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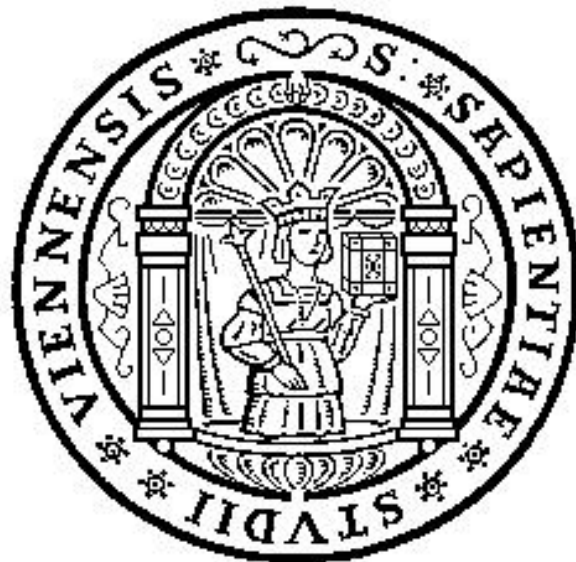
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for double earner couples

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The wage gap and the leisure gap for double earner couples

Miriam Beblo and Julio R. Robledo ^{*†}

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Empirical research has consistently shown that, on average, men are paid higher wages than women. At the same time, men enjoy more leisure time than women. We develop a model of private provision of family public goods to analyze whether the wage gap and the leisure gap are related. Within a noncooperative framework, different bargaining power situations within a couple are considered which lead to different empirical hypotheses. With data from the German Socio-Economic Panel we focus on the leisure gap and the wage gap within double earner couples and in this way are able to discriminate among the theoretical models. Our random effects estimates show that husbands have a stronger bargaining position and this advantage results in them enjoying, other things equal, more leisure time than their wives.

Keywords: Time Allocation, Gender Wage Gap, Gender Leisure Gap, Private Provision of Public Goods

JEL Classification: J22, J16, H41

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1 Introduction

The UN Human Development Report's review of time use in 31 countries in 1995 documents the fact that women consistently enjoy less leisure time than men (United Nations, 1995) with women working longer hours (paid and unpaid) than men in nearly every country. In the German Time Budget Survey for 1991/92 the overall leisure gap between men and women amounts to more than 20 minutes on an average day (Statistisches Bundesamt, 1995). When it comes to working adults the gender-specific difference increases to more than half an hour for those in full-time jobs. In this group, men enjoy 12% more leisure than women. Half an hour may seem a small amount of time, but it is worthwhile noting that it took several decades for contracted daily working time to fall by this amount.

There is also an empirical wage gap between men and women. On average, men are still paid about a fourth more than women with variations across branches and occupations. The unadjusted earnings gap has been hardly decreasing over the last decades (see the data in O'Neill (2003) for the US and in Statistisches Bundesamt (2002) for Germany). Even the adjusted wage differential, e.g. after controlling for individual and job characteristics, amounts to 5-17% of male earnings across the European Union (see European Commission, 2002). If men earn higher wages, one may argue that it may be efficient that men specialize in market work and women in household work, leading to the traditional intra-family time allocation. But this distribution of working hours to market and household work due to the different productivity (wage) does not necessarily imply that employed men work in sum shorter hours than their working wives, e.g., that men enjoy more free time than women.

Most empirical studies on the wage gap or the leisure gap concentrate on the gaps between men and women after controlling for individual and job characteristics like education, work experience, having children, etc. To our knowledge, no study analyzes, theoretically and empirically, the relationship between the wage gap and the leisure gap in a gender related way, and furthermore does this *within* couples. This is the central focus of our paper.

So far, the relationship between the wage gap and the leisure gap has been debated mostly in social science research. A sociological approach, represented by Huber and Spitze (1983) and later extended by Hochschild (1989), is based on the assumption that family time use arrangements are as much a cultural phenomenon as they are an economic one. By analyzing a sample of employed couples drawn from a larger national study by the University of Michigan in 1981, Hochschild found that women did more household work the less they earned relative to their husbands. But even if they had higher labor incomes than their husbands, they still performed "their" household tasks and did not enjoy increased leisure. Low-earning women increased their leisure time by working shorter hours.

Hochschild concluded "that the leisure gap between wives and husbands reflects something more than a pragmatic adaptation by couples to the higher wages of American men - an interplay of gender strategy." (Hochschild, 1989, p. 278). She interpreted this behavior as following a principle of balancing: wives who earn more than their husbands compensate

them for their “loss of face” by not delegating more household work. This finding is supported by a study of Brines (1994) who argues that an economically dependent husband does less household work the more he depends on his wife for income. Established domestic gender roles imply that once a man’s financial identity as the breadwinner has been undermined he cannot afford to further weaken his position by doing household work.¹

The economic theory of time allocation within the family was initiated by Becker (1965, 1976). In Becker’s theory a couple maximizes (joint) utility when both partners allocate their time according to their comparative productivity advantages. That is, if the husband has a higher wage than his wife he will specialize in paid employment and she will specialize in household production, while possibly holding a part-time job. The larger the wage differential, the greater the difference between the amount of time the man and the woman spend at home. Since Becker did not distinguish between household work and leisure, no direct link between wages and the leisure gap can be drawn in this setting.

In recent years, more sophisticated game-theoretic models have been developed where husband and wife interact as individual family members. Manser and Brown (1980), McElroy and Horney (1981) and Ott (1992) propose Nash bargaining models where divorce or remaining single are possible threat points. Lundberg and Pollak (1993) consider the case where the threat point is not divorce but a noncooperative outcome within marriage. Konrad and Lommerud (1995) explicitly model a noncooperative game of private provision of a public good, while Konrad and Lommerud (2000) mix cooperation and noncooperation at different decision stages in lifetime. In the emerging Nash equilibria there is, in general, underprovision of the family public good. Vagstad (2001) presents a similar model where the spouses have different comparative advantages in the production of family public goods.²

In most of these models, husband and wife basically maximize the consumption of two goods, a private good that is paid for by individual labor income, and a public family good that is generated by household production. This does not allow for predictions about different time uses at home. There is no distinction between time spent at home looking after the children and time spent watching TV. The aim of our approach is to model leisure time in an *explicit* way by including leisure as a distinct good in our model. Thus, we have a model with three time uses: (paid) labor work, (unpaid) household work and private leisure time.³

Leisure or private time is defined as time spent on self-determined activities. Since these are activities that are pursued for their own sake, they must be exclusively performed by that same person and cannot be delegated to anyone else and then be transferred. This concept of leisure is called the *third person criterion* (see Schäfer and Schwarz, 1996, and Ott, 1998). Whereas labor refers to all activities that are inputs of a production process, the output of

¹See also Daly (1996).

