Gender Discrimination and Efficiency in Marriage: the Bargaining Family under Scrutiny

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Abstract

This paper criticizes the view that discrimination limits the disadvantaged sex to undertaking housework and thus ensures that gains from specialization at the household level are not wasted. Our framework gives attention to causal links between labor market discrimination and the strategic behavior of women and men within families. We consider a repeated family bargaining model that links the topics of employment and households. A key aspect of the model is that marital bargaining power is determined endogenously: the amount of money a person earns—in comparison with a partner's income—establishes relative marital bargaining power. Gender discrimination can alter household behavior in surprising and sometimes unfortunate ways. We show that: (i) the efficiency of household decisions is sometimes inversely related to the prevailing degree of gender discrimination in labor markets; (ii) discriminated against females have difficulty enforcing cooperative household outcomes since they may be extremely limited to credibly punish opportunistic behavior by their male partners; (iii) the likelihood that sharing rules such as "equal sharing" are maintained throughout a marriage relationship is highest when men and women face equal opportunities in labor markets. A key policy implication obtained from our analysis is that efforts to promote greater gender equality in labor markets can also contribute to increasing the likelihood of fully cooperative outcomes at the household level.

Keywords: Gender Roles, Discrimination, Marital Negotiations, Reputation.

JEL Classifications: D13, J71, J82, C78.

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"Would it ever be optimal for a welfare-maximizing government, to wish to end discrimination? ... By restricting access to good jobs, a discrimination equilibrium limits the discriminated against sex to undertaking housework ... and thus ensures that household-specific human capital is not wasted." [Patrick Francois, *Journal of Public Economics*, 1998].

"...two persons of cultivated faculties, identical in opinions and purposes, between whom there exists that best of equality, similarity of powers and capacities ...This and this only is the ideal of marriage; ... all opinions, customs and institutions which favor any other notion of it ... are relics of primitive barbarism." [John Stuart Mill, *The Subjection of Women*, 1869].

1 Introduction

Although equality between women and men has been firmly recognized as a priority issue by the world's governments,[1] concerns about biased work practices and public policies are still raised at different levels. Differential wages and payment rates constitute one important part of gender discrimination in most societies, and there are many other spheres of differential benefits. For example, in opportunities for promotion and achievement;[2] in institutional characteristics of the labor market such as liberties to enter certain employment arrangements; but also in public policies such as the tax treatment of families.[3] The situation today from a policy point of view is thus a split one. On the one hand, fundamental antidiscrimination principles embedded in equal employment opportunity laws (EEO's) seek to create a framework within which women can compete with men on equal footing. On the other hand, EEO's are still subject to vigorous debate over whether their perceived benefits outweigh the associated regulatory and efficiency costs, with the consequence that unequal outcomes are perpetuated.

The debates about existing policies against gender discrimination is a subset of a broader issue: Why does gender discrimination exist as an equilibrium phenomenon in competitive labor markets? Can we explain the persistence of discrimination as arising from inherent asymmetries between men and women? We enter this broad debate with what we take to be an important issue. To begin, many economists contend that women's increased employment over the past few decade has reduced the joint gain from marriage because when wives are employed there is less specialization within families and such specialization increases joint gain (Becker *et al.,*

[1] See, for example, United Nations Human Development Report (1995).

[2] For example, the 'glass ceiling' restricting women's career and development prospects, in particular their seniority and responsibility, remains firmly in place (Blau and Ehrenberg, 1997); In addition, even if women are as likely as men to be promoted, they often find themselves at the bottom of the wage scale for the new grade (Booth *et al.*, 2002).

[3] *Joint taxation* systems tax both family members at the same rate. That joint taxation may lead to differential treatment of men and women—by lowering the tax rate of the high-earner which occurs at the expense of an increase in the marginal rate of the low-earner—is well understood. With *individual taxation*, the low-earner is taxed at a lower-rate than the high earner. For a insightful discussion of tax systems across Europe and elsewhere see O'Donoghue and Sutherland (1998).

1977; Becker, 1991). Motivated by this thought-provoking argument, this paper addresses the following questions: Is it in 'society's' interest to sustain discrimination as a means of discouraging women from entering work and supporting the division of labor within families (and thus, presumably, ensuring that no household-specific human capital is wasted)? Or, can we theoretically account for the possibility that the 'joint gain' from marriage increases even as specialization decreases within marriage?

The purpose of this paper is to investigate the impact of labor market discrimination on the economic roles of women and men within families. In doing so, we provide the first fully developed treatment of the claim that the full impact of gender discrimination also includes feedback effects on women's and men's strategic behavior within the household. We show that an assessment of this continuous underlying feedback effect is a key aspect in the analysis and formulation of policies, programs and initiatives targeted at gender differences. There are, of course, many channels through which gender-specific labor market trends may impinge on family decision-making. The finer points of this paper focus on how gender discrimination affects market and non-market decisions by women and men, intra-household bargaining, household distributional outcomes, and the degree of cooperation that can be sustained within families.

To address these issues, we develop a repeated-game model of family bargaining that links household and labor market decisions. A key aspect of the one-shot (constituent) game is that marital bargaining power is determined endogenously: the amount of money a person earns—in comparison with a partner's income—establishes relative bargaining power inside the family. This introduces a non-cooperative element to the couple's decision-making problem since both partners anticipate how their labor market decisions affect their marital bargaining power and the share they can extract from family resources. This sets up a two-stage decision problem. At the first stage each family member non-cooperatively chooses an investment in his or her individual earning power, while bargaining between the family members at stage 2 forms the basis of the allocation of time between labor market work and contributions to a household public good. The investment decision at stage 1 is to be interpreted broadly—for example, an 'on-the-job' effort or a career investment such as the commitment to work odd hours. It is shown that, introducing these dynamics result in strategic manoeuvreing by men and women, which traps the household in inefficient situations. There are two deviations from the first-best here: women's and men's participation in the world outside the family gives them power bases in family bargains based on income contributions. Anticipating this, they will overinvest in market activities in the first place. However, the personal gains (in terms of bargaining power) each family member makes by overinvesting in market activities are apparently lost at the level of collective contributions to domestic public goods, which are chosen inefficiently low. Thus, in our constituent game, there is a separation between the incentives motivating individual family members and the rewards of collective cooperation.

Given the above observation, we examine how gender-specific labor market trends affect investments, household public good provisions and welfare of a family in the equilibrium of the constituent game. Strikingly, in this environment, gender discrimination in the labor market generally enhances aggregate household outcomes. The basic argument for this point runs as follows. If family public goods are under provided, then discrimination serves the role of imposing unequal (marginal) returns on individuals of opposite sex in order to reallocate their incentives according to their comparative contribution efficiencies. The 'gender gap' acts as a disincentive to work, pushes women towards greater specialization in the household sphere, and supports traditional family arrangements. We show that total time contribution to the domestic public increases since the female devotes less time to the labor market. As a consequence, discrimination can be seen as a force that shifts family decision-making closer to the first-best efficient household equilibrium than it would be without discrimination.

It is also shown, however, that the one-shot interactions are characterized by an efficiency-equality trade off: subjecting women to greater inequality in the labor market, which, in turn, implies less involvement with outside work and paid employment, does tend to go with greater anti-female bias in intra-family distributions. In other words, the very presence of gender discrimination in the labor market may result in a 'Kuznets effect' at the micro level of intra-household resource allocations: households become better off; but better households become more unequal.

So, in the constituent game, gender discrimination is an exogenous force that deters socially costly but privately beneficial overinvestments in market activities or, put differently, it alleviates an collective action (or holdup) problem that arises among marital partners. However, when the spouses interact repeatedly over time, then the desirability of exogenous forces such as the "gender gap" does not only depend on the existence of a (socially costly) holdup problem within the family. It also depends on the way informal agreements between spouses regarding marital behavior already address the holdup problem and the extent to which environmental parameters would interfere with those informal agreements. In the second part of the paper, we therefore examine the repeated-game version of the constituent game. We are particularly interested in questions of *when* and *how* a couple can a achieve an efficient household equilibrium in a *self-enforcing* manner. One way to do this is for the family members to agree in advance to cooperate, with the efficient outcome being sustained by the threat that if one partner deviates then immediately 'play' proceeds according to the inefficient constituent game.

A key issue that separates the constituent game from the repeated-game model is whether environmental parameters (including wage and employment opportunities of each family member) matter for men's and women's *incentives to cooperate*. One of the fundamental insights that we obtain is that if the family members are identical in every respect — that is, they have identical market and non-market skills and face equal opportunities in the labor market — then reputational forces are most likely to work: in such circumstances, the efficient outcome can be sustained for the widest set of possible parameter values. However, if the family members are different in some respects (e.g., if there is a 'gender gap' in pay or occupational status), then there exists a conflict in the partners' incentives cooperate. For, in such circumstances, the shifting balance of power within the family makes the dominant partner more likely to demand a renegotiation of the arrangement that sustains the first-best after the marriage has begun.

What this suggests in the face of anti female-discrimination policy is the following: whatever the consequences of such policy elsewhere in society, our model predicts that it will be successful in promoting more balanced power arrangements inside families. This, in turn, implies that women's and men's incentives to cooperate are at a medium level, rather than one's being very strong *but* the other's being very weak. Thus, efforts to promote greater gender equality in the labor market can create the conditions for first-best efficient household equilibria to be sustainable in the long-run, by essentially increasing the *degree* of cooperation that can be sustained within families. This result motivates a new perspective on family policy in general: a major factor in the policy-making process should be whether policies targeted at families facilitate cooperation within households.

The remainder of this paper is organized as follows. The next section explains how the paper relates to the literature. Section 3 lays down our baseline model and studies its unique stationary subgame perfect equilibrium. The repeated game is studied in Section 4. Section 5 discusses the implications of the theory. A brief conclusion is contained in Section 6.

2 Related Literature

This paper contributes to two literatures. As a contribution to the economics of discrimination, it adds to the body of work investigating theoretically gender discrimination and its dimensions. Economists working in this area have generally focused on explaining the existence of gender discrimination in competitive labor markets. Becker's (1971) 'taste-for-discrimination model' describes discrimination as a preference for which the discriminator is willing to pay. Signalling theories (Rothschild and Stiglitz, 1982; Milgrom and Oster, 1987) explain discrimination as arising due to differences in the noise of productivity signals across gender. A final broad category of explanations arises from crowding theories of occupational segregation (Bergman, 1971; Arrow, 1973) which explore the consequences of confining women to a limited number of occupations.[4]

Theoretically, our paper is new primarily in emphasizing two levels of integration that we have found missing in previous studies. First, we integrate the topics of employment and households, pointing to discrimination against women in labor markets as affecting the division of labor at home and the way men and women behave on the job. Second, we provide a framework that gives attention to causal links between the relative position of men and women in employment and intra-household bargaining and power arrangements. Interest in this area is explained by the fact that an assessment of this continuous underlying feedback effect is a key aspect in the analysis and formulation of policies, programs and initiatives targeted at gender differences. The papers most similar in spirit to ours are Iyigun and Walsh (2002) and Dessy and Pallage (2003). Iyigun and Walsh's (2002) simulation

[4]More recently, Francois (1998), provides a rationale for the continued existence of gender discrimination which arises from the intra-household trade between men. This theory posits that firms can ensure that all of its employees are 'non-shirkers' if they do not have spouses in good jobs. As a consequence, firms should reserve good jobs for males exclusively.

of a family behavior model predicts that empowering women through institutional reform leads to lower fertility and higher educational attainment. Our framework is different from theirs, although some of the issues we are interested in are similar. Dessy and Pallage (2003) show that if women have a credible outside option to marriage (such as the right to start their own business) then gender discrimination is likely to disappear.

