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# A Theory of Gender Discrimination Based on the Household

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# A THEORY OF GENDER DISCRIMINATION BASED ON THE HOUSEHOLD

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# A THEORY OF GENDER DISCRIMINATION BASED ON THE HOUSEHOLD

## Abstract

This paper presents a new theory of gender discrimination in competitive labour markets which does not rely on any inherent gender asymmetries. Women and men are organized into households with each having identical household specific human capital. When labour market characteristics (effort, wages) differ, the possibility of mutually beneficial within household trades arises. Discrimination involves occupational segregation with men obtaining high paying efficiency wage jobs and women in piece rate work. It is shown that there always exists a Nash equilibrium in which firms benefit from discrimination by allocating high paying jobs exclusively to men, provided other firms also do so, as this ensures their employees (men) enjoy the benefits of within household trade and will satisfy incentive compatibility at a lower wage. A firm attempting to hire women in efficiency wage jobs makes strictly lower expected profits, since the predominance of men in the labour market means women are less likely to enjoy the benefits of within household trade and more likely to shirk. The model thus provides an intuitive explanation for discrimination in competitive labour markets even when the sexes are completely identical. It also suggests a positive role for affirmative action policies in moving the economy from the discrimination to a non-discrimination equilibrium.

**Keywords** Gender discrimination, efficiency wages, household models. JEL: J71, J41, J16.

# 1 Introduction

The huge “gender gap” literature has shown that women, on average, consistently earn less than men.<sup>2</sup> A difference in earnings persists even when controlling for hours worked, industry of work and human capital characteristics of workers, leading many to suggest that this provides evidence of wage discrimination against women, see Gunderson (1989) and Goldin (1990) for further discussion.

This paper explains gender discrimination as an equilibrium outcome in a world where labour markets are competitive, women and men are ex ante identical and neither employers nor anyone else have a preference for men or exogenous propensity to discriminate. The explanation utilizes the fact that women and men are organized into two person households in which both are equally well endowed with household specific human capital, that is, a capacity to provide household goods and services for themselves and each other at a cost which is less than the external market rate. Differences in labour market characteristics between household members (in particular, wage rates or job types) combined with this household specific human capital, give rise to the potential for mutually beneficial within household trades.

In the labour market there are two types of jobs: As in Bulow and Summers (1986) there exist a number of exogenously specified efficiency wage jobs in which workers receive a wage premium in order to be dissuaded from shirking. There also exist non-efficiency wage jobs which pay no such premium. If, and only if, one member of a couple at most has an efficiency wage job, both can benefit by a contract which calls for an increase in the household work effort of the lower paid member (with corresponding decrease in the higher paid member’s effort) in return for a monetary payment from the high to the low wage member. That is, there exist gains from trade which can be exploited within the household. Importantly, it is difference which gives rise to the benefits of such trades, so that they are only realized by couples with

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<sup>2</sup>See Cain (1986 p. 750) for early references to the empirical work in this area, Gunderson and Riddell (1993) for more recent studies and O’neill and Polachek (1993) for an account of changes in gender gap through the 1980’s.

different job characteristics. This benefit from trade acts as a benefit in kind which a worker receives in addition to the efficiency wage payment. Given this benefit in kind, employers can lower efficiency wage payments while still satisfying a worker's incentive compatibility constraint because threat of job loss entails loss of gains from trade in addition to loss of the wage premium. Herein lies a firm's desire to discriminate. If all other firms discriminate and allocate efficiency wage jobs to one sex only, then a single firm can ensure its employees receive this benefit in kind, and thus pay a lower efficiency wage, only if this firm also employs men exclusively as well. Only by doing so can it ensure that its employees are in households where they alone are the sole efficiency wage recipient, and therefore where they can enjoy the benefits of within household trades. Thus discrimination by other firms makes it strictly better for any one firm to also be a discriminator.

Intuitively, a culture of discrimination in the labour market (i.e. a Nash equilibrium in which all firms discriminate and allocate efficiency wage jobs to men only) leads a single firm to expect that men are likely to be in households where they alone have high paying jobs (and can thus trade off much of the work at home with their spouses). Women, on the other hand, have a much higher chance of being in a household where they are not alone in having a high paying job and cannot therefore enjoy the benefits of such trade. Thus, though ex ante women and men are identical, in a discrimination equilibrium, all firms correctly conjecture that women have a higher probability of shirking at a given wage and therefore rationally choose to discriminate.

This explanation differs from previous explanations of discrimination in two significant respects. Firstly, discrimination arises here because women and men are arranged into households. Secondly, it starts from ex ante equivalence between women and men in all respects. Previous models usually include either exogenous gender differences or inherent preferences for one gender over the other. Becker (1971) shows how a preference for men over women, either on the part of employers, employees or customers, can lead to a situation of women being paid less than men. Madden (1973) argues that the simultaneous existence of differences in labour supply elasticities between men and women, and firms with some degree of monopsonistic power,

can lead to gender differences in wages, with a monopsonist being able to pay the sex with lower elasticity less. Signalling theories, for example Rothschild and Stiglitz (1982), explain discrimination as arising due to differences in the noise of productivity signals across gender. Women, who are posited as having noisier signals, are paid a lower wage, since accurately signalling quality is more difficult for women, and a worker's output depends upon matching their quality type with the correct job. Milgrom and Oster (1987) take another approach at this by positing less observability of women's quality to outside firms. This generates strategic non-promotion of high quality women on the part of firms, in order to protect their informational advantage over outsiders, and women being worse off. A final broad category of explanations can be seen as arising from the segmented labour market theories of Bergmann (1971) and Arrow (1973). The existence of a dual labour market, either because of employer prejudices, as in Bergmann (1971), or because of a combination of efficiency wage jobs and differences in length of working life, as in Goldin (1986), or efficiency wage jobs and differences in employment turnover rates, as in Bulow and Summers (1986), can lead to differences in payments across gender. More recently, Kuhn (1993), shows that firm specific human capital investments, and, once again, an exogenously lower labour force commitment for women than for men, can lead to involuntary rationing of jobs to women.

Despite the prevalence of explanations Cain (1986 p.781) states, in conclusion to his survey of labour market discrimination, that:

“...the theories of discrimination have been useful for providing definitions and for suggesting measurements of discrimination but not for providing convincing explanations of the phenomenon nor of its patterns.”<sup>3</sup>

It could be argued that previous theories leave too much unexplained. Though useful in drawing out the labour market implications of preferences for men over women, theories which take such preferences as a starting point, as in Becker (1971) or Bergmann (1971) provide only part of

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<sup>3</sup>Recently, in rationalizing their findings of discrimination in the market for lawyers, Wood, Corcoran and Courant (1993) reach a similar conclusion.

the explanation. Madden (1973) does not explain why women should have less elastic labour supply responses than men, which is also empirically hard to justify. A major drawback of the other approaches is that they treat as exogenous, factors which, themselves, could be expected to be caused by discrimination. Differences in the noise of quality signals for men and women, if they exist at all, could be the outcome of discrimination themselves. Because of discrimination, women do not invest in obtaining such signals and therefore, because of fewer observations, are less reliable as an indicator of quality. Similarly, differences in length of working life as in Goldin (1986) or differences in turnover rates, as in Bulow and Summers (1986) can be seen as the outcome of a situation in which women, due to discrimination and therefore lower rewards, place less importance on labour market participation and therefore are more likely to leave their current job, or the labour force altogether, as suggested by Gunderson (1989 p.48).<sup>4</sup> These theories, then, are best seen as partial explanations only. A more complete explanation would account for discrimination without treating as exogenous those factors which are themselves, in turn, affected by discrimination.

This is the approach of the current paper, which attempts to generate gender discrimination in a model where men and women are completely equal in all labour market characteristics. The only role that gender plays is in the organization of households, which are assumed to contain one member of each sex. The aim of this paper is not to explain the existence of discrimination against women per Se. It is instead to show that one outcome of a competitive labour market where workers are identical in all respects, is discrimination against one of the sexes. It is demonstrated that this discrimination arises precisely because workers are organized into such two person households. The importance of such an explanation when there already exist an abundance of theories explaining the phenomenon, is that it may imply a markedly different set of policy responses. If, as in the previous literature, gender discrimination arises due to exogenous gender differences, then correcting these (say through improved childcare or encouragement of female labour force participation) will lead to an eventual improvement in female work and thus a narrowing of the gender gap. If, however, as the logic of the

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<sup>4</sup>In fact, Viscusi (1980), Blau and Kahn (1981) and Osterman (1982) find that sex differences in turnover rates all but disappear when labour market and job characteristics are controlled for, suggesting that these qualities may reside more in women's typical jobs than women themselves.



model presented here will suggest, labour market discrimination itself causes these gender differences (which can even persist when women have ex ante identical characteristics to men), then altering discriminatory outcomes may require direct policy responses (such as affirmative action). Moreover, focusing policy explicitly on the labour market, and only the labour market, may alleviate a substantial amount of discrimination even though factors sometimes considered external to the labour market (differences in household responsibilities, career interruptions, turnover rates) may appear to be empirically important explanatory variables.

The model developed here is very much in the tradition of the dual labour market models mentioned above. These models provide a useful starting point for an analysis of discrimination, because the dual labour market structure, which allows for gender segregation by type of job, accords well with our empirical understanding of the phenomenon. Empirical studies have shown that, in contemporary labour markets, discrimination rarely takes the form of women being paid less than men in the same jobs at the same establishments. Rather it is manifest in men having better access to the higher paying jobs within an occupation type, even when traditional labour market characteristics are controlled for.<sup>5</sup> The better paying jobs here are modelled as those which, for reasons of imperfect monitoring (as in Shapiro and Stiglitz (1984)), pay efficiency wages. For expositional simplicity this structure is useful, however it is not necessary for the basic story to go through. The essential features of the explanation are simply that 1) termination of a contract is costly to the firm and 2) workers are less likely to terminate the contract when their spouse does not also have a similar job. These features are present in dual labour markets generated by efficiency wage considerations, but not uniquely so.