²For a survey of noncooperative family models see Lommerud (1997).

³It is sometimes difficult to classify to which category a certain time use belongs. Juster and Stafford (1991) survey the problems of measurement that arise when dealing with time allocation and summarize the empirical evidence.

which is interpersonally transferable, leisure does not yield any such outputs that could be traded in return for other services. Sport activities, watching TV or eating and sleeping, for instance, are considered leisure activities, since they have to be performed by oneself.

Compared with intrinsically private leisure, we assume that time spent in paid market work and time spent in unpaid household work generate family public goods, to which both spouses contribute (see Leuthold, 1968, and Kooreman and Kapteyn, 1990). Time spent in paid labor yields wage income that can be regarded as a family public good since housing, transportation, the family car, the TV set, and, in general, the family's living is purchased with that income. Time spent in unpaid labor also yields a public good to the family. The household production of child care, a clean house and a neat garden are public goods provided privately by each partner.

In their exchange model of the household, Apps and Rees (1996) also distinguish between market work, household production and pure leisure. However, they assume the household equilibrium allocation to be Pareto efficient and do not model the decision process explicitly, as is our focus. Since the couple's decision about income and about who will be the main breadwinner is such a long reach decision, we believe that a noncooperative framework better captures the full commitment character of this decision than a cooperative game.⁴ Most economic models assume simultaneous Nash behavior with exogenous labor or household productivity influencing the outcome.⁵ We develop a model with a simultaneous game where both spouses have a similar bargaining position.

One could argue that in reality, there is usually one spouse who has a stronger bargaining position, be it because she/he is older and so is able to make the first move in time, or be it because it is socially accepted that she/he is the dominant partner. Thus, we also present an alternative, sequential model with a decision making process where one partner chooses first. Without loss of generality, we will assume that it is the male spouse who chooses in the first place.

This is also supported by a study of "investments of time" by men and women in the U.S. which found men to have more control over their time (Juster (1985)). This was attributed to a social structure where male roles are more purposive and female roles are more residually determined. In most households, women's wage income is still viewed as the "second" income. It seems plausible to assume that men "dominate" the family decision process on time allocation by deciding first. Frank (1978) develops a job matching model with a "male chauvinist family location decision rule", where the husband optimizes his individual job search in the first place. Given his decision, the wife optimizes her (now also individual) job search to maximize joint labor income, which is a public good for both spouses. Finally, men also have a timing advantage because they tend to be older than the women they marry. They

⁴Even if both partners made a cooperative choice, the outcome of the noncooperative game would be interesting in itself, because it might be a threat point in a cooperative game.

⁵Konrad and Lommerud (2000) endogenize the productivity decision and analyze its effect on the Nash bargaining between household members.

have had more time to search for a job or have longer job tenure, which leads to a higher income.⁶

In this sequential version of our model, the husband decides on his contributions to the public goods first and thereby sets the restrictions for the follower, his wife. By choosing his time allocation in the first place, the husband becomes the Stackelberg leader in a noncooperative game over household time allocation.

In both the simultaneous and the sequential contributions game, intra-household bargaining over the distribution of household resources therefore implies bargaining over individual leisure time. Housing, child care etc., on the contrary, are consumed publicly. It is assumed that they are not associated with distributive conflicts between the partners.

For the sake of simplicity, we assume a private provision model with no private utility of one's contribution as introduced by Cornes and Sandler (1984) and Bergstrom et al. (1986). Our model is also related to Buchholz et al. (1997), who analyze a game of private provision of public goods when two individuals contribute to a public good sequentially. In contrast to their model, where income is transferable, in our setting time cannot be transferred between the partners. Bolin (1996) also considers a similar Stackelberg model in a noncooperative setting with two goods. His noncooperative model explains the unequal division of family work as the outcome of a Stackelberg game between the spouses.

The simultaneous and the sequential contributions game lead to different, testable empirical hypotheses. First, we are able to discriminate between the model where both spouses have the same bargaining power and the model where one spouse has a dominant position. Second, we can estimate the effect of this bargaining power on intra-household allocation.

It turns out that even for the reference case where male and female earn equal wages, the husband generally enjoys more leisure than his wife. This result contradicts the simultaneous contributions game and supports the sequential, Stackelberg-like game where the husband exploits his strategic Stackelberg advantage. In this situation, women outearning their husbands bear a double time burden of market work plus household work as described in the sociological literature. Our empirical results thus confirm the sociological findings that there is more to a gender-specific leisure gap than the wage differential between women and men.

The paper proceeds as follows. In section 2 we outline the basic model. Section 3 and 4 analyze the simultaneous and the sequential Stackelberg game. An empirical analysis of the relationship between the wage and the leisure gap for German data is given in Section 5. The robustness of the results are discussed in the following section. The last section summarizes the main results.

⁶For the role of the age difference in a marriage matching model see Elul et al. (2002), for the relationship between income and job seniority see Topel (1991).

2 The model

We consider a model of intra-family time allocation in which each spouse has an exogenously given time endowment T . This “time budget” T is allocated among three time uses: paid market work g , unpaid household work h and leisure l :

$$T = g_i + h_i + l_i, \quad \text{with } i = f, m. \quad (1)$$

Market work g earns the household an income $w_m g_m + w_f g_f$, where g_m and g_f denote his and her contributions to household income and w_m and w_f denote his and her exogenous and observable wages. In our model it is irrelevant where the household’s money income comes from: a dollar from *his* income is as valuable as a dollar earned by *her*. This linearity in the contributions to money income allows for situations where one partner might in principle be the only money earner. This might be the case in a situation with a very large wage differential (see below on corner solutions). Both spouses earn the same utility from market income given by $G = G(w_m g_m + w_f g_f)$. One can think of the household income as a joint bank account where both spouses’ income is transferred to and from which the rent, food, the TV set etc. is paid.

The husband and the wife also contribute to the household good production h_m and h_f (male and female). The household production technology is more general, allowing for cross effects between his and her contribution. This is the case for the production of goods and services like bringing up the children, cooking, tidying up, etc. Both spouses also derive the same utility from household production, which we denote with $H = H(h_m, h_f)$.

Finally, the remaining time $l_i = T - g_i - h_i, i = m, f$ is the individual leisure time of the spouses. This is the time they spend reading a book, watching TV, surfing the net, etc. Here we also assume that husband and wife have the same leisure utility given by $V(l_i), i = m, f$.