Our approach to modelling discrimination envisions a discrimination coefficient which measures social and cultural attitudes towards gender inequality. The strength of this coefficient reduces the ability of the discriminated group to transform market skills and market time into incremental earnings. This aspect of the theory allows us to use nondiscrimination as a benchmark and to compare it with discriminatory labor market practices. The discrimination coefficient that we use to explain the feedback effect of sex discrimination on household outcomes is related to Becker's (1971) "taste-for-discrimination model" and to Iyigun and Walsh's (2002) "endogenous household bargaining power model". It should be emphasized, however, that, for the most part, the feedback effects to be discussed apply to other prominent explanations of gender discrimination such as signalling-based theories or segmented labor market theories.

The paper also contributes to the theoretical literature on household behavior. The theoretical approach taken here can be seen as part of the 'incomplete-contracting' approach to modelling family behavior. This strand of research explores the implications of the inability of family members to 'commit across time'—inability which typically leads to inefficient household outcomes. Recent family behavior models which have the feature of constraint efficiency include Konrad and Lommerud (2000), Lundberg and Pollak (2001), Vagstad (2001), Basu (2001) and Rainer (2003). The common feature of these models is that they set aside the ruling tradition in family economics that household are able to reach efficient outcomes.[5]

Konrad and Lommerud's (2000) family behavior model is most closely related to the present one. There are, however, three important differences between this paper and theirs. First, while Konrad and Lommerud (2000) focus on symmetric market and non-market decisions by males and females, a key point of the present paper is that these decisions may be asymmetric across gender. Second, this paper explores in great detail the impact of gender-specific labor market trends on family welfare and household distributional outcomes. The third difference is that we specify how family members can overcome inefficient situations and reach efficient household resource allocations that are implicitly enforced through reputational forces. Konrad and Lommerud (2000) instead propose a 'static' model in that the spouses are determining their relationship after one period. While the likely importance of reputational forces within households has been mentioned by numerous

[5]By contrast, most models of household behavior assume as a rule that families are able to reach efficient outcomes. For example, "the common preference approach" (Becker 1991), the "collective approach" (Chiappori 1992; Chiappori *et al.* 2002) and Nash bargaining models of the family (Manser and Brown 1980; McElroy and Horney 1981; McElroy 1990) work with this assumption. For an insightful survey see Lundberg and Pollak (1996).

authors,[6] the theoretical argument has not previously been developed.[7] Hence, the present paper could be viewed as a way of reconciling family models of constraint efficiency and models of the household that merely assume efficiency.

3 The Model

In this section we present a simple model of a dual-breadwinner household. The household is comprised of two decision-makers, one male (m) and one female (f). Time is divided into an infinite number of periods $t = 1, 2, ..., \infty$. In each period, the household resource allocation is made in two stages. We will refer to this two-stage game as the constituent game. In the first stage, each family member invests in his or her individual earning power, anticipating the impact this decision will have on the intra-household balance of power. In the second stage, the couple determine the allocation of time to household production through bargaining. Market work produces a pure private good for each person, whereas time spent at home produces a pure household public good. We have chosen the pure private good—pure public good formulation as a benchmark. We now present the specific assumptions in each stage of the base model.

A. Timing of the Constituent Game

Individuals must be proactive to be 'successful' in the labor market. At the beginning of STAGE 1 each agent of gender i, $i \in \{f, m\}$, simultaneously and non-cooperatively chooses an investment in his or her individual earning power. This investment is to be interpreted broadly—it could be, for example, a career investment such as the commitment to work odd hours and not taking leaves in connection with household duties. We model agent i's career investment as a continuous decision: let $w_i \in [0, \overline{w}]$ denote the investment of agent i. The cost to agent i of putting in effort w_i at work is measured by a strictly increasing and strictly convex cost function $\beta(w_i)$. After choice of his or her career strategy, agent i's labor market wage rate is equal to w_i. We assume that agents choose their career strategies by anticipating the impact this decision will have in the bargaining stage, in particular on the relative bargaining positions inside the household.

At the beginning of STAGE 2, the career investments w_f and w_m are observed by the individuals, and the couple bargain over the levels of their time contributions to the household public good g_f and g_m, respectively. The amount of the household public good is public in the sense that the payoffs that it generates are non-rival and non-excludable. In each period, both agents are endowed with one unit of time, $g_i \in [0, 1]$, which they allocate between market work and providing a home-produced family good. The family good that we have in mind is the time spent caring for children. The psychic cost attached to such a time contribution is $b_i(g_i)$.

[6] See, for example, Becker (1991), Konrad and Lommerud (1995), Lundberg (2002), and Rainer (2003).

[7] A notable exeption is the paper by Bernheim and Stark (1988). Using a repeated model of marriage, they criticize the view that altruism improves the allocation of resources within the family.

As in Lundberg and Pollak (1993) and Konrad and Lommerud (2000), we adopt the Nash bargaining solution to describe the outcome of the bargaining process at stage 2, in which the "fall-back" position comprises a non-cooperative contribution equilibrium at that stage.

Our dynamic model represents the infinite repetition of the two-stage game outlined above. We adopt the simplifying assumption that career efforts as well as contributions at home fully depreciate before the next period begins. While potentially restrictive, it allows to focus on a model that is already sufficiently rich.

B. Preferences

Firms buy a package of time and effort from each individual, with payment tied to the package rather than rendered separately for units of time and effort. The household public good is produced with a constant returns technology, i.e., output of a domestic good is proportional to time input. Agents derive utility from a purely private good and from a household public good. As will be now seen, the term 'gender' in our model refers to the home productivities and labor market opportunities associated with being male and female. The payoff function of agent i is:

$$u_i = \theta_i w_i(1 - g_i) + G - \gamma_i b(g_i) - \beta(w_i), \text{ for } i \in \{f, m\} \tag{1}$$

We would like to elaborate on this payoff formulation. The first term in the above equation reflects individual earnings implied by career effort w_i and time spent at work $1 - g_i$. We refer to the parameter θ_i in more detail below. The second term represents the amount of a household public good:

$$G = g_f + g_m.$$

Each agent i directly chooses his or her time contribution g_i, the cost of which is captured by $b(g_i)$. We assume that $b(g_i)$ is strictly increasing and strictly convex in g_i, that is, $b'(g_i) > 0$ and $b''(g_i)$. We further assume that women and men can have different (psychic) costs of providing the public good, measured by the individual-specific parameter γ_i, with the resulting contribution cost $\gamma_i b(g_i)$. The parameter γ_i reflects i's contribution productivity at home: family members i's capacity to contribute to the household good (childcare) is high when both total and marginal cost (as captured by γ_i) for any level of time input is low. A first major aspect of our analysis is to entertain intrinsic differences between the sexes' contribution productivities.

Assumption 1 $\gamma_f < \gamma_m$.

Analytically, the assumption implies that women have a (possibly small) comparative advantage in home production over men.[8] The distinguishing feature of

[8] There exists a strong biological basis for this assumption. Our specification captures the idea that women have a relatively strong commitment to the care of children because they want their heavy biological investment in production up until birth to be worthwhile (Triver, 1972, Wright, 1994). Men are typically less biologically committed to the care of children (Becker, 1991). It is well understood that these biological differences lead to a comparative advantage between the sexes in the care of children, and perhaps also in other household commodities (due to the complementarity between rearing children and other types of time use in the household sphere).

the analysis presented below is to provide a rationale for gender discrimination to disappear *despite inherent differences in comparative advantage between the sexes.*
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C. The Discrimination Coefficient

A second major aspect of the model under study is that we aim to examine the feedback effects of gender discrimination on household behavior. We do not attempt to identify which of the potential causes of discrimination is most relevant, nor do we take a stand on its microeconomic underpinnings. Instead, we introduce the exogenous coefficients θ_f and θ_m to capture the potential asymmetric opportunities of men and women in the outside labor market, where $(\theta_f, \theta_m) \in [0,1]^2$.[9] In the case where $\theta_f = \theta_m$, the labor market opportunities of men and women are the same,[10] which we will refer to as the non-discrimination benchmark. We characterize gender discrimination as a pair of infinitesimal changes in θ_f and θ_m in *opposite proportional directions*. Thus we capture the fact that the term "gender discrimination" in ordinary usage conflates two mutually connected aspects: negative versus positive discrimination. Indeed, in our analysis, not only do females suffer directly from discriminatory labor market practices, but such practices make the non-discriminated group perform better economically relative to the non-discrimination benchmark. Since we consider an environment where gender discrimination affects the economic opportunities of men and women in opposite proportional directions, much can be gained analytically by using the normalization $\theta_f \equiv \theta$ and $\theta_m \equiv 1 - \theta$, where an arbitrary value of θ over the interval $[0, \frac{1}{2})$ is a measure of the propensity to discriminate against women.[11]

We now solve the constituent game backwards, considering first the bargaining equilibrium at stage 2.

D. The Bargaining Equilibrium

We first derive the non-cooperative contribution equilibrium at stage 2. As in Lundberg and Pollak (1993) and Konrad and Lommerud (2000), we will use this outcome to derive the NBS in which the non-cooperative equilibrium payoffs are considered to be the disagreement point. For an arbitrary set of career investments, (w_f, w_m), at stage 1, the non-cooperative contribution payoff to person i is given by

$$d_i\left(g_i^n, g_j^n\right) = \theta_i w_i \left(1 - g_i^n\right) + g_i^n + g_j^n - \gamma_i b\left(g_i^n\right) - \beta(w_i), \tag{2}$$

were (g_i^n, g_j^n), $i \neq j$, are uniquely defined and solve the first order condition

$$\theta_i w_i + \gamma_i b'\left(g_i\right) = 1 \text{ for } i \in \{f, m\}. \tag{3}$$

[9] An alternative interpretation is also applicable. One can also interpret θ_f and θ_m to be inverse measures of the (potential asymmetric) cost of female and male participation in the labor market.

[10] Put differently, the rates of return on each level of effort and market time are the same for men and women

[11] Iyigun and Walsh (2002) use a similar concept in order to capture gender differences in the labor market, interpreting the parameter θ as social and cultural attitudes towards gender inequality.

In the non-cooperative contribution equilibrium, the marginal private cost of spending extra time at home must equal the marginal private benefit, which equals one. For future reference note that $g_i^n = g_i^n(w_i)$, that is, the allocation of time at stage 2 directly interacts with the allocation of effort at stage 1. At stage 2, the family members determine the allocation of time to household production, g_f and g_m through bargaining. The non-cooperative contribution equilibrium is important in defining the disagreement payoffs in the stage 2 bargaining game.

We start by characterizing the husband-wife utility possibility frontier of the set of feasible payoff pairs that can be reached if an agreement is struck at stage 2. The Nash bargaining solution picks one point on this frontier. The husband-wife utility possibility frontier, $u_f + u_m \equiv W$ is given by

$$W\left(g_i^e, g_j^e\right) = \sum_{i=f,m} \theta_i w_i \left(1 - g_i^e\right) + 2g_i^e - \gamma_i b\left(g_i^e\right) - \beta(w_i), \tag{4}$$

where (g_i^e, g_j^e) are the maximizers of joint family welfare. They are uniquely defined and solve the first order condition

$$\theta_i w_i + \gamma_i b'\left(g_i\right) = 2 \text{ for } i \in \{f, m\}. \tag{5}$$

It is obvious that $g_i^e = g_i^e(w_i)$. Notice that the first order conditions for g_i^n and g_i^e in (3) and (4), respectively, imply that, for an arbitrary w_i chosen at stage 1, $g_i^e > g_i^n$. That is, the non-cooperative contribution equilibrium at stage 2 suffers from *underprovision* of the domestic public good. Of course, this is due to the fact that the marginal private return from choosing g_i (i.e., the right-hand side of (3)) is less than the marginal social return from choosing g_i (i.e., the right-hand side of (5)). As a consequence,

$$W\left(g_i^e, g_i^e\right) > d_i(g_i^n, g_j^n) + d_j(g_i^n, g_j^n),$$

implying that gains from cooperation at stage 2 do exist. Hence it is Pareto-efficient for the couple to strike an agreement on how to allocate $W(g_i^e, g_j^e)$.