In considering links with the previous literature, the analysis also draws on Becker's (1985) insights in the modelling of internal organization of labour within the household, with some departures. Firstly, unlike Becker, human capital accumulation (either within the household or in the workforce) is ignored, so that gains from the division of labour to increasing returns

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<sup>5</sup>For more on this see, Treiman and Hartmann (1981 p.33) Johnson and Solon (1986) and an extensive discussion and survey in Gunderson (1989).

activities are not what drive gains from trade. Though, if this were allowed, it would generally work in the same direction as the other factors and strengthen the results. Secondly, individuals maximize their own utility functions, not a household welfare function. Finally there are no exogenous differences in either household or workforce productivity by gender which would give rise to benefits from trade within the household. The aim of the present paper is to generate these differences (in the workforce) endogenously by showing how discrimination by a number of firms (and thus lower female labour productivity) affects the composition of households and can therefore lead other firms to discriminate.

The paper proceeds as follows. In Section 2 the model is constructed and it is established that a Nash equilibrium in which all firms discriminate always exists. The necessary conditions for a non-discrimination equilibrium are also established and the stability properties of the equilibria are examined. In Section 3, the effects of an affirmative action policy are explored. It is shown there that such a policy can move the labour market from the discrimination equilibrium to the non-discrimination equilibrium. In Section 4 an attempt is made to see how well the model's predictions square off with our empirical understanding of male-female labour market differences. Section 5 concludes.

## 2 The model

There are  $N$  identical individuals,  $N/2$  of each sex, living in  $N/2$  households. Each household has one member of each sex. To avoid any perverse final period effects, individuals are assumed to live for an infinite number of discrete periods. The future is discounted at rate  $\rho$  ( $0 < \rho < 1$ ) per period. In each period, denoted  $t$ , an individual, denoted  $i$ , cares about three things only: consumption, denoted  $c_t^i$ ; effort spent at work,  $e_t^i$ ; and effort allocated to household tasks  $H_t^i$ , where  $e^i + H^i \leq e^{max}$  which is the total amount of effort each individual has available per period. Within period preferences for individual  $i$  are denoted by a twice continuously differentiable, separable utility function,  $U(c^i) + V(e^i + H^i)$ , with  $U' > 0$ ,  $V' < 0$ ,  $U'' < 0$  and  $V'' < 0$ .<sup>6</sup> It is

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<sup>6</sup>Primes denote derivatives here.

also assumed that the marginal utility of consumption is arbitrarily high as it approaches zero, i.e.  $\lim_{c^i \rightarrow 0} U'(c^i) = \infty$ , that effort is equally unenjoyable whether incurred in the household or at work; that is,  $e$  and  $H$  are perfect substitutes and that  $\lim_{e^i + H^i \rightarrow e^{max}} V'(e^i + H^i) = -\infty$ , that is, if all effort is devoted to work, the marginal disutility of work is infinitely high.<sup>7</sup> The price of consumption goods is normalized to equal one, and to simplify the individual's optimization problem, saving is not allowed. Thus if individual  $i$  receives wage  $w^i$  per unit of effort expended at work and works  $e^i$ , thereby receiving total income  $w^i e^i$  for the period, then  $i$  can consume upto  $c^i = w^i e^i$  by devoting all income to consumption. Each individual is responsible for a total of  $\bar{H}$  household tasks each period. Assume the simplest form of household production function for these tasks where one unit of effort expended in the household performs one unit of required housework. Thus if an individual were to personally undertake all of his or her tasks, effort expended in the household would equal  $\bar{H}$ . These tasks include things such as cleaning, shopping, preparing food, child care, home maintenance etc. As the sign of the derivative shows, these tasks are assumed to be unpleasant. Note that, for simplicity, the utility benefit of such tasks is not modelled here, however, in order to abstract from the problems of determining equilibrium allocations of public goods within the household, it is assumed that undertaking one's own housework does not create a benefit for one's spouse.<sup>8</sup> There also exists an external market for household tasks where, by paying a wage  $w^e$  per unit of labour employed, person  $i$  can reduce his or her household tasks by an amount  $\gamma < 1$  per unit of labour hired. Note the assumption of household specific human capital implicit in setting  $\gamma$  strictly less than one. This human capital is assumed to be common to both members of the household, thus if  $i$ 's spouse were to devote one unit of effort to undertaking  $i$ 's tasks this would be as effective as one unit of effort from  $i$ . More effort is therefore required from an outsider than from either member of the household in performing a given amount of household tasks. This seems reasonable as, even if it is believed that householders do not have inherent advantages in providing for their own household services, the existence of transport costs are sufficient to render internal provision of services cheaper. Thus, denoting  $H^e$  the

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<sup>7</sup>The separability of utility in income and effort is a standard simplifying assumption in efficiency wage models, see Shapiro and Stiglitz (1984).

<sup>8</sup>Konrad and Lommerud (1993) analyze a situation where members of a couple non-cooperatively choose the level of within household public good to provide.

amount of  $H$  bought externally, it is necessary that  $H^e\gamma \leq \bar{H}$ , as people will not employ more labour than necessary to undertake all of their housework. It is also possible that, in return for a transfer from  $i$ ,  $i$ 's spouse will undertake some of  $H_i$ . Denote the unit price for work which the spouse agrees to undertake,  $p^n$  and the maximal amount undertaken at that price  $H^{max}(p^n)$ .<sup>9</sup> Provided  $p^n < w^e$ , one possible example of a configuration of utilities within the household is  $U(w_i e^i - p^n H^{max} - w^e H^e) + V(e_i + \bar{H} - H^{max} - \gamma H^e)$  for  $i$  and  $U(w_j e_j + p^n H^{max}) + V(e_j + \bar{H} + H^{max})$  for  $i$ 's spouse  $j$ . In this case, there has been a transfer from  $i$  to  $j$  of  $p^n H^{max}$  and, in addition to this,  $i$  also buys  $H^e$  of household services externally at price  $w^e$ . The amount of transfer and the consequent share of household tasks that each individual undertakes will depend on income levels, effort expended at work and the internally negotiated price for housework. In order to specify these, let us now consider the labour market requirements of firms.

## 2.1 Firms

To avoid the complexity of determining the relative price of goods and wages in equilibrium, it is assumed that effort applied to labour outside the household, denoted  $e$ , produces goods which are sold on external markets at a fixed price. Labour can be used in one of three ways. There exists a constant returns to scale production function, with labour as its only input, which converts one unit of labour input to one unit of exported output, the price of which is  $p'$ . Anyone can set up production and produce as much output as desired without affecting the price; from hereon this work shall be referred to as piece rate work. People can also work in providing household services in the formal market for housework. These are provided perfectly competitively so that, in any equilibrium where such work is provided, workers receive  $p'$  for each unit of labour provided.

In addition to these two types of jobs, there exist a fixed number,  $F$ , of infinitely lived firms, each of which wishes to hire a fixed number of workers per period,  $n$ , in the production

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<sup>9</sup>As will subsequently become clear,  $n$  mnemonically denotes a negotiated price. The determinants of  $p^n$  and  $H^{max}$  will be analyzed further on.

of another good, also sold on world markets, at another exogenously determined price  $p^g$ .<sup>10</sup> Once again, production involves labour input only, but is undertaken using a markedly different technology. Effort put into these tasks is assumed to be completely non-verifiable. It is assumed that for  $e < \bar{e}$  (where  $\bar{e} > 0$ ) output per worker is zero, however for  $e \geq \bar{e}$  output per worker is 1. Firms pay efficiency wages in these jobs which serve to satisfy workers' incentive compatibility constraints, taking account of the benefit to be gained by shirking. The efficiency wages provide compensation greater than that required if effort were contractible, so that the threat of terminating employment, and therefore losing the higher compensation, serves to deter workers from shirking.<sup>11</sup>

The efficiency wage jobs will, from hereon, be called "good" jobs as they are jobs which more than compensate workers for the disutility of effort expended at work. It is assumed that there are more than enough workers of each sex to fill all of the good jobs, that is  $nF < N/2$ .

Most assumptions above are made to simplify the analysis and are not critical. All results will hold if it is instead assumed that, in all tasks, output responds continuously to effort and that the effort required for different tasks may differ. Furthermore, allowing each firm's labour demanded to vary has no substantive effect. The assumption of either perfect verifiability or complete non-verifiability in the two job types is also made for simplicity. Critical assumptions are that there exist some tasks which, due to informational problems, require efficiency wage payments to dissuade shirking and that there are more than enough workers of one gender to undertake all of these tasks.

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<sup>10</sup>I abstract from considerations of market structure, and from explicitly considering the profit maximizing problem of each firm, by imposing  $F, n$  and  $p^g$  exogenously here.  $F$  is large enough to render each firm arbitrarily small in comparison. The results will not be qualitatively affected if the model is extended slightly to allow any or all of these variables to be endogenously determined.

<sup>11</sup>This is a standard, if somewhat bare, characterization of an efficiency wage type problem. These models are often associated with Shapiro and Stiglitz (1984) and have been widely used, see Weiss (1990) for a survey of the main models and extensions. These models have received some empirical support, see Dickens and Katz (1987), Katz and Summers (1989), Krueger and Summers (1987,1988) and Campbell (1993). It has been demonstrated by Macleod and Malcolmson (1989) that the nature of out of equilibrium beliefs regarding the cause of separation between employees and employers determines whether the informational asymmetries inherent in these models lead to efficiency wage payments or instead result in the surplus from employment accruing to the firm. Thus, the efficiency wage structure used in this model is more accurately seen as arising from restrictions on beliefs, details of which I abstract from, see Macleod and Malcolmson (1989) for a complete treatment.

