Home Production, Market Production and the Gender Wage Gap: Incentives and Expectations*

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Abstract

We study a self-fulfilling model for the joint determination of gender differentials in earnings and in the household division of labor in an economy where informational frictions give rise to incentive problems in the labor market. We derive predictions on the equilibrium gender differentials in the level and structure of earnings. Specifically, in equilibria in which women's home hours are greater than men's, women will have lower earnings and fraction of incentive pay relative to men. Moreover, gender differences will be greater in occupations where the incentive problem is more severe. We confront these predictions with the data and find that they are broadly supported.

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1 Introduction

One important fact about women in the labor market is the substantial and persistent gender earnings gap. O'Neill (2003) shows that there is still a 10% differential in female and male wages in the U.S. in 2000 that remains unexplained by gender differences in schooling, actual experience and job characteristics. Moreover, there is a substantial gender difference in home hours. PSID data for the period 1976-2001 show that husbands' home hours are roughly one third of wives' and that this difference is stable over time.[1]

We study a self-fulfilling mechanism for the joint determination of gender differentials in earnings and in the household division of labor in an economy with incentive problems in the labor market. We derive predictions on the equilibrium gender differentials in the level and structure of earnings and we confront them with the data. Using the Census and the PSID, we find that these predictions are broadly supported.

The workings of the labor market play a key role in our model. The main assumptions are that the utility cost of work effort is increasing in home hours, as in Becker (1985), and that effort as well as home hours are private information. Firms and workers negotiate over earnings. Firms offer incentive compatible labor contracts that are constrained-efficient. Households value a public home good produced with time of both spouses. Household decisions are Pareto efficient, so that the allocation of home hours only depends on the spouses' relative earnings. The incentive problems in the labor market amplify gender differentials in earnings due to differences in home hours, while earnings differentials across genders reinforce the division of labor within the household, leading to a potentially self-fulfilling feedback mechanism. Even when productivity in home and market work across genders is the same, gendered equilibria are possible. If, for example, firms believe that home hours are higher for women, they will offer them labor contracts with lower earnings and effort. Then, the opportunity cost of home hours is lower for women and wives will allocate more time to home production, thus confirming firms' beliefs.

There are two classes of predictions in the model: partial equilibrium predictions on the relation between home hours, earnings and the fraction of incentive pay and general equilibrium predictions on the allocation of home hours across genders. Specifically, the workers' earnings and effort are inversely related to home hours, and higher effort corresponds to higher fraction of incentive pay. It follows that in equilibria in which women's home hours are greater than men's, women will be offered contracts that specify a lower level of effort, leading to lower earnings and lower fraction of incentive pay relative to men. An additional property of these equilibria is that gender differences in earnings and the fraction of incentive pay are positively related to the extent of the gender differential in home hours as well as the severity of the incentive problem. While our environment features a representative household and a representative firm, we posit that the severity of the incentive problem may vary across occupations. Then, our model delivers predictions on gender differentials in earnings and the structure of compensation across occupations.

Our empirical analysis confronts these predictions with the data, exploiting a variety of data

[1] Authors' calculation based on the PSID that update evidence reported in Kristin and Rupert (1995).

sources. We use Census data for year 2000 to study aggregate gender earnings differentials by marital status across industries and for three broad occupational categories: management, sales and production. We argue that incentive problems are most stringent in management and sales. Managers have a wide range of responsibilities, hence, the uncertainty associated with their performance, given their effort should be greater. Similarly, sales volumes depend to a large degree on variables that are not directly related to sales personnel's effort. These considerations are less important for production workers. We find that gender differentials in earnings are greater for married workers than for single workers in all industries and occupations, controlling for age and education. Moreover, gender differentials in earnings are greatest in management and sales occupations for married workers. Gender earnings differentials do not vary greatly by marital status for production workers, consistently with our model.

Since the Census does not include information on the structure of earnings, we use PSID data from the late 1990s to document the negative relation between the male/female difference in the fraction of incentive pay and the female/male earnings ratio. We find a negative and significant correlation between the two ratios across occupations. Moreover, differences in incentive pay account for 10 to 21% of the gender earnings differential for management occupations, and 6% for sales occupations. This evidence provides additional support for our Census findings, since incentive pay is used more in those occupations where the incentive problem is more severe, as discussed in MacLeod and Parent (2003). In a cross-section of married couples from the PSID, we also find a negative correlation between the wife/husband ratio of home hours and the wife/husband ratio of earnings, and a positive correlation between the hours ratio and the husband-wife difference in the fraction of incentive pay. These findings as consistent with our model's prediction.

Our model bridges three literatures: the literature on the sexual division of labor in the Beckerian tradition; the one on incentive contracts and job design, as in Holmstrom and Milgrom (1991); and finally the literature on statistical discrimination, as in Coate and Loury (1993). The centerpiece of our model is to identify the source of statistical discrimination with the incentive problem on the labor market. The idea that gender differences in labor market outcomes can result from a self-fulfilling mechanism based on the household is not new and dates back to Francois (1998)[2]. We make two novel contributions relative to the literature. First, the model we develop is based on a general constrained-efficient contracting framework that minimizes the potential for statistical discrimination, since it allows firms to offer menus of contracts. The generality of the environment enables us to provide additional empirical insights that are not sensitive to the details of our model. Secondly, we bring new empirical evidence to bear in support of these predictions.

Our model emphasizes the importance of incentives for gender differences in earnings and the structure of compensation. In this we build on Goldin's (1986) pioneering study. She explores the role of supervisory and monitoring costs in rationalizing aspects of occupational segregation by gender. She argues that the prevalence of piece-rate compensation in manufacturing and of "career tracks" in the clerical sector can both be understood in the context of a labor market model with private information and costly monitoring, where firms use gender as

[2] Also see Francois and van Ours (2000) for a related contribution.

a signal of labor market attachment. Goldin (1990) concludes that "... By segregating workers by sex into job ladders (and some dead-end positions), firms may have been better able to use the effort-inducing and ability-revealing mechanisms of the wage structure." More recently, Gayle and Golan (2006) estimate a structural dynamic adverse selection model with learning-by-doing. They quantify the effects of statistical discrimination on the changes in labor market experience and the gender earnings gap between the late 1970's and the late 1980's. They find that it can account for approximately 13% of the decline in the gender earnings gap.

These arguments also resonates with current debates on gender discrimination in personnel policy. For example, in June 2004 a federal judge ruled in favor of class-action status for the Dukes vs Wal-Mart gender discrimination lawsuit. The ruling was based on extensive evidence presented by the plaintiffs, Drogin (2003), showing that women working at Wal-Mart stores face pay disparities in most job categories, and take longer to enter management positions.[3] Finally, it is also interesting to note how expectations of a gender wage gap characterize both male and female workers. As documented by Babcock and Laschever (2003): "Women report salary expectations between 3 and 32 percent lower than those of men for the same jobs; men expect to earn 13 percent more than women during their first year of full-time work and 32 percent more at their career peaks."

Our paper is organized as follows. Section 2 presents the model and discusses the results of numerical simulations. Section 3 reports evidence supporting the model's predictions. Finally, Section 4 concludes.

2 The Model

The economy is populated by a continuum of adult agents, ex ante identical except for gender, and a continuum of identical firms. The agents are equally divided by gender, they are all married and belong to a household. All households are made up of two agents of different gender.[4] There are two types of goods in this economy- a market good and a home good. Individual utility is increasing in consumption of the market and home goods and decreasing in the number of hours worked at home and in the effort applied to market work. Households combine the market good and home hours of each spouse to produce the home good, which is household specific. Each household efficiently chooses the allocation of home hours across spouses. Firms produce the market good using labor as the only input. Individual agents are employed by a firm and each firm hires a continuum of workers. On the labor market, each firm and individual worker negotiate over labor contracts.

We now describe the problems of the representative firm and the representative household, and then present our definition of equilibrium.

[3] Discrimination lawsuits based on analogous complaints where filed by a team of women brokers at Merrill Lynch and by women researchers working at Rand corporation during the summer of 2004. See The New York Times, August 22, 2004 and The New York Times, September 5, 2004, respectively.

[4] Since the purpose of this paper is to study the joint determination of gender differentials in labor market outcomes and in the household division of labor, we abstract from modelling marriage decisions and concentrate on married couples.

2.1 Labor Contracts

The representative firm hires agents to produce output. An agent's output is a function of her effort:

$$y = f(e) + \omega, \tag{1}$$

The function $f(e)$ denotes expected output, where f is strictly increasing, twice continuously differentiable and weakly concave. The random variable ω is distributed normally with zero mean and variance $\Sigma^2 > 0$.

Agents' utility function, irrespective of gender, is:

$$U(c, h, e) = -\exp(-\sigma[c - v(h, e)]) + \theta \log G, \tag{2}$$

where c is individual consumption of the market good, h denotes home hours, e denotes effort applied to market work, and G is consumption of the home good. We adopt a CARA specification for utility over private market consumption, home hours and effort. The coefficient of absolute risk aversion is $\sigma > 0$, and $v(\cdot)$ denotes the disutility of market and home work, where $h \in \mathbb{R}_+$ and $e \in [0, 1]$. The function v is increasing in both its arguments, twice continuously differentiable. Following Becker (1985), we posit that an agent's marginal utility cost of effort is increasing in home hours:

$$v_{he} > 0. \tag{3}$$

The firm chooses labor contracts to maximize the surplus from the employment relationship. We assume that effort, e, and home hours, h, are *not observed* by firms, while output, y, is *observable*. Since home hours do not influence agents' output directly, they can be interpreted as an agent's *type* from the standpoint of firms. As in Holmstrom and Milgrom (1991), the unobservability of effort gives rise to *moral hazard*. The unobservability of home hours determines an additional *adverse selection* problem.

The optimal labor contracts will specify an earnings function, w, and effort to be implemented for each type of agent, h, in the population. Earnings will depend on output. This property is required to implement strictly positive effort, given the private information. Moreover, since home hours are also unobserved, the optimal menu of contracts will depend on the firms' belief over the distribution of home hours. We characterize this distribution with its density π, which is taken as given by firms but will be endogenously determined in equilibrium. Then, the optimal labor contract can be represented as a mapping, $\mathcal{C}(\pi) = \{w, e\}(h)$, where h is understood to belong to the support of π. Condition (3) is the analogue of a single crossing condition. It ensures that, given that contracts are incentive compatible, agents with home hours h will self-select into the appropriate contract in the menu implied by $\mathcal{C}(\pi)$. Since the contract space is *unrestricted*, the optimal labor contract will be constrained-efficient.

To isolate the role of moral hazard and adverse selection on the properties of the optimal labor contracts, we first consider the firm's problem when home hours are observable and then consider the case with private information on home hours.

If home hours are public information but effort is not observable, labor contracts solve:

$$\max_{\{w(y), e\}, e \in [0,1]} S(e; h) \tag{Problem F1}$$

subject to

$$e = \arg\max_{e\in[0,1]} E\left[U\left(c,h,e\right)\right], \tag{4}$$

where the objective function is the expected surplus from the employment relationship, and (4) is the incentive compatibility constraint associated with moral hazard.[5]

As shown in Holmstrom and Milgrom (1991), CARA utility implies that, without loss of generality, we can restrict attention to earnings functions of the form: $w\left(y\right) = \bar{w} + \tilde{w}y$. We refer to $\bar{w}$ and $\tilde{w}y$ as salary and incentive pay, respectively. This implies that the expected surplus from the employment relationship corresponds to the certainly equivalent given by:

$$S\left(e;h\right) = f\left(e\right) - v\left(h,e\right) - \sigma\Sigma^2\left(\tilde{w}\right)^2/2. \tag{5}$$

The first term is expected output, the second term is the utility cost of working, given home hours h. The last term corresponds to the reduction in the agents' utility due to earnings variability.

The CARA assumption on preferences implies that individual wealth is irrelevant for the agents' choice of effort and therefore for incentives. As will become clear in section 2.2, in our model individual wealth depends on household wealth, as well as on home hours and the labor market outcome of the spouse. It follows that CARA utility ensures that firms do not need to condition contracts on any household variables. Then, the incentive compatibility constraint can be restated in the following simple form:

$$e = \arg\max_{e\in[0,1]} \tilde{w}f\left(e\right) - v\left(h,e\right). \tag{6}$$

Using the first order approach, we can replace (6) with the following:

$$\begin{aligned} \tilde{w}f'\left(e\right) &= v_e\left(h,e\right), && (7)\\ \tilde{w}f''\left(e\right) - v_{ee}\left(h,e\right) &\leq 0. && (8) \end{aligned}$$

Since we assume $f'' \leq 0$ and $v_{ee} > 0$, (8) will automatically be satisfied. The salary component of earnings does not influence workers' incentives to exert effort. We impose a zero profit condition on firms, which implies: $\bar{w} = y\left(1-\tilde{w}\right)$ and $w = y$.