Applying the Nash bargaining solution with the non-cooperative contribution payoffs in (2) as the "fall-back" position, the Nash bargained payoffs to f and m at stage 2 are determined by the *split-the-difference* rule:

$$u_i^N = \frac{W(g_i^e, g_j^e) + d_i(g_i^n, g_j^n) - d_j(g_i^n, g_j^n)}{2}, \tag{6}$$

where $g_i^e = g_i^e(w_i)$ and $g_i^n = g_i^n(w_i)$. This says that each person first of all obtains a payoff equal to the payoff that she/he obtains in the non-cooperative contribution equilibrium–and then the remaining surplus from cooperation is split equally between the spouses.

E. Investment in Individual Earning Powers

Having solved the couple's bargaining problem at stage 2 (for an arbitrary set of decisions made at stage 1) we next turn to their on-the-job effort decisions at stage 1. As a benchmark, we first work out the FIRST-BEST effort levels and the individuals maximize joint surplus. The first-best efforts,

$$\left(w_i^e, w_j^e\right) \in \arg\max_{w_i, w_j} \; W\left(g_i^e(w_i), g_j^e(w_j)\right),$$

are the unique maximizers of the 'household welfare function' in (4). It is straightforward to establish that w_i^e uniquely solves the first-order condition

$$\theta_i \left[1 - g_i^e\left(w_i\right)\right] = \beta_i'\left(w_i\right) \text{ for } i \in \{f, m\}. \tag{7}$$

At the social optimum, the marginal social return from spending extra effort at work must equal the marginal cost of that extra effort.

Consider next the EQUILIBRIUM value of w_i. Career investments w_f and w_m are chosen simultaneously and non-cooperatively by f and m, respectively. The equilibrium investment level,

$$w_i^n = \arg\max_{w_i} \; u_i^N\left(g_i^e(w_i), g_i^n(w_i)\right),$$

is the unique maximizer of player i's Nash-bargained payoff in (6). Define $(g_i^n)' = \partial g_i^n / \partial w_i$. It is now straightforward to establish the following result:

Proposition 1 *The constituent game has a unique subgame-perfect equilibrium. In this equilibrium, family member i ($i = f, m$) sets $w_i = w_i^n$, where w_i^n is the unique solution to the first-order condition*

$$\frac{1}{2}\left[\theta_i \left[2 - g_i^e(w_i) - g_i^n(w_i)\right] - (g_i^n)'\right] = \beta'(w_i). \tag{8}$$

Equilibrium investments are chosen inefficiently high, that is $w_i^n > w_i^e$. Furthermore, equilibrium public good provisions are inefficiently low, $g^e\left(w_i^n\right) < g^e\left(w_i^e\right)$. An efficient household resource allocation cannot be achieved.

Proof. See the Appendix. ■

There are two deviations from first-best here. The first inefficiency that is described is the inefficiency of strategic over investment in individual earning powers. The mechanism that induces this excessive investment is a negative bargaining internality: since the division of the gains from cooperation at stage 2 depend on the *ex post* bargaining powers of the spouses, each spouse is led to put half weight on maximizing his or her relative bargaining position (as captured by the difference $d_i - d_j$) when deciding on investments at stage 1. As a consequence, a "rat-race" equilibrium will result in which career investments are driven to a point where the sum of individual utilities is decreased. It is worth emphasizing that the second type of deviation from the first-best that is described here—inefficiently low contributions to the domestic public good—is due to wrong *ex ante* decisions, since the assumption of Nash bargaining at stage 2 ensures that there is no *ex post* inefficiency. In sum, the personal gains family members make by investing in market activities are apparently lost at the level of collective contributions to domestic goods.

F. Returns to marriage through gender discrimination?

We are now ready to discuss the consequences of labor market discrimination against women on household behavior. We first investigate how a reduction of women's employment opportunities, relative to those of men, affects investments, time use, and welfare of a family in the subgame-perfect equilibrium of the constituent game. We then present comparative statics on the intra-household distribution of utility payoffs.

The feedback effect on aggregate household welfare. Since our aim is to examine the feedback effect of gender discrimination on men's and women's behavior within the household, we use non-discrimination as a benchmark and compare it to discriminatory labor market outcomes. Thus suppose that the *status quo* in the labor market is full gender equity: $\theta_f = \theta_m$. That is, the rates of return on each level of effort and market time are the same to women than to men. We characterize gender discrimination as a pair of infinitesimal changes in θ_m and θ_f in opposite proportional directions (as discussed in section 3.3). Now consider the impact of a marginal decrease in θ_w and a marginal increase in θ_h on aggregate household welfare. To derive this we take total differentials of the sum of the (Nash bargained) equilibrium utilities of all individuals in the household, using (6), and recalling that $w_i^n = w_i^n(\theta_i)$, and $g_i^e = g_i^e(w_i^n, \theta_i)$. The following general result is useful in developing our subsequent analysis of the feedback effects of gender discrimination:

Lemma 1 *Consider the case of discrimination for which $d\theta_f = -d\theta < 0 < d\theta_m = d\theta$, with female market opportunities reduced and male market opportunities raised compared to the non-discrimination benchmark. Then*

$$
\begin{aligned}
dW^N = & \left[w_f^n \left(1 - g_f^e\right) + \frac{1}{2} \left[\theta_f \left(g_f^n - g_f^e\right) + \left(g_f^n\right)' \right] \frac{\partial w_f^n}{\partial \theta_f} \right] d\theta_f \\
& + \left[w_m^n \left(1 - g_m^e\right) + \frac{1}{2} \left[\theta_m \left(g_m^n - g_m^e\right) + \left(g_m^n\right)' \right] \frac{\partial w_m^n}{\partial \theta_m} \right] d\theta_m. \quad (9)
\end{aligned}
$$

Proof. See the Appendix. ■

A pair of changes in θ_f and θ_m has four opposing effects on aggregate household welfare. We interpret the expressions in (9) term by term. The first term on the right-hand side of (9) represents the negative *wage-income effect* of female income reduction induced by a marginal decrease in θ_f. The female wage income effect is negative precisely because a reduction in θ_f reduces f's marginal return from putting in effort w_f^n and time $(1 - g_f^e)$ at work. On the other hand, the second term on the right-hand side of (9), which is strictly positive, may be called the *strategic effect* of a marginal reduction in θ_f; it follows from the fact that a marginal decrease in θ_f reduces f's incentive to strategically over invest in market activities (as discussed after Proposition 1). Indeed, the term $\frac{1}{2}[\theta_f(g_f^n - g_f^e) + (g_f^n)']$, which is negative, represents the exact value of the inefficiency that arises due to f's incentive to strategically over invest in market activities by choosing the privately optimal w_f^n rather than the socially optimal w_i^e. Apart from reducing female full income and reducing female incentives to behave strategically, discrimination has two additional effects: the third term on the right-hand side of (9), which is strictly positive, represents the male *wage-income effect*, while the fourth term, which is strictly negative, is the *strategic effect* of a marginal increase in θ_m; it follows from the fact that a marginal increase in θ_m further increases m's incentive to behave strategically inside the household compared to the non-discrimination benchmark.

To investigate the quantitative implications of those four opposing effects, we make the following additional assumptions: We assume that the cost function $b(g_i)$ and $\beta(w_i)$ are quadratic, which is stated formally in the following:[12]

Assumption 2

$$\gamma_i b(g_i) = \frac{\gamma_i}{2} g_i^2 \qquad \textit{and} \qquad \beta(w_i) = \frac{1}{2} w_i^2.$$

We further assume that $\frac{\gamma_i}{2} > 1$, which ensures that interior solutions for all choice variables exist. Under these assumptions, we first derive the counterpart of equation (9). After setting $d\theta_f = -d\theta = -d\theta_m$ (where $d\theta > 0$), we obtain the following result:

Lemma 2 *Given Assumption 2, the condition for the change in aggregate household welfare is:*

$$\left.\frac{dW^N}{d\theta}\right|_{\tilde{\theta}=\theta_f=\theta_m} = \left[\frac{\tilde{\theta}\left(\gamma_f - 1\right)\left(\hat{\gamma} - \gamma_f\right)}{\left(\gamma_f - \tilde{\theta}^2\right)^2}\right] + \left[\frac{\tilde{\theta}\left(\gamma_m - 1\right)\left(\gamma_m - \hat{\gamma}\right)}{\left(\gamma_m - \tilde{\theta}^2\right)^2}\right], \tag{10}$$

where $\hat{\gamma} = 3$.

Proof. See the Appendix. ■

Recall that γ_f and γ_m (where $\gamma_f < \gamma_m$ by Assumption 1) reflect the inverses of the family members' contribution productivities at home, so that i's contribution to the domestic public good is an important component of aggregate household welfare when γ_i is low and *vice versa.* The first term in brackets represents the sum of the negative (*wage-income*) effect of female full income reduction and the positive (*strategic*) effect of reduced female incentives to strategically overinvest in market activities. Similarly, the second term in brackets captures the sum of the male wage-income effect (> 0) and the male strategic effect (< 0). The focus of the subsequent discussion is on equation (10). The following result, which is explored after its statement, shows that there may be a close connection between women's employment opportunities, relative to those of men, and aggregate household welfare.

[12] We make this assumption purely to simplify the exposition of some of our results, but, it should emphasized, without affecting our main insights. Let us be more specific: the assumption of quadratic cost functions guarantees that the third derivatives of b and β are zero. One can generally show that $b''' = 0$ and $\beta''' = 0$ are sufficient conditions under which the conclusions stated in Proposition 2 holds. Weaker sufficient conditions — which, for example, allow for $b''' > 0$ or $b''' < 0$ — exist under which the stated conclusion would also hold.

Proposition 2 *Suppose that Assumptions 1 and 2 hold. Then gender discrimination with female market opportunities reduced and male market opportunities raised compared to the non-discrimination benchmark increases aggregate household welfare.*

Proof. See the Appendix. ■

Intuitively, the mechanism is the following. Consider first the scenario where $\gamma_f < \hat{\gamma} < \gamma_m$. In this case female contributions to the household public good are an important component of aggregate household welfare, while male contributions are relatively unproductive. The type of gender discrimination considered here is welfare-enhancing in its impact precisely because it reduces female incentives to strategically overinvest in market activities. This, in turn, shifts female household public good provisions closer to the first-best than they would be in the non-discrimination benchmark. What is more, the chain reaction set in motion by reducing females incentives to overinvest in market activities results in offsetting the negative effect of female full income reduction. To see this, simply note that the first-term in brackets in (10) will be strictly positive when $\gamma_f < \hat{\gamma}$. The exact opposite will be true for men. Male incentives to strategically overinvest in market activities increase. This, in turn, reduces male household public good provisions even further. However, since male contributions are less productive than female contributions, male underinvestment in the household sphere is much less of a problem in terms of aggregate household welfare. In fact, when $\hat{\gamma} < \gamma_m$, then the positive male income effect dominates the negative strategic effect. To see, this note that the second-term in (10) is strictly positive with the parameter values under consideration.