## 2.2 Labour market equilibrium

At  $t = 0$  each firm calls a wage,  $w^g$ , where  $g$  mnemonically denotes good jobs, which it is willing to pay good workers.<sup>12</sup> Firms then hire some of the applicants for the good jobs. All individuals are equally productive as workers, and identical in characteristics, with the exception that they differ in gender, which is readily observable. In principle, firms are able to dismiss and hire other workers in future periods, however most equilibria focussed on will involve wage payments which dissuade shirking and thus involve no dismissal or re-hiring. Since other firms observe separation but not the reasons for separation (for if this were observable then contracting around the informational asymmetry would be possible and efficiency wages would not occur) these firms strictly prefer to hire workers not previously employed in “good” jobs provided any weight at all is attached to the possibility of the separation occurring due to shirking.<sup>13</sup> Thus a worker knows that if he or she shirks and is dismissed he or she can expect to never again be hired.<sup>14</sup> Since piece rate production is always possible, an individual not employed by any firm can always obtain a wage  $p'$  per unit of effort spent at work. It will now be demonstrated that the wage required to dissuade shirking in a good job depends critically on the characteristics of the household in which each individual resides. The dependence of hiring decisions across firms will then be shown by demonstrating that these characteristics are affected by the labour hiring decisions of other firms.

To show the dependence of efficiency wages on household characteristics I first characterize, more fully, individual labour supply decisions. For individuals not in good jobs, this involves calculating their optimal level of  $e$  denoted  $\hat{e}$ , given a wage  $w^e = p'$  for external work. Due to the equilibrium equality between  $w^e$  and  $p'$ , individuals will be indifferent between supplying effort to either task, without loss of generality then, all workers not engaged in good jobs are

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<sup>12</sup>Time subscripts will be suppressed, since, in equilibrium, wages do not vary.

<sup>13</sup>Which is, of course, consistent with the form of beliefs required to sustain efficiency wages as an outcome.

<sup>14</sup>All of the equilibria to be examined involve no shirking and thus permanent employment. Introducing exogenous turnover in employment and the possibility of re-hiring for shirkers will not affect the results provided re-hiring is not instantaneous and dismissal still acts as a penalty, i.e. provided that the efficiency wage structure persists.

referred to as piece rate workers.<sup>15</sup> In some households a person's spouse may wish to buy household services from them at an internally negotiated, mutually beneficial price. Gains from trade within the household are possible because a piece rate worker receives only  $p'$  for a unit of outside work and a person buying household services externally pays  $p'/\gamma$ , denoted  $\bar{p}$ , for each unit reduction in housework purchased. Since  $\bar{p}$  exceeds  $p'$ , any internally negotiated price  $p^n \in (p', \bar{p})$  for internal provision of household services will be mutually beneficial. Since this is a situation of trade between a constrained monopolist and a monopsonist, both the value of the negotiated price and the quantity traded are indeterminate. It is assumed however, that if such mutually beneficial trades exist, for some set of prices, a price from within that set, is always found and the couple manage to exploit the benefits from trade. For the purposes of this paper, it does not matter how  $p^n$  is arrived at as long as a solution is found and the gains from trade exploited.<sup>16</sup>

Consider the maximization problem facing individual  $i$ , under negotiated price  $p^n$  which will be paid per unit of housework provided:

$$\max_{e_i, H_i^S} U(e_i p' + H_i^S p^n) + V(e_i + \bar{H} + H_i^S) \quad (2.1)$$

$$s.t. e_i \geq 0 \quad (2.2)$$

$$0 \leq H_i^S \leq H^{max} \quad (2.3)$$

where  $H^{max}(p^n) \leq \bar{H}$  denotes the upper bound on household services which person  $i$ 's spouse will buy at price  $p^n$ . Denote the solutions to this problem  $H^{s*}$  and  $\hat{e}$ . It is shown in the appendix that, for  $p^n > p'$ ,  $H^{s*} > 0$ , whereas  $\hat{e}$  may equal zero. It is also shown that any solution obtained is unique. Denote the indirect utility function obtained from this maximization  $\Psi^S(p^n, H^{max}(p^n))$  where the superscript  $S$  mnemonically denotes a seller of household services, note that the wage  $p'$  is suppressed in  $\Psi^S$  as it will not play an important role. The appendix also derives the indirect utility function for a person who does not have the opportunity to sell household services to their spouse. In this case, the indirect utility function is denoted  $\Psi^S(\cdot, 0)$

<sup>15</sup>As seems reasonable, it is assumed that aggregate labour supply is sufficient to satisfy all demand for household services.

<sup>16</sup>For example it may be the outcome of a household bargaining game, as in McElroy and Horney (1981), where the threat points are a function of employment characteristics.

where the first argument which denotes the negotiated price, is left blank, and the 0 shows that the person's spouse does not want to buy household services. It is clear that the opportunity to trade with one's spouse raises (weakly) the value of the indirect utility function. Furthermore, since  $H^{s*} > 0$ , such trades make an individual strictly better off. That is:

$$\Psi^S(p^n, H^{max}) > \Psi^S(\cdot, 0). \quad (2.4)$$

Intuitively, this is because internal trades, occurring as they do at a mutually beneficial price, ensure that the seller of household services works internally at a higher wage than that available in the market.

It is people in good jobs who potentially demand household services. Here I establish the conditions under which this demand is positive. In a good job one always chooses between two values of  $e$  at work. If shirking one sets  $e = 0$ , as any other value less than  $\bar{e}$  yields strictly less utility and does not affect the probability of dismissal. If not shirking, one sets  $e = \bar{e}$  as a higher level of effort yields strictly lower utility and again does not affect the probability of dismissal. I characterize the indirect utility function of a person in a good job under the two cases separately. Let  $\Psi^{B,0}$  denote the indirect utility function of a shirker and  $\Psi^{B,\bar{e}}$  denote the indirect utility function of a non-shirker, where  $B$  mnemonically shows that this is the case for a buyer of household services.

For a non-shirker,  $i$ , this function is obtained by maximizing utility by choice of  $H^B$ , the amount of household services bought internally, and by choice of  $H^e$  the amount bought externally:

$$\max_{H^B, H^e} U(w^g \bar{e} - p^n H^B - p' H^e) + V(\bar{e} + \bar{H} - H^B - \gamma H^e) \quad (2.5)$$

$$s.t. H^B \leq H^{lim}(p^n) \quad (2.6)$$

$$H^B + \gamma H^e \leq \bar{H} \quad (2.7)$$

$$p^n H^B + p' H^e \leq w^g \bar{e} \quad (2.8)$$

where  $H^{lim}(p^n)$  is the most labour that  $i$ 's spouse will supply at price  $p^n$ . Solutions are denoted  $H^{B*}$  and  $H^{e*}$ . The appendix shows that if an individual wishes to buy household services, they



always prefer to do so from their spouse than from the market. This is simply due to the household specific human capital which allows the buyer to buy services cheaper than that available in the market even though the seller is providing these at a wage above the market wage. It is shown in the appendix that a sufficient condition for a person in a good job to wish to buy household services,  $H^{B*} > 0$ , is given by the following assumption.

**A 1** For a person working  $\bar{e}$  in a good job, the external price of household services is less than the marginal rate of substitution of effort for income, i.e.  $p' < -\frac{V'(\bar{e} + \bar{H})}{U'(w^g \bar{e})}$ .

This condition implies both that good jobs pay well enough and that these jobs demand high enough effort from workers so that workers wish to buy household services even at the external market price.<sup>17</sup> The maximization problem for a shirker is identical except that  $V(0 + \bar{H} - H^B - \gamma H^e)$  replaces  $V(\bar{e} + \bar{H} - H^B - \gamma H^e)$  in the maximand. Both maximization problems are analyzed in the appendix.

An immediate implication of **A1** is that the possibility of household trade in services at  $p^n < p'$  makes a non-shirker strictly better off. That is:

$$\Psi^{B, \bar{e}}(p^n, H^{lim}(p^n), w^g) > \Psi^{B, \bar{e}}(\cdot, 0, w^g) \quad (2.9)$$

For this indirect utility function I include the wage variable  $w^g$  as it will play an important role. For a shirker, however, it is shown in the appendix that the possibility of household trades does not necessarily strictly raise utility. Furthermore the following Lemma shows that, for given  $p^n$ , a shirker will trade no more than a non-shirker.

**Lemma 1**  $H_{\bar{e}}^{B*} \geq H_0^{B*}$ .

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<sup>17</sup>It should be noted that ensuring household difference leads to mutually beneficial trades does not require this assumption, since  $\bar{e} > 0$  and the marginal disutility of effort is increasing, mutually beneficial within household trades will often exist between a person in a good job and one working a piece rate. At the cost of some complexity it is possible to relax this assumption and more accurately determine the reduced limits within which  $p^n$  must lie, however this adds nothing to the results. In fact, modelling the household in Becker's (1991) classic framework (which includes all members of the household maximizing a joint welfare function) ensures that a household will always benefit by such a division of labour and will not alter any of the model's conclusions.

Proof: See appendix.

This Lemma is intuitively obvious. If expending less effort at work, effort at home causes less disutility so one will not wish to buy more household services. Furthermore, it follows from Lemma 1 that not being able to trade household services internally, makes a non-shirker at least as much worse off as a shirker. That is:

$$\textbf{Lemma 2} \quad \Psi^{B,\bar{e}}(w^g, p^n) - \Psi^{B,\bar{e}}(w^g, \cdot) \geq \Psi^{B,0}(w^g, p^n) - \Psi^{B,0}(w^g, \cdot)$$

Proof: See appendix.

I now determine the level of wages sufficient to dissuade shirking.

### 2.2.1 Wages sufficient to dissuade shirking

It is necessary to define an individual's no shirking constraint for two different situations: 1) the person in a good job has a spouse who is a piece rate worker, 2) the person in a good job has a spouse in a good job.

