suggested as the solution concepts for the family bargaining problem. With a linear UPF, there is no need to distinguish between these two.

life-time marriage is thus given by

$$U_h = D_h + \frac{U - D_h - D_w}{2}, U_w = D_w + \frac{U - D_h - D_w}{2}, \tag{7}$$

where the first term in each spouse's utility from life-time marriage represents the utility in the intertemporal threat point and the second term represents half of the utility gains from life-time marriage.

3.3.2 Period-by-Period Bargaining

In period-by-period bargaining, spouses cannot make a binding agreement at the beginning of marriage. Denote the utility spouse i has in the threat point in period k by d_{ik}. Utility gains from marriage in period k are equal to $u_k - d_{hk} - d_{wk}$. Both spouses know that once they have chosen labour supply non-cooperatively in each period, they will split utility gains from marriage in this period equally. Each spouse's utility from marriage in period k is thus given by

$$u_h = d_{hk} + \frac{u_k - d_{hk} - d_{wk}}{2}, u_w = d_{wk} + \frac{u_k - d_{hk} - d_{wk}}{2}, \tag{8}$$

where the first term in each spouse's utility from marriage in period k represents the utility in the threat point in period k and the second term represents half of the utility gains from marriage in period k.

3.4 Threat Point Specification

I assume that people's preferences are the same whether they are married, single or divorced. If people are single or divorced they still engage in household production, but the household good is now a private good (denoted by y_{ik}). Let l_{ik}^d be the labour supply of a

person if single or divorced in period k. Household production in period k is given by

$$y_{ik} = T - l_{ik}^d. \tag{9}$$

As mentioned, in countries with the household as the unit of taxation rather than the individual (e.g. in the US, Ireland or Germany) people face different marginal tax rates when they are single/divorced or married even if they earn the same income before taxes. My model must therefore distinguish between the tax schedules of individuals filing as singles and individuals filing as married. Again I use a linearized model to represent the tax schedule. Let σ_{ik} be person i's marginal tax rate when filing as single in period k and let β_{ik} be the lump-sum transfer from the government to person i in period k. A single person or a divorced person's budget constraint is given by

$$x_{ik} = w_{ik}\left(1 - \sigma_{ik}\right) l_{ik}^d + \beta_{ik} \tag{10}$$

in period k.

3.4.1 Bargaining over Life-Time Utility

If negotiations break down when spouses can make a binding agreement at the beginning of marriage, the couple falls back to a situation in which they stay single for the rest of their lives. Spouses then ask themselves: How well off would I be if I do not marry at all? Here the tax schedule of individuals filing as singles determines their net wage rates in the threat point. A spouse's intertemporal utility when single is given by

$$D_i = \max_{x_{i1}, y_{i1}, x_{i2}, y_{i2}} \sum_{k=1,2} x_{ik} + v\left(y_{ik}\right)$$

subject to the constraints given by equations (9) and (10) for $k = 1, 2$. Note that the intertemporal threat-point utility of each spouse when bargaining over life-time utility does not depend on first-period labour supply within marriage. This is the critical distinguishing point between bargaining over life-time utility and period-by-period bargaining (see section 4).

3.4.2 Period-by-Period Bargaining

If negotiations break down when spouses bargain with each other in each period, they fall back to a situation in which they stay single in the first period and they fall back to either divorce or to a non-cooperative marriage in the second period. Hence the relevant tax schedule in the first-period threat point is the tax schedule of individuals filing as singles and the relevant tax schedule in the second-period threat point is either the tax schedule of individuals filing as singles (divorce) or the tax schedule applied to married couples (non-cooperative marriage).

First-Period Threat Point A person's utility if he or she remains single in the first period, denoted by d_{i1}, is given by

$$d_{i1} = \max_{x_{i1}, y_{i1}} x_{i1} + v\left(y_{i1}\right)$$

subject to the constraints given by equations (9) and (10) for $k = 1$. The first-period threat point does not depend on actions taken during marriage.

Divorce As Second-Period Threat Point A spouse's utility if he or she gets divorced in the second period, denoted by d_{i2}^{d}, is given by

$$d_{i2}^{d} = \max_{x_{i2}, y_{i2}} x_{i2} + v\left(y_{i2}\right)$$

subject to the constraints (9) and (10) for $k = 2$. The first order condition of this utility maximization problem is necessary and sufficient. I assume that preferences and net wage rates are such that the first order conditions for both spouses are binding. Each ex-spouse will then supply labour in divorce according to

$$v'\left(\left(T - l_{i2}^{d}\right)\right) = w_{i1}\left(1 + \pi l_{i1}\right)\left(1 - \sigma_{i2}\right), \tag{11}$$

where the left hand side represents ex-spouse i's marginal benefit of time spent in household production and the right hand side represents the opportunity cost of time spent in household production in the second period (forgone net wage rate). In the second-period threat point the first-period labour supply during marriage, l_{i1}, plays a role through its impact on the second-period wage rate (see equation (2)). This is the source of inefficiency in period-by-period bargaining (see section 4.2).

Non-Cooperative Marriage As Second-Period Threat Point As an alternative to using divorce as the second-period threat point, spouses could fall back to a non-cooperative marriage. In non-cooperative marriage, spouses non-cooperatively choose how much time to devote to household production and they finance their private consumption with their own net wages.[22]

Denote the labour supply of spouse i in non-cooperative marriage in the second period by l_{i2}^{nc}. In countries with individual taxation, a spouse's net wage rate is the same as in divorce and hence the budget constraint in non-cooperative marriage is easily determined. It is given by

$$x_{i2} = w_{i2}\left(1 - \sigma_{i2}\right) l_{i2}^{nc} + \beta_{i2}, \tag{12}$$

[22] See Woolley (1988) and Konrad and Lummerud (2000).

the same as in divorce. In contrast, the net wage rate of a spouse in non-cooperative marriage is not obvious when the government taxes married couples jointly. To be on the utility possibility frontier, it is clear that the spouse with the lower wage rate will be the secondary earner. However, in non-cooperative marriage spouses do not benefit from the other spouse's earnings and so each of them might claim to be the primary earner.