To obtain analytical solutions, we will restrict attention to the following functional forms:

$$\begin{aligned} f\left(e\right) &= e, && (9)\\ v\left(h,e\right) &= \left(\psi + h\right)\frac{e^2}{2}. && (10) \end{aligned}$$

The parameter $\psi > 0$ can be interpreted as a fixed cost of working on the market.

Proposition 1 *The optimal labor contract with observed home hours satisfies:*

$$\begin{aligned} e^*\left(h\right) &= \frac{1}{\left(\psi+h\right)\left(1+\sigma\Sigma^2\left(\psi+h\right)\right)}, && (11)\\ \tilde{w}^*\left(h\right) &= \left(\psi+h\right)e^*. && (12) \end{aligned}$$

[5] Consumption of the home good is irrelevant for incentive compatibility given that utility is separable between market and home goods. Hence, we can ignore it for Problem F1 and Problem F2 below.

In addition, expected earnings are given by $Ew^*(h) = f(e^*(h))$, *with* $Ew^{*\prime}(h) < 0$ *and* $Ew^{*\prime\prime}(h) > 0$.

Proof. In Appendix. ■

The main properties of the optimal contract are that effort, e, the fraction of incentive pay, $\tilde{w}$, and expected total earnings, w, are *decreasing* in h. This follows from the assumption that the marginal utility cost of effort is increasing in home hours and, therefore, it is more costly for firms to provide incentives to workers with high home hours. Effort and the fraction of incentive pay also decrease with the parameter Σ. High values of Σ reduce the ability of output to serve as a signal for high effort, making the moral hazard problem more severe. By a similar logic, effort and the fraction of incentive pay also fall with risk aversion, σ.

If both home hours and effort are unobserved, the firm also faces adverse selection incentive compatibility constraints. She will offer a menu of contracts corresponding to each value of home hours in the population and workers will self-select the contract appropriate to their type. The workers with binding adverse selection incentive compatibility constraints will extract an informational rent, which reduces the surplus from the employment relation.

We assume that home hours can only take on two values and $h \in \{h_L, h_H\}$ with $h_L < h_H$, respectively, with distribution $\pi(h_j)$ for $j = L, H$, since this is the only case that can occur in equilibrium, as we prove in section 2.3. The representative firm takes h_L, h_H and $\pi(\cdot)$ as given, but the support of the home hours distribution will be determined from the optimal equilibrium behavior of the representative household.

The contracting problem with adverse selection is given by:

$$\max_{\{e_j, \tilde{w}_j\}_{j=L,H}, T_L, T_H} \sum_j \pi(h_j) \left(f(e_j) - v(h_j, e_j) - \sigma \Sigma^2 \frac{\tilde{w}_j^2}{2} - T_j \right) \qquad \text{(Problem F2)}$$

subject to

$$\tilde{w}_j f'(e_j) = v_e(h_j, e_j) \qquad (13)$$

$$f(\hat{e}_i)\tilde{w}_i - v(h_j, \hat{e}_i) - \sigma\Sigma^2 \frac{\tilde{w}_i^2}{2} + T_i \leq f(e_j)\tilde{w}_j - v(h_j, e_j) - \sigma\Sigma^2 \frac{\tilde{w}_j^2}{2} + T_j \qquad (14)$$

$$f'(\hat{e}_i)\tilde{w}_i = v_e(h_j, \hat{e}_i), \qquad (15)$$

for $j = L, H$, where $\hat{e}_i$ denotes the level of effort chosen by an agent of type j when she untruthfully reports to be of type i, and T_j, $j = L, H$ denotes the informational rent If the distribution of home hours is degenerate so that $\pi(h_L) = 1$ or $\pi(h_H) = 1$, then this problem collapses to Problem F1

We now state a proposition that simply summarizes the relevant properties of the optimal labor contracts. The full analytical characterization of optimal labor contracts for Problem F2 and a formal proof of the proposition, as well as a full discussion of their properties in this case can be found in Albanesi and Olivetti (2006).

Proposition 2 *For* $j = L, H$, $\tilde{w}_j^*$, w_j^* *and* e_j^* *are decreasing in* h_j. *A) If utility is decreasing in* $\tilde{w}$ *for both types, the adverse selection incentive compatibility constraint (14) is binding for* *workers with* low *home hours. Then,* $T_L > 0$ *and* $\tilde{w}_H > \tilde{w}_L$. *B) If utility is increasing in* $\tilde{w}$ *for both types, the adverse selection incentive compatibility constraint (14) is binding for workers with* high *home hours. Then,* $T_H > 0$ *and* $\tilde{w}_L > \tilde{w}_H$. *C) If utility is increasing in* $\tilde{w}$ *for* h_L *types and decreasing in* $\tilde{w}$ *for* h_H *types, the adverse selection incentive compatibility constraints (14) is* not *binding. Then,* $T_j = 0$ *and* $\tilde{w}_j^*$, w_j^* *and* e_j^* *satisfy (12) and (11) for* $j = L, H$.

The three possible scenarios depend on the binding pattern of adverse selection incentive compatibility constraints, which in turn is a function of the primitives of the firm problem. Cases A) and B) can only arise if the difference between high and low home hours, $h_H - h_L$, is large enough. They feature an additional distortion in the allocation of effort due to the binding adverse selection incentive compatibility constraint, which reduces total output relative to the case when home hours are known. It follows that equilibria with adverse selection are Pareto dominated by equilibria with observable home hours, for given values of h_L and h_H. In case C), the adverse selection constraints are not binding and the optimal menu of labor contracts corresponds to the one in which home hours are observed, that is Problem F1.

In all cases, earnings, the fraction of incentive pay and effort for each type are decreasing in home hours as in the case with observable hours. Adverse selection implies in addition that differences in total earnings across workers with high and low home hours are greater and average output is lower than in the case with only moral hazard.

Given that gender is observable, firms can offer different contracts to female and male workers. They will find it optimal to do so *if and only if* they believe that the distribution of home hours differs across genders. We then denote the set of labor contracts offered with $C_i(\pi_i) = \{w_i^*, e_i^*\}(h)$, $i = f, m$, where f, m stand for female and male and the functions w_i^* and e_i^* satisfy Problem F2. If $\pi_f = \pi_m$, the same set of labor contracts will be offered to both genders.

The labor contracting environment described above parsimoniously embeds elements of job design and of optimal compensation policy, as discussed in Milgrom and Roberts (1992). Interpreting the variable y as an observable measure of performance, the incentive pay component in earnings is consistent with a variety of widely used compensation schemes. For example, for sales workers, y would correspond to the volume of sales and $\tilde{w}$ to the commission rate. For management positions, y may stand for profits for the unit under a manager's supervision with $\tilde{w}$ representing the bonus rate. For production workers, y would correspond to units of output and $\tilde{w}$ to the piece-rate. A menu of contracts in which one specifies high effort and one specifies low effort can also be interpreted as two different jobs or positions within a firm.[6]

2.2 Households

The representative household takes as given the price of the market good and the mapping between individual home hours, earnings and effort, conditional on gender, implied by the labor contracts offered by firms, $\mathcal{C}_i(\pi_i) = \{w_i^*, e_i^*\}(h)$, $i = f, m$. The fact that labor contracts

[6] For this interpretation, see Lommerud and Vagstad (2007).

are incentive compatible and the CARA specification of preferences jointly imply that *individual* optimality of effort for given home hours is satisfied for each spouse for given h_i and a consumption level $c_i \geq 0$ under the optimal contracts. We can then define the following individual indirect utility function:

$$V_i\left(s_i, h_i; \mathcal{C}\right) = EU\left(c_i, h_i, e_i^*\left(h_i\right)\right), \tag{16}$$

for $i = f, m$, from the solution of Problem F2.

The production function for the home public good is

$$G = g\left(h_f, h_m, k\right), \tag{17}$$

where k is the amount of market good used in home production. We restrict attention to specifications in which h_f and h_m are substitutes. We assume that g is increasing in each argument and concave.

The representative household's problem is to choose G, k h_i and c_i to maximize:

$$\sum_{i=f,m} \lambda_i V_i\left(c_i, h_i; \mathcal{C}\right) + \theta \log\left(G\right), \tag{Problem H}$$

subject to (17),

$$h_i, c_i \geq 0 \text{ for } i = f, m, \tag{18}$$

$$k = a + \sum_i w_i^*\left(h_i\right), \tag{19}$$

where a denotes exogenous household wealth. The parameters, λ_i, for $i = f, m$, represent the weight of each spouse in household decisions[7].

2.2.1 Choice of Home Hours

The optimal allocation of home hours depends on the spouses' relative opportunity cost of home hours and, therefore, on the prevailing labor contracts. The substitutability of spousal hours implies that marginal differences in market earnings will give rise to an allocation of home hours in which the spouse with lower earning potential in market work devotes more time to home production. We interpret the intra-household allocation of home hours as a long term arrangement of the spouses, that may be costly to reverse in the short run.

We assume that G is produced according to the following technology:

$$g\left(h_f, h_m, k\right) = H\left(h_f, h_m\right)^{\delta} k^{1-\delta}, \tag{20}$$

$$H\left(h_f, h_m\right) = \left[h_m^{\zeta} + h_f^{\zeta}\right]^{1/\zeta}, \tag{21}$$

[7] Problem H implies that household decisions are Pareto efficient, as in Chiappori's (1997) "collective labor supply" approach. This framework is consistent with a variety of "household bargaining" models, as in McElroy and Horney (1981) and Manser and Brown (1980). See also Bergstrom (1997) for a review.

with $\delta, \zeta \in (0,1)$. The function $H(\cdot)$ aggregates the contribution of spousal home hours to the production of the home public good. The parameter δ denotes the contribution of market goods to the production of the public home good, while ζ determines the substitutability of spousal home hours in home production.

The optimal choice of h_f, h_m, k and G can be analyzed as a sequence of cost minimization problems and is independent of the Pareto weights λ_i. The optimal values of h_f and h_m for given H solve the following cost minimization problem:

$$C^H\left(\bar{H};\mathcal{C}\right) = \min_{h_f,h_m \geq 0} Ew_f\left(h_f\right) + Ew_m\left(h_m\right) \qquad \text{(Problem H1)}$$

subject to

$$\left[h_m^{\zeta} + h_f^{\zeta}\right]^{1/\zeta} \geq \bar{H},$$

for given $\bar{H} > 0$ and given $\mathcal{C}_j\left(\pi_i\right)$ for $j = f, m$. Here, expectations are taken with respect to ω.

The first order necessary conditions are:

$$\left(\frac{h_f}{h_m}\right)^{1-\zeta} = \frac{E\left[w_m'\left(h_m\right)\right]}{E\left[w_f'\left(h_f\right)\right]}, \tag{22}$$

$$\bar{H} = h_m\left[\left(\frac{h_f}{h_m}\right)^{\zeta} + 1\right]^{1/\zeta}, \tag{23}$$

where $w'(h)$ denotes the derivative of total earnings with respect to home hours, which corresponds to the opportunity cost of home hours. The sufficient condition for optimality of the home hours allocation is:

$$h_f \gtrless h_m \;\Leftrightarrow\; Ew_f\left(h_f\right) \lessgtr Ew_m\left(h_m\right). \tag{24}$$

The terms $E\left[w_j'\left(h_j\right)\right]$ for $j = f, m$ correspond to the opportunity cost of home hours for each spouse and depend on labor contracts. Equation (22) implies that the spouse with lower opportunity cost, will devote more time to home production. The difference in spousal home hours for given labor contracts depends on the elasticity of substitution in H. If $w_f(h) = w_m(h)$ for all $h \geq 0$, that is the same menu of labor contracts is being offered to workers of different gender, households are indifferent over the allocation of home hours across spouses and they will randomize.

We describe the problems for the choice of H, k and G in Appendix. The solution to the household problem can be represented by the policy functions $c_i(a;\mathcal{C})$, $h_i(a;\mathcal{C})$, $k(a;\mathcal{C})$, and $G(a;\mathcal{C})$ for $i = f, m$.