In situation (1) the no shirking constraint is the following:

$$\Psi^{B,0}(w^g, p^n) + \frac{\rho \Psi^S(\cdot)}{1 - \rho} \leq \frac{\Psi^{B,\bar{e}}(w^g, p^n)}{1 - \rho} \quad (2.10)$$

remembering that  $\Psi^S(\cdot)$  is the indirect utility function of a potential seller of household services when trades are not available. To simplify notation, the argument for the limit on the amount of  $H$  which can be traded is suppressed, since it plays no role. The left hand side is the discounted lifetime stream of utility obtained when deciding to shirk in the current period. The right hand side is the discounted lifetime stream of utility obtained if one decides to be a non-shirker.<sup>18</sup> Note that there is no uncertainty in these calculations. A non-shirker expects to

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<sup>18</sup>As is standard in efficiency wage models, if one wishes to shirk, then it is optimal to do so immediately. The no shirking condition then needs to only compare returns to shirking in the current period to those from deciding to never shirk.

maintain employment forever while a shirker is certain to be dismissed in the next period and to never again receive a good job.<sup>19</sup> The first term on the left hand side is the one period benefit to shirking, note that, even if shirking, an individual in a good job still has the opportunity to trade with his or her spouse, though such trade may not be worthwhile. The second term is the discounted infinite stream of utility obtained when employed as a piece rate worker from the next period on. In this case, trade within the household is not possible, as one's spouse is also a piece rate worker and does not demand one's services. The right hand side is calculated allowing for trades, since in this situation the worker has a good job and buys household services from their piece rate working spouse.

In situation (2) the no shirking constraint is given by:

$$\Psi^{B,0}(w^g, \cdot) + \frac{\rho \Psi^S(p^n)}{1 - \rho} \leq \frac{\Psi^{B,\bar{e}}(w^g, \cdot)}{1 - \rho} \quad (2.11)$$

This equation is similar to (2.10) except that now within household trading opportunities are reversed. Here, whenever one is in a good job, i.e. the first term on the left hand side and the term on the right hand side, household trades are unavailable since one's spouse also has a good job and will not provide household services. However when not in a good job, one can sell household services to one's spouse and thus benefit from internal trade, i.e. the first term on the left hand side.

Denote  $w^g$  solving (2.10) with equality  $w_d^g$  and denote  $w^g$  solving (2.11) with equality  $w_n^g$ . As will soon be clear,  $d$  and  $n$  are intended to denote discrimination and non-discrimination respectively. From the assumed separability of the utility function and the use of the envelope theorem, it follows that for given  $w^g$ ,  $\Psi_w^{B,0} \leq \Psi_w^{B,\bar{e}}$ , where  $\Psi_w$  is the derivative of  $\Psi$  with respect to  $w^g$ , see the appendix for details.<sup>20</sup> Thus, since  $\rho > 1$ , an increase in  $w^g$  makes shirking less

<sup>19</sup>It will be shown that in both the discrimination and non-discrimination equilibria which are considered further on, no one shirks and thus no one is dismissed in any period. Thus if someone were to shirk they calculate their return to shirking under the expectation that, if dismissed, they will never again receive a good job. Note however that given expectations which define a non-zero probability of termination being due to shirking, firms will never hire workers previously dismissed from good jobs. Thus (2.10) would still apply even if the model were extended to allow for exogenous, involuntary turnover as in Shapiro and Stiglitz (1984).

<sup>20</sup>Note that since the constraint set in the maximization of equation (2.5) is convex,  $\Psi_w$  is therefore well defined except at kink points where  $H^B = H^{lim}$  and  $H^B + \gamma H^e = \bar{H}$ . For simplicity, the problems raised by these two points are ignored since they are negligible in the domain of  $H$ .

attractive in either situation since it raises the right hand side in equations (2.10) and (2.11), by more than the left. It can also be shown that the values  $w_d^g$  and  $w_n^g$  are unique.<sup>21</sup>

### 2.3 Discrimination equilibrium

I now establish a result which is essential in proving the existence of a discrimination equilibrium, i.e. an equilibrium in which only men receive good jobs.

**Proposition 1**  $w_d^g < w_n^g$ .

**Proof:**

$w_d^g$  is given by

$$\Psi^{B,0}(w_d^g, p^n) + \frac{\rho\Psi^S(\cdot)}{1-\rho} = \frac{\Psi^{B,\bar{e}}(w_d^g, p^n)}{1-\rho}. \quad (2.12)$$

$w_n^g$  is given by

$$\Psi^{B,0}(w_n^g, \cdot) + \frac{\rho\Psi^S(p^n)}{1-\rho} = \frac{\Psi^{B,\bar{e}}(w_n^g, \cdot)}{1-\rho}. \quad (2.13)$$

This proof proceeds by demonstrating that, when  $w_n^g$  is substituted into (2.12) the left hand side [LHS] of the equation obtained is less than its right hand side [RHS]. This will imply that  $w_d^g$  which solves (2.12) with equality is less than  $w_n^g$ , since, as discussed previously  $w^g$  raises the [RHS] by more than the left.

Substitute  $w_n^g$  into (2.12). This yields

$$[LHS] = \Psi^{B,0}(w_n^g, p^n) + \frac{\rho\Psi^S(\cdot)}{1-\rho} \quad (2.14)$$

and

$$[RHS] = \frac{\Psi^{B,\bar{e}}(w_n^g, p^n)}{1-\rho}. \quad (2.15)$$

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<sup>21</sup>Here the separability assumption is useful. It is possible to replace this assumption with a weaker assumption limiting the complementarity between leisure and income and still preserve the basic efficiency wage structure. However, since this has no qualitative effects we persist with the standard assumption of separability.

Add and subtract the left hand side of (2.13) to [LHS] yielding:

$$[LHS] = \Psi^{B,0}(w_n^g, \cdot) + [\Psi^{B,0}(w_n^g, p^n) - \Psi^{B,0}(w_n^g, \cdot)] + \frac{\rho \Psi^S(p^n)}{1 - \rho} + \left[ \frac{\rho \Psi^S(\cdot)}{1 - \rho} - \frac{\rho \Psi^S(p^n)}{1 - \rho} \right]. \quad (2.16)$$

Denote the first term in square brackets, which represents the one period utility gain from being able to trade,  $D_1$  and the second term, which represents the net present value of the infinite loss to a piece rate worker from losing trading opportunities with their spouse,  $D_2$ . Similarly, by adding and subtracting the right hand side of (2.13) to [RHS] yields,

$$\frac{\Psi^{B,\bar{e}}(w_n^g, \cdot)}{1 - \rho} + \left[ \frac{\Psi^{B,\bar{e}}(w_n^g, p^n)}{1 - \rho} - \frac{\Psi^{B,\bar{e}}(w_n^g, \cdot)}{1 - \rho} \right] \quad (2.17)$$

In this expression, define the term in square brackets  $D_3$ , this represents the net present value of the gain from being able to trade in all future periods to a non-shirker. Since  $\rho > 0$  we know, from Lemma 2, that  $D_3 > D_1$ , that is, the one period benefit of trade to a shirker must be less than the infinite period discounted benefit of trade to a non-shirker. Also, from equation (2.4) we know that  $D_2 < 0$ . Thus, since it follows from (2.13) that the remaining two terms not in square brackets in [LHS] equal the term not in square brackets in [RHS], it must be the case that [LHS] < [RHS]. Since it was shown earlier, that an increase in  $w^g$  raises the left hand side by less than the right hand side, it therefore follows that  $w^g$  solving (2.12) with equality is less than  $w_n^g$ . Thus  $w_d^g < w_n^g$ .  $\square$

Good jobs, though requiring higher effort, yield higher income. The income is useful to an individual both for buying goods and reducing housework. However trading housework for income internally depends on individuals having different characteristics. If one's spouse does not have a good job, then obtaining a good job opens up possibilities for mutually beneficial trade, the net benefits of which for a non-shirker are denoted by the expression  $D_3$ , which is greater than that for a shirker,  $D_1$ . If one's spouse has a good job, then working at piece rate opens up possibilities for mutually beneficial trade, the benefits of which are equal to the negative of expression  $D_2$ . Thus if one's spouse has a good job, the cost of losing a good job is lower than if one's spouse has a bad job, because in the former case, losing a good job also entails the loss of mutually beneficial trades. Thus the wage required to ensure no shirking is higher if a worker's spouse also has a good job.

It will now be shown that a Nash equilibrium in the labour market is for all firms to discriminate in allocating jobs. Since the model assumes no inherent differences between men and women, discrimination could involve the systematic exclusion of either men or women from “good” jobs. For concreteness, however, discrimination will be taken to imply the reserving of good jobs for men not women.

**Proposition 2** *If the employment status of a person’s spouse is not freely observable, and if all other firms discriminate, then each firm finds it individually worthwhile to discriminate.*

Proof:

Consider the decision faced by one firm,  $f$ . Suppose all other firms discriminate, that is they only employ males in “good” jobs. If  $f$  discriminates, wage  $w_d^g$  for good jobs will satisfy each of  $f$ ’s “good” worker’s shirking constraints, since  $f$  can be sure that none of these workers will be married to spouses in good jobs. This yields a total labour cost for  $f$  of  $nw_d^g$  to produce output of value  $np^g$ .

Suppose that  $f$  does not discriminate. Each of  $f$ ’s employees will be either married to a spouse in a good job or a piece rate worker. If an employee’s spouse does not have a good job, then  $w_d^g$  will be sufficient to discourage shirking. If, however, an employee’s spouse has a good job then only a wage of at least  $w_n^g$  will discourage shirking. At the lower wage of  $w_d^g$  the employee will take the job and shirk. To see this, note that Proposition 1 implies that the no shirking constraint is not satisfied at  $w_d^g$  and shirking yields utility  $\Psi^{B,0}(w_d^g, \cdot, 0) + \frac{\rho}{1-\rho} \Psi^S(p^n, H^{max}(p^n))$ , which exceeds  $\frac{\Psi^S(p^n, H^{max}(p^n))}{1-\rho}$ . Since a firm cannot determine the employment status of an employee’s spouse, a non-discriminating firm chooses between offering a wage  $w_n^g$  to each employee and guaranteeing output  $n$  or offering wage  $w_d^g$  and expecting some workers to shirk. With all other firms discriminating,  $(F - 1)n$  men are hired. Thus the probability of a woman having a spouse in a good job is  $2(F - 1)n/N > 0$ , denoted  $\alpha$ . Thus the firm can expect a proportion  $\alpha$  of the women they hire to shirk at wage  $w_d^g$ . Thus since Proposition 1 establishes that  $w_n^g > w_d^g$ , a firm that discriminates and offers good jobs to men only, either faces lower labour costs to obtain the same output or pays the same wage bill for lower output. Thus if

all other labour hirers are discriminators,  $f$  strictly prefers to be a discriminator.  $\square$

This proposition establishes that one possible Nash equilibrium in the labour market involves each firm discriminating in the allocation of good jobs and paying a wage  $w_d^g$  for these workers. Intuitively when all other firms discriminate against women, a single firm can ensure all of its “good” employees do not have spouses in “good” jobs, only if it reserves these jobs for men exclusively. Then, by Proposition 1, discrimination ensures that the firm is guaranteed effort  $\bar{e}$  at  $w_d^g$  which is less than the wage required to guarantee  $\bar{e}$  if women were also hired,  $w_n^g$ . Thus, in this equilibrium, the outcome is wage discrimination. Women and men with identical characteristics as workers, receive different wages, since only men get the “good” jobs.