Notice that both spouses derive the same utility from market income (G), household production (H) and leisure (V). Besides, market income and household production are family public goods to which both partners contribute. The decision problems of the two partners are interrelated due to this setting where family public goods are provided privately.

The utility functions are given by:⁷

$$U^m(g_m, g_f, h_m, h_f, l_m) = G(w_m g_m + w_f g_f) + H(h_m, h_f) + V(l_m) \quad \text{and} \quad (2)$$

$$U^f(g_m, g_f, h_m, h_f, l_f) = G(w_m g_m + w_f g_f) + H(h_m, h_f) + V(l_f). \quad (3)$$

The assumption that the utility associated with each of the three time uses enters total utility in an additive way is certainly restrictive, but it is made for the sake of tractability of the model. The functions V and G are assumed to have positive but decreasing first

⁷We use capital letters G , H and V to denote the contribution to utility from market income, household production and leisure. Small letters $g_i, h_i, l_i, i = m, f$ represent the spouses’ time allocated to those time uses. An subscript used with capital letters will denote, as usual in the literature, the first (partial) derivative. When written with a small letter, the subscript denotes the origin of the contribution, *male* and *female*.

derivatives. The household production function H has marginal productivities $H_{h_m} > 0$ and $H_{h_f} > 0$, with $H_{h_m h_m} < 0$ and $H_{h_f h_f} < 0$ and $H_{h_m h_f} < 0$ for the second derivatives. This last assumption means that the contributions h_m and h_f to household work H are substitutes. To avoid corner solutions suppose that $V'(0) = G'(0) = \infty$, $V'(T) = G'(w_m T) = G'(w_f T) = 0$, $\lim_{h_m \rightarrow 0} \frac{H_{h_m}}{H_{h_f}} = \lim_{h_f \rightarrow 0} \frac{H_{h_f}}{H_{h_m}} = \infty$. In the following, we will throughout assume interior equilibria where both spouses contribute to market work and household work and enjoy at least some private leisure, e.g. we want to concentrate on double earner couples and therefore exclude cases where one partner earns such a high wage that the other partner does not contribute to household income.

The additive separability of the utility functions U^m and U^f ensures that all three time uses (leisure, market work and household work) are “normal” in the sense that for an increase in the time endowment T , the spouse increases her/his time commitment to all three activities.⁸

Finally, notice that in our model both spouses are as symmetric as possible. Specifically, we do not assume that one spouse has an intrinsic comparative advantage in household production. Any asymmetry in our model is due only to a potential wage differential and to the game structure which reflects the bargaining position of the spouses, and not to differences in preferences.

3 The simultaneous game with equal bargaining power

Each spouse maximizes utility (2) or (3) subject to the time budget constraint (1) for a given contribution of the other spouse (Nash behavior). We obtain the following result when both spouses choose their time allocation simultaneously:

Proposition 1

If both spouses have the same bargaining power and make their decisions simultaneously, the interior Nash equilibrium is defined by

$$\frac{V'(l_m)}{V'(l_f)} = \frac{w_m G'}{w_f G'} = \frac{w_m}{w_f} = \frac{H_{h_m}}{H_{h_f}}. \quad (4)$$

Proof. Calculating the first order conditions for an interior solution and re-arranging leads to condition (4).

Proposition 1 implies that, for equal wage rates of husband and wife, the same amounts of leisure time result. This allows us to derive a testable hypothesis:

⁸This normality result guarantees the uniqueness of the equilibrium in the private provision game, see Bergstrom et al. (1986).

Hypothesis 1

Suppose both spouses choose their contributions simultaneously. Then the better paid spouse should have less leisure time and we should observe similar amounts of leisure time in couples where the spouses have similar wage rates.

4 The sequential game with one dominant partner

What happens if one spouse has more bargaining power and is able to decide in the first place or his/her decision carries more power? Without loss of generality, let us call this Stackelberg leader “husband”. The time structure of the game is the following:

1. The husband makes his choice about outside (money earning) work and household work.
2. The husband’s choice is observed by his wife.
3. The wife chooses her optimal amount of work.

Since there is no uncertainty and the wife takes the decision of her spouse as given, we solve the Nash equilibrium of this Stackelberg game backwards, calculating first the wife’s optimal behavior as the Stackelberg follower. Her first order conditions are given by

$$\frac{\partial U^f(h_m, h_f, g_m, g_f)}{\partial g_f} = -V'(l_f) + w_f G' = 0 \quad (5)$$

$$\frac{\partial U^f(h_m, h_f, g_m, g_f)}{\partial h_f} = -V'(l_f) + H_{h_f} = 0, \quad (6)$$

where the indices denote the partial derivative with respect to the variables and the arguments are omitted for the sake of clarity. The budget constraint has been eliminated by setting $l_i = T_i - g_i - h_i$, $i = g, h$. These first order conditions implicitly define the wife’s best response functions $g_f(g_m, h_m)$ and $h_f(g_m, h_m)$ for a given choice of the husband. By the implicit function theorem, it can be shown:

$$\frac{\partial g_f(g_m, h_m)}{\partial g_m} = \frac{-w_f w_m G''(V_f'' + H_{h_f h_f})}{D} < 0 \quad (7)$$

$$\frac{\partial g_f(g_m, h_m)}{\partial h_m} = \frac{V_f'' H_{h_m h_f}}{D} > 0 \quad (8)$$

$$\frac{\partial h_f(g_m, h_m)}{\partial g_m} = \frac{w_f w_m G'' V_f''}{D} > 0 \quad (9)$$

$$\frac{\partial h_f(g_m, h_m)}{\partial h_m} = \frac{-(w_f^2 G'' + V_f'') H_{h_m h_f}}{D} < 0, \quad (10)$$

where the denominator is $D = (w_f^2 G'' + V_f'')(V_f'' + H_{h_f h_f}) - (V_f'')^2$. D is the determinant of the 2x2 unbordered Hessian corresponding to the wife's optimization problem. Our assumptions about V , G and H guarantee that the second order conditions for the wife's optimization problem are fulfilled, D is therefore positive.

That the reaction functions (7) and (10) are downward sloping is a well known fact in the literature on the private provision of public goods.⁹ If the husband contributes more to one public good, the wife has an incentive to reduce her contribution to this public good, e.g. to do less out-of-home or household work, respectively. The reaction functions (8) and (9) are different. Consider equation (8): If the husband contributes more to household work $dh_m > 0$, this decreases the wife's marginal utility of household work, since we have assumed h_f and h_m to be substitutes. Therefore, the wife shifts time from household work into gainful employment and leisure. Equation (9) shows that the wife reacts with an increased contribution to household production if the husband makes a larger contribution to the common income $dg_m > 0$.