2.3 Equilibrium

We now provide a definition of equilibrium for our economy.

Definition 3 *An equilibrium is given by beliefs on the distribution of home hours* $\pi_i(h)$ *for* $i = f, m$, *labor contracts* $\mathcal{C}_i(\pi_i) = \{w_i(y), e_i\}(h)$ *for* $i = f, m$, *and policy functions for the household* $\{G, k, h_f, h_m, c_f, c_m\}(a, \mathcal{C})$, *such that:*

i) Labor contracts solve Problem F2, given beliefs;

ii) Household policy functions solve the household problem, given labor contracts;

iii) The resulting distribution of home hours in the population is consistent with firms' beliefs.

The equilibrium distribution of home hours is the outcome of a self-fulfilling mechanism. Firms' beliefs over this distribution shape the trade-off faced by households in the allocation of home hours, since they determine the spouses' relative earning potential by gender. The representative household takes labor contracts as given and chooses home hours based on this trade-off. This, in turn, induces the effective distribution of home hours in the population. Given that individuals of different gender are ex ante identical, the equilibrium distribution of home hours across genders only depends on firms' self-fulfilling beliefs.

We say that an equilibrium is *gendered* when firms believe that the distribution of home hours is different for female and male workers. We say that it is *ungendered* otherwise. The same selection of labor contracts will be offered to female and male workers in ungendered equilibria. The household will be indifferent over which spouse should be assigned high home hours and they will randomize.

We focus on *symmetric* equilibria, in which identical agents take the same actions. This is a natural restriction, given our representative agent/firm assumption. The following proposition characterizes the full set of possible symmetric equilibria.

Proposition 4 *In any symmetric equilibrium, there will at most be two values of home hours in the population,* $\{h_L, h_H\}$, *with* $0 < h_L \leq h_H$. *The set of equilibria uniquely includes:*

i) Two gendered equilibria *with degenerate distribution of home hours,* $\pi_i(h_H) = 1$ *and* $\pi_j(h_L) = 1$ *for* $i, j = f, m$ *and* $i \neq j$;

ii) One ungendered equilibrium *with degenerate distribution of home hours,* $\pi_f(\bar{h}) = \pi_m(\bar{h}) = 1$ *for some* $\bar{h} > 0$;

iii) A family of ungendered equilibria *with non-degenerate distribution of home hours,* $\pi_f(h_j) = \pi_m(h_j) \in (0, 1)$ *for* $j = L, H$.

We prove proposition 4 in the Appendix. Here, we describe the argument heuristically, since it clarifies the feedback mechanism between labor contracts and the households' problem.

The first result is a mere consequence of the fact that all agents are identical except for gender and we are restricting attention to symmetric equilibria. Given that there can be at most two values of home hours in the population, if the representative firm believes that the distribution of home hours is different across genders, then such a distribution will be degenerate. Then, there will be no adverse selection in equilibrium.

To illustrate the argument, we focus on the gendered equilibrium in which women have higher home hours. For such an equilibrium to exist, equation (22) must have a solution with $h_m/h_f < 1$. Equation (22) is represented in figure 1 for a given value of h_f. The solid line

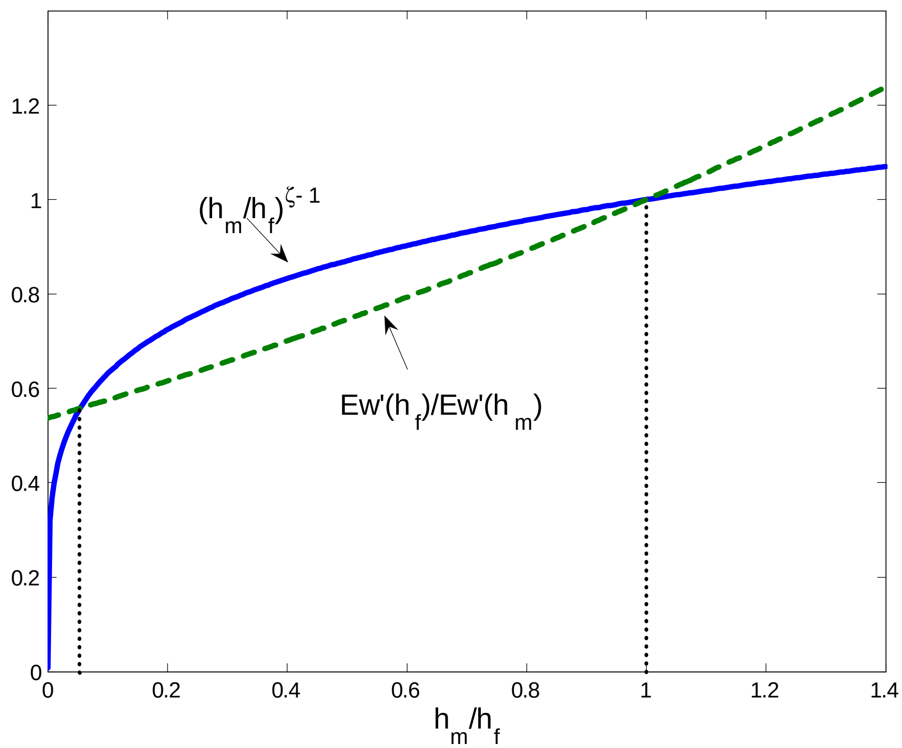

Figure 1: Solutions to equation (22).

represents the left hand side of the equation while the dashed line represents the right hand side. This curve is plotted allowing for "out of equilibrium" menus of labor contracts that satisfy the restriction, $\max Ew_f(h) < \max Ew_m(h)$. By Propositions 1 and 2, this restriction would arise if the representative firm believes that female workers have lower home hours than male workers.

Generically, there are two values of the ratio h_m/h_f that solve this equation for given h_f. The first is $h_m/h_f = 1$, the second is a value of this ratio strictly greater than zero and strictly smaller than 1. Given that $\max Ew_f(h) < \max Ew_m(h)$, a symmetric allocation of home hours is not optimal for Problem H1. Therefore, the solution is the one with higher female home hours. This pins down the equilibrium ratio of home hours and establishes that the distribution $\pi_f(h_H) = 1$ and $\pi_m(h_L) = 1$ is an equilibrium. The equilibrium value of h_f can then be derived by solving the rest of the household problem. Since Problem H1 has a unique solution, the resulting equilibrium is unique in its class. A similar reasoning can be used to construct the equilibrium in which men have higher home hours. Finally, the ungendered equilibrium can be constructed based on the restriction $Ew_f(h) = Ew_m(h)$, which implies that $h_f = h_m$ solves Problem H1.

An immediate implication of the fact that there can be at most two values of home hours in the population is that any equilibrium with non-degenerate distribution of home hours must be ungendered. A non-degenerate distribution of home hours in a symmetric equilibrium requires household to randomize over the allocation of home hours across spouses, so that they must be indifferent over this allocation. This outcome can occur only if firms believe such a distribution to be identical across genders. The existence of this equilibrium can be guaranteed by appropriately restricting the parameters. Rather than characterize these restrictions, we concentrate on ungendered equilibria with a degenerate distribution of home hours, since they strictly Pareto-dominate ungendered equilibria with non-degenerate distribution.

Proposition 4 identifies the set of possible equilibria for the model with no ex ante differences across genders. Only one of these equilibria reproduces the arrangement prevailing in most societies, in which men specialize in market production and women in home production leading to lower relative earnings for women. This pattern has often been justified on the basis of biological differences leading to a comparative advantage for women in home production, namely their ability to bear children.

To explore this argument, we allow women to be more productive in home work. Specifically, we posit that:

$$H(h_f, h_m) = \left[h_m^{\zeta} + (1+\varepsilon)\, h_f^{\zeta}\right]^{1/\zeta}, \tag{25}$$

where $\varepsilon > 0$. A strictly positive sign of ε corresponds to women's higher relative productivity in home work, which we relate to their ability to bear children. The parameter ε can be interpreted as a measure of the decreased relative market productivity of women during and after pregnancy. Alternatively, if children are viewed as a component of the public home good, ε captures women's greater relative contribution in its production due to their ability to give birth and breast feed children. We maintain the assumption that female and male workers are equally productive in market work.

The following result holds.

Proposition 5 *There exists a unique value of* ε, $\bar{\varepsilon}$, *such that: i) For* $0 < \varepsilon \leq \bar{\varepsilon}$, *there are two equilibria, one of which features* $h_f/h_m < 1$, *with distribution of home hours* $\pi_f(h_H) = 0$ *and* $\pi_m(h_L) = 0$, *and one which features* $h_f/h_m > 1$, *with distribution of home hours* $\pi_f(h_H) = 1$ *and* $\pi_m(h_L) = 1$; *ii) for* $\varepsilon > \bar{\varepsilon}$, *there is one equilibrium with* $h_f/h_m > 1$ *and distribution of home hours* $\pi_f(h_H) = 1$ *and* $\pi_m(h_L) = 1$.

The proof is in the Appendix. The argument is similar to the proof of proposition 4.

Proposition 5 has several interesting implications. No ungendered equilibria are possible when there are ex ante differences across genders. Interpreting ε as a small perturbation to relative productivities across genders, this result implies that the ungendered equilibrium with a degenerate distribution of home hours, described in Proposition 4, is unstable. On the other hand, there always exists an equilibrium in which wives devote more time to home production. In this equilibrium, h_f/h_m is increasing in ε. Surprisingly, if relative productivity differences are small enough, an additional equilibrium exists in which wives' home hours are *lower* than husbands'. The region of multiple equilibria can be characterized by the threshold $\bar{\varepsilon}$.

The existence of this counterintuitive equilibrium is rooted in the incentive problem on the labor market. If firms believe that women's home hours are lower than men's, the optimal labor contracts will specify higher effort and higher marginal earnings for women, offsetting their comparative advantage in home production. Households will consequently find it optimal for wives to devote less time to home work than husbands. Such an equilibrium is more likely to exist, if the degree of complementarity in spouses' home hours in home production is high, which corresponds to low values of the parameter ζ in the aggregator $H(h_f, h_m)$. A greater degree of complementarity reduces the incentives to specialize within the household. The threshold $\bar{\varepsilon}$ also negatively depends on the utility cost of market work ψ. Hence, technological changes that reduce the complementarity between spouses' hours in the production of the public home good would reduce the region in which the equilibrium with lower home hours can occur for given ε. By contrast, a lower value of the utility cost of work would expand this region.

Taken together, these results suggest a potential explanation for both the prevailing pattern of gender specialization and for the persistence of gender wage differentials. Initially, poor medical knowledge and obstetric practices and the lack of alternatives to breast feeding imply that ε is high and the only possible equilibrium is one in which women are mostly devoted to home production and men specialize in market work. Advances in this area can be captured as a decline in the value of ε. These improvements give rise to the possibility of ungendered equilibria. The self-fulfilling nature of the equilibrium for low ε implies that ungendered equilibria may not prevail, despite the declining differences in relative productivities. We explore the impact of medical progress related to motherhood in Albanesi and Olivetti (2007).

2.4 The Feedback Between Home Hours and Labor Market Outcomes

To explore the relation between home hours and earnings predicted by our model, we now conduct several comparative statics exercises. Since our equilibrium analysis concentrates on equilibria with degenerate distribution of home hours, we restrict attention to labor contracts under moral hazard only that satisfy Proposition 1.

We first study the role of the parameter Σ, which corresponds to the standard deviation of output for given effort. An increase in this parameter makes it harder to infer effort from observed output and exacerbates the incentive problem. Equation (11) makes clear that effort is decreasing in the value of this parameter, and that this effect is greater for higher levels of home hours. Given that higher Σ reduces the optimal level of effort to be implemented, the fraction of incentive pay will also be declining in Σ. By equation (12), this effect will be stronger at higher home hours, since the marginal cost of effort for the worker is increasing in home hours.