Note that the existence of profits plays no part in this result. Extending the model and allowing entry in the output market and elimination of profits still requires that surviving firms are those employing the cheapest labour hiring policy. If all other firms discriminate, this remains a policy of discrimination. It is however important that firms can not freely observe the labour market status of an employee’s spouse. This is sensible for a number of reasons, firstly if observation is possible but of even arbitrarily small cost, discrimination remains the least cost policy for the firm and the equilibrium persists. This is true also if observation is unreliable. Secondly, firms could costlessly ask applicants about their spouse’s status but people with spouses in good jobs would have an incentive to lie since taking the job and shirking yields strictly higher utility. <sup>22</sup>

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<sup>22</sup>It should be noted that this explanation bears some resemblance to the arguments often made by Marxist feminists. Here, firms benefit because good workers pay their spouses to do housework at less than the market rate. Compare this explanation with the conclusions of Dalla Costa and James (1972 p. 35):

“Men appear to be the sole recipients of domestic services but, in fact, the figure of the boss is concealed behind that of the husband.”

And also that of Edmond and Fleming (1975 p. 8):

“All the toiling power of thousands of housewives enables the possessing classes to increase their riches, and to get the labour power of men and children in the most profitable way.”

Proposition 2 provides one possible rationale for these assertions, even when firms in the labour market act competitively.

## 2.4 Non-discrimination equilibrium

I now derive a necessary and sufficient condition for the existence of a Nash equilibrium in which all firms do not benefit by discriminating. It is shown that this condition depends critically on the costs of lost output as a result of shirking. In contrast, it is also demonstrated that the necessary and sufficient condition for the existence of a Nash equilibrium in which all firms discriminate is always satisfied.

**Proposition 3**  $(n/N)(F - 1)p^g > w_n^g - w_d^g$  is a necessary and sufficient condition for the existence of a Nash equilibrium in which no firm discriminates.

Proof:

Assuming a large number of firms, if all other firms do not discriminate then a single firm,  $f$ , expects equal numbers of men and women employed in good jobs elsewhere. If the firm sets  $w = w_d^g$ , only workers with spouses not in good jobs will not shirk. If  $\alpha$  denotes the probability of hiring a worker in a good job whose spouse also has a good job, i.e. a shirker at  $w_d^g$ , then expected profits are

$$n[p^g(1 - \alpha) - w_d^g] = \Pi^d. \quad (2.18)$$

recalling that  $p^g$  denotes the price of the output of good workers as defined in Section (2.1). If a firm sets wage at  $w_n^g$  it is assured that no worker will shirk. Therefore profits are given by

$$n[p^g - w_n^g] = \Pi^n. \quad (2.19)$$

Thus  $\Pi^n \geq \Pi^d$  if  $p^g - w_n^g \geq p^g(1 - \alpha) - w_d^g$  which implies

$$w_n^g - w_d^g \leq \alpha p^g. \quad (2.20)$$

This condition will depend on the value of  $\alpha$  which is determined as follows.

Here we determine  $\alpha$  as a function of  $D$ , the number of discriminating firms. For the purposes of this proposition, however, the only relevant case is  $D = 0$ . Since  $N$  is the size



of the workforce, there are  $F - 1$  other firms, and  $D \leq F - 1$  is the number of firms that discriminate, then  $F - 1 - D$  do not discriminate. This implies that  $(F - 1 - D)n/2$  women are hired and  $Dn + (F - 1 - D)n/2 = (F - 1 + D)n/2$  men are hired. Since there are  $N/2$  of each gender, the probability of a man having a spouse with a good job is  $(n/N)(F - 1 - D)$  and the probability of a woman having a spouse with a good job is  $(n/N)(F - 1 + D)$ . If a firm pays  $w_d^g$  and discriminates, the firm allocates all good jobs to men, if  $D > 0$ , as this lowers the chances of hiring a shirker since  $(n/N)(F - 1 + D) > (n/N)(F - 1 - D)$ . Therefore  $\alpha = (F - 1 - D)n/N$ . However if  $D = 0$  then a firm following a low wage strategy is indifferent between hiring all men and all women. The firm will, however, not hire a mixture of both since by hiring all men or all women  $\alpha = (F - 1)n/N$ , whereas by mixing with proportion  $\delta$  females  $\alpha = (F - 1)n/N + \delta/N$  for male workers and  $\alpha = (F - 1)n/N + (1 - \delta)/N$  for female workers, both of which exceed  $(F - 1)n/N$ . Thus if the firm chooses the low wage option it will still do better by discriminating even if other firms do not. This follows simply because by hiring all of one gender the firm at least ensures that it is not hiring a married couple itself. Therefore if  $D = 0$ , we use  $\alpha = (F - 1)n/N$  in equation (2.20), to obtain the following condition under which the low wage option will not be chosen:

$$(n/N)(F - 1)p^g > w_n^g - w_d^g. \quad (2.21)$$

This is thus a sufficient condition for the non-discrimination equilibrium since, when it holds, if all other firms do not discriminate a single firm will not care about its employee's gender. By reversing the inequality in (2.21) we obtain the condition under which firms prefer to follow the low wage (discrimination) strategy when all others discriminate, thus (2.21) is also a necessary condition for the existence of the non-discrimination equilibrium.  $\square$

If this condition holds, then a Nash equilibrium exists in which no firms discriminate and all pay wage  $w_n^g$ . This condition is more likely to hold when the cost to the firm of a worker shirking,  $p^g$ , is large, the proportion of people with good jobs,  $nF/N$ , is high and when the difference between wages necessary to dissuade shirking for a non-discriminator and a discriminator,

$w_n^g - w_d^g$ , are small. Intuitively, a non-discrimination Nash equilibrium may fail to exist because, if either the costs of hiring a shirker are small or the probability of hiring one low, firms prefer to pay wage  $w_d^g$  instead of  $w_n^g$  and take the chance of hiring a shirker. They discriminate, even if other firms do not, because, by doing so, they ensure that two people from the same household do not work in their firm and thus slightly reduce the probability of hiring a shirker.

**Proposition 4** *The necessary and sufficient condition for there to exist a Nash equilibrium in which all firms strictly prefer to discriminate is always satisfied.*

This condition is given by setting  $D$  the number of firms discriminating, equal to  $F - 1$  in determining  $\alpha$ , which implies  $\alpha = 0$ , and reversing the inequality in (2.20) which gives the condition under which a firm prefers the discrimination policy. This yields

$$0 < w_n^g - w_d^g. \tag{2.22}$$

Since  $w_n^g > w_d^g$  by Proposition 1, condition (2.22) is always satisfied.  $\square$

Note that in both the discrimination and non-discrimination equilibria, no one ever shirks. Thus the assumptions under which equations (2.10) and (2.11) were calculated are correct. <sup>23</sup>

## 2.5 Stability of the equilibria

Even though not a dynamic model, we discuss stability here in the sense of robustness to deviations from the equilibrium strategy by small numbers of players. Unstable equilibria are therefore those in which deviations from the equilibrium strategy by a small number of firms lead to further deviations by other players and thus to an unravelling of the equilibrium. It is

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<sup>23</sup>The stability properties of both equilibria are discussed subsequently. Under some conditions there may also exist another equilibrium in which half of the firms discriminate against women and the other half against men. However since such an equilibrium is never stable it is ignored.

often the case with models of multiple equilibria that asymmetric equilibria tend to be stable while symmetric equilibria are unstable, as surveyed in Matsuyama (1993). Alternatively, where there exist many interior equilibria, these often alternate between being stable and unstable. Neither of these outcomes are a property of the current model where it will be shown that almost any configuration of stability properties may apply. This section shows the dependence of the stability results on the model's primitives and provides an interpretation of these results.

This model's unusual stability properties arise from the existence of an alternative employment strategy for firms, the returns from which do not depend upon the activities of other firms in the market. Labour market policies of other firms affect a firm by determining the gender composition of the labour force and thus the probability of hiring an employee with a spouse in a good job. However by pursuing the strategy of non-discrimination and paying the higher wage,  $w_n^g$ , no shirking is ensured irrespective of household characteristics, thus implying that other firms' policies do not matter. The extra cost of pursuing such a strategy is the wage differential  $w_n^g - w_d^g$ . Thus, if parameter values render this a preferred strategy, deviations by a number of other firms may not matter and the equilibrium can be stable.

To see this clearly consider Figure 2.1, which plots a firm's costs on the vertical axis and  $D$ , the number of discriminating firms, on the horizontal axis. The cost of pursuing the high wage strategy is depicted by the horizontal line,  $w_n^g - w_d^g$ , showing the differential between low and high wage jobs, which is independent of  $D$ . The cost of following the low wage strategy is the risk of hiring a shirker (someone with a spouse also in a good job), which is denoted by the downward sloping line  $(F - 1 - D)(n/N)p^g$ . The line slopes downward because the probability of hiring a shirker at  $w_d^g$  falls with an increase in economy wide discrimination, since fewer women participate in good jobs and thus fewer men come from households where they undertake substantial household tasks. At  $D = F - 1$  all firms discriminate, the probability of hiring a shirker is zero, since women never have good jobs, and the line touches the horizontal axis.