We can formulate the maximization problem of the Stackelberg leader as

$$\max U^m(h_m, g_m) = V(l_m) + G(w_m g_m + w_f g_f(g_m, h_m)) + H(h_m, h_f(g_m, h_m)),$$

which leads to the following first order conditions:

$$\frac{\partial U^m(h_m, h_f, g_m, g_f)}{\partial g_m} = -V'(l_m) + w_m G' + w_f G' \frac{\partial g_f}{\partial g_m} + H_{h_f} \frac{\partial h_f}{\partial g_m} = 0, \quad (11)$$

$$\frac{\partial U^m(h_m, h_f, g_m, g_f)}{\partial h_m} = -V'(l_m) + w_f G' \frac{\partial g_f}{\partial h_m} + H_{h_m} + H_{h_f} \frac{\partial h_f}{\partial h_m} = 0. \quad (12)$$

Combining the four first order conditions (5), (6), (11) and (12) we obtain the following optimality conditions for the time allocation of the couple:

$$\frac{V'(l_m)}{V'(l_f)} = \frac{w_m G' + w_f G' \frac{\partial g_f}{\partial g_m} + H_{h_f} \frac{\partial h_f}{\partial g_m}}{w_f G'} \quad (13)$$

$$= \frac{H_{h_m} + w_f G' \frac{\partial g_f}{\partial h_m} + H_{h_f} \frac{\partial h_f}{\partial h_m}}{H_{h_f}}. \quad (14)$$

The four reaction functions $\frac{\partial g_f}{\partial g_m}$, $\frac{\partial h_f}{\partial g_m}$, $\frac{\partial g_f}{\partial h_m}$ and $\frac{\partial h_f}{\partial h_m}$ reflect the sequential nature of the game structure. If we eliminate those reaction functions by setting them zero, we arrive at the solution (4) of the simultaneous game.

From the wife's first-order conditions (5) and (6) we obtain $H_{h_f} = w G'$. The right hand side (RHS) of equation (13) simplifies to:

$$\begin{aligned} w_m G' + w_f G' \frac{\partial g_f}{\partial g_m} + H_{h_f} \frac{\partial h_f}{\partial g_m} &= w_m G' + w_f G' \left(\frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \right) \\ &= \frac{w_m}{w_f} + \left(\frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \right). \end{aligned}$$

⁹See for instance Bergstrom et al. (1986).

In an analogous way, we transform the RHS of condition (14) and arrive at the following proposition:

Proposition 2

Assume that (without loss of generality) the husband m can make his decisions in the first place. The interior Nash equilibrium of this sequential game is defined by the following conditions:

$$\frac{V'(l_m)}{V'(l_f)} = \frac{w_m}{w_f} + \frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} = \frac{H_{h_m}}{H_{h_f}} + \frac{\partial g_f}{\partial h_m} + \frac{\partial h_f}{\partial h_m}. \quad (15)$$

In the following, we will analyze several subcases of the sequential model. For this purpose, let us define the husband's wage and leisure time as functions of the wife's corresponding variables: the husband's wage is $w_m = w_f + \Delta w$ and the husband's leisure time is $l_m = l_f + \Delta l$. The variables Δw and Δl denote the wage gap and the leisure gap, respectively.

4.1 A negative wage gap

Consider first the situation where the wife earns a higher wage than her partner: the wage gap is negative. The husband earns less than his wife and he enjoys more leisure. Since the first term in condition (15) (the wage "ratio") is smaller than one and the sum of the reaction functions is always negative, the expression in (15) is smaller than one: the condition will always be fulfilled as long as the husband earns a lower wage. The sequential Stackelberg model makes a strong prediction: women outearning their husbands enjoy less leisure time than their partners. A negative wage gap always leads to a positive leisure gap.

The sequential model provides an economic explanation for the findings of Brines (1994) and Daly (1996) concerning couples where the female earns a higher wage and still enjoys less leisure time than her partner. Intuitively, this is the case because the husband benefits both from his Stackelberg leadership and from his wife's higher productivity in the marketplace.

4.2 Equal wages

Assume now for a fixed female wage that the male wage increases and thus the wage gap diminishes. The husband's increased market productivity makes him shift some time to market work. His wife reacts by reducing her commitment to market work and increasing both household work and leisure time.

Consider now the special case where the market wages of both partners are equal, $w_m = w_f$. Even when both partners have the same contribution costs to the public goods, we would expect the husband to benefit from his Stackelberg advantage. This amounts to a reduction of his contributions to the public goods and to enjoying more leisure compared to the Nash

equilibrium when both spouses make simultaneous decisions.

$$\frac{V'(l_m)}{V'(l_f)} = \frac{w_m}{w_f} + \frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \quad (16)$$

$$= 1 + \left(\frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \right) \quad (17)$$

$$= 1 + \underbrace{\left(\frac{-w_f w_m G'' H_{h_f h_f}}{D} \right)}_{<0} < 1 \quad (18)$$

Since “his” marginal utility of leisure is smaller than “her” marginal utility of leisure, the husband as Stackelberg leader enjoys more leisure time than his wife $l_m > l_f$. Intuitively, this is the case because, if the husband contributes more to the public good market work, $dg_m > 0$, this always leads to a greater (absolute) change of his wife’s commitment to G than of her commitment to H . In other words, the “direct” effect (in absolute terms) exceeds the “indirect” effect:

$$0 < \frac{\partial h_f}{\partial g_m} < \left| \frac{\partial g_f}{\partial g_m} \right| < 1. \quad (19)$$

Proposition 2 implies that, for equal wage rates of husband and wife, the husband uses his Stackelberg advantage and reduces his contributions to the public goods, thereby enjoying more leisure. This leads to the next testable hypothesis:

Hypothesis 2

Consider couples where the spouses have similar wage rates and assume that spouses choose their contributions sequentially, because one spouse has a better bargaining position. We expect that the spouse having a better bargaining position and thereby choosing first enjoys more leisure time than his/her partner.

4.3 A large, positive wage gap

For a very large wage differential it can be shown that the direct effect of the wage gap is larger than the reaction effect, that is, the RHS of (16) is greater than one. In this situation, the husband enjoys less leisure than his spouse *despite* being the Stackelberg leader. Intuitively, this happens because his market productivity is so much higher than his wife’s that it dillutes his Stackelberg advantage.

We know from inequality (19) that, in absolute terms, the direct effect on g_f of a change of g_m exceeds the indirect effect on h_f . Since even the direct effect $\frac{\partial g_f}{\partial g_m}$ can never be greater than 1, the bracketed term in inequality (17) is always negative, but never smaller than -1 .