Consider now the scenario where $\gamma_f < \gamma_m < \hat{\gamma}$, that is, both female and male contributions in the household sphere are an important component of household welfare. In this case, the first term in (10) is strictly positive while the second term is strictly negative. That is, the negative female wage-income effect is offset by the positive female strategic effect, while the positive male wage-income is dominated by the negative male strategic effect. It is easily verified that, on aggregate term, the first term strictly exceeds the second term.[13] The intuitive reason for this result is straightforward. The female (strategic) underprovision of the domestic good the subgame perfect equilibrium of the constituent is a more severe problem than the male underprovision because her investment is more productive. Consequently, given our assumption about domestic technology, a change in θ_f and θ_m in opposite proportional directions will increase female domestic contributions by more than it reduces male domestic provisions, thereby pushing aggregate household welfare closer to the first-best outcome.

So, it has been shown that concerns about intra-household lead to over investment in market activities, which, in turn, implies underprovision of domestic public goods. In such an environment, discrimination may be long lived precisely because it plays the role of imposing unequal (marginal) returns on individuals of opposite

[13]Note that, since we are using non-discrimination as a benchmark and compare it to discriminatory labor market outcomes, the equation (10) must be evaluated at $\theta_f = \theta_m = \tilde{\theta}$.

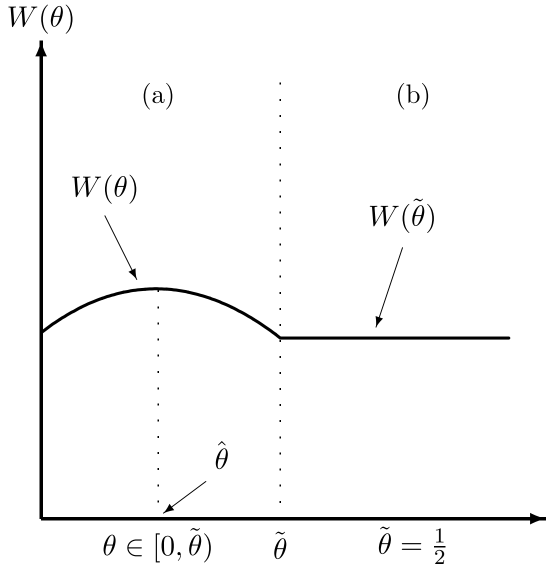

Figure 1: The relationship between aggregate household welfare and men's and women's relative opportunities outside the household.

sex, thereby reallocating their incentives according to their domestic contribution efficiencies: discrimination acts as an disincentive to invest in market activities, pushes women towards greater contributions in the domestic sphere, and thus sustains some of the gains from specialization according to comparative advantages.

The present analysis is limited to environments in which, relative to the non-discrimination benchmark, discriminatory practices affect the economic opportunities of women and men in opposite proportional directions. Some additional intuitive insights can be gained by abusing previously used notation and normalize $\theta_f = \theta$ and $\theta_m = 1 - \theta$, where an arbitrary value of θ over the interval $\theta \in [0, \tilde{\theta})$ (where $\tilde{\theta} = \theta_f = \theta_m$) is a measure of the society's propensity to discriminate against women. Figure 1 plots aggregate household welfare W^N against the coefficient θ. Panel (a) depicts household welfare for an arbitrary $\theta \in [0, \tilde{\theta})$. Panel (b) depicts household welfare when men and women have equal opportunities outside the household, that is, when $\theta_f = \theta_m = \tilde{\theta}$.

What is clear from the figure is that aggregate household welfare is a nonmonotonic function of θ.[14] Indeed there exist a critical value $\hat{\theta}$ over the interval $[0, \tilde{\theta})$ such that an intensification of the "gender gap" (as represented by a decrease in

[14] We should note that, given Assumption 2, aggregate household welfare is given by

$$W^N = \frac{\theta_f^2 \left(\gamma_f^2 - 1\right) + 4\gamma_f \left(1 - \theta_f^2\right)}{2\gamma_f \left(\gamma_f - \theta_f^2\right)} + \frac{\theta_m^2 \left(\gamma_m^2 - 1\right) + 4\gamma_m \left(1 - \theta_m^2\right)}{2\gamma_m \left(\gamma_m - \theta_m^2\right)}$$

where $\theta_f \equiv \theta$ and $\theta_m \equiv 1 - \theta$. Figure 1 depicts the case $\gamma_f < \gamma_m < \hat{\gamma}$. We also note that W^N is not necessarily nonmonotonic in θ. Indeed, when the parameters are such that either $\gamma_f < \hat{\gamma} < \gamma_m$ or $\hat{\gamma} < \gamma_f < \gamma_m$, then W^N is a strictly decreasing function over the interval $[0, \tilde{\theta})$, with a maximum at the corner $\theta = 0$. In the case where $\gamma_f < \hat{\gamma} < \gamma_m$, W^N decreases at decreasing rates; when $\hat{\gamma} < \gamma_f < \gamma_m$, then W^N decreases at increasing rates.

θ) increases welfare for all $\theta \in (\hat{\theta}, \tilde{\theta})$. While we do not propose to characterize the critical value $\hat{\theta}$, some remarks on its structure worth making. In particular, it is readily verified that the larger are the comparative advantages of women over men in terms of contributions in the domestic sphere, the smaller is the value of $\hat{\theta}$ (and hence the larger the "gender gap") at which household welfare is maximized.

The discussion thus far has focused on the relative positions men and women occupy within the labor market, and the consequences for aggregate household welfare. We have said little about the potential effect on intra-household distributions. We now turn to a closer examination of this issue.

The feedback effect on intra-household distributions. Proposition 2 implies that a welfare maximizing 'society' or 'central planner' may never wish to end discrimination as a way of supporting family arrangements with a sustained specialization according to comparative advantages. So far, we have left it entirely open as to how gender discrimination in the labor market affects the final distribution of utilities within the household. An obvious measure of the final distribution of utilities (i.e., of intra-household inequality) in this representative household is the deviation from 'equal shares' of the female partner's Nash bargained utility payoff:

$$I = \frac{u_f^N}{W^N} - \frac{1}{2} = \frac{1}{2}\left[\frac{d_f^N - d_m^N}{W^N}\right]. \tag{11}$$

Changes in the final distribution of utilities will depend, therefore, on how changes in θ_w and θ_h affect total household welfare as captured by the household welfare function W^N. In fact when household welfare increases then the final distribution of utilities between u_f^N and u_m^N will, other things being equal, become more equal. Similarly, when household welfare decreases then the final distribution of utilities between u_f^N and u_m^N will, other things being equal, become more unequal. Of course, other things are not equal and the disagreement payoffs d_f^N and d_m^N (i.e., the relative bargaining positions within the household) will also change with changes in θ_f and θ_m. It this interaction which is of interest and which yields the following proposition.

Proposition 3 *Labor discrimination against women does tend to go with greater anti-female bias in intra-family distributions:*

$$2(du_f^N) = \left[w_f^n\left(2 - g_f^e - g_f^n\right) - \frac{\partial g_f^n}{\partial \theta_f}\right] d\theta_f - \left[w_m^n\left(g_m^e - g_m^n\right) - 2\left(g_m^n\right)' \frac{\partial w_m^n}{\partial \theta_m} - \frac{\partial g_m^n}{\partial \theta_m}\right] d\theta_m < 0$$

and

$$2(du_m^N) = \left[w_m^n\left(2 - g_m^e - g_m^n\right) - \frac{\partial g_m^n}{\partial \theta_m}\right] d\theta_m - \left[w_f^n\left(g_f^e - g_f^n\right) - 2\left(g_f^n\right)' \frac{\partial w_f^n}{\partial \theta_f} - \frac{\partial g_f^n}{\partial \theta_f}\right] d\theta_f > 0,$$

implying that the male partner is always better off and the female partner is always worse off compared to the non-discrimination benchmark.

Proof. See the Appendix. ■

Discrimination has two opposing effects on the *female* partner's Nash bargained equilibrium payoff. On the one the hand, total household welfare increases (see

Propositions 2 and 3), the Pareto frontier shifts outwards, and the female partner reaps half of that increase. On the other hand, gender discrimination in the labor market affects marital bargaining power directly. The wife's disagreement payoff d_f^N decreases and the husbands disagreement payoff d_m^N increases. Therefore, the inequality between d_m^N and d_f^N increases, which, in turn, increases the inequality between u_f^N and u_m^N. The above result then implies that, on aggregate terms, the female partner's bargaining position deteriorates by more than half the increase in household welfare. Hence, the persistence of discrimination can have serious repercussions for women by not only decreasing their opportunities and rewards in the labor market but by also increasing intra-household inequality.

So, to summarize, when intra-household bargaining positions are determined endogenously according to spousal incomes , then the power relationship in the family closely resembles the relative opportunities of men and women in the existing stratification system of the labor market. Consequently discrimination against women in the labor market goes hand-in-hand with an unbalanced distribution of family power. We can thus expect that when women are excluded from attaining equal access to valued positions in the labor market, then inequality in equilibrium payoffs at the household level will also persist. It should be also emphasized that the very presence of gender discrimination in the labor market may result in a 'Kuznets effect' at the micro level of intra-household allocations: households become better off because females are less likely to strategically overinvest in market activities; but better off households become more unequal.[15]

The results of the static model are interesting *per se.* If investments in individual earning powers are presumed to affect intra-household bargaining powers, our study demonstrates that excessive incentives to invest in market activities will curtail the couple's present contributions to domestic public goods. In such an environment, discrimination is likely to be long-lived because it guarantees second-best household arrangements and thus sustains the *some* of benefits that 'society' gains from the specialization of men and women according to comparative advantages.

Yet, the baseline model lacks an important dimension of the reality of household behavior: we have described a 'static' model, in that the spouses are determining their relationship after one period. Implicitly, therefore, we have been ignoring the potential effects of reputation. This restrictive since it is often argued that reputational forces can overcome many of the inefficiencies identified in the first half of this paper. In the following section we explore the robustness of our results to such 'dynamic' considerations. In particular, we address the questions of *when* and *how* a household may succeed in using its resources efficiently in a *self-enforcing* manner.

4 Fully Cooperative Household Outcomes

In this part, we study the ability of family members to achieve efficient outcomes when the underlying family structures are sub-optimal. The key to our approach

[15]Kuznets (1955) posed the classic question as to whether inequality increases or decreases as the economy grows.

is recognizing that when households are potentially trapped by strategic over investments in market activities, then implicit informal agreements enforced through repeated interaction can protect family members against the resulting inefficient outcome. As we mentioned below, while the likely importance of 'reputational forces' within households has been mentioned by numerous authors, the theoretical argument has not previously been developed. The repeated-game version of the base model of Section 2 is well-suited to analyze implicit agreements between spouses enforced through reputational forces.