Taken together, these properties of labor contracts imply that if women's home hours are higher than men's, the female/male earnings ratio will be declining in Σ, while the male-female difference in the fraction of incentive pay will be increasing in Σ. This property is illustrated in figure 2 for a numerical example. The female/male earnings ratio corresponds to the red line (left axis) and the difference in the fraction of incentive pay between male and female workers corresponds to the black line (right axis). Σ ranges between 0 and 70% of worker potential output. Home hours are set to $h_f = 0.3$ and $h_m = 0.1$, which corresponds to the average ratio

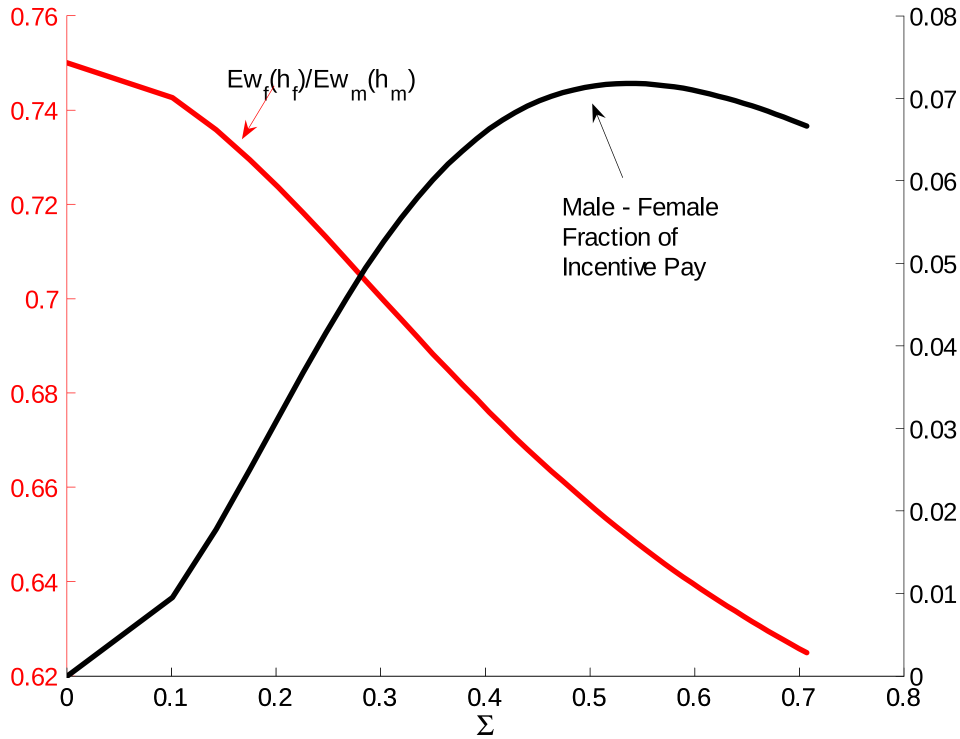

Figure 2: Properties of optimal labor contracts for $h_f = 0.3$ and $h_m = 0.1$.

of wives to husbands home hours observed in the PSID for the 1990's.[8]

For $\Sigma = 0$, effort is equal to output, there is no moral hazard, and the fraction of incentive pay is zero for both female and male workers. However, since women have higher home hours, firms will offer them a labor contract in which they exert lower effort. Hence, earnings will be lower for female workers. In this example, the earnings ratio is 75%. Positive values of Σ exacerbate gender differentials in earnings for given differences in home hours. As Σ increases, the earnings ratio drops quite rapidly, while the male-female fraction of incentive pay increases. For Σ equal to 50%, the earnings ratio is equal to 60%, while male workers' fraction of incentive pay is 8 percentage points greater than for female workers.

In figure 3, we reproduce this graph for smaller differences in home hours across genders, specifically $h_f = 0.15$ and $h_m = 0.10$. The ratio of female to male home hours in this example corresponds to the average female/male ratio of home hours for never married workers in the PSID. The pattern of variation in relation to Σ is analogous to that in figure 2. However, the earnings ratio is significantly higher, equal to 93% for $\Sigma = 0$ and dropping to 89% for $\Sigma = 50\%$. The difference in the fraction of incentive pay across male and female workers only reaches 2% for $\Sigma = 50\%$.

These findings translate into the following predictions:

[8]Other parameter values are $\psi = 0.1$ and $\sigma = 1$.

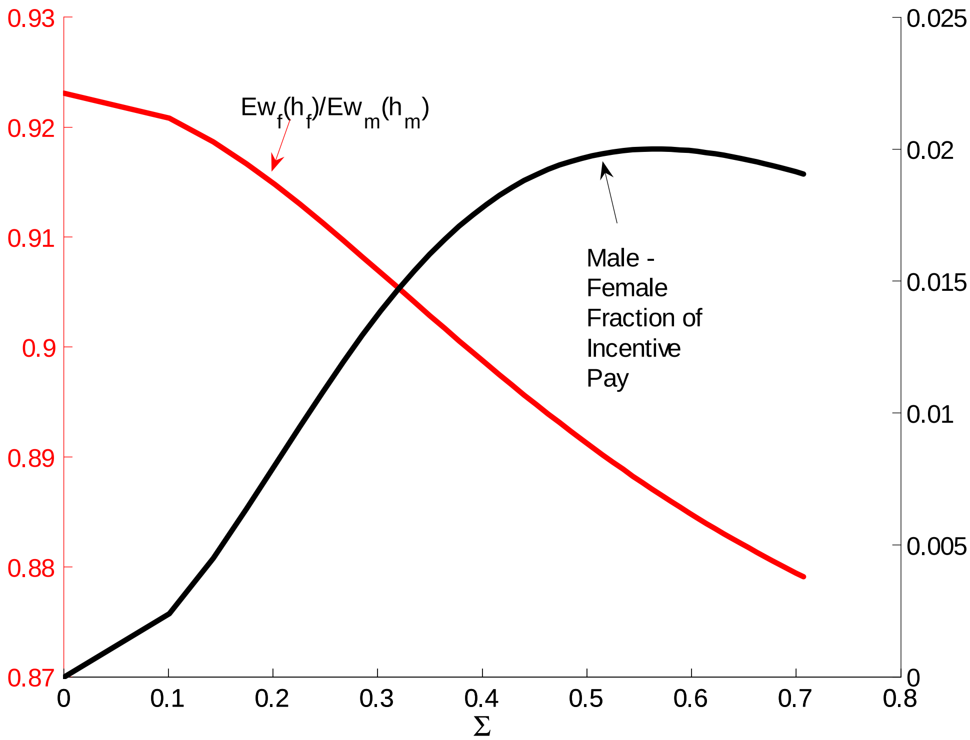

Figure 3: Properties of optimal labor contracts for $h_f = 0.15$ and $h_m = 0.1$.

1. The female/male earnings ratio should be lower when the incentive problem is more severe and the difference in the fraction of incentive pay across male and female workers should be negatively related to the female/male earnings ratio.

2. These effects are stronger when the differences in home hours between women and men is greater.

The dependence of labor market outcomes on home hours delivers additional predictions concerning the relation between earnings ratios, incentive pay and home hours across spouses. Specifically:

3. The wife/husband ratio of home hours should display a negative correlation with the wife/husband earnings ratio.

4. The wife/husband ratio of home hours should display a positive correlation with the husband/wife difference in the fraction of incentive pay.

Prediction 3 is a direct implication of Problem H1, the households' optimal choice of home hours across spouses. This property is common to other efficient models of intra-household allocation. Prediction 4 stems from the specific feedback mechanism between home hours and the incentive problem in the labor market that we highlight in our model.

We illustrate these predictions in figure 4. The red line corresponds to the wife/husband earnings ratio (left axis) and the black line to the husband/wife difference in the fraction of incentive pay (right axis). They are plotted against h_f/h_m for $\Sigma = 0.31$. Clearly, the earnings ratio is smaller than 1 only if the wife's home hours are greater than the husband's. Moreover, this ratio is decreasing in the difference in home hours across spouses, while the opposite is true for the fraction of incentive pay. For $h_f/h_m = 3$, the wife/husband earnings ratio is equal to 70% in this example, while men's fraction of incentive pay is 5 percentage points greater than women's.

3 Connecting the Model with the Evidence

To empirically evaluate the link between incentives and gender differentials in home hours, earnings and incentive pay, we posit that the severity of the incentive problem varies across occupations. Thus, we can interpret the comparative statics results in Section 2.4 as predictions on gender differentials in earnings and the structure of compensation across occupations. This extrapolation is based on the result that effort, the fraction of incentive pay and total earnings are inversely related to home hours. Hence, in any equilibrium in which women have higher home hours, gender differentials in these variables should be positively related at all levels of aggregation, that is positions within a firm, jobs, occupations, industry etc.

We also exploit the smaller gender differences in home hours for never married than for married individuals, a well known fact. Extrapolating from our model, gender differentials in earnings and incentive pay should be smaller for never marrieds within occupations and the

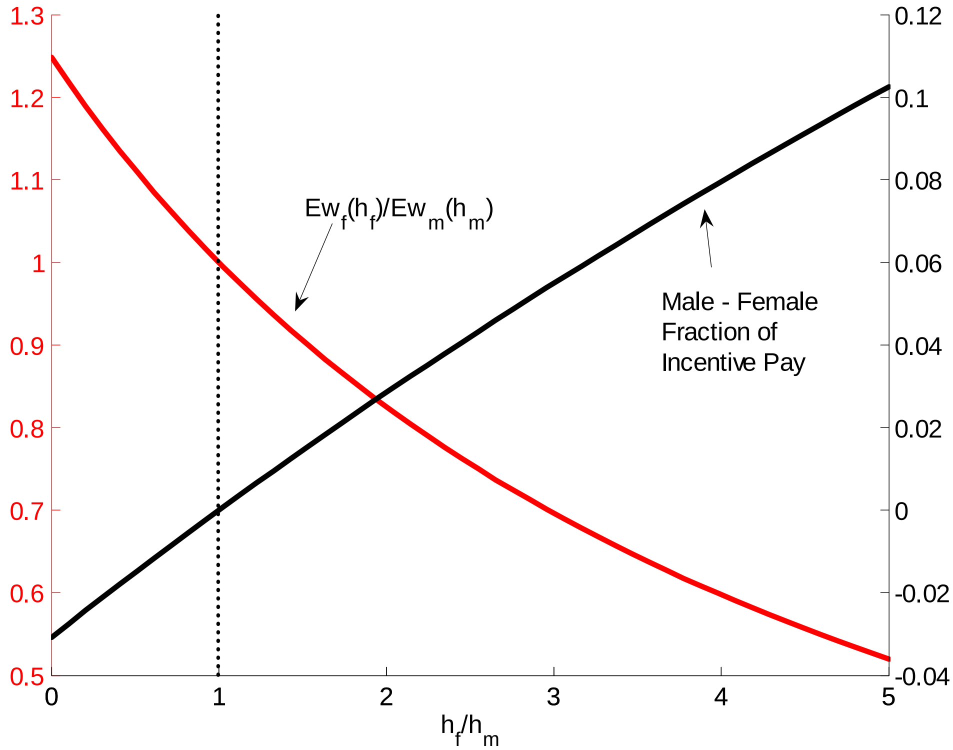

Figure 4: Properties of optimal labor contracts for $\Sigma = 0.31$.

variation by marital status of these differences should be greatest in those occupations where the incentive problem is more severe[9].

Predictions 1 and 2 can then be restated as follows:

1. Gender earning differentials should be higher in occupations in which the incentive problem is more severe. Differences in incentive pay between male and female workers should be inversely related to the gender differential in earnings.

2. These effects should be stronger for married than for never married workers.

How do we measure the severity of the incentive problem? In our model, it is related to the variance of output conditional on effort, that is the parameter Σ[10]. Intuitively, the uncertainty associated with a worker's effort conditional on output should increase with the complexity of the job. For example, it should be higher for management occupations, since for managers profits or revenues depend on a variety of factors, many of which are outside the managers control. For sales occupations, sales volumes depend to a large degree on variables that are not directly related to a sales personnel's effort and may be uncertain.[11] These considerations are less important for production workers.

This suggests a natural ranking across these occupations which is consistent with evidence on job characteristics by occupation reported in MacLeod and Parent (2003). Using the Quality of Employment Survey and the National Longitudinal Survey of Youth, they find that management and sales occupations are characterized by greater workers' autonomy and larger variety of tasks, characteristics that exacerbate incentive problems. They also find that in those occupations, incentive pay is used more than in others. This is also consistent with the fact that incentive problems are more severe in these occupations.[12] Based on this evidence, we consider three broad occupational categories: management, sales and production.[13]

We draw on two data sources to evaluate these predictions. We use data from the one-percent Integrated Public Use Microsample (IPUMS) of the decennial Census for the year 2000 to study aggregate gender earnings differentials by marital status across industries and occupations. Since the Census does not include information on the structure of earnings, we use PSID data from the late 1990s to document the negative relation between the male/female difference in the fraction of incentive pay and the female/male earnings ratio. We also consider a cross-section of married couples from the PSID, in order to evaluate predictions 3. and 4.