For a wage ratio greater than 2, the RHS of (17) will always be bigger than 1:

$$\frac{w_m}{w_f} + \left(\frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \right) > 2 + \underbrace{\left(\frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \right)}_{-1 < (\cdot) < 0} > 1 \quad (20)$$

$$\implies V'(l_m) > V'(l_f) \quad (21)$$

$$l_m < l_f \quad (22)$$

For a “large enough” wage gap, the leisure gap is negative and the husband takes less free time than his wife.

4.4 Comparative statics

How does the (leisure) time allocation change in reaction to an exogenous change of the relative wages? Suppose the male wage increases, $dg_m > 0$. The term with the wage ratio on the RHS of (16) also adjusts to a wage change. If there were no further reactions, the LHS would have to increase, e.g. the husband would shift time away from leisure. But the reaction functions on the RHS of (16) also change with a wage change. In the following, we turn to this more general case and analyze the effect of the wage gap on the leisure gap. We can re-state the first equilibrium condition of expression (15) corresponding to the sequential Stackelberg game in terms of the leisure gap:

$$F(\Delta l, w_m, w_f) := -\frac{V'(l_f + \Delta l)}{V'(l_f)} + \frac{w_m}{w_f} + \frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \equiv 0, \quad (23)$$

We obtain the following negative relationship between the wage gap and the leisure gap:

Proposition 3

Assume the following properties of the function $G(w_m g_m + w_f g_f)$ which describes the contribution of market income to utility: $G''' > 0$ and $-w_f g_f \frac{G'''}{G'} < 2$. Then the leisure gap Δl decreases if the male (female) wage increases (decreases):

$$\frac{d(\Delta l)}{dw_m} < 0 \quad \text{and} \quad \frac{d(\Delta l)}{dw_f} > 0 \quad (24)$$

Proof. See Appendix.

Basically, what Proposition 3 states is that the larger the wage gap, the lower the leisure gap. As the male relative wage increases, the husband’s leisure time decreases and the wife’s leisure disadvantage diminishes. Under additional assumptions, we obtain a monotonic result with respect to the leisure gap: For a negative wage gap (high earning women), husbands enjoy more leisure (positive wage gap). If the male wage increases, the male’s leisure advantage decreases. For equal wages $w_m = w_f$, the husband still has more leisure because he is able to extract a leisure rent from his Stackelberg leadership, even though both spouses

have the same market productivity. If the male wage increases further, there will be a critical, large enough wage differential where the leisure gap Δl turns negative, e.g. the husband enjoys less leisure than his spouse *despite* being the Stackelberg leader.

What is the intuition behind the additional requirements of Proposition 3? Suppose the male wage rises and the husband increases his commitment g_m to the joint household income. The wife is better off, and the effect amounts to a time budget increase for the wife in units of household income. Let us call this effect the “endowment effect” (in analogy to the usual income effect, where, in our setting, income is time). By normality, the wife increases her commitments to H (household work) and V (leisure), therefore raising her leisure time. But this adjustment also makes the husband better off. If the additional conditions apply, the endowment effect decreases in the male wage, and this ensures that the indirect reaction of the wife to the male wage increase is small enough, leading to a smaller leisure gap. The opposite effect works in a similar way: a female wage increase leads to a smaller leisure gap, if the endowment effect increases in the female wage.

We summarize our results in the following conjecture:

Hypothesis 3

If both spouses choose their contributions sequentially and under the additional assumptions of Proposition 3, we expect a negative, monotonic relationship between the wage gap and the leisure gap.

5 Empirical Analysis

Theoretically, we have developed three testable hypotheses which allow us to discriminate between the model where both spouses have the same bargaining power and the model where one spouse is the dominant partner (the “simultaneous” and the “sequential” model, respectively). For spouses earning a similar wage (a zero wage gap), the distribution of leisure gives information about the bargaining situation in the couple (Hypothesis 1 vs. Hypothesis 2).

If Hypothesis 1 is rejected empirically and one spouse is the dominant partner, we can check Hypothesis 3: When the husband earns less than his wife, the husband should enjoy more leisure than his wife. The husband wins both from his Stackelberg leadership and from his wife’s higher productivity in the marketplace. As the wage gap diminishes and turns positive, the husband’s increased market productivity makes him shift some time from leisure to market work. His wife reacts by reducing her commitment to market work and increasing both household work and leisure time. For a large enough wage gap, the leisure gap turns negative and the husband enjoys less free time than his wife.

We now investigate the relationship between the wage gap and the leisure gap with data from the German Socio-Economic Panel (GSOEP). The GSOEP is a representative micro data set of the German population, gathered since 1984 for West Germany and since 1990 for East Germany. While far from being competitive with a time use survey as regards infor-

mation on the individual use of (leisure) time, the GSOEP has the advantage of containing many additional socio-economic variables, e.g. the reported time spent on different activities as well as data on various sources of income, particularly earned income, and working hours.¹⁰ This information is necessary to compute the hourly wage rate and, hence, the difference in wages between spouses. Due to changes in the questionnaire over time, only the uneven years 1993, 1995, 1997, 1999 and 2001 yield comparable information on time use.¹¹ Hence these five waves constitute our panel. We restrict the sample to couples (married or cohabiting) where both spouses are in gainful employment and report a positive hourly wage rate. It is further limited to adults between the age of 20 and 60 to prevent the results from being excessively affected by education decisions and early retirement behavior, possibly accompanied by special part time work arrangements.

Table 1 summarizes the characteristics of the pooled sample with 5190 unweighted observations from 2810 couples. Wives are 39 of age on average, husbands almost 42. Men out-earn women by 6.18 German marks (approx. 3.16 euro) in terms of hourly gross earnings. 41 percent of the wives in the sample work part time. 37 percent of all couples live in East Germany which means that East Germans are over-represented both due to over-sampling as well as a larger percentage of dual-earner couples in the Eastern part of Germany. A majority of 83 percent is married. 5 percent have at least one child under 3 years of age, three fifths of which have no institutional care to rely on. 10 percent of couples live with a child age 4 to 6 and 25 percent with a child 7 to 12. As regards leisure time, we have different variables for leisure to choose from. The first variable is defined in a very restrictive way: Respondents are asked to report the average amount of time per day spent on TV and hobbies. We refer to the reported hours as the genuine leisure time (leisure I). Therefore, we have constructed a better measure of disposable or personal leisure time as the residual of total daily time minus work activities (see the work categories in Footnote 11). This latter variable, called leisure II,

¹⁰Individual wage income, in particular, cannot be taken for granted in time use surveys. The German time budget survey 1991/92 for instance did not include individual income sources.