Inspired by the idea of sanctioned gender roles in the separate-spheres bargaining model by Lundberg and Pollak (1993), I propose the following. The wife still recognizes her husband as the primary earner of the family in non-cooperative marriage and thus the husband's income is deemed to be the first portion of family income. His budget constraint is then given by

$$x_{h2} = w_{h2}\left(1 - \tau_{h2}\right) l_{h2}^{nc} + \alpha_2. \tag{13}$$

The wife's budget constraint in non-cooperative marriage is given by

$$x_{w2} = w_{w2}\left(1 - \tau_{w2}\right) l_{w2}^{nc}. \tag{14}$$

Recall that under joint taxation $\tau_{hk} \leq \tau_{wk}$ and the husband so enjoys a lower average tax rate than the wife.

I solve the optimization problem for husband and wife in non-cooperative marriage in the appendix. My assumption of perfect substitutes allows the husband to completely free ride on the wife's provision of the household public good and therefore works full time. The provision of the public good is inefficiently low, because the wife does not take into account the husband's benefit of the household good when she decides on the level of household production. With individual taxation, the wife's first order condition is the same as in divorce, and $l_{w2}^{nc} = l_{w2}^{d}$. Under joint taxation, the wife supplies labour in non-cooperative

marriage according to

$$v'\left((T - l_{w2}^{nc})\right) = w_{w1}\left(1 + \pi l_{w1}\right)\left(1 - \tau_{w2}\right). \tag{15}$$

Comparing (11) for $i = w$ and (15), under joint taxation the wife has a lower opportunity cost of household production due to the higher tax rate than in divorce/non-cooperative marriage with individual taxation. The wife thus supplies more of the household public good in non-cooperative marriage if the couple is taxed jointly than if the couple is taxed individually. In addition, the husband's marginal tax rate is lower under joint taxation than under individual taxation. The husband is therefore better off in non-cooperative marriage if the couple is taxed jointly than under individual taxation and the wife is worse off.[23]

Which Second-Period Threat Point? Both threat point specifications have their merits. It is not difficult to see that a non-cooperative marriage increases the husband's utility compared to his utility in divorce independent of the tax schedule for couples. In contrast, the wife is not better off in non-cooperative marriage than in divorce. With joint taxation of couples the wife's utility is higher in divorce than it is in non-cooperative marriage because she would face a lower marginal tax rate in divorce than as the secondary earner in a non-cooperative marriage. With individual taxation of couples, her utility is exactly the same in both threat point specifications.

[23]Spouses have the option in the US to file separately while married following a tax schedule distinct from the tax schedule applied to taxpayers filing as singles. Pollak (2005) therefore argues that US couples file separately as a couple in non-cooperative marriage. One argument in favour of filing jointly in non-cooperative marriage even in the US, although the option of filing separately exists, is that the couple can always decrease its tax liability by filing jointly under the current US tax system. Even if spouses disagree about other issues in marriage, it seems plausible that they would agree on minimizing the amount of taxes they have to pay if it benefits both. The wife would then receive a lump-sum payment from the husband in non-cooperative marriage to make her no worse off than if they filed separately as a couple, but her marginal tax rate would still depend on the joint taxation schedule.

Of course, these results are partly due to my model assumptions and one can easily make both spouses better off in non-cooperative marriage than in divorce by changing the household production function or by introducing a lump-sum payment from the husband to the wife in non-cooperative marriage. However, my simple model makes it obvious that taxation of couples matters in determining their bargaining position in period-by-period bargaining with non-cooperative marriage as the threat point.

There is nothing the government can do to prevent spouses from renegotiating their resource allocation each period and applying a threat point within marriage - and arguably, this may have been going on for centuries. The government can, however, influence to some extent on which threat point spouses will rely when they bargain each period with each other. By making divorce more costly or prohibiting divorce the government can induce family bargaining with non-cooperative marriage as the threat point, and by decreasing divorce costs it may induce family bargaining with a divorce threat point.

4 Bargaining Outcomes

I solve for the bargaining outcomes below distinguishing between bargaining over life-time utility and period-by-period bargaining. I assume that preferences and net-wage differentials are such that the husband wage rate always chooses full-time employment independent of the tax schedule and bargaining regime. The wife as the spouse with the lower net wage rate adjusts her labour supply depending on her opportunity cost of time that changes with her marginal tax rate. A model that allows for interior solutions for both spouses would not qualitatively change my results and assuming perfect substitutes in household production allows me to focus on the choices of the spouse with the lower net-wage only.

4.1 Bargaining over Life-Time Utility

I prove in the appendix that splitting utility gains from marriage equally applied to the bargaining problem over life-time utility is intertemporally efficient. The intuition for this result is the following. Given the bargaining rule, a spouse's utility in marriage depends (1) on his or her utility in the threat point and (2) on the utility possibility set in life-time marriage. Since a spouse cannot manipulate his or her threat-point utility through actions taken during marriage it is in the best interest of each spouse to maximize the sum of intertemporal utilities. Hence bargaining over life-time utility is efficient.