The predictions of the model are broadly supported by the empirical findings.

[9] In a model with both singles and married individuals, firms would optimally condition on marriage status only if the distribution of home hours is different for these groups. If singles were included in our model, in equilibria in which married women have higher home hours than married men, home hours of married women would be greater than for single women, while the opposite would be true for men, since households have an incentive to specialize.

[10] See sections 2.1 and 2.4.

[11] For example, sales workers are typically assigned to specific territories or products. Hence, sales volumes will fluctuate with shocks to local demand. See Catalyst (1995) for a description of the sales occupation, especially in relation to gender.

[12] See also Lemiux, MacLeod, Parent (2007) for additional evidence.

[13] In this exercise, we are implicitly assuming that unobserved differences in Σ across occupations are uncorrelated with other unobserved factors affecting the endogenous variables of interest.

3.1 Evidence from the Census

Our Census sample includes all white individuals between 25 and 54 years of age, who are not in school, do not reside on a farm or live in group quarters. We also exclude the armed forces and restrict attention to those individuals who worked at least 50 weeks in the previous year and who usually work at least 30 hours per week. We consider three occupational categories: sales, management and production in 16 industries. We analyze separately married and never married workers.[14]

In order to make a meaningful comparison of gender earnings differentials, we need to take into account systematic differences in observable characteristics such as age and education by marital status and across occupations/industries. For example, never married individuals tend, on average, to be younger than married individuals. Since gender gaps in earnings increase by age this could bias the comparison in our favor. In order to control for these systematic differences we compute the gender gap in earnings for married and never married workers by running median regressions that control for a gender dummy, as well as for human capital variables - age and its square term and three education dummies.[15] We estimate this measure of *residual* gender earnings differentials separately for each industry and for each of the three broad occupational categories. Thus, we are effectively controlling for systematic differences by gender, age, education and marital status in the distribution of workers across occupations/industries.

The dependent variable in the regressions for each industry/occupation cell is the log of annual earnings. In our analysis we use total labor earnings because this is the data counterpart of the measure of total labor compensation in our model. However, one could argue that this is not the appropriate measure of labor compensation, since women tend to work fewer hours than men. This concern is attenuated by the fact that we only consider individuals that work at least 30 hours per week and who were employed for at least 50 weeks. This sample selection criterion considerably reduces the variation in market hours but does not eliminate the concern since high earnings jobs tend to be associated with higher hours.

To control for the robustness of our results to this observation, we conducted our analysis using the log of hourly earnings as a dependent variable. Our findings, reported in Table A2 in the appendix, are consistent with those for annual earnings. We also ran the annual earnings regressions with the addition of a cubic in hours worked in the set of controls. The results of this analysis are identical to those reported in Table 1 and we omit them for brevity.[16]

Table 1 reports the *residual* female/male ratio of median earnings for full-time year-round

[14] See the Data Appendix, Table A1, for variable definitions and for summary statistics for our sample.

[15] The three dummies correspond to the following categories: high school completed, some college and college completed. The omitted dummy variable corresponds to individuals who completed less than twelve years of schooling.

[16] We also performed the analysis for the sample of workers with children. The pattern of ranking of the gender earnings ratios by marital status across occupational categories and industries is identical to the one reported in the paper for the overall sample. These results are reported in the Data Appendix, Table A3.

We have also experimented with different sample inclusion rules by considering all racial groups and by expanding the sample to include all individuals aged 16 to 64. In all the cases the results of our analysis are quantitatively similar to the ones reported in the paper.

workers for the three occupational categories by industry and by marital status.[17] The first column refers to management occupations, the second to sales occupations and the third to production occupations. In each column, we report the statistics separately for married workers and for never married workers. The first row of the table, displays the average female/male ratio of median earnings across all industries for each occupational category. The residual gender earning ratios are estimated very precisely within each occupation/industry cell. All estimates are statistically significant at the 1% level and for ease of exposition, we do not report them in the table.

We find a considerable variation in the female/male earnings ratio across industries, and across the three occupational categories within each industry, even after controlling for gender difference in human capital characteristics. Moreover, the patterns of variation differ substantially by marital status. We can summarize our findings as follows:

1. There is a large variation in residual female/male median earnings ratios across industries conditional on marital status, yet in all industries and occupations the female/male earnings ratio is lower for married than for never married workers.

2. For married workers, the female/male earnings ratio is lowest in management and sales occupations. The median married woman in sales earns, just 69 percent of what the median married man earns on average across all industries, while in management occupations she earns 72 percent of the median married man's total earnings. The highest value of the gender earnings ratio for married workers is in production occupations, where the median woman earns 80 percent of median male earnings.

3. For never married workers, the ranking of earnings ratios across occupations is reversed and gender differentials are smallest for management and sales, and highest in production. The median single woman earns 92 percent in sales and 94 percent in management of the total labor compensation earned by the median man in the corresponding occupation. Production occupations display the lowest ratio, equal to 83 percent.

As a result, the difference in gender earnings ratio of married relative to never married workers is substantial in sales and management occupations, approximately 20 percentage points. By contrast, gender earnings ratios do not vary significantly by marital status for production workers. These patterns suggest that across all industries married women are subject to the largest earnings penalty in those occupations where the incentive problem is most severe and that gender earnings differentials are positively related to gender differentials in home hours. We have conducted robustness checks by replicating the analysis for a finer set of occupation categories. The findings are largely confirmed. We discuss this exercise in the appendix and report the results in Table A4.

[17] Entries in the table are in percentage points. They are obtained by taking the exponential of the estimated regression coefficient for the female dummy expressed in log points.

Table 1: Female/male median earnings ratios across industries, occupations, and marital status
(Full-time, year-round workers, entries in %)

	Management		*Sales*		*Production*	
	married	single	married	single	married	single
Average across all industries	**72**	**94**	**69**	**92**	**80**	**83**
Accommodation and Food	71	95	55	99	80	84
Administrative, Support, Waste mgmt	76	90	68	86	81	85
Arts, Entertainment & Recreation	77	104	78	87	83	87
Construction	67	75	75	77	83	87
Educational Services	81	93	82	95	83	87
Finance and Insurance	65	88	64	87	83	87
Health Care & Social Assistance	70	91	57	70	77	80
Information	73	91	83	102	82	86
Manufacturing	76	90	71	93	66	67
Other Services (no Public Adm.)	72	101	64	78	76	79
Profess,Scientific&Tech. Services	72	90	70	90	83	86
Public Administration	80	103	81	129	83	87
Real Estate and Rental/Leasing	66	103	64	113	83	87
Retail Trade	65	101	56	83	72	74
Transportation and Warehousing	71	94	64	85	83	87
Wholesale Trade	70	101	75	92	79	83

3.2 Evidence from the PSID

We document the negative relation between male/female difference in the fraction of incentive pay and the female/male earnings ratio across occupations predicted by our model using PSID data for the late 1990s. As we did with the Census data, we select our sample to include all white men and women between 25 and 54 years of age who are not in school, who are not in the armed forces, and who worked at least 30 hours per week and 50 weeks per year. As in the previous section, gender earnings ratios correspond to the estimated coefficients for a female dummy in log-earnings regressions that also control for age and its square term and three education dummies.

We concentrate on gender earnings ratios at the occupation/industry level. The PSID coding of occupations differs from the one available from the Census 2000, but we construct occupational categories that are similar to the ones used for our Census analysis. This level of disaggregation requires a larger sample size than the one available in each wave of the PSID. Hence, we do not exploit the panel dimension of the data but simply pool together all the individuals in the 1994 to 2001 waves. The resulting statistics can be interpreted as medium run averages of the relevant variables.[18] Our measure of the fraction of incentive pay is the ratio of bonuses and commissions to labor income, defined as wages and salaries, plus bonuses and commissions. Since the PSID only reports information on bonuses and commissions for household heads, that are predominantly married males or single women, we cannot condition on marital status.[19] Summary statistics for this sample are reported in the Data Appendix, Table A5.

We find a strong negative correlation between the female/male earnings ratio and the male/female difference in the fraction of incentive pay. The correlation coefficient is -0.65 and it is significant at the one percent level. This correlation (as well as all the subsequent ones we report) takes into account the relative weight of each occupation in aggregate employment. Figure 5 displays a scatter plot of these two variables. Consistent with our Census findings, sales and management occupations in banking, finance and in the clerical sector are characterized by the lowest female/male earnings ratio and the highest male/female difference in the fraction of incentive pay.[20]

We also use the PSID data on bonuses and commissions to corroborate our findings on the severity of the incentive problem and gender earnings differentials discussed in section 3.1. Figure 6 reports a scatter plot of the aggregate fraction of incentive pay, which we interpret as a proxy for the general strength of incentives in an occupation, and the female/male earnings ratio across occupations. The correlation between these two variables is -0.57, significant at the five percent level. Consistent with MacLeod and Parent (2003), the occupations with job characteristics that imply a more severe incentive problem exhibit a higher fraction of incentive pay. These same occupations also have low female/male earnings ratios. The fraction of incentive pay varies between 0 (for Teachers) and 3.2% (for Sales). These incentive pay shares are averages over the entire sample. If we restrict attention to those respondents that report positive bonuses or commissions, which comprise approximately 10% of the sample,[21] the fraction of incentive pay varies from 1.7% for laborers to 23% for sales, as reported in figure 7. The correlation between the fraction of incentive pay and the female/male earnings ratio in this case is -0.65, significant at the one percent level.

Since our female sample is disproportionately composed of single women, the average female shares of incentive pay by occupation are likely to provide an upper bound on the actual statistics for the entire female population. As a consequence, the male-female differences in

[18] In the PSID, data on hours worked, total labor earnings, bonuses and commision income, are reported for the previous calendar year. Hence, our data covers the time period 1993-2000. In 1997 the PSID started collecting information bi-annually. Hence, our sample includes 6 waves of PSID data.

[19] Information on bonuses and commission is only available for 27% women in the sample. Of these, only 13 are married. Information on incentive pay is available for 99% of the men in the sample, of which 80% are married.

[20] To account for the role of differences in hours worked in determining gender earnings differentials, we also conduct this analysis for hourly wages. We find that the correlation between the female/male difference in log hourly wages and the male/female difference in the fraction of incentive pay is -0.54 and significant at the five percent level.

[21] MacLeod and Parent (2003) find that the percentage of workers reporting positive incentive pay is 17% in the 1993 wave of the PSID and 20% in the NLSY. For the PSID, this discrepancy may be due to the fact that they include older and part-time workers in their sample.

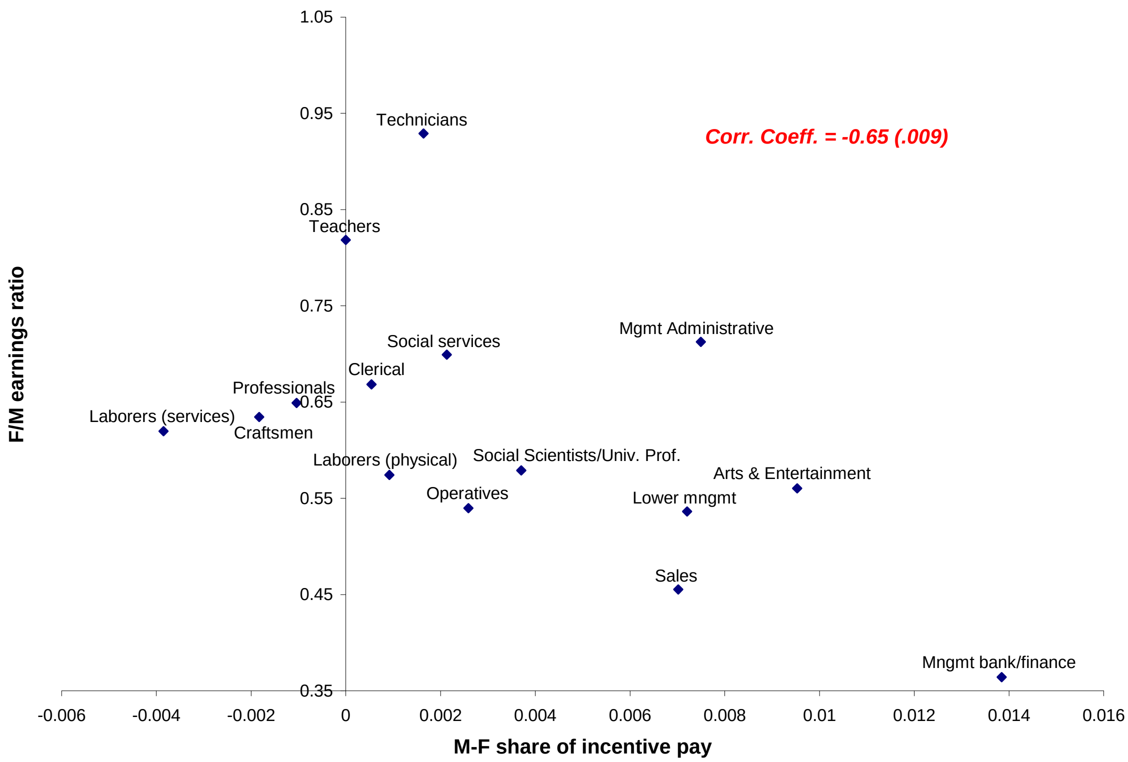

Figure 5: Correlation between the F/M earnings ratio and the M-F fraction of incentive pay.