¹¹ The time use data in the respective years of the GSOEP are based on the following question: „How does your typical (work-)day look like? How many hours do you spend on the following activities?

- occupation (including multiple jobs and commuting time),
- housework and shopping,
- child care,
- repairs at the house or the car and garden work,
- education, training,
- TV, hobbies.“

Hours and minutes are to be given for weekdays, Saturdays and Sundays separately by both the husband and the wife. The 2001 wave additionally contains time spent with those in need of care. Other years do not include Saturday and/or Sunday time use. Some years list different activities.

Table 1: Sample characteristics

Variables	Mean	Std. Dev.	Min.	Max.
Age wife	39.13	8.85	20.00	60.00
Age husband	41.66	9.16	20.00	60.00
Age difference	2.53	3.88	-14.00	26.00
Gross hourly wage wife	21.67	9.88	2.03	118.70
Gross hourly wage husband	27.84	12.81	2.11	154.07
Wage difference (h-w)	6.18	12.62	-102.71	134.30
Part time wife	0.41	0.49	0.00	1.00
East Germany	0.37	0.48	0.00	1.00
Married	0.83	0.37	0.00	1.00
Number of children	0.70	0.88	0.00	5.00
Child <3	0.05	0.22	0.00	1.00
Child 4-6	0.10	0.30	0.00	1.00
Child 7-12	0.25	0.43	0.00	1.00
Child <3*No care	0.03	0.18	0.00	1.00
Daily hours of leisure wife	1.81	1.41	0.00	12.29
Daily hours of leisure husband	1.90	1.45	0.00	10.00
Leisure gap (h-w)	0.09	1.35	-9.00	7.14
Disposable time per day (hours) wife	12.46	2.73	8.00	21.86
Disposable time per day (hours) husband	13.23	2.34	8.00	24.00
Disposable time gap (h-w)	0.77	2.53	-13.29	10.86

Notes: Sample of 5190 observations from 2810 dual-earner couples, age 20-60, GSOEP waves 1993, 1995, 1997, 1999, and 2001.

includes genuine leisure as well as regeneration time (sleeping, eating etc.) and is censored at a minimum of eight hours per day. Both variables reveal a positive gap for the husband. The average husband enjoys a plus of 0.09 hours per day, that is about five minutes, of genuine leisure time compared to his wife. The difference in disposable time amounts to 0.77 hours (46 minutes) between the spouses.¹²

¹²Notice that the wage and leisure gaps, on their own, are not statistically significant from zero. This is due to the high variation in our data and is not the focus of our analysis. Our hypothesis does not consider the wage and the leisure gap on its own, but the (negative) relationship between them, which may indeed be both statistically and economically significant (see McCloskey and Ziliak, 1996).

Table 2: Estimation of the intra-family difference in disposable time with random effects

Expl. variables	Model 1		Model 2		Model 3		Model 4		Model 5	
	Coef.	T-val.	Coef.	T-val.	Coef.	T-val.	Coef.	T-val.	Coef.	T-val.
Constant	0.842	18	1.049	9.51	0.513	4.52	0.525	4.63	-0.101	-0.47
Wage diff. (h-w)	-0.013	-4.22	-0.015	-4.70	-0.015	-4.80	-0.016	-4.93	-0.020	-5.74
Wage level (wife)			-0.009	-2.07	-0.003	-0.70	-0.003	-0.77	-0.008	-1.75
No. of children					0.159	2.45	0.154	2.38	0.147	2.25
Child <3					1.069	6.79	0.453	1.81	0.564	2.24
Child 4-6					0.861	6.80	0.863	6.82	0.930	7.23
Child 7-12					0.599	5.36	0.602	5.38	0.638	5.67
Child <3*No care							0.951	3.17	0.891	2.95
Married									0.136	1.22
Age wife									0.015	2.94
Age diff. (h-w)									0.029	2.77
East Germany									-0.139	-1.49
R ² within	0.0009		0.0012		0.0213		0.0225		0.0223	
R ² between	0.0045		0.0057		0.0771		0.0799		0.0875	
R ² overall	0.006		0.0069		0.0545		0.0566		0.0627	
Hausmann-Test χ^2 -statistic (p-value)									15.55	0.1585

Notes: Sample of 5190 observations from 2810 dual-earner couples, age 20-60, GSOEP waves 1993, 1995, 1997, 1999, and 2001.

Table 2 reports the findings on the relationship between the leisure gap and the wage gap between spouses in a panel regression while taking account of individual heterogeneity. Individual effects are assumed exogenous in a random effects specification (see below for details on a fixed effects specification).

The first model in Table 2 is our basic regression of the absolute difference between husbands' and wives' disposable time (leisure II) on the absolute difference between gross hourly wages as the only explanatory variable. Notice that the intercept is positive: for a zero wage gap (equal wages), we thus obtain a positive leisure gap. This result rejects Hypothesis 1 (which predicts also a zero leisure gap) and is compatible with Hypothesis 2. Since, on average, for equal wages the husband enjoys more leisure time than his wife, this means according to our theory that it is the male spouse who has a better bargaining position within the couple, which confirms the observations in the sociological literature cited above. The coefficient of the wage gap is negative and statistically significant at the 1 percent level. That is, the larger the husband's wage rate compared to his wife's, the less leisure time he enjoys. Both the positive intercept and the negative relationship between the wage gap and the leisure gap are confirmed in the following steps when supplementary variables are included in more refined estimation equations.

In addition to the wage difference we first control for the wage level (Model 2). The negative coefficient estimate of the wage gap remains while the wage level is also negatively related to the difference in disposable time. High-earning women face a smaller intra-household inequality in leisure time, suggesting that women (and men) in high-income households have more leisure than poorer households.

In Model 3, information on children in the household is added. The more children under 16 are present, the larger the leisure gap between mother and father. The presence of small children up to 3 years adds further to this difference in a significant magnitude. Older offspring has positive though smaller effects on the leisure gap: The older the age category the smaller the estimated coefficient. When including an interaction term for infants for whom no institutional care is available (Model 4), the coefficient of the infant dummy is much smaller and statistically significant at the 10-percent level only, implying that mothers' leisure is not only affected by the pure fact of having small children but mainly by not having them looked after.