A. Efficient Household Equilibrium

Suppose the parties play repeatedly the constituent game described in the previous section. We assume complete information, that is, at each decision node both players can observe the entire back history of the game. Call $\Gamma(\delta)$ the resulting repeated game with joint discount factor δ. Unlike in the constituent game, the repeated interactions among spouses may provide incentives to achieve and sustain an efficient household equilibrium (EHE, for short), provided the spouses value their reputations sufficiently. The chore of our analysis is therefore deriving the *incentive-compatibility* conditions that are required to hold in order for there to exist an EHE in which, in each period, the Pareto-efficient outcome is reached and no strategic problems arise. We analyze grim-trigger-strategy equilibria, in which the EHE is sustained by moving play to the subgame-perfect equilibrium of the constituent game if any spouse ever unilaterally deviates from the EHE path

There are, of course, several plausible manners in which the opportunity to sustain efficient outcomes can be interlaced within the structure of the constituent game. We know turn to a description of one such 'implicit agreement' between spouses. Suppose that at the beginning of their relationship the spouses meet and agree not to behave strategically throughout their relationship. That is, they commit themselves to choose (in each period $t = 1, 2, ..., \infty$) the socially optimal $w_i = w_i^e$ and $g_i = g_i^e$ $(i = f, m)$ in order to maximize aggregate household welfare. To support the efficient outcome on the equilibrium path of the repeated game, the spouses may need to split the surplus from cooperation in a different way than in the constituent game. We assume that to split the gains from cooperation, the spouses also implicitly commit themselves to a per-period utility transfer $\widehat{t} \in \Re$ from m to f (which can be positive or negative). The transfer will be determined later. If both spouses "honor" this implicit agreement and cooperate, then the per-period payoffs of the spouses along the EHE path are given by $u_f^E + \widehat{t}$ and $u_m^E - \widehat{t}$, where

$$u_i^E = \theta_i w_i^e \left[1 - g_i^e\left(w_i^e\right)\right] + \left[g_f^e\left(w_f^e\right) + g_m^e\left(w_m^e\right)\right] - \gamma_i b\left(g_i^e\left(w_i^e\right)\right) - \beta_i\left(w_i^e\right).$$

However, since an agreement on $(w_f^e, w_m^e, g_f^e, g_m^e)$ and $\widehat{t}$ is not automatically enforceable,[16] each spouse can choose whether or not to renege on his or her part of the

[16]This is precisely because the vector $\left(w_f^e, w_m^e, g_f^e, g_m^e\right)$ and the transfer $\widehat{t}$ do not constitute a subgame-perfect equilibrium of the constituent game.

agreement at any of the two stages within each period: either at stage 1: either at stage 1 by choosing $w_i \neq w_i^e$, or, at stage 2 by choosing not to make (or accept) the agreed transfer $\widehat{t}$. If any family member unilaterally violates the agreement, then immediately play proceeds according to the constituent game in Section 3. In particular, if family member i deviates at stage 1 by choosing $w_i \neq w_i^e$, then the division of the marital surplus in that period would be determined by the parties respective disagreement points d_i and d_j (as in the constituent game). That is, bargaining at stage 2 would result in the 'split-the-difference' rule. It thus follows immediately that i's deviation payoff is maximized by deviating at stage 1 and setting $w_i = w_i^n$. Hence the deviation investment level at stage 1 is equal to the investment level in the constituent game. Family member i's deviation payoff of setting $w_i = w_i^n$ at stage 1 therefore equals

$$u_i^D = \frac{W^D + d_i^N - d_j^B}{2}. \tag{12}$$

For explicitness we have introduced some shortcut variables. The expression W^D represents joint family welfare when i behaves as unilateral defector, while j honors the implicit agreement.[17] The expression d_i^N represents the disagreement point of the spouse who behaves as a unilateral defector. (Note that the deviation disagreement point of i is equal to his or her disagreement point in the constituent game.[18]) Finally, d_i^B represents the disagreement point of the "betrayed" spouse, that is, the one who honors the implicit agreement and chooses socially optimal actions at stage 1.[19]

Since the EHE is not a subgame-perfect equilibrium of the constituent game, the EHE path can only be sustained by the threat of credible punishment if any spouse ever unilaterally deviates from the EHE path. We assume that the parties support the EHE through grim-trigger strategies. That is, if any family unilaterally violates the EHE, then immediately his or her partner punishes this transgression by switching play forever after to subgame-perfect equilibrium of the constituent game. Such punishment is credible in that each family member willingly participates in punishment, given the other's participation. Family member i's payoff along the "punishment path" therefore equals his or her payoff in the constituent game:

$$u_i^N = \frac{W^N + d_i^N - d_j^N}{2}. \tag{13}$$

Again we are using shortcut variables: W^N denotes joint family welfare in the constituent game, while $d_i^N - d_j^N$ represents the relative bargaining positions along the punishment path.

B. The Incentive-Compatibility Conditions

An efficient household equilibrium is self-enforcing if, in each period, family member i ($i = f, m$) sets $w_i = w_i^e$ at stage 1, sets $g_i = g_i^e(w_i^e)$ at stage 2, and the agreed

[17] Therefore W^D as in (4), but with g_i^e replaced by $g_i^e(w_i^n)$ and g_j^e replaced by $g_j^e = g_j^e(w_j^e)$.
[18] Hence d_i^N is as in (2), but with g_i^n replaced by $g_i^n(w_i^n)$.
[19] Hence d_i^B is as in (2), but with g_i^n replaced by $g_i^n(w_i^e)$.

transfer $\widehat{t}$ is implemented. Of course, the efficient outcome will be supported in equilibrium if and only if the discounted payoff stream from honoring the implicit agreement that sustains the EHE exceeds the discounted payoff stream from the deviation-punishment path. It is straightforward to verify that the partners' respective incentive constraints are given by

$$\begin{aligned} \delta\left[\left(u_f^E+\widehat{t}\right)-u_f^N\right] &\geq (1-\delta)\left[u_f^D-\left(u_f^E+\widehat{t}\right)\right] \\ \delta\left[\left(u_m^E-\widehat{t}\right)-u_m^N\right] &\geq (1-\delta)\left[u_m^D-\left(u_m^E-\widehat{t}\right)\right], \end{aligned}$$

The left-hand side of each inequality represents the long-term average cost of deviating from the EHE path. This is because from next period onwards, f's per-period loss would be $\left(u_f^F+t\right)-u_f^N$, while m's per-period loss would be $\left(u_m^F-t\right)-u_m^N$. The right-hand side of each inequality represents the short-term average benefit from the optimal deviation. Through straightforward manipulation of these two inequalities, we obtain that agreed utility-transfer $\widehat{t}$ is incentive-compatible if and only if

$$\begin{aligned} \widehat{t} &\geq (1-\delta)\left[u_f^D-u_f^N\right]-\left(u_f^E-u_f^N\right) && (14) \\ \widehat{t} &\leq \left(u_m^E-u_m^N\right)-(1-\delta)\left[u_m^D-u_f^N\right]. && (15) \end{aligned}$$

These conditions are the parties' incentive-compatibility conditions, which are required to be satisfied in order for the EHE to be sustainable as a subgame-perfect equilibrium path. So far, we have been silent on the properties of the equilibrium transfer $\widehat{t}$ along the EHE path. We now turn our attention to this issue.

C. An Example of Possible Co-operation: "Equal Sharing"

How do husbands and wives plan to share in the spoils from cooperation? There are many possible scenarios, and our aim is not simply the demonstration that household equilibria that generate efficient outcomes in the repeated game exist, but rather the exploration of descriptively interesting sharing rules that support efficient resource allocations in the long-term. We now construct an example of a bargaining game in which the family members agree to implement, at the beginning of their relationship, a sharing rule that splits the gains from cooperation equally between them. That is, we assume that the bargaining over the sharing rule at the outset of marriage is such that the equilibrium negotiated transfer can be characterized by the Nash bargaining solution with the disagreement point $(0,0)$. A natural interpretation of the repeated game model is thus implicit in its description: the model captures an environment in which the probability that one person exerts his or her (bargaining) power over the other partner at the outset of marriage is negligible.[20] Although we lack the direct evidence to make such an assertion, we strongly suspect that this captures a very realistic feature of life. Namely the stylized fact that the balance of power when a couple is first married is more or

[20]Farrell and Scotchmer (1988, p. 279), in their introductory discussion of partnerships, note that "marriage is an equal sharing, and we avoid making spouses' payoffs depend on their outside opportunities."

less equal, and then shifts in line with the individual's access to resources such as income or occupational status (see, for example, Hesse-Biber and Williamson, 1984).[21]

The following alternative interpretation is also applicable: the model represents an environment in which the family members have a good sense, somehow socially and culturally derived, that equal sharing is a norm that supports mutually beneficial household outcomes; but also the fact that once this norm is violated family members will permanently enter into (costly) bargains in search of a new 'sharing rule' along the punishment path.

Given our assumption that the sharing rule $\widehat{t}$ can be characterized by the Nash bargaining solution with disagreement point $(0,0)$, an application of NBS implies that the equilibrium negotiated sharing rules maximizes $(u_f^E + \widehat{t})(u_m^E - \widehat{t})$ subject to (14) and (15). The following intermediate result is useful in developing our subsequent analysis of an efficient household equilibrium with equal sharing:

Lemma 3 *For each $i = f, m$, define*

$$\phi_i \equiv \left[(1-\delta_i)\, u_i^D + \delta_i u_i^N\right]. \tag{16}$$

(a) If the parameter values are such that $\frac{1}{2}(u_f^E + u_m^E) > \max\{\phi_f, \phi_m\}$, then the equilibrium negotiated sharing rule is given by

$$t^S = \frac{u_m^E - u_f^E}{2}. \tag{17}$$

(b) Otherwise, if the parameter values are such that $\frac{1}{2}(u_f^E + u_m^E) \leq \max\{\phi_f, \phi_m\}$, then the equilibrium negotiated sharing rule is a corner solution given by

$$t^{Co} = \begin{cases} u_f^E - \phi_f & \text{if } \frac{1}{2}(u_f^E + u_m^E) \leq \phi_f \\ u_m^E - \phi_m & \text{if } \frac{1}{2}(u_f^E + u_m^E) \leq \phi_m \end{cases}. \tag{18}$$

Proof. Straightforward – hence omitted. ■

It is now straightforward (after substituting t^S for $\widehat{t}$ in (14) and (15), and simplifying) to derive the appropriate incentive-compatibility constraints under which the EHE with "equal sharing" can be sustained as a sub-game perfect equilibrium path:

[21] It should be emphasized that no general consensus on how to determine the "sharing rule" in repeated hold-up problems has been reached in the literature. The "incomplete contracting approach" (Halonen 2002) generally postulates a sharing that provides partners with balanced incentives to deviate from Pareto-efficient outcomes. It is however silent on whether the partners would agree in equilibrium to such a sharing rule. The "basic property rights approach" (Muthoo, 2004) assumes that the equilibrium negotiated sharing rule can be characterized by the Nash bargaining solution, in which the disagreement point is given by the payoffs of the underlying (inefficient) constituent game. So other sharing rules than "equal sharing" are of course possible. But in general it seems descriptively most persuasive that marital partners plan to share the spoils from cooperation fifty-fifty, but may have an incentive to renege on this sharing rule once the marital relationship is under way.

Proposition 4 *The EHE can be sustained as a subgame perfect equilibrium path (using "equal sharing") if and only if* $\delta \geq \delta_f^*(\theta)$ *and* $\delta \geq \delta_m^*(\theta)$*, where*

$$\delta_f^*(\theta) = 1 - \frac{\frac{1}{2}(u_f^E + u_m^E) - u_f^N}{u_f^D - u_f^N} \quad \text{and} \quad \delta_m^*(\theta) = 1 - \frac{\frac{1}{2}(u_f^E + u_m^E) - u_m^N}{u_m^D - u_m^N} \tag{19}$$

with $\theta = (\theta_f, \theta_m)$.