The efficient division of labour requires the wife to work up to the point where the sum of marginal benefits of her time spent in household production (left hand side below) equals her marginal forgone earnings (right hand side below). The first order condition (FOC) for first-period labour supply is

$$2v'\left(T - l_{w1}\right) = w_{w1}\left(\left(1 - \tau_{w1}\right) + \left(1 - \tau_{w2}\right)\pi l_{w2}\right). \tag{16}$$

For first-period labour supply the opportunity cost of time depends on the wage rate in both periods, where $w_{w1}\left(1 - \tau_{w1}\right)$ is the marginal benefit of working in the first period and $\left(1 - \tau_{w2}\right)\pi l_{w2}$ is the marginal benefit in the second period of working in the first period. The FOC for intertemporal efficiency for second-period labour supply is given by

$$2v'\left(T - l_{w2}\right) = \left(1 - \tau_{w2}\right) w_{w1}\left(1 + \pi l_{w1}\right). \tag{17}$$

Since the second period is also the last period, the opportunity cost of time depends on the wage rate in the same period only.

4.2 Period-by-Period Bargaining

I solve for the utility maximizing problem of husband and wife in period-by-period bargaining in the appendix. Period-by-period bargaining is not intertemporally efficient. The wife has an incentive to oversupply labour in the first period because she takes into account the impact that first-period labour supply has on the second-period threat point.

The FOC for the second-period labour supply of the wife as a function of first-period labour supply in period-by-period bargaining is the same as in bargaining over life-time utility, equation (17). The reason for this result is that in the second period, spouses cannot influence their threat-point utilities by any actions they take in marriage in the same period, and thus achieve efficiency in the second period conditional on first-period labour supply. However, first-period labour supply in marriage has an impact on the wage rate in the second period and in turn increases the second-period utility in the threat point for a spouse. The wife's FOC for her first-period labour supply in period-by-period bargaining with non-cooperative marriage as the threat point and individual taxation or with divorce as the threat point is given by

$$2v'\left(T-l_{w1}\right)=w_{w1}\left(\left(1-\tau_{w1}\right)+\left(1-\tau_{w2}\right)\pi l_{w2}\right)+\left(1-\sigma_{w2}\right)w_{w1}\pi l_{w2}^{d}. \tag{18}$$

The wife's FOC for her first-period labour supply in period-by-period bargaining with non-cooperative marriage as the threat point and with joint taxation is given by

$$2v'\left(T-l_{w1}\right)=w_{w1}\left(\left(1-\tau_{w1}\right)+\left(1-\tau_{w2}\right)\pi l_{w2}\right)+\left(1-\tau_{w2}\right)w_{w1}\pi l_{w2}^{nc}. \tag{19}$$

In both equations, the left hand side represents the sum of marginal benefits of the wife's time spent in household production and the right hand side represents her opportunity cost of time spent in household production. Apart from the marginal foregone earnings in

marriage (first term), if the wife decreases her labour supply in marriage in the first period she also faces the additional cost of decreasing her utility in the second-period threat point, a decrease equal to $(1-\sigma_{w2})\, w_{w1}\pi l_{w2}^{d}$ in equation (18) and equal to $(1-\tau_{w2})\, w_{w1}\pi l_{w2}^{nc}$ in equation (19) .

The increase in the wife's labour supplies in both periods in period-by-period bargaining as compared to bargaining over life-time utility is a result of the shift of the wife's first-period labour supply function due to the positive effect that first-period labour supply has on the wife's second-period threat-point utility. An increase in first-period labour supply increases second-period labour supply. To see this, implicitly differentiating equation (17) with respect to l_{w1}

$$\frac{dl_{w_2}}{dl_{w_1}} = \frac{(1-\tau_{w_2})\, w_{w1}\pi}{-2v''\,(T-l_{w2})} > 0. \tag{20}$$

That is, an increase in first-period labour supply increases second-period labour supply in marriage, because an increase in first-period labour supply increases the opportunity cost of household production in the second period.

4.2.1 Policy Applications and Empirical Predictions

The wife's incentive to increase her first-period labour supply is higher if her marginal tax rate in the second-period threat point is lower. This means that if a government taxes couples jointly and couples rely on non-cooperative marriage as the threat point, household decisions are more efficient than with a divorce threat point.

Since in a divorce threat point in the second period the wife's marginal tax rate is based on individual taxation and therefore never higher than her marginal tax rate during marriage in the case of joint taxation, a divorce threat point increases a wife's labour supply compared to non-cooperative marriage with joint taxation. Recent empirical evidence from

the US suggests that married women's labour supply elasticities have decreased over time. I offer a new possible explanation why this has happened: If women are taxed under joint taxation in marriage a switch from a non-cooperative marriage to divorce as the threat point makes the wife's labour supply within marriage less elastic as the lower marginal tax rate in the divorce threat point creates more incentive for the wife to increase her labour supply within marriage.

5 Tax Reform

This section presents an analysis of changes in marginal tax rates under the different bargaining regimes. In the case of period-by-period bargaining I further distinguish between divorce as the second-period threat point and non-cooperative marriage as the second-period threat point.

Within each model, I will focus on a change of tax rates for singles and a change of tax rates for couples. Of course, under individual taxation of couples, the tax schedule for singles is also the tax schedule for spouses. Whenever I discuss a change in tax schedules for singles, my analysis thus applies to the case of joint taxation of married couples. Similarly, under individual taxation of couples, the tax schedule for spouses is also the tax schedule for singles. Whenever I discuss a change in tax schedules for couples, my analysis thus applies to the case of changing the tax treatment of married couples (i.e. from joint taxation to individual taxation of married couples or from individual taxation to joint taxation of married couples) or to a change in the income tax brackets for married couples under joint taxation.