Model 5, finally, brings in several variables that are supposed to reveal some of the family model idea the couple pursues. Being married, for instance, may be more likely among those couples pursuing a more traditional role model where the husband is the main earner and the wife carries responsibility for housework and child care. If the wife decides to take on gainful employment in this setting, she has to deal with a double shift. The traditional role model may also be more likely for older couples as reflected by the wife's age in the regression equation (cohort effect). The age difference between husband and wife is possibly related to the extent to which human capital and job decisions have been made sequentially. This variable may reflect the sequence in job search (first the male "chauvinist", then the

female) as modeled in Frank (1978) mentioned above. In our analysis the wife's age and the spouses' age difference are positively related to the leisure gap. In accordance with our expectations the results indicate that older women and those who are much younger than their husbands have relatively less time at their disposal. The variables 'being married' and 'living in East Germany' yield no significant coefficient estimates. Further regressions¹³ show that education, on the contrary, is not statistically significantly related to the leisure gap, neither the wife's years in schooling nor the difference in schooling years between the husband and the wife.

6 Discussion

The empirical results reject the hypothesis that men and women have equal bargaining power and support our second, sequential decision model. Besides, the wage gap is found to have an additional effect on the leisure gap within couples. However, we would like to discuss a few possible complications and robustness tests we used to check our results.

Determinants of bargaining power. In our theoretical models, both the exogenous wage gap and the time structure (e.g. the bargaining power) are the driving forces behind our results. The wage gap itself may determine the bargaining power situation within the couple. Thus, the high-income spouse becomes the Stackelberg leader in the household's time allocation decision game. To check this possibility, we split our sample in three subsamples corresponding to a positive, a zero, and a negative wage gap and estimate our model for the subsamples. If the wage gap were the variable determining the bargaining power, we should observe no effect on the leisure gap for a zero wage gap. But in the zero-wage-gap sample, the husband still has a "Stackelberg" advantage, thus rejecting the hypothesis that the wage gap is the determinant variable. In line with the sequential job search argument it may also be argued that the Stackelberg leader does not necessarily have to be the husband but the older one of the two spouses. Thus we investigate whether the results are the same for those couples where the wife is older than the husband. Even here the hypothesis of the Stackelberg advantage of the husband is supported.

Fixed effects model. It may be argued that in an analysis of the determinants of the intra-family leisure gap the individual specific, or couple specific, effects shall be treated as fixed effects because couples' preferences towards time allocation may differ systematically rather than randomly. When applying fixed instead of random effects, time-constant variables cannot be analyzed as explanatory variables, though. Because the age difference of a couple hardly changes between years, neither does being married or living in East Germany, these variables cannot be included in a fixed effects specification. In any case, a Hausman test

¹³Available from the authors on request.

on the hypothesis of the appropriateness of a random effects specification cannot be rejected (see the test statistic in Table 2).

Matching bias. A further matter of concern may be a possible “matching bias” in the data: possibly, couples do not match by chance, but instead partners with common social, cultural or economic background marry each other. This self-selection effect would tend to equalize all wage gaps and work against our findings. Thus, our results may even be underestimating the link between the wage gap and the leisure gap.

East and West Germany. A control regression on a subgroup of full-time employed women and men confirms the previous results. For this subset, living in East Germany, which is meant to take up the cultural aspect of family time use arrangements as well as the greater availability of institutional child care, is also statistically significantly related to the leisure gap. On average, East German working couples experience a more equal distribution of leisure time between spouses. In a second control regression, the inclusion of a variable indicating whether the woman originates from East Germany does not reveal any correlation with the leisure gap. Thus, the negative coefficient of living in East Germany seems to capture the provision of public provision of child care rather than cultural differences between the two regions.¹⁴

Extreme values. We also controlled for the possibility of outliers influencing our results. But eliminating extreme wage gap values (of either sign) did not alter our results significantly.

Summing up, all estimations and robustness checks lead us to reject the hypothesis that spouses have the same bargaining power. Instead, the husband has a better bargaining position and enjoys more leisure time. Only when there is a large enough wage gap between husband and wife, does his higher productivity at the market place lead to more leisure time for his wife.

7 Conclusions

In this paper we explicitly model leisure time decisions of a couple. This allows us to establish a direct link between the leisure gap and the wage gap between spouses. We show that even with equal wage rates men enjoy more leisure than their wives, but with larger wage differentials, this leisure gap diminishes. This result is confirmed empirically. Social structures in which the male makes the first move lead to an intra-family time allocation that keeps women out of full-time employment, because that maximizes their disposable free time or minimizes their leisure reduction, respectively.

¹⁴The provision of all-day child care is much more extended in East than in West Germany, see Spieß et al. (2002).

Our model shows that gender inequality within the household cannot be abolished by “simply” closing the wage gap between male and female employees, since even (or particularly) with a wage differential of zero, men dispose of more leisure. This result is due to the husband’s advantage in deciding first on his provision of the family public goods. Hence, if the policy goal is to abolish gender inequality, social structures that define gender roles decisive for asymmetries in family decision making will have to change. The gender-specific leisure gap results not only from the pay differential between men and women, but also from socially based gender inequality.

This asymmetric decision process, in which women usually adapt to the career needs of their husbands, and the structural discrimination of women through lower wages together foster a vicious circle since: “In as much as women’s work is consistently linked with lower power, prestige, and material rewards than men’s work [...], men continue to enjoy advantages in the control of their time by virtue of their status advantages.” (Daly (1996), p. 153). Hence, the only way to break this vicious circle is to address simultaneously both the wage gap and the asymmetry in the intra-family decision process.

Let us finally note that all results are derived within a static setting. In a dynamic context, employment might also bear human capital effects that have private good character that change the incentives of both spouses regarding their human capital investment (see Becker, 1985, Konrad and Lommerud, 2000, and Ott, 1992). Such a dynamic analysis points in a possible direction of further research.

8 Appendix

Proof of Proposition 3.

First, let us derive the effect of a change in the time endowment T on the optimal choice of the wife with the help of equations (5) and (6). We will call this reaction “endowment effect” in analogy to the usual income effect:

$$\frac{dg_f}{dT} = \frac{V_f'' H_{h_f h_f}}{D} > 0 \quad (25)$$

$$\frac{dh_f}{dT} = \frac{w_f^2 G'' V_f''}{D} > 0 \quad (26)$$

$$\frac{dl_f}{dT} = \frac{w_f^2 G'' H_{h_f h_f}}{D} > 0, \quad (27)$$

$$= \frac{w_f^2 G'' (w_m g_m + w_f g_f) H_{h_f h_f}}{w_f^2 G'' (w_m g_m + w_f g_f) V_f''(l_f) + w_f^2 G'' (w_m g_m + w_f g_f) H_{h_f h_f} + V_f''(l_f) H_{h_f h_f}}$$

where $D > 0$ is the determinant from above corresponding to the wife’s optimization problem.