In the one-shot game studied in the previous section, labor discrimination against women was likely to be long-lived because it guaranteed traditional household arrangements and thus sustained some of the benefits from the division of labor in different spheres. The issues that arise in the repeated-game framework are very different. In particular, the values of the threshold discount factors δ_f^* and δ_m^* depend in a not-so-simple manner on the value of the discrimination coefficient θ. We now follow the tradition in the theory of repeated games by adopting the minimum discount factors δ_f^* and δ_m^* at which the EHE can be achieved in subgame-perfect equilibrium as a measure of long-term marital efficiency. The main focus of the analysis below is to examine how changes in θ_f and θ_m affects δ_f^* and δ_m^*. Interest in this question is explained by the fact that is important to know how environmental forces affect the degree of cooperation that can be sustained within marriage.

D. The Rationale for Gender Discrimination to Disappear

How do social, legal or cultural attitudes towards gender discrimination affect the propensity that efficient household equilibria with "equal sharing" rules emerge? How do those attitudes affect the likelihood that such equilibria can be sustained in the long-run? Our first result concerns the question of how labor discrimination against women affect the prospects for full cooperation within households:

Proposition 5 *Suppose the parameter values are such that* $u_f^E + u_m^E > \max\{\phi_f, \phi_m\}$. *Gender discrimination with female market opportunities reduced and male market opportunities raised compared to non-discrimination benchmark would make the husband less likely to cooperate* $(d\delta_m^* > 0)$ *and the wife more likely to cooperate* $\left(d\delta_f^* < 0\right)$ *within the marital relationship.*

Proof. See the Appendix. ■

The intuition for this result is as follows. The factors considered in this paper — namely that the amount of income a person earns dictates the relative bargaining position inside the household — imply that men have a bargaining power advantage under discrimination compared to the non-discrimination benchmark. This, in turn, makes men more likely to deviate from the EHE path. Intuitively, there are two reasons for this. First, the male partner would receive a large short-term gain from a unilateral deviation from "equal sharing". In the same time, the punishment imposed on male deviators would be minimal. To see this, note that when play reverts to the subgame-perfect equilibrium of the constituent game after a unilateral

Table 1: Threshold Discount Factors

Index of Women's Relative Market Opportunities	Threshold Discount Factors	
θ	δ_f^*	δ_m^*
$\tilde{\theta} = .5$	.473	.526
.49	.425	.580
.48	.381	.639
.47	.341	.705
.46	.304	.776
.45	.271	.855
.44	.239	.941
.43	.212	n.s.

defection from the EHE path, it is the case that (i) discrimination improves aggregate marital surplus compared to the non-discrimination benchmark (as discussed after Proposition 2); and (ii) men have relatively greater power within the family compared to the non-discrimination benchmark and are therefore able to command a larger share of joint marital surplus along the punishment path (as discussed after Proposition 3). So, the fact that economic inequality in the labor market contributes to an imbalance of power within marriage implies that discriminated against females have difficulties enforcing cooperative family outcomes precisely because they are extremely limited to credibly punish opportunistic behavior by their male partners. This may severely restrict the willingness of male partners to participate in cooperative family agreements in the first place.

To illustrate the above result more concretely, we report the results of a numerical example (using Assumption 2). Let $\gamma_f = 2.05$ and $\gamma_m = 2.07$. Also, let use the normalization $\theta_f = \theta$ and $\theta_m = 1 - \theta$. For values of $\theta \in [0, 0.5]$ (recall that with $\theta_f = \theta$ and $\theta_m = 1 - \theta$, $\tilde{\theta} = 0.5$ represents the non-discrimination benchmark), we calculate the thresholds δ_f^* and δ_m^*, the lowest discount factors for which one can sustain cooperation. Lower values of δ_f^* and δ_m^* imply that it is easier to sustain cooperation. The results of the numerical example in question are reported in Table 1. Notice that when men and women have equal opportunities outside the household, then their incentives to cooperate at the household level are at a medium level rather than one's being very high but the other's being very low. Next note that δ_f^* decreases monotonically with reductions in θ. On the other hand, δ_m^* rises monotonically with reductions in θ. This implies that, regardless where one starts, reduced relative market opportunities for women makes male cooperation at the household level more difficult to sustain. Suppose, for example, that $\delta = 0.55$. When men and women have exactly the same market opportunities, it is possible to sustain efficient outcomes at the household level. However, a small reduction in employment opportunities for women would automatically create conditions for the efficient outcome to be no longer sustainable (in the sense that the male threshold discount factor δ_m^* would be above the discount factor δ). On the other hand, suppose that $\delta = 0.8$. In this case, an environment with large disparities in the labor market (say with $\theta = 0.45$) is inimical to emergence of efficient outcomes at the household level. However, a small expansion in employment opportunities for women would translate into fully cooperative (and hence efficient) household outcomes.

Are there pointers for policy? Our analysis suggests that the reality of labor market discrimination against women assigns men and women assigns men and women to different roles within marital relationships. The resulting division of labor generates unequal bargaining positions within families because men can accumulate resources (primarily earning power) which translates into a bargaining power advantage. This male advantage makes it difficult for females to enforce fully cooperative (and hence efficient) outcomes at the household level. The immediate, main policy consequences are thus self-evident:

- If the labor market environment exhibits gender discrimination for women, and discount factors are such that the efficient household equilibrium (EHE) does initially not exist, then empowering women (through institutional or legal reform) may create the conditions for the EHE to emerge and be sustainable in the long-run.
- If, on the other hand, discount factors are such that an efficient household equilibrium does initially exist, then a small increase of gender differentials in the labor market may create conditions for the EHE to be no longer sustainable.

Note that there are some additional insights that are implied by our numerical example concerning the existence of parameter values under which there does *not* exist a subgame perfect equilibrium that sustains an efficient household equilibrium in which the spouses split the spoils from full cooperation equally. In particular, there exists a critical value $\bar{\theta} \in [0, \tilde{\theta})$ (which lies between 0.43 and 0.44 in the context of the parameters used for the example) such that if $\theta \in [0, \bar{\theta})$, then an efficient household equilibrium with "equal sharing" can never emerge in the long-run (i.e., not even in the limit as δ tends to one). The intuition is simple and follows from the fact when women's relative market opportunities are below the threshold $\bar{\theta}$, then the sharing rule t^S that splits the gains from cooperation equally between the spouses is not incentive compatible. More precisely, t^S fails to satisfy the male partner's incentive constraint (15) in the sense that agreement to it would give him a utility level along the EHE path that is below what he could get from reneging on the agreement that sustains the EHE. This has to be viewed within the logic that the male partner would loose out when the EHE is established since he would then not be able to use his (large) bargaining power advantage to extract a large share of the marital surplus. In this case, the sharing rule is a corner solution and given by $t^{Co} = u_m^E - \phi_m$ (see Lemma 2b). The equilibrium payoffs are

$$\bar{u}_m = \phi_m \quad \text{and} \quad \bar{u}_f = u_f^E + u_m^E - \phi_m,$$

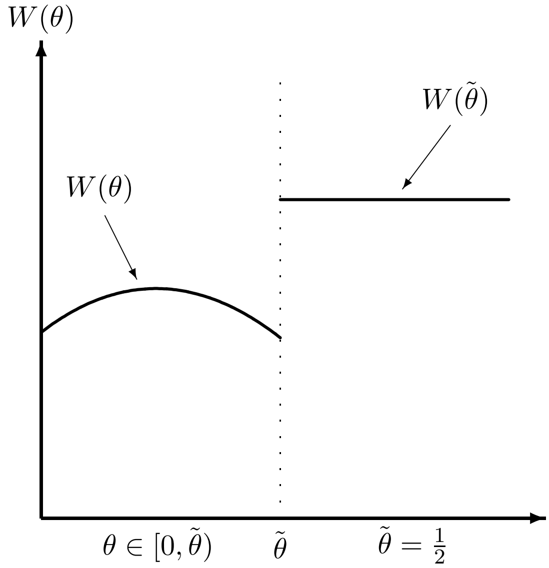

Figure 2: Relationship between gains from marriage and men's and women's relative opportunities outside the household in the repeated game.

where $\bar{u}_m > \bar{u}_f$. As such, our main qualitative insights about intra-household inequality — in particular, that labor discrimination against women triggers differences in equilibrium payoffs at the household level — is robust when the family members interact in a sequence of situations and can sustain the Pareto efficient outcome.

We conclude this section by returning to one of the questions raised at the outset of this paper. Can we theoretically account for the possibility that the gains from marriage increase even as specialization within marriage decreases? Figure 2 illustrates and summarizes our main insights, using the normalization $\theta_f = \theta$ and $\theta_m = 1 - \theta$. For a given discount factor δ, it plots aggregate family welfare against the discrimination coefficient θ. Recall that $\theta = \tilde{\theta}$ describes an environment with equal opportunities for men and women outside the household, while $\theta < \tilde{\theta}$ captures an environment that disadvantages women and favors men. Also note that the coefficient θ not only measure the opportunities of women in the labor market, but it is also an index of the degree of specialization within households. This is exactly because a small value of θ provides little incentives for women to invest in market activities and large incentives to put available endowments to productive use in the household sphere. The figure clearly shows that aggregate family welfare is a discontinuous function of θ.[22]

For values of θ over the interval $[0, \tilde{\theta})$, female face low opportunities outside the household compared to men, and there exists a substantial degree of division of

[22]We have used the following numerical example to construct Figure 2. We let $b_i(g_i) = \frac{\gamma_i g_i^2}{2}$, $\beta(w_i) = \frac{w_i^2}{2}$ $(i = f, m)$, and $(\gamma_m, \gamma_f) = (2.4, 2.1)$, so that there is difference in the spouses home productivities, with the female partner having a comparative advantage. In addition, we consider discount factors $\delta \gtrapprox 0.84$. With this we have $\hat{\theta} \approx 0.5$.

labor in the household. The household as a whole recaptures some of the advantages of the specialization of family members according to comparative advantages, but cooperation (and hence efficient household outcomes) do not emerge in a self-enforcing way. This is exactly because wives have little power in family bargains, and are consequently restricted to enforce efficient household equilibria because they are extremely limited to punish opportunistic behavior of their male partners. What is more, there is a anti-female bias in intra-family distribution (as discussed after Proposition 3).

When θ equals $\tilde{\theta}$, women have the same opportunities outside the household as men. We note that there may still exist some degree of division of labor in the household,[23] but less extreme than before and less dependent on traditional sex roles. Put it differently, both spouses participate more equally in the market and in household production. The implications for aggregate household welfare are very powerful, the most notable feature being the sizeable increase in the gains from marriage at $\tilde{\theta}$. The increase in the gains from marriage arises in equilibrium precisely because the better opportunities of women outside the household maintains a balance in the incentives to cooperate within the household. Put it differently, the greater participation of women in the market gives them power in family bargains based on income contributions. This, in turn, gives them a means to punish opportunistic behavior within households, and so limits the extent to which husbands have an incentive to renege on efficient household equilibria with equal sharing. In sum, even if grant that specialization according to comparative advantages produce *some* joint gain in marriage, the above results suggest there is a countervailing force which actually generates a larger joint gain when spouses play similar rather than different "roles" both inside and outside marriage.

5 Discussion: The Relationship between Working and Family Life

The model described above has a number of specific implications, some of which we have already discussed. In this section, we highlight the major points more generally and present empirical predictions that are relevant to some.