I assume that the change in tax rates between spouses differs, but that the change for

one spouse is the same across time periods, that is

$$\begin{aligned} d\tau_i &= d\tau_{i1} = d\tau_{i2}, \\ d\sigma_i &= d\sigma_{i1} = d\sigma_{i2}. \end{aligned}$$

5.1 Bargaining over Life-Time Utility[24]

5.1.1 Tax Rates for Singles

A change in the tax rates for singles only changes the threat-point utility of spouses, without changing the utility possibility frontier. If, for example, the husband's tax rate when single goes up while the wife's tax rate when single goes down (an increase in the progressivity of the tax schedule), the wife, whose threat-point utility goes up, benefits and the husband, whose threat-point utility goes down, loses. Thus a change in the tax rates for singles under bargaining over life-time utility is what McElroy (1990) calls a shift in extrahousehold environmental parameters - a change that affects only the distribution of utility shares in the household without changing the utility possibility set.

5.1.2 Tax Rates for Couples

A change in the tax rate for married people changes the utility possibility frontier of the couple by shifting it parallel outwards or inwards, but it does not change the threat point. Hence both spouses gain or lose with a tax reform that changes the tax rates of married couples only (e.g. a widening or narrowing of the tax brackets for couples under joint taxation or a change from individual taxation of couples to joint taxation).

[24] **The results in section 5.1 are obvious and proofs are therefore omitted.**

5.2 Period-by-Period Bargaining

5.2.1 Tax Rates for Singles

Tax rates for singles have a different impact on household efficiency depending on whether the second-period threat point depends on them or not. If the second-period threat point is non-cooperative marriage, a change in the tax rates for singles will only change intrafamily distribution through the change in the first-period threat point, but will not change the couple's intertemporal utility possibility set.

In the case of the divorce threat point, the second-period threat point depends on the tax rates for singles. An increase in the wife's marginal tax rate in the hypothetical case of divorce decreases her first-period labour supply in marriage. Implicitly differentiating (18) , an increase in σ_{w2} changes the wife's first-period labour supply by

$$\frac{dl_{w1}}{d\sigma_{w2}} = \frac{-w_{w1}\pi l^d_{w2} + (1-\sigma_{w2})\, w_{w1}\pi \frac{dl^d_{w2}}{d\sigma_{w2}}}{-\left(w_{w1}(1-\tau_{w2})\,\pi \frac{dl_{w2}}{dl_{w_1}} + (1-\sigma_{w2})\, w_{w1}\pi \frac{dl^d_{w2}}{dl_{w_1}} + 2v''(T-l_{w1})\right)} < 0. \tag{21}$$

The term in parentheses in the denominator is equal to the second order sufficient condition (SOSC).[25] An increase in the wife's marginal tax rate in divorce decreases her net wage rate in divorce lowering her marginal benefit of increasing her labour supply in the first period (first term of the numerator). At the same time, an increase in the tax rate for the wife when divorced will cause the wife to consume more of the household good in divorce thus lowering labour supply in divorce. A lower labour supply in divorce decreases the wife's marginal benefit of increasing her labour supply in the first period (second term of the numerator).[26]

A decrease in the wife's first-period labour supply increases the level of household public

[25] See appendix for derivation of SOSC.

[26] To see why, implicitly differentiating equation (11) for $i = w$, an increase in σ_{w2} changes the wife's

good in both periods increasing household efficiency. The husband's utility in the threat point does not change, but utility gains in marriage go up, hence he is better off. By equation (8) , the wife's intertemporal utility is given by

$$U_w = \frac{u_1 + d_{w1}(\sigma_{w1}) - d_{h1} + u_2 + d^d_{w2}(\sigma_{w2}) - d^d_{h2}}{2}.$$

Applying the envelope theorem, the wife's intertemporal utility changes by

$$\frac{\partial U_w}{\partial \sigma_w} = \frac{1}{2}\left(\frac{\partial d_{w_1}}{\partial \sigma_{w1}} + \frac{\partial d^d_{w_2}}{\partial \sigma_{w2}}\right) = \frac{-w_{w1} - w_{w1}(1 + \pi l_{w1})}{2} < 0.$$

Edlund and Pande (2002) note that the political gender gap in the US has widened over the years. The authors argue that it is the increase in divorced women and their demand for redistribution that has increased the political gender gap. As demonstrated in this section, married women have also an incentive to favour a progressive tax system for singles because it increases their utilities in the divorce threat point and their utility in marriage.

5.2.2 Tax Rates for Couples Change

A change in the tax rate for couples will always increase or decrease the utility possibility set of couples, because the prices that the household faces change.[27] A change in the wife's marginal tax rate during marriage induces her to change her labour supply as her

second-period labour supply in divorce by

$$\frac{dl^d_{w2}}{d\sigma_{w2}} = \frac{-w_{w1}(1 + \pi l_{w1})}{-v''\left(T - l^d_{w2}\right)} < 0.$$

[27] As Apps and Rees (1999b) point out, in reality there are many different households in which spouses earn different wage rates to different degrees. Since no real household is likely to be equal to the average household, tax reform will not be revenue neutral for any specific household and households may therefore gain or lose with tax reform depending on their position relative to the average household.

opportunity cost of time changes. This change also has an impact on her second-period threat point, even if the second-period threat point is taken to be divorce. In the case of a non-cooperative marriage as the second-period threat point, the wife has an additional incentive to increase her first-period labour supply as her marginal tax rate decreases, because her threat-point utility depends on the marginal tax rate during marriage.

Divorce As Second-Period Threat Point Recall that the wife's first order conditions in period-by-period bargaining with divorce threat point are given by equations (17) , and (19) . Then first-period labour supply changes by

$$\frac{\partial l_{w1}}{\partial \tau_w} = \frac{-w_{w1}\left(1+\pi l_{w2}\right) + w_{w1}\left(1-\tau_{w2}\right)\pi \frac{\partial l_{w2}}{\partial \tau_{w2}}}{-\left(w_{w1}\left(1-\tau_{w2}\right)\pi \frac{dl_{w2}}{dl_{w_1}} + \left(1-\sigma_{w2}\right) w_{w1}\pi \frac{dl^d_{w2}}{dl_{w_1}} + 2v''\left(T-l_{w1}\right)\right)} < 0. \tag{22}$$

The denominator of (22) is the same as in (21) and the numerator is negative.[28] The wife's first-period labour supply thus decreases with an increase in her marginal tax rate and increases with a decrease in her marginal tax rate. The intuition is clear: if the marginal tax rate of the wife increases during marriage her opportunity cost of time decreases and hence she will provide more of the household public good in both periods. The husband's labour supply does not change with a change in his marginal tax rate in marriage as long as inequality (4) holds.