We can then calculate the reaction of this endowment effect to a wage change:

$$\frac{d\left(\frac{dl_f}{dT}\right)}{dw_f} = \frac{DH_{h_f h_f} N_f - w_f^2 G'' H_{h_f h_f} N_f (V_f'' + H_{h_f h_f})}{D^2} \quad (28)$$

$$= \frac{(N_f H_{h_f h_f})(D - w_f^2 G'' (V_f'' + H_{h_f h_f}))}{D^2} \quad (29)$$

$$= \frac{(N_f H_{h_f h_f})(w_f^2 G'' V_f'' + w_f^2 G'' H_{h_f h_f} + V_f'' H_{h_f h_f} - w_f^2 G'' (V_f'' + H_{h_f h_f}))}{D^2} \quad (30)$$

$$= \frac{(N_f H_{h_f h_f}) V_f'' H_{h_f h_f}}{D^2} = \frac{N_f V_f'' H_{h_f h_f}^2}{D^2} > 0 \quad \text{if } N_f < 0, \quad (31)$$

$$\frac{d\left(\frac{dl_f}{dT}\right)}{dw_m} = \frac{N_m V_f'' H_{h_f h_f}^2}{D^2} < 0 \quad \text{for } N_m > 0, \quad (32)$$

where $N_f = (2w_f G'' + w_f^2 G''' g_f)$ and $N_m = (w_f^2 G''' g_m)$. The expressions N_f and N_m are the derivatives (with respect to w_f and w_m respectively) of the numerator of the endowment effect $\frac{dl_f}{dT}$ corrected for the term $H_{h_f h_f}$. N_f and N_m both determine the direction of the endowment effect.

Consider now the FOC given by expression (23):

$$F(l_f, \Delta l, w_m, w_f) = -\frac{V'(l_f + \Delta l)}{V'(l_f)} + \frac{w_m}{w_f} + \frac{\partial g_f}{\partial g_m} + \frac{\partial h_f}{\partial g_m} \quad (33)$$

$$= -\frac{V'(l_f + \Delta l)}{V'(l_f)} + \frac{w_m}{w_f} + \frac{-w_f w_m G'' (w_m g_m + w_f g_f)(V_f''(l_f) + H_{h_f h_f}(h_m, h_f))}{D} \quad (34)$$

$$+ \frac{w_f w_m G'' (w_m g_m + w_f g_f) V_f''(l_f)}{D} = -\frac{V'(l_f + \Delta l)}{V'(l_f)} + \frac{w_m}{w_f} - \frac{w_f w_m G'' (w_m g_m + w_f g_f) H_{h_f h_f}(h_m, h_f)}{D} \equiv 0. \quad (35)$$

Substituting the endowment effect into the last term of expression (35) gives:

$$F(l_f, \Delta l, w_m, w_f) = -\frac{V'(l_f + \Delta l)}{V'(l_f)} + \frac{w_m}{w_f} - \frac{w_m}{w_f} \frac{dl_f}{dT} \quad (36)$$

$$= -\frac{V'(l_f + \Delta l)}{V'(l_f)} + \frac{w_m}{w_f} \left(1 - \frac{dl_f}{dT}\right) \equiv 0. \quad (37)$$

We are interested in the change of Δl when the male wage w_m increases or the female wage w_f decreases, leading to an increased wage gap. By the implicit function theorem we obtain for the expressions $\frac{d\Delta l}{dw_f}$ and $\frac{d\Delta l}{dw_m}$:

$$\frac{d\Delta l}{dw_f} = \frac{\frac{\partial F(\Delta l, w_f, w_m)}{\partial w_f}}{\frac{\partial F(\Delta l, w_f, w_m)}{\partial(\Delta l)}} = - \frac{\overbrace{-\frac{w_m}{w_f^2}}^{(-)} \overbrace{\left(1 - \frac{dl_f}{dT}\right)}^{(+), \text{by normality}} - \overbrace{\frac{w_m}{w_f}}^{(+)} \overbrace{\left(\frac{d\left(\frac{dl_f}{dT}\right)}{dw_f}\right)}^{(+), \text{by assumption, see eqn. (31)}}}{\underbrace{-\frac{V''(l_f + \Delta l)}{V'(l_f)}}_{(+)}} > 0 \quad (38)$$

$$\frac{d\Delta l}{dw_m} = \frac{\frac{\partial F(\Delta l, w_f, w_m)}{\partial w_m}}{\frac{\partial F(\Delta l, w_f, w_m)}{\partial(\Delta l)}} = - \frac{\overbrace{\frac{1}{w_f}}^{(+)} \overbrace{\left(1 - \frac{dl_f}{dT}\right)}^{(+), \text{by normality}} - \overbrace{\frac{w_m}{w_f}}^{(+)} \overbrace{\left(\frac{d\left(\frac{dl_f}{dT}\right)}{dw_m}\right)}^{(-), \text{by assumption, see eqn. (32)}}}{\underbrace{-\frac{V''(l_f + \Delta l)}{V'(l_f)}}_{(+)}} < 0 \quad (39)$$

Thus, an increasing wage gap leads to an increasing leisure gap, if the endowment effect as given by (31) is positive with respect to w_f and (32) is analogously negative with respect to w_m . That is, a higher female wage leads to a greater endowment effect and a higher male wage leads to smaller endowment effects. The sign of the change of the endowment effects depends on the signs of $N_f = (2w_f G'' + w_f^2 G''' g_f)$ and $N_m = (w_f^2 G''' g_m)$.

For N_m to be positive we assume a positive third derivative of G : $G''' > 0$. Then, a condition for N_f to be negative is given by

$$\begin{aligned} 2w_f G'' + w_f^2 G''' g_f &< 0 \\ \iff -w_f g_f \frac{G'''}{G''} &< 2. \end{aligned} \quad (40)$$

QED.

The expression on the left hand side of (40) resembles the coefficient of relative prudence as defined by Kimball (1990). In the theory of precautionary saving under uncertainty, the relative prudence influences the optimal variable choice under risk. In our setting, $-w_f g_f \frac{G'''}{G''}$ determines the comparative statics result of the wife's optimal choice. If condition (40) holds and her coefficient of "relative prudence" is sufficiently small, then her endowment effect increases in her wage and a higher female wage leads to the wife having less leisure. Of course our setting is a setting under certainty, and we acknowledge that making assumptions regarding the third derivative is not without problems. However, this cardinalization of utility allows us to establish the monotonicity result given in Proposition 3.

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