• *Limits to specialization: the effects of reputation.* Our findings are particularly interesting in the context of prior work, which has typically concluded that the specialization of family member according to comparative advantages would raise the gains from marriage. When family members have 'common preferences', Becker (1991) has argued that family members will specialize according to comparative advantages, not only regarding the division of labor, but also when it comes to human capital investments. Moreover, with common preferences, investments as well as time will be allocated efficiently, i.e., so as to maximize joint family welfare. Becker's (arguably powerful) approach ignores, however, the existence of so called cooperative conflicts inside the family. The class of problems called 'cooperative conflicts' generally acknowledges that in many social arrangements there are co-

[23]This is because females have a comparative advantage in home production (see Assumption 2).

operative elements, but also elements of conflict in the choice of one arrangement rather than another.[24] The existence of such cooperative conflicts within households is now fully acknowledged by discussions of the bargaining problem inside the family. Vagstad (2001) shows that even if real conflicts inside the family are accounted for, different family members will continue to specialize according to comparative advantages. However, the result that family decision-making is efficient does no longer hold: investments will be inefficient because they are chosen opportunistically so as to affect the outcome of the bargaining process itself.

Our family behavior model acknowledges the possibility of real conflicts of interests coexisting with an understanding of what is a natural way to overcome the inefficiencies due to 'cooperative conflicts'. The key to our approach is recognizing that reputational forces can alleviate many of the problems of opportunism identified in static bargaining models of the family. One of the fundamental insights that we obtain is that if the family members are identical in *every* respect—that is, they have identical market and non-market skills and face equal opportunities—then reputational forces are most likely to work. Indeed, in such circumstances, the efficient outcome (like in Becker's framework) can be sustained for the widest set of possible parameter values. However, if the family members are different in some respects (such as in their occupational status), then there exists a conflict in the partners' incentives to sustain the agreement that guarantees the efficient outcome. For, in such circumstances, the shifting balance of power within the family makes the dominant partner (i.e., the one with power based on income contributions) more likely to renege on his or her part of the agreement. Hence, where two members of a household specialize completely in the market and household sector respectively, our study predicts that reputation is least likely to overcome the problems of opportunism. And, without the influence of reputation, cooperation is unlikely to be sustainable inside the family. This conclusion finds clear confirmation in the United Nations adoption of the *Beijing Declaration and Platform for Action (1995)* in which the ratifying countries declare that

> "[E]qual rights, opportunities and access to resources, equal sharing of responsibilities for the family by men and women, and a harmonious partnership between them are critical to their well-being and that of their families as well as to the consolidation of democracy."[25]

In contrast, 'Beckerian' theories of specialization emphasize the benefits that 'society' would gain from the division of labor in exclusively different spheres—and thus fail to provide a rationale for initiatives promoting equal responsibilities of women and men in *all* sectors, including the family, the labor market and society at large.

• *The balance of power inside the family closely resembles the position of men and women in the existing stratification system of the labor market.* Marriage and family life is very much a matter of give and take. But who gives and who takes? Such issues are resolved by a process of negotiating and bargaining. Hence the concept of bargaining power is a key to understanding the interactions between different

[24] See Sen (1990) for an insightful characterization and analysis of co-operative conflicts.

[25] See, for example, the OECD Development Assistant Committee (1998), Annex 2, Article 15, p. 35.

members of the family. With the intra-household balance of power determined endogenously according to spousal incomes, the existence of gender discrimination in the labor market goes hand-in-hand with an unbalanced distribution of family power. Thus, without equal access to pay and occupational status, women lack an important tool in determining the allocation of household resources. From a distributional point of view one should be concerned, therefore, that the gender gap in the labor market increases the differences in equilibrium payoffs at the household level (as discussed after Proposition 3).

Why does this matter? Firstly, gender equality in all sectors is an important goal in itself—an issue of human rights and social justice (see, for example, United Nations Development Program, 1995). Secondly, the well-being of children — in particular in the context of poor countries — is intrinsically bound up with that of women: a certain amount of money given to the male partner and the same amount given to the female can have very different effects on a child's education, health, and the incidence of child labor (Basu, 2001). Thirdly, in many parts of the world, a neglect of the notion of 'intra-household inequality' is likely to lead to considerable understatement of the *levels* of inequality and poverty. In this regard, Haddad and Kanbur (1990) found underestimation by 30 percent and more in an analysis of inequality in calorie intake on the basis of Philippine data set. Finally, sociologists have long emphasized that the failure to address gender inequalities within households is significant because the family is the most influential institution of social development. In this regard, households that operate according to power arrangements based on gender differences are unlikely to be environments in which to 'unlearn' norms of inequality (see, for example, Moller Okin, 1995).

While the above discussion is tailored to the context of developing countries, the problem of gender discrimination in the labor market can also have an effect on families in the economically advanced countries of Europe and North America.

• *Gender-specific labor market trends and divorce rates: some speculations on the empirical relationship.* Marriage and family life provide a means of attaining specific economic goals, and these relationships persist as long as both partners expect to be better off married than divorced (Becker *et al.*, 1977).[26] We can relax our assumption that divorce is impossible and modify our model to allow for the probability of divorce to be positive and endogenously determined by the level of "surplus" generated by that marriage (see, for example, Weiss and Willis,1985). Imagine first that divorce is the relevant threat point in the family bargain.[27] In addition, let the spouses payoffs in marriage be $u_i + \varepsilon_i$ (rather than u_i as in (1)), where the private gains from marriage, ε_i, are randomly drawn from a known

[26] Becker *et al.* (1977) demonstrate that the assertion that a couple will divorce each other only if it is efficient to do so is a special case of the Coase theorem (Coase, 1960).

[27] Konrad and Lommerud (2000) note that the predictions of using noncooperation as the disagreement point in the family bargain are similar to the case with utilities as single as the divorce threat point. The difference between noncooperation and divorce is that the parties in the former case still live together so the family public goods are still public goods. After a divorce some goods cease to be public goods, whereas others, as children, remain public goods. For the discussion to follow, let us interpret the disagreement points d_f and d_m as the divorce threat points of the parties.

distribution and measure the quality of the marriage.[28] It is straightforward to show that the partners remain married if the total gains from marriage exceed the total gains from divorce; i.e., when $\phi = (\varepsilon_f + \varepsilon_m) \geq -(W - d_f - d_f)$ where $W = u_f + u_m$ captures the surplus generated by that marriage.

In such an environment, a marriage can remain intact either because the private gains from marriage, ε_i, are high, or because the surplus generated by that marriage, W, is high. The surplus generated is, of course, maximized when family-decision making is efficient, i.e., when the first-best is implicitly enforced through repeated interaction. However, as we have shown in the preceding section, when family-decision making is efficient, then a small increase in the discrimination coefficient may create conditions for the first-best to be no longer sustainable. For, in such circumstances, the shifting balance of power within the family makes the male partner less likely to cooperate and more likely to renege the implicit agreement that sustains the first-best. Thus, an increase in the discrimination coefficient may shift family decision making from efficient to inefficient, inducing a fall in the surplus generated. Since a decrease in the surplus generated also decreases the gain from staying married compared to the gain from divorce, couples with an unbalanced distribution of bargaining power are more likely to divorce.

Hence, there are good reasons to believe that women's equal access to income and occupational status in the labor market is likely to reduce the probability of divorce, by essentially increasing the degree of cooperation that can be sustained within the family. This conclusion goes counter to popular opinion that the increased labor force participation of married women in Western countries is responsible for much of the acceleration in divorce rates over the past four decades. In general, the framework discussed here provides a basis for understanding how two significant trends over the last few decade—the rise in divorce rates, and the gender gap in pay and occupational status—are correlated.

6 Concluding Remarks

This paper has explored the theoretical basis for the claim that the full impact of gender discrimination also includes feedback effects on women's and men's strategic behavior within the household. To understand this interaction theoretically it is necessary to study it as a part of a model that links household and labor market decisions. Our findings are directly relevant to the literature on the economics of the family, in that they call into question the views mentioned at the outset of the paper. One should not necessarily expect that the efficiencies of specialization produce a large joint gain in marriage, nor should gender discrimination be a constructive social force that ensures that gains from specialization at the household level are not wasted. Instead, our results suggest that the reality of labor market

[28] The sequence of events that we have in mind is as follows. In each period, at stage 1, each partner makes the investment into his or her individual earning power. At stage $1\frac{1}{2}$, each partner's private gain from marriage is realized, and the investment decisions are observed. At stage 2, if they remain married, the partners bargain over time allocations and the surplus created by marriage over divorce. If they, divorce each spouse chooses his or her time allocation non-cooperatively.

discrimination against women assigns men and women to different roles within marital relationships.The resulting division of labor generates unequal intra-household bargaining positions because men accumulate resources (primarily earning power) which translate into a bargaining power advantage. This male advantage makes it very difficult to implement fully cooperative (and hence efficient) outcomes at the household level, because women are severely restricted to credibly punish opportunistic behavior by their male partners. Conversely, efforts to promote greater gender equality in labor markets lead to more balanced bargaining positions within families and thus increase the likelihood that the household remains an institution that is successful in allocating its resources efficiently.

7 Appendix

Proof of Proposition 1:

Differentiating u_i^N in (6) w.r.t w_i yields

$$\frac{\partial u_i^N}{\partial w_i} = \theta_i(2-g_i^e-g_i^n)-\overbrace{\left[\theta_i w_i - 2g + \gamma_i b_i'\left(g_i^e\right)\right]}^{=0 \text{ by } (5)}\left(g_h^e\right)'-\overbrace{\left[\theta_i w_i + \gamma_i b_i'\left(g_i^n\right)\right]}^{=1 \text{ by } (3)}\left(g_i^n\right)' = 2\beta'(w_i)$$

where $g_i^e = g_i^e\left(w_i\right)$ and $g_i^n = g_i^n\left(w_i\right)$ with

$$\left(g_i^e\right)' = \frac{\partial g_i^e}{\partial w_i} = -\frac{\theta_i}{\gamma_i b''(g_i^e)} < 0 \qquad \text{and} \qquad \left(g_i^n\right)' = \frac{\partial g_i^n}{\partial w_i} = -\frac{\theta_i}{\gamma_i b''(g_i^n)} < 0.$$

After using the first-order conditions in (3) and (5), we obtain condition (8) [which is stated in the proposition]. We then note that the private marginal return of choosing w_i is given by the left-hand side of (8):

$$r^p \equiv \frac{1}{2}\left[\theta_i\left[2 - g_i^e(w_i) - g_i^n(w_i)\right] - \left(g_i^n\right)'\right].$$

Similarly, the social marginal return of choosing w_i is given by the left-hand side of (7):

$$r^s \equiv \theta_i\left[1 - g_i^e\left(w_i\right)\right].$$

Differencing r^p and r^s one obtains

$$r^p - r^s = \frac{1}{2}\left[\theta_i(g_i^e - g_i^n) - \left(g_i^n\right)'\right] > 0.$$

This term is strictly positive because $g_i^e > g_i^n$ and $\left(g_i^n\right)' < 0$. Since the private marginal return strictly exceeds the social marginal return, it follows that, at any equilibrium at stage 1, the equilibrium market investments (w_f^n, w_m^n) are strictly above the joint surplus maximizing levels (w_f^e, w_m^e). Furthermore, since g_i^e is a strictly decreasing function of w_i, it follows that $g_i^e\left(w_i^n\right) < g_i^e\left(w_i^e\right)$.