A non-discrimination equilibrium exists when the downward sloping line intersects with the

wage differential line, corresponding to condition (2.21), and touches the vertical axis at the point  $(F - 1)(n/N)p^g$ . As shown in Figure 2.1, this equilibrium will be robust to deviations by any number of firms less than  $D^*$ , i.e., if fewer than  $D^*$  firms discriminate, then the preferred strategy of any other firm is to be a non-discriminator, and thus all other firms will remain non-discriminators. Clearly the greater the value  $(F - 1)(n/N)p^g$  relative to  $w_n^g - w_d^g$ , the more stable the equilibrium. As the point of intersection approaches the origin, the equilibrium becomes less robust to deviations and eventually completely unstable where it meets the line  $w_n^g - w_d^g$ .

Conversely a discrimination equilibrium,  $D = F$ , always exists and is locally stable. The diagram thus makes clear the logic of proposition 4. With all others discriminating,  $D = F - 1$  the cost of discrimination is zero whereas proposition 1 shows  $w_n^g - w_d^g > 0$ . The stability of the equilibrium increases with the wage differential which is determined implicitly by equations (2.12) and (2.13). In terms of the model's primitives, it is easy to show that the wage differential is falling in  $\gamma$ . As  $\gamma$  rises, the benefits of household trades relative to market purchases of services fall and  $w_d^g$  must correspondingly rise to ensure incentive compatibility. With  $\gamma$  close to 1 the difference is very small and the equilibrium becomes less stable, as in Figure 2.2, where deviations by more firms than  $F - 1 - D^{**}$  breaks down the discrimination equilibrium.

Thus, though it is possible for the usual configuration of stability properties to arise in this model, it is also possible that both equilibria be locally stable. It will be shown in Section 3 that the stability of the discrimination equilibrium can have important policy implications.

### 3 Effect of affirmative action policies

The model can provide some rationale for the use of affirmative action policies in alleviating labour market discrimination. Affirmative action can require the setting of target quotas for the hiring of selected groups, in this case women. The usual rationale for these policies is that equal opportunity legislation (which is almost universally law) is insufficient to compensate

for the legacy of a cumulative history of discrimination, Gunderson and Riddell (1993 p.567). Thus these policies are advocated as a temporary corrective device serving to partially offset this history of discrimination.

In the model presented here, an affirmative action policy which requires all targeted firms to give half of their good jobs to women, can also be shown to be useful in moving the labour market away from an equilibrium in which firms discriminate to one in which firms do not.

**Proposition 5** *If a non-discrimination Nash equilibrium exists, and is stable, a policy of affirmative action, if applied widely enough, can move the economy from a discrimination equilibrium to a non-discrimination equilibrium.*

Proof: Equation (2.21) gives the necessary and sufficient condition for the existence of a Nash equilibrium in which all firms do not discriminate. If this condition is satisfied then it is possible to find a value of  $D$ , denoted  $D^{**}$ , (corresponding to the same point in figure 2.2) such that

$$(n/N)(F - 1 - D^*)p^g = w_n^g - w_d^g. \quad (3.1)$$

Suppose the labour market starts in a situation where  $D = F$ , that is, the discrimination Nash equilibrium. Now, suppose that affirmative action policies can be applied to  $F - D^{**} + 1$  of the  $F$  firms. This yields the following inequality:

$$(n/N)(F - D^{**})p^g > w_n^g - w_d^g. \quad (3.2)$$

Which is the condition for any one firm to prefer paying the wage  $w_n^g$  and not discriminate (derived from equation (2.20), substituting  $(n/N)F - D^{**}$  for  $\alpha$ ). Thus, from (3.2), we see that the remaining firms, who are not directly stopped from discriminating by the affirmative action policy, voluntarily choose to stop discrimination and  $D$  goes to zero.  $\square$

Here a policy of affirmative action is able to move the labour market from a situation in which all firms discriminate to one in which there is no discrimination. The intuition for this result is straightforward. Discrimination may cease to be beneficial if the affirmative

action policy can induce enough other firms to not discriminate because, with enough women employed, the probability of hiring a man with a spouse not in a good job is sufficiently small to make it no longer worth the risk. Firms expect a high chance of hiring a shirker at the lower wage,  $w_d^g$ , and thus pay wage  $w_n^g$  to induce  $\bar{e}$  from any worker. In this case, even firms not directly affected by the affirmative action policy no longer benefit by reserving “good” jobs exclusively for men. An implication of this result is that to conclude affirmative action policies do not have wide reaching effects, because they only affect a few firms directly, as in Gunderson (1989 p.63), may be incorrect. This model shows that, to the extent that such a policy contributes to increasing opportunities for women outside the household, it can serve to reduce incentives for other firms to discriminate.

### 3.1 Welfare properties of equilibria

It can be shown that the discrimination equilibrium is a potential Pareto improvement over the non-discrimination equilibrium. This is because the existence of household specific human capital makes it always more socially efficient for either one or both members of the household to undertake their own housework instead of hiring in an outsider to do it. By restricting access to good jobs, a discrimination equilibrium limits the discriminated against sex to undertaking housework or piece work and thus ensures household specific human capital is not wasted. Provided employment, per Se, is not valued and the government can levy lump sum taxes on employees in good jobs (so that the discrimination equilibrium is not affected by the taxes) it will, in general, be possible for a government policy of taxing men in good jobs to attain the desired distribution across sexes as well as the efficiency gains of the discrimination equilibrium. It should be noted however, that this result can be sensitive to the simplifying assumption that all individuals are of equal ability, or, in other words, that ability does not matter in production. In a more complex framework where ability matters, the dominance of the discrimination equilibrium may no longer be maintained as there is a social loss to excluding all high ability individuals of one gender from the good jobs. The social optimality of the discrimination equilibrium will depend on a comparison between this social loss and the lost household specific

human capital which arises when both members of some households work good jobs.

## 4 Some implications

This section demonstrates that the model's conclusions are at least consistent with the results of existing empirical studies and suggests a tentative explanation for the observed recent reduction in the wage gap.

### Occupational segregation

Goldin (1986) argues using historical data, that women have been over represented in jobs paying by the piece in comparison with men. In U.S. manufacturing, in 1890, 47% of female operatives worked in piece rate jobs, defined as jobs in which monitoring was easy or direct, as compared with men among whom only 13% had such jobs. She also finds a much higher probability of employment in team production for men, where one would expect that individual effort is more difficult to determine. Evidence from U.S. clerical employees in the 1940's suggests a similar trend. It was seen there that a large influx of female employees followed technological change in clerical work which led to the "routinization" of clerical tasks. She shows that "routinization" led to a fall in supervision requirements, a consequent lowering of wages paid, and, soon after, to a large influx of female employees. A similar pattern is echoed in Reskin and Roos (1990) survey of the "feminization" of 11 previously male dominated American industries. They find that women's entry had little impact on the gender gap since women were mostly placed in lower paying, less prestigious occupational sub-specialties. An example fitting well with the theme of this paper is the experience of adjusters in the insurance industry as documented by Phipps (1990). In the 1960's, insurance adjusters scheduled their own claims (relatively few per day) and were largely self-monitoring, having their own car and conducting much of their work outside the office. In the 1970's however, adjusting was standardized so that it was able to be conducted from within the office, largely with the use of a phone and computer. Workers then became subject to quotas and electronic management. Just after this

dramatic fall in supervision costs, the profession saw a marked change in gender composition. U.S. census bureau data shows that from 1970 to 1980 the occupation increased by more than 67,000 new jobs to total 98,407 with a rise in female adjusters to 73,744 and a corresponding reduction in male employees of 6,477.

Although not all incidences of feminization surveyed in Reskin and Roos (1990) followed such stark changes in the technology of work, the pattern of “feminization” in most occupations examined was consistent with a clustering of women in the relatively low paying, part-time, and/or less responsible and autonomous jobs which is consistent with the pattern predicted by the model.

### **Marriage Premia**

Goldin (1990, p.102) states that:

“..... the role of marriage in enhancing the earnings of male workers is still only dimly understood.”

As Korenman and Neumark (1991) note, the existence of a wage premium for married men is one of the most robust empirical findings in the social sciences. Most studies, however, find no similar premium for women and often instead that marriage is actually negatively correlated with female earnings. This sort of result is not unique to the U.S., in a recent analysis of Swedish labour markets Richardson (1995) finds a similar premium for married men, even though much of it is reduced when fixed unobservables are accounted for. It was also found in a sample of 12 OECD countries by Schoeni (1990).

Korenman and Neumark (1991) attempt to better understand the existence of the male marriage premium with a detailed analysis of company level data. They summarize the work of Medoff and Abraham (1981) who looked at company personnel data for a large U.S. manufacturing firm’s white male, managerial employees, the information included detailed employee



appraisals and extensive job classification. It was observed that married men were more likely to be located in higher paying job grades, as opposed to being paid more within a grade, and that marriage was positively correlated with promotion once employed in a firm, the probability of promotion being 10.5% higher for married men, but had little effect on entry level employment prospects. Interestingly, analysis of worker evaluations suggested that the promotion success of married men stemmed from their exhibiting higher productivity on the job rather than reputational reasons. They find supervisors' performance ratings of married male subordinates tend to dominate the ratings of unmarried males.