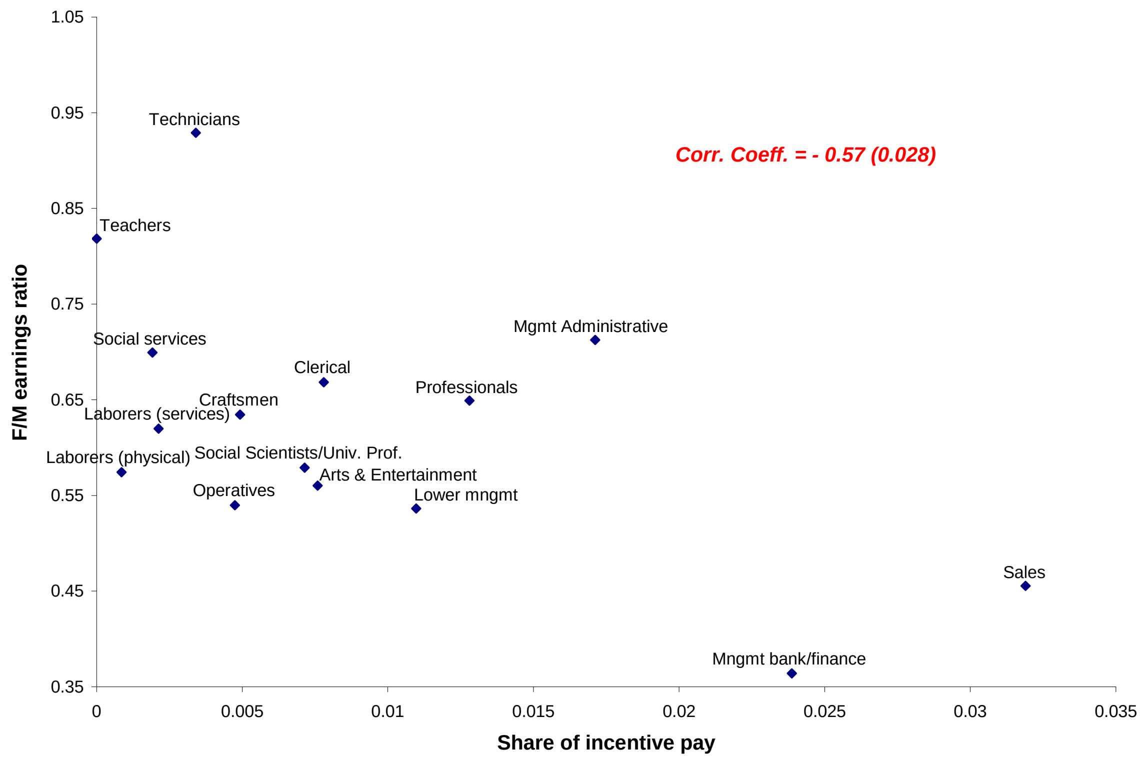

Figure 6: Correlation between the F/M earnings ratio and the aggregate fraction of incentive pay.

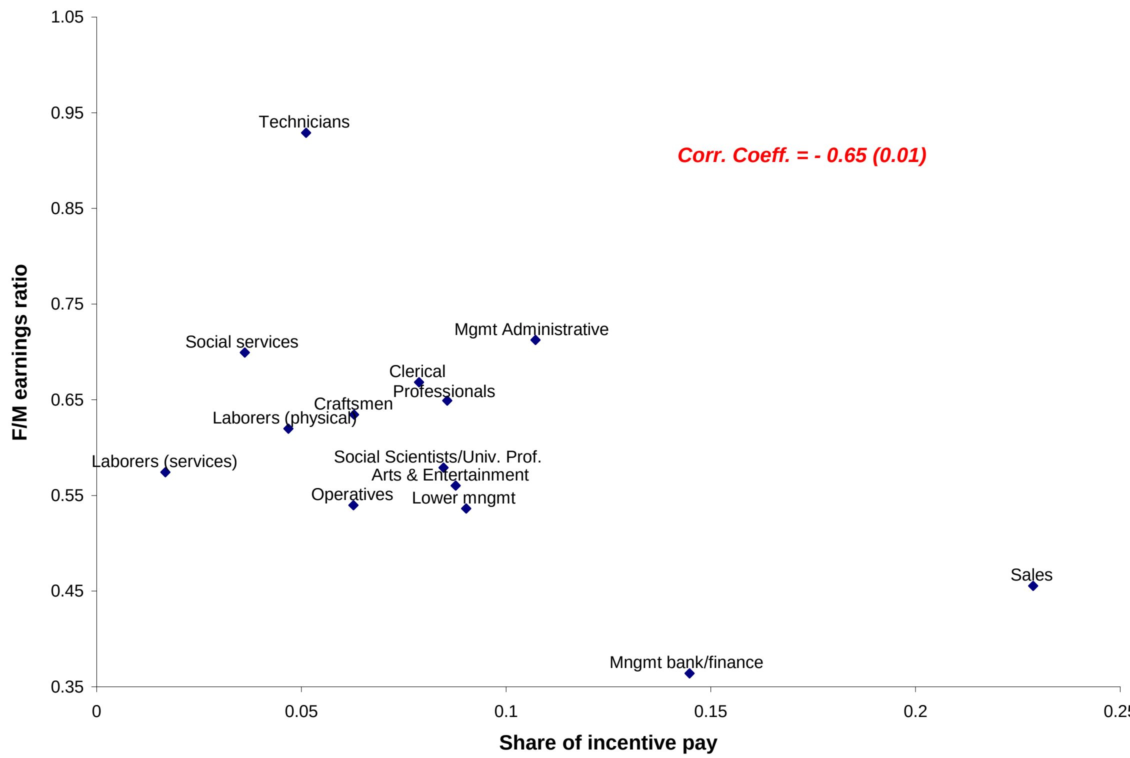

Figure 7: Correlation between the F/M earnings ratio and the aggregate fraction of incentive pay for workers with positive incentive pay.

incentive pay shares we report may underestimate the actual difference observed in the data, especially so for sales and management occupations, where the incentive problem is most severe.

The analysis above highlights gender differences in incentive pay *shares* across occupations. Although this statistic is informative it does not provide a correct measure of the role of incentive pay in explaining gender differentials because it does not take into account of differences in the levels of total compensation across genders/occupations. For instance, if the male-female difference in total compensation is larger in occupations where the incentive problem is most severe and these occupations are also characterized by the highest levels of total compensation, then a small percentage points difference in incentive pay share across genders will translate into a relatively larger gender difference in total compensation.

In order to quantitatively assess the role of incentive pay in explaining gender differentials, we estimate the fraction of male-female differences in total compensation that can be attributed to male-female differences in performance-based pay. Suppose that i_j is the monetary value of incentive pay and w_j is total earnings for a worker of sex $j = f, m$, then the average value of $\frac{i_m - i_f}{w_m - w_f}$, by occupation and overall, represents the fraction of the gender differential in earnings explained by gender differences in incentive pay. We compute this statistic both for the entire sample and for just those workers who report positive incentive pay.

The results are reported in Table 2. The first two columns of the table report the fraction of the gender earnings differential that can be attributed to differences in incentive pay respectively for the overall sample and for the sample that excludes workers who did not report any incentive pay. The last two columns of the table display the fraction of workers reporting positive incentive pay. We report the statistics for the four broad occupation/industry categories characterized by the largest incidence of incentive pay and for all the occupations. If we average over the entire sample, we find that for management, banking and finance the gender differences in incentive pay account for respectively 10% and 21% of the differences in total earnings. For lower management and sales, they account for 6%. If we restrict our sample to those workers who report positive incentive pay, for management, banking and finance the fraction increases to 24 and 31%, respectively. For lower management and sales, it reaches 22 and 28%, respectively. Note moreover, that the fraction of females and males that report incentive pay is very similar for each occupation, which indicates there is no gender bias in reporting incentive pay. This analysis suggests that differences in incentive pay are quite important in accounting for differences in earnings in those occupations where incentives play a role. These results confirm our Census analysis.

Table 2: Share of gender earnings differential explained by gender differences in incentive pay (entries in %)

	Overall Sample	Sample with incentive pay	% with positive incentive pay	
			Males	Females
Management	10	24	19	24
Mngmnt, Banking, Finance	21	31	26	20
Lower Management	6	22	13	14
Sales	6	28	17	14
Overall*	5	24	11	14

Based on PSID data for 1994 to 2001. See text for sample selection rules. *Overall refers to the weighted average of each statistics across all occupations.

Interestingly, the large variation in the female/male earnings ratio across the occupations considered is not systematically related to the fraction of females working in a given occupation. As shown in Figure 8, there is no clear relation between these two variables and their correlation is not significantly different from zero.[22] This evidence casts doubts on explanations of gender earnings differentials based solely on occupational sorting by gender. Although it would be interesting to study the differential role of occupational sorting and incentive problems within each occupation in accounting for gender earnings differentials, this analysis is beyond the scope of this paper since our representative household/representative firm environment does not generate predictions on occupational sorting.

Finally, we tackle predictions 3 and 4 in Section 2.4, which in a cross-section of married couples translate into:

3. The correlation between the wife/husband ratio of home hours and the wife/husband ratio of earnings should be negative.

4. The correlation between the wife/husband ratio of home hours and the husband-wife difference in the fraction of incentive pay should be positive.

We study these correlations across a sample of married couples using the PSID. The ideal data set for this exercise would include information on home hours, market hours, labor earnings and the structure of compensation for both spouses for an ample cross-section of married couples. While being far from ideal, the PSID is one of the few data sets that allows us to move in this direction. In particular, we have information on home hours, market hours and earnings of both spouses.[23] However, we only have information on bonuses and commissions for household heads. In order to recover the information for spouses, we use the available

[22] The same is true for the difference in log hourly wages and for the Census 2000 sample. This is also consistent with evidence from the National Committee on Pay Equity, based on the 2000 Household Data Annual Averages from the Bureau of Labor Statistics.