Proof of Lemma 1:

Let the household welfare function be defined on the sum of (Nash bargained) utilities of the two family members. At the equilibrium of the constituent game we have that

$$W^N = \sum_{i=f,m} \theta_i w_i^n \left(1 - g_i^e\right) + 2g_i^e - \gamma_i b_i \left(g_i^e\right) - \beta \left(w_i^n\right), \tag{20}$$

where $g_i^e = g_i^e \left(w_i^n, \theta_i\right)$ and $w_i^n = w_i^n \left(\theta_i\right)$. Consider the case of discrimination for which $d\theta_f = -d\theta < 0 < d\theta = d\theta_m$, with female market opportunities reduced and male market opportunities raised compared to the non-discrimination benchmark. After totally differentiating W^N, the expression for the change in household welfare is

$$\begin{aligned} dW^N &= \left[w_f^n \left(1 - g_f^e\right) + \left[\theta_f \left(1 - g_f^e\right) - \beta' \left(w_f^n\right)\right] \frac{\partial w_f^n}{\partial \theta_f}\right] d\theta_f \\ &\quad + \left[w_m^n \left(1 - g_m^e\right) + \left[\theta_m \left(1 - g_m^e\right) - \beta' \left(w_m^n\right)\right] \frac{\partial w_m^n}{\partial \theta_m}\right] d\theta_m. \end{aligned} \tag{21}$$

After making use of (8) to substitute out $\beta' \left(w_i^n\right)$, expression (9) [which is stated in the lemma] follows immediately.

Proof of Lemma 2:

Given Assumption 2, it is readily checked that the cooperative and non-cooperative public good contributions at stage 2 are respectively given by

$$g_i^e = f\left(\frac{2 - \theta_i w_i}{\gamma_i}\right) = \frac{2 - \theta_i w_i}{\gamma_i} \qquad \text{and} \qquad g_i^n = f\left(\frac{1 - \theta_i w_i}{\gamma_i}\right) = \frac{1 - \theta_i w_i}{\gamma_i},$$

where $f = (b')^{-1}$. After substituting g_i^e, g_i^n and $(g_i^n)'$ [which equals $-\theta_i/\gamma_i$] into (8) and setting $\beta' \left(w_i\right) = w_i$ one obtains

$$\theta_i \left[\left(\gamma_i - 1\right) - \theta_i w_i\right] = \gamma_i w_i.$$

It thus follows immediately that

$$w_i^n = \frac{\theta_i \left(\gamma_i - 1\right)}{\gamma_i - \theta_i^2} \tag{22}$$

and

$$\frac{\partial w_i^n}{\partial \theta_i} = \frac{\left(\gamma_i - 1\right)\left(\gamma_i + \theta_i^2\right)}{\gamma_i - \theta_i^2}. \tag{23}$$

We also note that

$$g_i^e \left(w_i^n\right) = \frac{\gamma_i \left(2 - \theta_i^2\right) - \theta_i^2}{\gamma_i \left(\gamma_i - \theta_i^2\right)} \qquad \text{and} \qquad g_i^n \left(w_i^n\right) = \frac{1 - \theta_i^2}{\gamma_i - \theta_i^2}. \tag{24}$$

After substituting (22) to (24) into (9), setting $d\theta_f = -d\theta = -d\theta_m$ (where $d\theta > 0$) and evaluating the resulting expression at $\theta_f = \theta_m = \tilde{\theta}$, the desired condition [which is stated in the lemma] now follows immediately.

Proof of Proposition 2:

It is readily checked that the right-hand side of (10) is positive. Clearly $\gamma_f - \tilde{\theta}^2 < \gamma_f - \tilde{\theta}^2$ because $\gamma_f < \gamma_m$ by Assumption 2. Furthermore, $\tilde{\theta}\left(\gamma_f - 1\right)\left(\hat{\gamma} - \gamma_f\right) > \tilde{\theta}\left(\gamma_f - 1\right)\left(\hat{\gamma} - \gamma_f\right)$ because $\left(\gamma_f + \gamma_m\right)\left(\gamma_f - \gamma_m\right) > 4\left(\gamma_f - \gamma_m\right)$ by Assumption 2 and the additional assumption that $\frac{\gamma_i}{2} > 1$ $(i = f, m)$. As a result, aggregate household welfare is unambiguously higher with discriminatory labor market practices compared to the non-discrimination benchmark.

Proof of Proposition 3:

The Nash bargained equilibrium payoff to i is given by $u_i^N = (W^N + d_i^N - d_j^N)/2$, where W^N is defined in (20) and where

$$d_i^N = \theta_i w_i^n \left(1 - g_i^n\right) + g_i^n + g_j^n - \gamma_i b\left(g_i^n\right) - \beta\left(w_i^n\right). \tag{25}$$

Consider the case of discrimination for which $d\theta_f = -d\theta < 0 < d\theta = d\theta_m$, with female market opportunities reduced and male market opportunities raised compared to the non-discrimination benchmark. Notice that changes in the (Nash bargained) equilibrium payoffs u_f^N and u_m^N depend on how changes in θ_f and θ_m affect (i) aggregate household welfare W^N [see Lemma 1], and (ii) the intra-household bargaining positions $d_f - d_m$ and $d_m - d_f$. To derive the latter, we take the total differential of $d_f - d_m$, recalling that $g_i^n = g_i^n\left(w_i^n, \theta_i\right)$ and $w_i^n = w_i^n\left(\theta_i\right)$:

$$\begin{aligned} d\left(\cdot\right) &= \left[w_f^n\left(1 - g_f^n\right) + \frac{1}{2}\left[\theta_f\left(g_f^e - g_f^n\right) - \left(g_f^n\right)'\right]\frac{\partial w_f^n}{\partial \theta_f} - \frac{\partial g_f^n}{\partial \theta_f}\right] d\theta_f \\ &\quad + \left[w_m^n\left(1 - g_m^n\right) + \frac{1}{2}\left[\theta_m\left(g_m^e - g_m^n\right) - \left(g_m^n\right)'\right]\frac{\partial w_m^n}{\partial \theta_m} - \frac{\partial g_m^n}{\partial \theta_m}\right] d\theta_m, \end{aligned} \tag{26}$$

where
$$\frac{\partial g_f^n}{\partial \theta_f} = -\frac{w_f^n}{\gamma_f b''(g_f^n)} < 0 \quad \text{and} \quad \frac{\partial g_m^n}{\partial \theta_m} = -\frac{w_m^n}{\gamma_m b''(g_m^n)} < 0.$$

After combining (9) and (26), one obtains

$$2(du_f^N) = \left[w_f^n\left(2 - \overset{>0}{g_f^e} - g_f^n\right) - \overset{<0}{\frac{\partial g_f^n}{\partial \theta_f}}\right]\overset{<0}{d\theta_f} - \left[w_m^n\left(\overset{>0}{g_m^e} - g_m^n\right) - 2\overset{<0}{\left(g_m^n\right)'}\overset{>0}{\frac{\partial w_m^n}{\partial \theta_m}} - \overset{<0}{\frac{\partial g_m^n}{\partial \theta_m}}\right]\overset{>0}{d\theta_m} < 0.$$

and

$$2(du_m^N) = \left[w_m^n\left(2 - \overset{>0}{g_m^e} - g_m^n\right) - \overset{<0}{\frac{\partial g_m^n}{\partial \theta_m}}\right]\overset{>0}{d\theta_m} - \left[w_f^n\left(\overset{>0}{g_f^e} - g_f^n\right) - 2\overset{<0}{\left(g_f^n\right)'}\overset{>0}{\frac{\partial w_f^n}{\partial \theta_f}} - \overset{<0}{\frac{\partial g_f^n}{\partial \theta_f}}\right]\overset{<0}{d\theta_f} > 0.$$

The desired conclusion [which is stated in the proposition] now follows immediately.

Proof of Proposition 5:

Let

$$L_i \equiv \frac{1}{2}(u_f^E + u_m^E) - u_i^N$$

denote agent i's ($i = f, m$) per-period loss in the punishment phase. Let

$$G_i \equiv u_i^D - \frac{1}{2}(u_f^E + u_m^E)$$

denote agent i's ($i = f, m$) per-period gain from a unilateral (one-shot) deviation. It follows from (18) that full cooperation is sustainable as long as

$$\delta \geq \delta_f^* = 1 - \frac{L_f}{L_f + G_f} \quad \text{and} \quad \delta \geq \delta_f^* = 1 - \frac{L_m}{L_m + G_m}. \tag{27}$$

Consider the case of discrimination for which $d\theta_f = -d\theta < 0 < d\theta = d\theta_m$, with female market opportunities reduced and male market opportunities raised compared to the non-discrimination benchmark. After totally differentiating L_m, one obtains

$$\begin{aligned} 2\,(dL_m) \quad = \quad & \left[w_m^e \left[1 - g_m^e\left(w_m^e\right)\right] - w_m^n \left[2 - g_m^e\left(w_m^n\right) - g_m^n\left(w_m^n\right)\right] + \overbrace{\frac{\partial g_m^n}{\partial \theta_m}}^{<0} \right] \overbrace{d\theta_m}^{>0} \\ & + \left[w_f^e \left[1 - \overbrace{g_f^e\left(w_f^e\right)}^{>0}\right] + w_m^n \left[\overbrace{g_f^e\left(w_f^n\right)}^{>0} - g_f^n\left(w_f^n\right)\right] - 2\,\overbrace{\left(g_f^n\right)'}^{<0} \overbrace{\frac{\partial w_f^n}{\partial \theta_f}}^{>0} - \overbrace{\frac{\partial g_f^n}{\partial \theta_f}}^{<0} \right] \overbrace{d\theta_f}^{<0}. \end{aligned}$$

We then note that the term $w_m^e \left[1 - g_m^e\left(w_m^e\right)\right] - w_m^n \left[2 - g_m^e\left(w_m^n\right) - g_m^n\left(w_m^n\right)\right]$ is unambiguously negative.[29] It thus follows that

$$dL_m < 0. \tag{28}$$

After totally differentiating G_m, we obtain

$$\begin{aligned} 2\,(dG_m) \quad = \quad & \left[w_m^n \left[2 - g_m^e\left(w_m^n\right) - g_m^n\left(w_m^n\right)\right] - w_m^e \left[1 - g_m^e\left(w_m^e\right)\right] - \overbrace{\frac{\partial g_m^n}{\partial \theta_m}}^{<0} \right] \overbrace{d\theta_m}^{>0} \\ & - \left[w_m^e \left[1 - \overbrace{g_f^n\left(w_f^n\right)}^{>0}\right] - 2\,\overbrace{\left(g_f^n\right)'}^{<0} \overbrace{\frac{\partial w_f^n}{\partial \theta_f}}^{>0} - \overbrace{\frac{\partial g_f^n}{\partial \theta_f}}^{<0} \right] \overbrace{d\theta_f}^{<0}. \end{aligned}$$

Since the term $w_m^n \left[2 - g_m^e\left(w_m^n\right) - g_m^n\left(w_m^n\right)\right] - w_m^e \left[1 - g_m^e\left(w_m^e\right)\right]$ is unambiguously positive, it follows that

$$dG_m > 0. \tag{29}$$

From equation (28) it is clear that changes in θ_f and θ_m such that $d\theta_f < 0 < d\theta_m$ reduce m's per-period loss in the punishment phase. From equation (29) it is clear

[29] This is because $w_m^e < w_m^n$ and $g_m^e\left(w_m^e\right) > g_m^e\left(w_m^n\right)$.

that those changes increase m's one-shot gain from a unilateral deviation from the efficient household equilibrium. Equation (27) then implies that

$$d\delta_m^* > 0.$$

Hence male cooperation becomes more difficult to sustain within the marital relationship. Along the lines of this proof, it is readily checked that $dL_f > 0$ and $dG_f < 0$. Hence $d\delta_f^* < 0$, and female cooperation becomes less difficult to sustain within the marital relationship.

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