The model presented in this paper provides an explanation for why married men should have higher on the job productivity. In the discrimination equilibrium, men alone have good jobs and those who are married are able to trade with their spouses to undertake the provision of household services. These people will tend to outperform unmarried men since, for a given wage, they are less likely to be shirkers. To married men, loss of the job involves loss of the benefits from within household trades as well as loss of the wage premium, whereas to unmarried men the only cost of job loss is the loss of the wage premium. Unmarried women, on the other hand, should fare no worse than married women since, in a discrimination equilibrium, all women are excluded from good jobs.<sup>24</sup>

On a final and more speculative note, the model also suggests a direction of explanation for observed recent declines in the gender gap. O'neill and Polachek (1993) show that the unadjusted female male wage differential in the U.S. rose from .602 in 1976 (approximately where it had been since the end of World War II) to .716 in 1990. They show that this trend reflects improved female training (both on and off the job) but cannot determine whether this arises due to a decrease in employer discrimination, or increase in women's education efforts and/or work attachment. Whichever explanation holds, the current model suggests

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<sup>24</sup>Note that if, for some reason, a firm were forced to employ some women in efficiency wage jobs it may strictly prefer unmarried women, depending on the number of men employed in efficiency wage jobs. If a high proportion of such men have good jobs, then married women are very likely to be married to men in good jobs and thus more likely to be shirkers than unmarried women (since losing the job opens up the possibility of within household trades and thus raises the possibility of shirking). This may explain the policy of marriage bars, which were prevalent in the U.S., see Goldin (1990 ch. 6, and 1991), which explicitly discriminate against the hiring of married women and call for the dismissal of female employees upon marriage.

a connection between those factors and the decline in prominence of the traditional nuclear family.

This decline has been well documented by sociologists. It appears that almost all of the traditional characteristics of the family have seen a marked change since 1960. Fewer persons are marrying, they are marrying later, more marriages are broken by divorce and those who are marrying are having fewer children, see the survey article by Popenoe (1993) for a discussion of evidence from U.S. census data. According to Popenoe p.528, since the 1960's

“They [families] have grown smaller in size, less stable, and shorter in life span. People have become less willing to invest time, money and energy in family life, turning instead to investments in themselves.”

The model presented here suggests a link between weakening family structure, better female training and reduced discrimination by employers. It would suggest firstly, that the presence of more single people of either gender reduces employers' benefits from discrimination. Secondly, since the size of families is declining, the benefits of within household trade due to specific human capital may be smaller than previously, thus again reducing incentives for discrimination. Finally, though this is not explicitly explored in the current model, if household human capital were explicitly considered, lower expected marriage duration, would imply that the benefits to male employees in good jobs from trade with their spouses may not be available, this would then imply that firm's benefits to reserving good jobs for men exclusively would also be lower and incentives for discrimination weaker.

## 5 Conclusions

In reality, it is not because firms understand the impact of different jobs on the allocation of household tasks that they favour men over women in the allocation of “good” jobs. Firms

probably discriminate because they follow a rule of thumb which states that women are not as good in those jobs or not as reliable as men and should therefore not be hired. This paper provides no explanation or historical analysis for why such a situation may have evolved to the disadvantage of women and not men. The paper does, however, provide one explanation for why rational, profit seeking firms following that rule of thumb may outperform firms who have a more egalitarian hiring policy. I believe any theory of discrimination must do at least this to provide a compelling explanation of a phenomenon that has existed in labour markets for so long. When all others discriminate, one firm benefits by doing so since this ensures reliable employment at a lower price. Here this assurance is endogenous, created as it is by the exclusion of women by other firms, and does not depend on exogenous characteristics of either gender. A hiring policy of discrimination is thus reinforced and maintained in a competitive labour market setting, even when people are all identical.

This explanation differs from traditional explanations of discrimination in that 1) it does not rely on any inherent asymmetry between men and women and 2) it is based on the interaction between men and women within a household. The model also shows, however, that there exist conditions under which an equilibrium in which firms do not wish to discriminate can exist and be a stable outcome. When a non-discrimination equilibrium is stable, Section 3 shows that a policy of affirmative action can move the labour market from the discrimination equilibrium to the non-discrimination equilibrium. That is, non-discrimination can become preferred even by firms not directly affected by affirmative action policies. This suggests that, even if a policy of affirmative action can not target many establishments, it may still have wide ranging effects.

Empirically, the model provides one explanation for why, within occupation types, men seem to be allocated the good, or higher paying, jobs. (For a recent example of this in a competitive labour market see Wood Corcoran and Courant (1993)). It also explains the existence of a wage premium for married men, without any similar premium to married women, and links the recently seen improvements in women's labour market performance to changes in the stability of the traditional family structure.

In conclusion, this paper shows that labour market discrimination can be linked to the allocation of tasks and resources within the household. Perhaps less obviously, the model developed here also demonstrates the self-sustaining nature of a discrimination equilibrium. Not only does discrimination stem from an unequal allocation of household tasks, but, in the other direction, an unequal allocation is reinforced when firms exclude women from the high paying jobs.

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## Appendix

• Maximization problem of a potential seller of household services when trading with a spouse buying, at most,  $H^{max}$  at internal price  $p^n$ , which determines  $\Psi(p^n, H^{max}(p^n))$ . Firstly, note that both  $H^{lim}$  and  $H^{max}$  are less than  $\bar{H}$ , since it is impossible to provide or purchase more household services than exist.

The Kuhn-Tucker conditions for this problem, derived from equations (2.1) to (2.3), are:

$$e_i : p'U'(\cdot) + V'(\cdot) \leq 0, = 0 \text{ if } e^i > 0. \quad (1.1)$$

$$H_i^s : p^n U'(\cdot) + V'(\cdot) - \lambda \leq 0, = 0 \text{ if } H_i^s > 0. \quad (1.2)$$

$$\lambda(H^{max} - H_i^s) = 0 \quad (1.3)$$

where  $\lambda$  is the multiplier on the constraint  $H_i^s \leq H^{max}$ .

Since the objective function is continuous, and the feasible set is non-empty and compact a solution to this set of conditions must exist. Since  $U''(\cdot)$  and  $V''(\cdot) < 0$  the function is globally concave, and thus the uniqueness of the solution is guaranteed.

By the assumption that  $\lim_{c^i \rightarrow 0} U'(c^i) = \infty$ , it follows that  $\hat{e}$  and  $H^{S*}$  cannot both equal zero as neither conditions (1.1) nor (1.2) can be satisfied.

Suppose  $0 < H^{S*} < H^{max}$ . From (1.3) this implies that  $\lambda = 0$ . (1.2) then holds with equality, i.e.

$$p^n U'(\cdot) = -V'(\cdot) \quad (1.4)$$

Since  $\hat{e} > 0$  implies that (1.1) needs to hold with equality and since  $p' < p^n$  and (1.4) violates equality in (1.1), it is only possible that for  $H^{max} > H^{S*} > 0$ ,  $\hat{e} = 0$ .

Since for any  $H^{S*} < H^{max}$ ,  $\hat{e} = 0$ , and since  $\hat{e}$  and  $H^{S*}$  cannot both equal zero, this implies that  $H^{S*} > 0$  always.

Suppose  $H^{S*} = H^{max}$ . This implies that  $\lambda \geq 0$  from equation (1.3). Thus (1.2) implies:

$$p^n U'(\cdot) + V'(\cdot) \geq 0 \quad (1.5)$$



$\hat{e} > 0$  implies  $p'U'(\cdot)+V'(\cdot) = 0$  which is consistent with (1.5), and  $\hat{e} = 0$  implies  $p'U'(\cdot)+V'(\cdot) \leq 0$  which is also consistent with (1.5). So  $H^{S*} = H^{max}$  and both  $\hat{e} = 0$  and  $\hat{e} > 0$  are possible solutions.

- Maximization problem of a potential seller of household services when spouse does not wish to purchase services, i.e.  $H^{max} = 0$ . This problem is similar to the one above except that  $H_i^S = 0$  by equation (2.3) and the individual chooses  $\hat{e}$  only. In this case  $\hat{e} > 0$  as  $\lim_{c_i \rightarrow 0} U'(c_i) = \infty$  implies that (1.1) cannot hold with equality.

- Maximization problem of a potential buyer of household services who is a non-shirker, buying, at most  $H^{lim}$  from spouse at internally negotiated price  $p^n$ , the solution of which determines  $\Psi^{B,\bar{e}}(p^n)$ :

The Kuhn Tucker conditions from equations (2.5) to (2.8) are:

$$H^B : -p^n U'(\cdot) - V'(\cdot) - \lambda_1 - \lambda_2 - p^n \lambda_3 \leq 0, = 0 \text{ if } H^b > 0. \quad (1.6)$$

$$H^e : -p' U'(\cdot) - \gamma V'(\cdot) - \gamma \lambda_2 - p' \lambda_3 \leq 0, = 0 \text{ if } H^e > 0. \quad (1.7)$$

$$\lambda_1 (H^{lim} - H^B) = 0 \quad (1.8)$$

$$\lambda_2 (\bar{H} - H^B - \gamma H^e) = 0 \quad (1.9)$$

$$\lambda_3 (w^g \bar{e} - p^n H^B - p' H^e) = 0 \quad (1.10)$$

Since  $0 \leq H^B \leq \bar{H}$ , and the maximand is continuous, a solution exists. Again, it follows from the strict concavity of the objective function and the convexity of the constraint set that any solution obtained is unique. As seems realistic, I proceed by assuming that the budget constraint for a worker in a good job is never binding with respect to the purchase of household services, thus  $\lambda_3$  will always equal zero at any solution. A solution with this constraint binding does not change any of the results.

Firstly, it can be seen directly from assumption A1, that even though a person in a good job is not precluded from also gaining piece rate work at wage  $p'$  he or she does not wish to.

This is because, to work at wage  $p'$  a necessary condition is:

$$p'U'(w^g\bar{e}) + V'(\bar{e} + \bar{H}) \geq 0. \quad (1.11)$$

But this condition violates assumption A1. Thus ignoring a non-shirker's choice of  $e$  is not critical.