[23] The variable that reports home hours in the PSID poses a measurement problem. The survey respondent is asked to provide a measure of weekly hours worked at home by him- or herself and by the spouse (if married.) No time diaries are used. This could be problematic if respondents tend to overestimate their own home hours

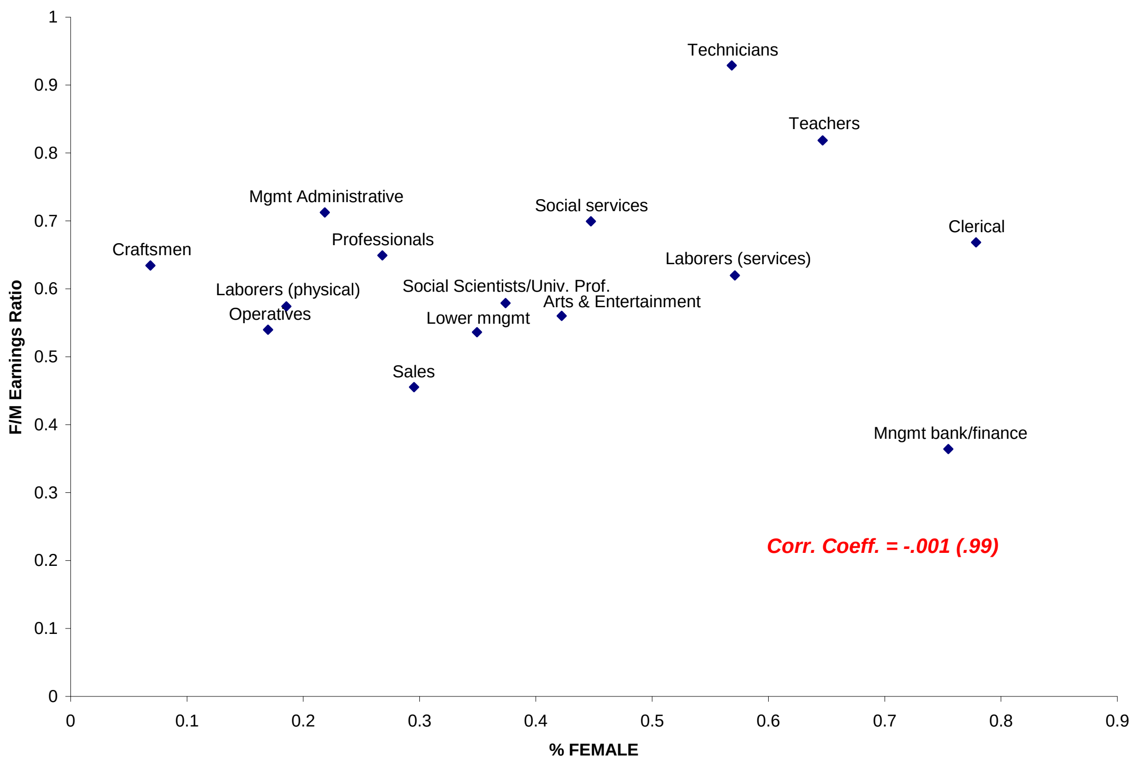

Figure 8: Correlation between the percentage of female workers and the F/M earnings ratio.

information on occupation jointly with the gender-specific average shares of incentive pay by occupational categories. We impute a value of $\tilde{w}$ that is equal to the fraction of incentive pay received by the average worker of the same gender in the same occupation. We then compute $\tilde{w}_m - \tilde{w}_f$ for each couple as the difference of the reported incentive pay shares of husband and of the imputed incentive pay share of the wife.

To minimize the impact of additional factors, such as race, cohort and wife's labor market attachment, that could be driving the cross-sectional correlations we are interested in exploring, we aim to build a sample that is homogeneous with respect to age, presence of young children in the household, and labor market attachment of both spouses, while maintaining a reasonable sample size. We include male-headed married couples where both husband and wife are white, the head of the household is between 25 and 44 years old and both spouses are full-time year-round workers (they both work at least 30 hours per week and at least 50 weeks per year). Moreover, we only consider couples that report all the relevant variables for both partners. Summary statistics for this sample are presented in Data Appendix, Table A6. We report the results of our analysis in Table 3.

Table 3
Home hours, earnings and incentive pay across a sample of married couples

	all	with kids
$\text{corr}\left(\frac{w_f}{w_m}, \frac{h_f}{h_m}\right)$	**-0.27**	**-0.27**
	(.0003)	(0.000)
$\text{corr}\left(\tilde{w}_m - \tilde{w}_f, \frac{h_f}{h_m}\right)$	0.03	**0.21**
	(0.582)	(0.007)
Number of couples	300	167

p-values in parentheses.

Entries in column 1 refer to the sample of married couples. Column 2 reports correlation coefficients for the sample of married couples with children less than 13 years old. Our sample consists of 300 couples of which 167 have children. The data confirms prediction 3 that wife/husband earnings and home hours ratios are negatively correlated across all households. This is true irrespective of the presence of children. The correlation coefficient is -0.27 and significant at the one percent level in both samples. On the other hand, the validity of prediction

and to underestimate their spouses' home hours. In particular, if respondents are disproportionately women we would tend to overestimate the wife/husband ratio of home hours. Evidence from time-use surveys for the late-1990s (Freeman (2000)) confirms the PSID evidence that wives spend, on average, at least twice as much time than their husbands in home production activities irrespective of their labor market status.

The first wave of the American Time-Use data set (ATUS), made available by the Bureau of Labor Statistics in January 2005, could provide an alternative to the PSID. The ATUS data, however, also has a serious drawback for married households. Only one spouse is selected at random and asked to fill the time-use questionnaire. Consequently, time-use information is not available for both husbands and wives for the CPS sample. This makes it impossible to analyze patterns of relative home hours and earnings across married couples.

4 depends on the presence of children. We find that for the overall sample there is a positive but small and not significant correlation between the difference in incentive pay shares across spouses and the wife/husband ratio of home hours, whereas for the sample of married couples with children, the correlation coefficient is equal to 0.21 and it is significant at the one percent level.

4 Concluding Remarks

This paper lays out a simple framework that endogenizes gender differentials in earnings and home hours. Incentive problems in the labor market play an essential role and lead to novel predictions on the link between gender differences in the structure of compensation and home hours that are broadly supported in the data.

One limitation of our analysis stems from the assumption that all agents are ex ante identical except for gender and production is carried out by a representative firm. This implies that we cannot address selection of women and men into different occupations or industries. Moreover, there are no efficiency losses associated with gender discrimination. An extension of the model that allows for a non-degenerate distribution of individual productivities, symmetric across genders, could address in part both these issues. In a gendered equilibrium, female workers with high productivity may be induced to sort into low skill occupations and be offered contracts in which they exert inefficiently low effort. This would generate misallocation costs associated with gender discrimination.[24]

The empirical analysis based on Census and PSID data. While the results provide suggestive evidence in support of the mechanism, these data sets cannot be used to directly test our model's predictions. Specifically, the Census does not report home hours or the fraction of incentive pay. This information is available in the PSID, which does not report incentive of pay for *both* husbands and wives. The ideal data set would include observations on the structure of earnings at the individual level for a broad class of sectors and jobs, as well as detailed household level information. To the best of our knowledge, such a data set is not available for the U.S. While a structural empirical analysis of our model is beyond the scope of this paper, it constitutes an interesting avenue of research.

Our analysis sheds light on the role of biological differences for gender differentials in labor market outcomes. Equilibria in which women have higher home hours and consequently lower earnings are possible even without ex ante gender differences. On the other hand, even if women have a comparative advantage in home production, equilibria in which men have higher home hours and lower earnings are still possible. This outcome is rooted in the incentive problem on the labor market. Taken together these results lead to the conclusion that biological differences are neither a necessary or a sufficient condition for women's lower earnings.

[24] The innefficiencies associated with gender discrimination may also depend on the nature of the household bargaining process. See Ishida (2003).

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5 Appendix

5.1 Labor Contracts

Proof of Proposition 1. The first order necessary conditions for Problem 1 at an interior solution are:

$$f'(e) - v_e(h,e) + \mu\left(\tilde{w}f''(e) - v_{ee}(h,e)\right) = 0, \tag{26}$$

$$-\sigma\Sigma^2\tilde{w} + \mu f'(e) = 0. \tag{27}$$

To solve for effort, substitute $\mu = \frac{\sigma\Sigma^2\tilde{w}}{f'(e)}$ and $\tilde{w} = \frac{v_e(h,e)}{f'(e)}$, into (26) to obtain an equation in e :

$$f'(e) - v_e(h,e) + \frac{\sigma\Sigma^2 \frac{v_e(h,e)}{f'(e)}}{f'(e)} \left(\frac{v_e(h,e)}{f'(e)} f''(e) - v_{ee}(h,e) \right) = 0. \tag{28}$$

Assuming (9)-(10), (28) simplifies to:

$$1 - (\psi + h)e - \sigma\Sigma^2 (\psi + h)^2 e = 0,$$

which implies (11) and (12). Imposing zero profits on firms, delivers $Ew^*(h) = f(e^*(h))$. Then:

$$\begin{aligned} Ew^{*\prime}(h) &= \frac{-\left(1 + 2\sigma\Sigma^2(\psi + h)\right)}{\left((\psi + h) + \sigma\Sigma^2(\psi + h)^2\right)^2} < 0, \\ Ew^{*\prime\prime}(h) &= 2\frac{1 + 3\sigma\Sigma^2(\psi + h) + 3\left[\sigma\Sigma^2(\psi + h)\right]^2}{\left((\psi + h) + \sigma\Sigma^2(\psi + h)^2\right)^3} > 0. \end{aligned}$$

■

5.2 Household Problem

Let $MC^H(\mathcal{C}) = \partial C^H(H;\mathcal{C})/\partial H$ be the marginal cost of H, which is independent of H given that $H(\cdot)$ is homogeneous of degree 1. Specifically, by (22)-(23):

$$MC^H(\mathcal{C}) = \left[(1+\varepsilon) \left(\frac{Ew'(h_f)}{(1+\varepsilon)} \right)^{\zeta/(\zeta-1)} + \left(Ew'(h_m) \right)^{\zeta/(\zeta-1)} \right]^{(\zeta-1)/\zeta}.$$

The second cost minimization problem for the household can be written as:

$$C^G\left(\bar{G};\mathcal{C}\right) = \min_{k,H\geq 0} k + MC^H(\mathcal{C}) H \tag{Problem H2}$$

subject to

$$H^\delta k^{1-\delta} \geq \bar{G},$$

for $\bar{G} > 0$. The first order necessary conditions for this problem imply:

$$\begin{aligned} k &= \left(\frac{1}{MC^H(\mathcal{C})} \frac{\delta}{1-\delta} \right)^{-\delta} G, \\ \frac{H}{k} &= \left(\frac{1}{MC^H(\mathcal{C})} \frac{\delta}{1-\delta} \right). \end{aligned}$$

These equations define k and H as a function of G. We can then define $MC^G(\mathcal{C}) = \partial C^G(G;\mathcal{C})/\partial G$, with:

$$MC^G(\mathcal{C}) = (1-\delta)^{-(1-\delta)} \left(\frac{\delta}{MC^H(\mathcal{C})} \right)^{-\delta}.$$

Problems H1 and H2 are convex minimization problems. Hence, first order necessary conditions are sufficient and the optima will be attained by the respective policy functions. Combining the solutions to problem H1 and H2, we can define the functions $\hat{h}_f(G;\mathcal{C}), \hat{h}_m(G;\mathcal{C})$ that express the optimal intra-household allocation of home hours as a function of the level of public home consumption. The last step of the household problem is to optimize (**??**) by choice of G, c_f and c_m subject to $c_f + c_m + MC^G(\mathcal{C})\,G \leq a + \sum_i w_i^*\left(\hat{h}_i(G;\mathcal{C})\right)$. The solution to this problem gives rise to the policy functions: $c_i(a;\mathcal{C})$, and $G(a;\mathcal{C})$, and recursively to $h_i(a;\mathcal{C}) = \hat{h}_m(G(a;\mathcal{C});\mathcal{C})$ for $i = f, m$.

5.3 Equilibrium

We prove the proposition in two steps. We first establish that any symmetric equilibrium there are at most two values of home hours in the population and that any such equilibrium with non-degenerate distribution of home hours must be ungendered. Then, we show the set of equilibria with degenerate distribution of home hours.

Lemma 6 *If the distribution of home hours in the population is non-degenerate, that is* $\pi_f(h_j) \in (0,1)$ *and* $\pi_m(h_j) \in (0,1)$ *for* $j = H, L$ *with* $h_L < h_H$*, then the equilibrium is ungendered and* $\pi_f(h_j) = \pi_m(h_j)$ *for* $j = L, H$.