The wife's utility is given by

$$U_w = \frac{u_1\left(\tau_{w1}, \tau_{h1}\right) - d_{h1} + d_{w1} + u_2\left(\tau_{w2}, \tau_{h2}\right) - d^d_{h2} + d^d_{w2}}{2}.$$

[28] Implicitly differentiating (17) with respect to τ_{w2}

$$\frac{\partial l_{w2}}{\partial \tau_{w2}} = \frac{-w_{w1}\left(1+\pi l_{w1}\right)}{-2v''\left(T-l_{w2}\right)} < 0.$$

Applying the envelope theorem, the wife's intertemporal utility changes with a change in wife's and the husband's tax rates during marriage by

$$\frac{\partial U_w}{\partial \tau_w} + \frac{\partial U_w}{\partial \tau_h} = \frac{1}{2}\left(\frac{\partial u_1}{\partial \tau_w} + \frac{\partial u_2}{\partial \tau_w} + \frac{\partial u_1}{\partial \tau_h} + \frac{\partial u_2}{\partial \tau_h}\right).$$

That is, the wife benefits from tax reform if the intertemporal utility possibility set increases, i.e. $\frac{\partial u_1}{\partial \tau_w} + \frac{\partial u_2}{\partial \tau_w} + \frac{\partial u_1}{\partial \tau_h} + \frac{\partial u_2}{\partial \tau_h} > 0$. The husband's utility is given by

$$U_h = \frac{u_1\left(l_{w1}, \tau_{w1}, \tau_{h1}\right) - d_{w1} + d_{h1} + u_2\left(l_{w1}, \tau_{w2}, \tau_{h2}\right) - d^d_{w2}\left(l_{w1}\right) + d^d_{h2}}{2}.$$

However, the husband's intertemporal utility increases if[29]

$$\frac{\partial U_h}{\partial \tau_w} + \frac{\partial U_h}{\partial \tau_h} = \frac{1}{2}\left(\frac{\partial u_1}{\partial \tau_w} + \frac{\partial u_2}{\partial \tau_w} + \frac{\partial u_1}{\partial \tau_h} + \frac{\partial u_2}{\partial \tau_h}\right) - \frac{\partial d^d_{w2}}{\partial l_{w1}}\frac{dl_{w1}}{d\tau_w} > 0.$$

This means that if there is a decrease in the wife's marginal tax rate and an increase in the husband's marginal tax rate (moving from joint taxation towards individual taxation), the wife benefits from such a tax reform if the intertemporal utility possibility set increases, while the husband may still lose, since the wife's threat-point utility in the second period increases due to her increased labour supply in the first period. Here tax reform of couples may have opposite effects on the spouses and the husband may favour joint taxation in

[29] The wife's FOC given by (19) can be written as

$$\frac{\partial u_1}{\partial l_{w1}} + \frac{\partial u_2}{\partial l_{w1}} + \frac{\partial d^d_{w2}}{\partial l_{w1}} = 0.$$

However, the husband's intertemporal utility changes with a change in the wife's first period labour supply by

$$\frac{1}{2}\left(\frac{\partial u_1}{\partial l_{w1}} + \frac{\partial u_2}{\partial l_{w1}} - \frac{\partial d^d_{w2}}{\partial l_{w1}}\right) = -\frac{\partial d^d_{w2}}{\partial l_{w1}}.$$

this situation while the wife prefers individual taxation.

In the case in which spouses were taxed individually before tax reform and tax reform allows couples to split income as in Germany (see Wrede (2003)), the utility possibility set of the couple expands because tax liability for the household can only decrease with income splitting and thus $\frac{\partial u_1}{\partial \tau_w} + \frac{\partial u_2}{\partial \tau_w} + \frac{\partial u_1}{\partial \tau_h} + \frac{\partial u_2}{\partial \tau_h} > 0$.[30] Although the wife faces a higher tax rate under the income splitting method than under individual taxation, she would agree with her husband in favouring this type of taxation over individual taxation if the second-period threat point is divorce.

Non-Cooperative Marriage As Second-Period Threat Point The analysis in the case of non-cooperative marriage as the threat point is similar to the analysis above with the divorce threat point. However, the optimality condition for first-period labour supply now also depends on how the marginal tax rates change in the second-period threat point.

$$\frac{\partial l_{w1}}{\partial \tau_w} = \frac{-w_{w1}\left(1+\pi l_{w2}\right) + w_{w1}\left(1-\tau_{w2}\right)\pi\frac{\partial l_{w2}}{\partial \tau_w} - w_{w1}\pi l_{w2}^{nc} + w_{w1}\left(1-\tau_{w2}\right)\pi\frac{\partial l_{w2}^{nc}}{\partial \tau_w}}{-\left(w_{w1}\left(1-\tau_{w2}\right)\pi\frac{dl_{w_2}}{dl_{w_1}} + \left(1-\tau_{w2}\right)w_{w1}\pi\frac{dl_{w2}^{nc}}{dl_{w_1}} + 2v''\left(T-l_{w1}\right)\right)} < 0.$$

The denominator is positive, while the numerator is unambiguously negative. Recall that in this specification of the model the wife's intertemporal utility is given by

$$U_w = \frac{u_1\left(\tau_{w1},\tau_{h1}\right) + d_{w1} - d_{h1} + u_2\left(\tau_{w2},\tau_{h2}\right) + d_{w2}^{nc}\left(\tau_{w2}\right) - d_{h1}^{nc}\left(\tau_{h2}\right)}{2}.$$