Suppose  $0 < H^{B*} < H^{lim}$  and  $H^{e*} > 0$ . This implies that  $\lambda_1 = 0$  from equation (1.8). Equation (1.6) then implies:

$$-p^n U'(\cdot) - V'(\cdot) = \lambda_2 \quad (1.12)$$

Equation (1.7) implies:

$$-p'U'(\cdot) - \gamma V'(\cdot) = \gamma\lambda_2 \quad (1.13)$$

Re-arranging (1.13) yields

$$\bar{p}U'(\cdot) - V'(\cdot) = \lambda_2 \quad (1.14)$$

recalling that  $\bar{p} = p'/\gamma$  from the paragraph before equation (2.1) in the text. Since  $p^n < \bar{p}$  it is clear that these equations are inconsistent. This implies that for  $0 \leq H^{B*} < H^{lim}$ ,  $H^{e*} = 0$ .

Suppose  $H^{B*} = 0$ , we know this implies  $H^{e*} = 0$  from above. Thus (1.6) implies:

$$-p^n U'(\cdot) - V'(\cdot) \leq 0. \quad (1.15)$$

This in turn implies that  $p^n \geq -\frac{V'(\bar{e}+H)}{U'(w^g e)}$  which directly violates assumption A1. Thus  $H^{B*} > 0$  for a non-shirker.

Suppose  $H^{B*} = H^{lim}$ , it is straightforward to show in this situation that  $H^{e*}$  can be either 0 or greater than zero.

- Maximization problem of a potential buyer of household services who is a shirker, buying, at most  $H^{lim}$  from spouse at internally negotiated price  $p^n$ , the solution of which determines  $\Psi^{B,0}(p^n)$ :

As with the non-shirker, for a shirker it is the case that if  $0 \leq H^{B*} < H^{lim}$  then  $H^{e*} = 0$ . Some

differences are that, in this situation, the worker in good job may not wish to purchase household services from their spouse, i.e. it is possible that  $H^{B*} = 0$ . But if they wish to buy services at all they will wish to buy as much from their spouse as possible before considering buying externally. It may also be the case that they will supplement their income with employment in the piece rate job, i.e.  $\hat{e}$  may exceed zero. The condition for this is:

$$p'U'(w^g\bar{e}) + V'(0 + \bar{H}) \geq 0. \quad (1.16)$$

It can be seen that this condition need not violate assumption A1 because of the 0 term in  $V'$ .

• Proof of Lemma 1, i.e that  $H^B$  is weakly lower for a worker in a good job who sets  $e = 0$  than for one who sets  $e = \bar{e}$ :

In this section denote  $H_{\bar{e}}^{B*}$  the solution for a non-shirker and  $H_0^{B*}$  the solution for a shirker. Clearly if  $H_{\bar{e}}^{B*} = H^{lim}$  for a non-shirker then the assertion is true. Thus since it has been shown above that a non-shirker never sets  $H_{\bar{e}}^{B*} = 0$ , the only case that needs to be considered is the one in which  $0 < H_{\bar{e}}^{B*} < H^{lim}$ . In this situation it has been shown above that  $H^{e*} = 0$ . The first order condition for this case from equation (1.6) is:

$$-p^n U'(w^g\bar{e} + p^n H^i) - V'(\bar{e} + \bar{H} - H^i) = 0 \quad (1.17)$$

since  $\lambda_1$  disappears due to equation (1.8) and  $\lambda_2 = 0$  since  $H^B < H^{lim} < \bar{H}$ . For a shirker this condition is almost identical, the only difference being that in  $V'$ ,  $\bar{e}$  is replaced by a zero yielding:

$$-p^n U'(w^g\bar{e} + p^n H^i) - V'(0 + \bar{H} - H^i) \leq 0 \quad (1.18)$$

It is possible that the solution to this is  $H_0^{B*} = 0$ , if this is the case, then a shirker clearly buys fewer household services. However  $H_0^{B*}$  may be greater than zero. In this case, the condition for determining it is:

$$-p^n U'(w^g\bar{e} + p^n H^i) - V'(0 + \bar{H} - H^i) = 0 \quad (1.19)$$

Since  $V' < 0$  and  $V'' < 0$  the solution to this must strictly be less than the solution to (1.17). Thus if a positive amount but less than the maximum is purchased by both a shirker and a non-shirker, the non-shirker purchases strictly more. Thus it has been shown that, in all possible cases, a shirker buys less than or the same amount of household services than a non-shirker.

• Proof of Lemma 2: The left hand side is the extra gain in utility to a non-shirker by being able to trade household services with their spouse. The right hand side is a similar expression for a shirker. These amounts can be most easily compared by comparing the consumer surplus generated by trade in each of the two cases. Consider Figure A2.1 which sketches the marginal utility of leisure and consumption as a function of total household services purchased  $H^p$ . Total household services purchased comprise those purchased internally upto  $H^{lim}$  since this is always exhausted first, and the remaining amount purchased externally. Since a non-shirker starts off applying  $\bar{e}$  more units of effort, for a given  $H^p$ , her marginal utility of leisure is higher. Thus the shirker's marginal utility of leisure function ( $MUL^0$ ) lies uniformly below that of a non-shirker ( $MUL^{\bar{e}}$ ). The marginal utility of consumption function will be identical for both, since both start with the same income and leisure does not interact with consumption due to the separable utility function. There will be two cases of this function, one with trades available ( $MUC^t$ ) and one without trades ( $MUC^n$ ). The former lying below the latter since, with trades available, services are purchased at a lower price, implying that remaining consumption is greater (for given  $H^p$ ) and thus marginal utility of consumption lower. The consumer surplus from trading for a non-shirker is given by the area between the two curves  $MUC$  and  $MUL^{\bar{e}}$ . Similarly for a shirker with the area between the curve  $MUL^0$  and  $MUC$ . The left hand side of the expression in the lemma is given by the difference between the area between  $MUC^t$  and  $MUL^{\bar{e}}$  and the area between  $MUC^n$  and  $MUL^{\bar{e}}$ , and can be thought of as the consumer surplus available from trading with one's spouse rather than on the market for a non-shirker. This is given by the total shaded area in Figure A2.1. Compare this with the consumer surplus from trading with one's spouse rather than on the market for a shirker which is given by the cross hatch shaded area only representing the difference between  $MUC^t$  and  $MUL^0$  and the area between  $MUC^n$  and  $MUL^0$ . The diagram shows clearly that since  $MUL^0$  always lies below  $MUL^{\bar{e}}$  the intersection point for a non-shirker is always to the right of that for a shirker, thus leading to larger gains from trade and therefore, in terms of the lemma implying that the right hand side of the expression, always exceeds the left.

• Proof that  $\Psi_w^{B,\bar{e}} \geq \Psi_w^{B,0}$ .

$$\Psi^{B,\bar{e}} = U(w^g - p^n H^{B,\bar{e}} - p' H^{e,\bar{e}}) + V(\bar{H} - H^{B,\bar{e}} - \gamma H^{e,\bar{e}} - \bar{e}) \text{ and } \Psi^{B,0} = U(w^g - p^n H^{B,0} -$$

$p' H^{e,0}) + V(\bar{H} - H^{B,0} - \gamma H^{e,0} - 0)$ , where  $H^{B,\bar{e}}$ ,  $H^{B,0}$ ,  $H^{e,\bar{e}}$  and  $H^{e,0}$ , denote the maximized values of the choice variables. The envelope theorem implies that we can ignore induced changes in the maximized variables when considering a change in  $w^g$ . Also, the separability of utility in  $U$  and  $V$  implies that differences in  $e$  do not change the effect of changes in  $w^g$ . However, it follows from Lemma 1 that  $H^{B,\bar{e}} + H^{e,\bar{e}} \geq H^{B,0} + H^{e,0}$  and since  $U''(\cdot) < 0$  it follows directly that  $\Psi_w^{B,\bar{e}} \geq \Psi_w^{B,0}$ . Intuitively, since a non-shirker starts off with a lower level of consumption (because he or she buys more household services) his or her marginal valuation of extra income is greater.

FIGURE 2.1

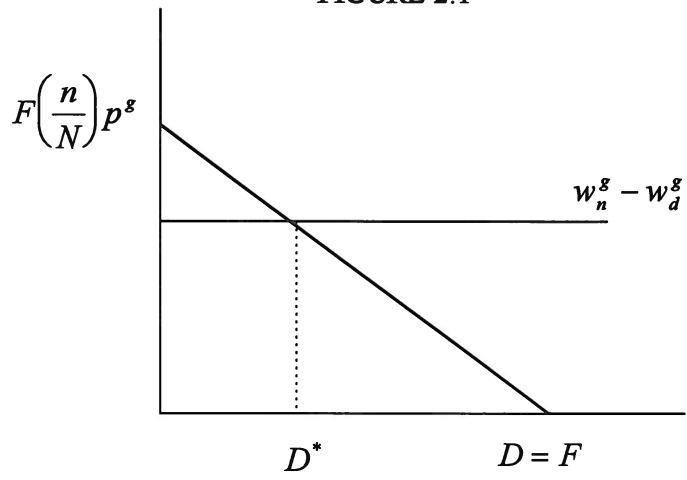


FIGURE 2.2

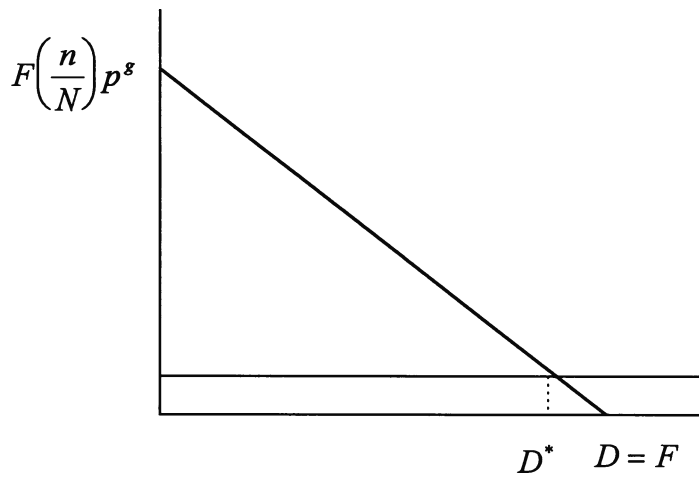


FIGURE A 2.1