With non-cooperative marriage as the threat point, both spouses benefit from household production and thus the utility each spouse receives from household production cancels out in the difference of threat-point utilities, $-d_{h2}^{nc} + d_{w2}^{nc}$. The difference of spouses' utilities in the second-period threat point in non-cooperative marriage is determined by the difference

[30] Income splitting has no impact on a household if both spouses earn exactly the same wage rate.

in spouses' net wages only. Let $\Delta_w^{nc} = -d_{h2}^{nc} + d_{w2}^{nc}$, then

$$\frac{\partial \Delta_w^{nc}}{\partial \tau_{w2}} = -w_w \left(1 + \pi l_{w1}\right) l_{w2}^{nc}, \frac{\partial \Delta_w^{nc}}{\partial \tau_{h2}} = w_h \left(1 + \pi\right).$$

The intertemporal utility of the wife changes with a change in the wife's and the husband's marginal tax rates during marriage by

$$\frac{\partial U_w}{\partial \tau_w} + \frac{\partial U_w}{\partial \tau_h} = \frac{1}{2}\left(\frac{\partial u_1}{\partial \tau_{w1}} + \frac{\partial u_1}{\partial \tau_{h1}} + \frac{\partial u_2}{\partial \tau_{w1}} + \frac{\partial u_2}{\partial \tau_{h1}} + \frac{\partial \Delta_w^{nc}}{\partial \tau_{w2}} + \frac{\partial \Delta_w^{nc}}{\partial \tau_{h2}}\right),$$

while the husband's intertemporal utility changes by

$$\frac{\partial U_h}{\partial \tau_w} + \frac{\partial U_h}{\partial \tau_h} = \frac{1}{2}\left(\frac{\partial u_1}{\partial \tau_{w1}} + \frac{\partial u_1}{\partial \tau_{h1}} + \frac{\partial u_2}{\partial \tau_{w1}} + \frac{\partial u_2}{\partial \tau_{h1}} - \left(\frac{\partial \Delta_w^{nc}}{\partial \tau_{w2}} + \frac{\partial \Delta_w^{nc}}{\partial \tau_{h2}}\right)\right) - \frac{\partial \Delta_w^{nc}}{\partial l_{w1}} \frac{dl_{w1}}{d\tau_{w2}}.$$

One can see that if the wife benefits from a tax reform that lowers her marginal tax rate and increases the marginal tax rate of the husband, the husband may be worse off with such a reform. If marginal tax rates move closer together, i.e. τ_{wk} goes up and τ_{hk} goes down as in the case of a reform from individual taxation to the income splitting method, such a change could now cause disagreement in the family: the negative impact of such a reform on the bargaining position of the wife, $\frac{\partial \Delta_w^{nc}}{\partial \tau_{w2}} + \frac{\partial \Delta_w^{nc}}{\partial \tau_{h2}} < 0$, could potentially offset the positive impact it has on the utility possibility set of the family, $\frac{\partial u_1}{\partial \tau_{w1}} + \frac{\partial u_1}{\partial \tau_{h1}} + \frac{\partial u_2}{\partial \tau_{w1}} + \frac{\partial u_2}{\partial \tau_{h1}} > 0$. The husband's utility unambiguously increases. This result is in marked contrast to Wrede (2003) who finds that both spouses always prefer income splitting to individual taxation.

6 Conclusion

Tax reform can have opposite effects on spouses' welfare in a simple two-period model of household production and human capital accumulation.

I have made strong assumptions about spouses' preferences in order to keep this model simple and tractable. The point that this paper makes is that attention needs to be paid to the bargaining regime in the household and the determinants of the threat point when evaluating tax reform. A change from bargaining over life-time utility to period-by-period bargaining and/or a change from divorce to non-cooperative marriage as the second-period threat point change the assessment of tax reform in terms of its impacts on household efficiency and intrafamily distribution.

My paper is the first to analyze how tax policies and other family policies interact. The utility of the wife in divorce and non-cooperative marriage differ in my model if the tax rates that the wife faces when married differ from the taxes she faces when divorced, i.e. if a country uses joint taxation for married couples. This implies that the labour supply of the wife increases if the couple switches from non-cooperative marriage to divorce as the second-period threat point.

Ireland presents an interesting case to test the predictions of my model. The Irish government taxes married couples jointly and, until 1996, divorce was prohibited. The paper offers an explanation to why in Ireland married women's labour supply has dramatically increased in the late 90ies. With the introduction of divorce in 1996, married women may have increased their labour supply because own net wage increases utility in the divorce threat point more than it does in the threat point given by non-cooperative marriage.[31] I will explore these predictions of my model in future research.

[31] In 2002 Ireland had a divorce rate of .7 per 1,000 married people according to National Statistics (2006). It is still very unlikely that a marriage actually ends in divorce.

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8 Appendix

8.1 Non-cooperative marriage as the threat point

In a non-cooperative marriage and under individual taxation spouse i maximizes

$$d_{i2}^{nc} = \max_{l_{i2}^{nc}} w_{i1}\left(1+\pi l_{i1}\right)\left(1-\sigma_{i2}\right) l_{i2}^{nc} + \beta_{i2} + v\left(\left(T-l_{i2}^{nc}\right)+\left(T-l_{j2}^{nc}\right)\right).$$

Under joint taxation the husband maximizes

$$d_{h2}^{nc} = \max_{l_{h2}^{nc}} w_{h1}\left(1+\pi l_{h1}\right)\left(1-\tau_{h2}\right) l_{h2}^{nc} + \alpha_2 + v\left(\left(T-l_{h2}^{nc}\right)+\left(T-l_{w2}^{nc}\right)\right),$$

and the wife maximizes

$$d_{w2}^{nc} = \max_{l_{w2}^{nc}} w_{w1}\left(1+\pi l_{w1}\right)\left(1-\tau_{w2}\right) l_{w2}^{nc} + v\left(\left(T-l_{h2}^{nc}\right)+\left(T-l_{w2}^{nc}\right)\right).$$

It is clear that first order conditions under the two tax treatments will only differ in the parameter for the marginal tax rate. I will thus stick with the general notation that τ_{i2} denotes the marginal tax rate of the spouse in marriage when I solve for the first order conditions below. Spouse i's first order condition is given by

$$\begin{aligned}
w_{i1}\left(1+\pi l_{i1}\right)\left(1-\tau_{i2}\right) - v'\left(\left(T-l_{i2}^{nc}\right)+\left(T-l_{j2}^{nc}\right)\right) &= 0 \text{ for } l_{i2}^{nc} \in [0,T], \\
w_{i1}\left(1+\pi l_{i1}\right)\left(1-\tau_{i2}\right) - v'\left(\left(T-l_{i2}^{nc}\right)+\left(T-l_{j2}^{nc}\right)\right) &> 0 \text{ for } l_{i2}^{nc} = T, \\
w_{i1}\left(1+\pi l_{i1}\right)\left(1-\tau_{i2}\right) - v'\left(\left(T-l_{i2}^{nc}\right)+\left(T-l_{j2}^{nc}\right)\right) &< 0 \text{ for } l_{i2}^{nc} = 0.
\end{aligned}$$

Suppose the first order condition is binding for the wife. Then

$$w_{w1}\left(1+\pi l_{w1}\right)\left(1-\tau_{w2}\right) - v'\left(\left(T-l_{w2}^{nc}\right)+\left(T-l_{h2}^{nc}\right)\right) = 0.$$

Assumption (4) implies that

$$w_{h1}\left(1+\pi l_{h1}\right)\left(1-\tau_{h2}\right) > w_{w1}\left(1+\pi l_{w1}\right)\left(1-\tau_{w2}\right).$$

The husband's first order condition cannot be binding simultaneously and hence $l_{h2}^{nc} = T$, and the wife is therefore the only spouse working in household production.

To sum up, assuming an interior solution for the wife and a corner solution for the husband independent of how married couples are taxed, the threat-point utility of spouse i in non-cooperative marriage is a function of own net wage rate in marriage in the second period, and therefore a function of first-period labour supply, l_{i1}. A spouse's tax rate in marriage also influences the utility of a spouse in the threat point and thus depends on τ_{i2}. The husband's utility, however, also depends on the amount of the household public good provided by his wife which is a function of her own net wage rate in the second period and thus depends on l_{w1} and τ_{w2}.

8.2 Bargaining over life-time utility is efficient

Let $\widetilde{U}$ be the sum of intertemporal utilities given labour supply decisions of both spouses in both periods, and $\widetilde{U}_i$ be the intertemporal utility of spouse i given labour supply. Since the intertemporal utility possibility frontier is linear,

$$\widetilde{U} = \widetilde{U}_w + \widetilde{U}_h.$$

Splitting utility gains $\widetilde{U} - D_w - D_h$ equally, the intertemporal utility of each spouse is given by

$$\begin{aligned} \widetilde{U}_w &= \frac{\widetilde{U} + D_w - D_h}{2}, \\ \widetilde{U}_h &= \frac{\widetilde{U} - D_w + D_h}{2}. \end{aligned}$$

Next, I let each spouse choose their own labour supply given the utility shares awarded by the bargaining solution. Recall that the intertemporal threat-point utility of each spouse does not depend on labour supply during marriage, that is $\frac{\partial D_i}{\partial l_{ik}} = 0$. The problem of spouse i becomes

$$\max_{l_{i1}, l_{i2}} \frac{1}{2} \left[u_1 \left(l_{i1}, l_{j1} \right) + u_2 \left(l_{i1}, l_{j1}, l_{i2}, l_{j2} \right) \right] + \frac{D_i - D_j}{2}.$$

It is not difficult to see that each individual's utility maximizing problem yields the same first order conditions as the problem that maximizes the sum of both people's intertemporal utilities and hence maximizes the intertemporal utility possibility set: bargaining over lifetime utility is efficient.

8.3 Period-by-period bargaining

Note that solving for the spouses' labour supplies in period-by-period bargaining will yield the same first order conditions independent of the threat point specification in the second period except that the tax parameter changes. I therefore focus on non-cooperative marriage as the threat point. Spouse i maximizes his or her intertemporal utility based on period-by-period bargaining by determining second-period labour supply first.

$$\max_{l_{i2}} \frac{u_2 \left(l_{i2}, l_{j2} \right) - d_{j2}^{nc} + d_{i2}^{nc}}{2}.$$

Spouse i's first order condition is given by

$$\begin{aligned} w_{i1}\left(1+\pi l_{i1}\right)\left(1-\tau_{i2}\right)-2v'\left(\left(T-l_{i2}\right)+\left(T-l_{j2}\right)\right) &= 0 \text{ for } l_{i2}\in[0,T], \\ w_{i1}\left(1+\pi l_{i1}\right)\left(1-\tau_{i2}\right)-2v'\left(\left(T-l_{i2}\right)+\left(T-l_{j2}\right)\right) &> 0 \text{ for } l_{i2}=T, \\ w_{i1}\left(1+\pi l_{i1}\right)\left(1-\tau_{i2}\right)-2v'\left(\left(T-l_{i2}\right)+\left(T-l_{j2}\right)\right) &< 0 \text{ for } l_{i2}=0. \end{aligned}$$

Suppose the first order condition is binding for the wife. Then

$$w_{w1}\left(1+\pi l_{w1}\right)\left(1-\tau_{w2}\right)-2v'\left(\left(T-l_{w2}\right)+\left(T-l_{h2}\right)\right)=0.$$

Assumption (4) implies that

$$w_{h1}\left(1+\pi l_{h1}\right)\left(1-\tau_{h2}\right)>w_{w1}\left(1+\pi l_{w1}\right)\left(1-\tau_{w2}\right).$$

The husband's first order condition cannot be binding simultaneously and hence $l_{h2}=T$, and the wife is therefore the only spouse working in household production in the second period.

The wife finds her first-period labour supply by solving for

$$\max_{l_{w1}}\frac{u_1\left(l_{w1},l_{h1}\right)-d_{h1}+d_{w1}+u_2-d_{h2}^{mc}\left(l_{h1},l_{w1}\right)+d_{w2}^{mc}\left(l_{w1}\right)}{2}$$

s.t. $\left(1-\tau_{w2}\right)w_{w1}\left(1+\pi l_{w1}\right)=2v'\left(T-l_{w2}\right)$. Hence the FOC for the first-period labour supply is given by

$$\begin{aligned} w_{w1}\left(\left(1-\tau_{w1}\right)+\left(1-\tau_{w2}\right)\pi l_{w2}\right)+\left(1-\tau_{w2}\right)w_{w1}\pi l_{w2}^{nc}-2v'\left(T-l_{w1}+T-l_{h1}\right) &= 0 \text{ for } l_{w1}\in[0,T], \\ w_{w1}\left(\left(1-\tau_{w1}\right)+\left(1-\tau_{w2}\right)\pi l_{w2}\right)+\left(1-\tau_{w2}\right)w_{w1}\pi l_{w2}^{nc}-2v'\left(T-l_{w1}+T-l_{h1}\right) &> 0 \text{ for } l_{w1}=T, \\ w_{w1}\left(\left(1-\tau_{w1}\right)+\left(1-\tau_{w2}\right)\pi l_{w2}\right)+\left(1-\tau_{w2}\right)w_{w1}\pi l_{w2}^{nc}-2v'\left(T-l_{w1}+T-l_{h1}\right) &< 0 \text{ for } l_{w1}=0. \end{aligned}$$

The husband finds his first-period labour supply by solving for

$$\max_{l_{h1}} \frac{u_1(l_{w1}, l_{h1}) + d_{h1} - d_{w1} + u_2 + d_{h2}^{mc}(l_{h1}, l_{w1}) - d_{w2}^{nc}(l_{w1})}{2}$$

s.t. $l_{h2} = T$. Hence the FOC for the first-period labour supply is given by

$$\begin{aligned}
w_{h1}((1-\tau_{h1}) + (1-\tau_{h2})\pi) + (1-\tau_{h2})w_{h1}\pi T - 2v'(T - l_{w1} + T - l_{h1}) &= 0 \text{ for } l_{h1} \in [0, T], \\
w_{h1}((1-\tau_{h1}) + (1-\tau_{h2})\pi) + (1-\tau_{h2})w_{h1}\pi T - 2v'(T - l_{w1} + T - l_{h1}) &> 0 \text{ for } l_{h1} = T, \\
w_{h1}((1-\tau_{h1}) + (1-\tau_{h2})\pi) + (1-\tau_{h2})w_{h1}\pi T - 2v'(T - l_{w1} + T - l_{h1}) &< 0 \text{ for } l_{h1} = 0.
\end{aligned}$$

Suppose the first order condition is binding for the wife. Then

$$w_{w1}((1-\tau_{w1}) + (1-\tau_{w2})\pi l_{w2}) + (1-\tau_{w2})w_{w1}\pi l_{w2}^{nc} - 2v'(T - l_{w1} + T - l_{h1}) = 0.$$

Assumption (4) implies that

$$w_{h1}((1-\tau_{h1}) + (1-\tau_{h2})\pi) + (1-\tau_{h2})w_{h1}\pi T > w_{w1}((1-\tau_{w1}) + (1-\tau_{w2})\pi l_{w2}) + (1-\tau_{w2})w_{w1}\pi l_{w2}^{nc}.$$

The husband's first order condition cannot be binding simultaneously and hence $l_{h1} = T$, and the wife is therefore the only spouse working in household production in the first period.

The second order sufficient condition (SOSC) requires

$$w_{w1}(1-\tau_{w2})\pi\frac{dl_{w_2}}{dl_{w_1}} + (1-\tau_{w2})w_{w1}\pi\frac{dl_{w_2}^{nc}}{dl_{w_1}} + 2v''(T - l_{w1}) < 0,$$

which I assume holds. Note that

$$\begin{aligned}\frac{dl_{w_2}}{dl_{w_1}} &= \frac{(1-\tau_{w_2})\,w_{w1}\pi}{-2v''\,(T-l_{w2})} > 0,\\ \frac{dl^{nc}_{w_2}}{dl_{w_1}} &= \frac{(1-\tau_{w2})\,w_{w1}\pi}{-v''\,(T-l^{nc}_{w2})} > 0.\end{aligned}$$

Similarly for period-by-period bargaining with a divorce threat point the second order sufficient condition (SOSC) requires

$$w_{w1}\,(1-\tau_{w2})\,\pi\frac{dl_{w_2}}{dl_{w_1}} + (1-\sigma_{w2})\,w_{w1}\pi\frac{dl^{d}_{w_2}}{dl_{w_1}} + 2v''\,(T-l_{w1}) < 0,$$

which I assume holds. Note that

$$\frac{dl^{d}_{w_2}}{dl_{w_1}} = \frac{(1-\sigma_{w2})\,w_{w1}\pi}{-v''\left(T-l^{d}_{w2}\right)} > 0.$$