Proof of Lemma 6

To prove the first result, note that given that there is a representative household, in a gendered equilibrium, home hours will be constant across wives and husbands, leading to two values of home hours in the population with $0 < h_L < h_H$. In an ungendered equilibrium, households are indifferent over the distribution of home hours across spouses and they randomize. The randomization strategy will be the same across all households leading to at most two values of home hours in the population. To prove the second result, note that a non-degenerate distribution of home hours occurs when households are indifferent over the allocation of home hours across spouses. Suppose that the distribution of home hours is non-degenerate and the equilibrium is gendered, so that $\pi_m(h_j) \neq \pi_f(h_j)$ for $j = L, M$ for some $0 < h_L < h_H$. Then, wives and husbands will not be facing the same menu of labor contracts and randomization will not be optimal and the distribution of home hours will be degenerate. Contradiction. Hence, if the distribution of home hours is non-degenerate, the equilibrium is ungendered. ■

Proof of Proposition 4

If firms' beliefs satisfy $\Pr(h_f < h_m) = 1$, then $\max Ew_f(h) > \max Ew_m(h)$. If such an equilibrium exists, $h_f < h_m$ and the distribution of home hours will be given by $\pi_f(h_H) = 0$ and $\pi_m(h_L) = 0$, by Lemma 6. Hence, equilibrium labor contracts will satisfy proposition 1. Such an equilibrium exists, if Problem H1 has a solution with $h_f/h_m < 1$. Such an equilibrium is unique, if this is the unique solution to Problem H1. Note that (22) and (23) can be rewritten as:

$$(x)^{1-\zeta} = \frac{Ew'(h_m)}{Ew'(xh_m)}, \tag{29}$$

$$\frac{H}{h_m} = \left[x^{\zeta} + 1\right]^{1/\zeta}, \tag{30}$$

where $x = h_f/h_m$. Equation (29) implicitly defines x as a function of h_m, while (30) defines h_m as a function of H. The following lemma characterizes the solutions to (29).

Lemma 7 *If labor contracts satisfy proposition 1, equation (29) generically has two solutions,* $x_1(h_m) = 1$ *and* $x_2(h_m) < 1$, *with* $\lim_{h_m \to 0} x_2(h_m) = 1$ *and* $\lim_{h_m \to \infty} x_2(h_m) = 0$. *Moreover, equation (30) has a unique finite solution* h_m^i *for each branch* $x_i(h_m)$ *for* $i = 1, 2$, *with* $h_m^1 > h_m^2$ *for given* H.

Proof. The left hand side of equation (29) is increasing and concave in x and crosses the forty-five degree line at $x = 0$ and $x = 1$. Given that firms' beliefs over the distribution of home hours in the population are degenerate, the contracts offered to female and male workers are described by proposition 1. It follows that $\frac{Ew'(h_m)}{Ew'(h_m)} = 1$, so that one solution to (29) is $x_1(h_m) = 1$. Since, $E'w^{*\prime}(h) < 0$ and $Ew^{*\prime\prime}(h) > 0$, for all $0 < x < 1$, $\frac{Ew'(h_m)}{Ew'(xh_m)} < 1$. Moreover, the right hand side of (29) is continuous and increasing in x, since the slope of this expression as a function of x, given by $h_m \frac{Ew'(h_m)}{Ew'(xh_m)} \frac{-Ew''(xh_m)}{Ew'(xh_m)}$, is positive. Since by (12) and (11), $\lim_{x \to 0} Ew'(xh_m) < 0$ and $Ew'(h_m) / \lim_{x \to 0} Ew'(xh_m) < 1$, there must be another crossing at $x_2(h_m) < 1$. The convexity of $Ew'(h)$, implies that $x_2(h_m)$ is decreasing in h_m. In addition, proposition 1 implies $w^{*\prime}(0)$ is finite and $\lim_{h_m \to \infty} Ew'(h) = 0$. Then, $\lim_{h_m \to 0} x_2(h_m) = 1$ and $\lim_{h_m \to \infty} x_2(h_m) = 0$ follows. By (30), $h_m^1(H) = H2^{-1/\zeta}$. Since $x_2(h_m)$ is decreasing in h_m, $\lim_{h_m \to 0} x_2(h_m) = 1$ and $\lim_{h_m \to \infty} x_2(h_m) = 0$, the right hand side of equation (30) evaluated at $x_2(h_m)$ is bounded below 1, and bounded above by $2^{-1/\zeta}$. Since $\lim_{h_m \to 0} H/h_m = \infty$ and $\lim_{h_m \to \infty} H/h_m = 0$, (29) has a unique finite solution when evaluated at $x_2(h_m)$, $h_m^2(H) > 0$. ■

By lemma 7, generically there exist two zeros for equation (29), $x_1 = 1$ and $x_2 \in (0, 1)$. However, under $\max Ew_f(h) < \max Ew_m(h)$, $x_1 = 1$ is not optimal for Problem H1. Hence, the unique solution to problem H1 is $0 < h_L = h_f = x_2 h_m = x_2 h_H$ for h_m that solves (23) and H that solves Problem H2. This solution is constant for all households. Hence, the resulting distribution of home hours is $\pi_f(h_H) = 0$ and $\pi_m(h_L) = 0$, consistent with firms' beliefs.

If firms' beliefs satisfy $\Pr(h_f > h_m) = 0$, then $\max Ew_f(h) < \max Ew_m(h)$. If such an equilibrium exists, $h_f > h_m$ and the distribution of home hours will be given by $\pi_f(h_H) = 1$ and $\pi_m(h_L) = 1$. By (22) and (23), we can write:

$$(y)^{1-\zeta} = \frac{Ew'(h_f)}{Ew'(yh_f)}, \tag{31}$$

$$\frac{H}{h_f} = \left[1 + y^{\zeta}\right]^{1/\zeta}, \tag{32}$$

where $y = h_m/h_f$. Applying lemma 7 to (31)-(32) implies that there are two zeros for (31): $y_1 = 1$ and $y_2(h_f) < 1$. But under $\max Ew_f(h) < \max Ew_m(h)$, $y_1 = 1$ is not optimal for Problem H1. Hence, the unique solution to Problem H1 is $0 < h_L = h_m = y_2 h_f = y_2 h_H$ for all households, resulting in the distribution of home hours $\pi_m(h_H) = 0$ and $\pi_f(h_L) = 0$, consistent with firms' beliefs. This proves result i) in proposition 4. Note that $y_2(h) = x_2(h)$ and $h_m^2(H) = h_f^2(H)$.

If firms' beliefs satisfy $\Pr(h_f = h_m) = 1$, then $Ew_f(h) = Ew_m(h)$ for all possible values of h. By Lemma 7, $x_1 = 1$ is a zero for equation (29). Moreover, under $Ew_f(h) = Ew_m(h)$, the ratio $h_f/h_m = 1$ solves Problem H1 and induces distribution of home hours $\pi_i(\bar{h}) = 1$ for $i = f, m$ with $\bar{h} = H2^{-1/\zeta}$, by (30), consistent with firms' beliefs. By contrast the zero $x_2 < 1$ for equation (29) would induce a distribution of home hours inconsistent with firms' beliefs. Since there is a unique value of $\bar{h}$ which solves Problem H1, this equilibrium is unique. This proves result ii) in proposition 4.■

5.4 Ex Ante Differences

Proof of Proposition 5

Assume that firms believe that female home hours are smaller than male home hours, so that $\max Ew_f(h) > \max Ew_m(h)$. To see if $h_f/h_m < 1$ is optimal for the household, we need verify whether the system:

$$(x)^{1-\zeta} = \frac{E\left[w'_m(h_m)\right]}{E\left[w'_f(xh_m)\right]/(1+\varepsilon)}, \tag{33}$$

$$\frac{H}{h_m} = \left[(1+\varepsilon)x^{\zeta} + 1\right]^{1/\zeta}, \tag{34}$$

has a solution with $x < 1$ when, by Lemma 6, labor contracts solve Problem F1. By Lemma 7, for $\varepsilon > 0$ (33) has two zeros, with $0 < x_2 < x_1 < 1$. By $\max Ew_f(h) > \max Ew_m(h)$ and since $Ew(h)$ is decreasing and convex in h by Proposition 1, x_1 will not be optimal for Problem H1. Hence, households will choose $h_L = h_f = x_2 h_m = h_H$ and the resulting distribution of home hours will be $\pi_f(h_H) = 0$ and $\pi_m(h_L) = 0$, consistent with firms' beliefs. If ε is high enough, however, equation (33) fails to have a solution so that this equilibrium fails to exist.

If firms believe female home hours are greater than male home hours, $\max Ew_f(h) < \max Ew_m(h)$. This outcome can be an equilibrium if $h_m/h_f > 1$ solves Problem H1. To verify this, consider the system of equations:

$$(y)^{1-\zeta} = \frac{E\left[w'_f(h_f)\right]}{E\left[w'_m(yh_f)\right](1+\varepsilon)}, \tag{35}$$

$$\frac{H}{h_f} = \left[(1+\varepsilon) + y^{\zeta}\right]^{1/\zeta}. \tag{36}$$

By Lemma 7, for $\varepsilon > 0$, generically, there are two zeros for equation (35), $0 < y_1 < 1 < y_2$. However, y_2 is not optimal for Problem H1 under $\max Ew_f(h) < \max Ew_m(h)$. Hence, the unique solution to Problem H1 is $y_2 > 1$. Then, the equilibrium distribution of home hours will satisfy $\pi_f(h_H) = 1$ and $\pi_m(h_L) = 1$, with $0 < h_L = h_m = y_2 h_f = h_H$, consistent with firm beliefs.■

Data Appendix

1. Census Analysis

The Census sample includes 25-54 year old white men and women, who are not in school, not in the armed forces, do not reside on a farm or live in group quarters. We include individuals who worked at least 50 weeks in the previous year and who usually work at least 30 hours per week.

We use the following Census variables in our analysis. INCWAGE for total annual wages and salaries, WKSWORK1 for weeks worked and UHRSWORK for usual hours worked per week. These three variables report information for the year preceding the Census survey. For educational attainment we use the variable EDUCREC to group individuals according to four broad educational categories: less than high school, high school completed, some college and college completed. We construct four education dummies based on this categorization. The first dummy is equal to one if an individual has completed less than twelve years of schooling and is equal to zero otherwise. The second dummy variable is equal to one if he or she has completed twelve years of schooling, and is equal to zero otherwise. The third dummy variable equals one if the individual has completed between twelve and fifteen years of schooling and it is equal to zero otherwise. Finally, the fourth dummy variable is equal to one if an individual has completed at least sixteen years of education and it equals zero otherwise. The omitted dummy variable in the regressions corresponds to individuals who completed less than twelve years of schooling. For industry, we use the variable INDNAICS that reports the type of establishment in which a person worked in terms of the good or service produced. Industries are coded according to the North American Industrial Classification System developed in 1997. We have excluded from our sample workers in Agriculture Forestry Fishing, and Hunting, Mining and Utilities. This is because for these three industries we are unable to compute adjusted gender earnings ratios for the sample of never married workers in sales and management occupations. That is, once we control for age and education in each of the occupation/industry cells there is not enough variation left to estimate the coefficient on the female dummy. We use the variable OCCSOC for occupation. OCCSOC classifies occupations according to the 1998 Standard Occupational Classification (SOC) system. The Census also provides an aggregation of all the occupations in 23 broader categories that include the three categories considered in the analysis. The definition of production occupations also includes construction and extraction workers.

Table A1: Summary Statistics for the Census sample

	Males		Females	
	mean	st. dev.	mean	st. dev.
Age	40.03	8.06	40.14	8.19
Less thanHS	0.07	0.25	0.04	0.20
HS	0.30	0.46	0.30	0.46
Some college	0.30	0.46	0.35	0.48
College+	0.33	0.47	0.30	0.46

Married spouse present	0.70	0.46	0.62	0.49
Married spouse absent	0.01	0.10	0.01	0.09
Separated	0.02	0.12	0.03	0.16
Divorced	0.11	0.31	0.17	0.38
Widowed	0.00	0.06	0.02	0.12
Never married	0.16	0.37	0.16	0.36
Number of children	1.09	1.20	0.94	1.08
Salary (annual)	49552	49929	33240	29358
Market Hours (annual)	2405	477	2185	387
Log hourly earnings	2.86	0.65	2.59	0.58
Management	0.07	0.25	0.05	0.22
Business and financial operations	0.04	0.21	0.07	0.25
Computer and math	0.04	0.19	0.02	0.15
Architecture and engineering	0.04	0.20	0.01	0.09
Life, physical, and social science	0.01	0.11	0.01	0.10
Community and social services	0.01	0.10	0.02	0.14
Legal occupations	0.01	0.12	0.02	0.13
Education, training and library	0.02	0.13	0.05	0.22
Arts, design, ent, sports and media	0.02	0.14	0.02	0.14
Healthcare practitioner and techn.	0.03	0.16	0.09	0.28
Healthcare support	0.00	0.05	0.03	0.17
Protective services	0.03	0.18	0.01	0.09
Food preparation and serving	0.02	0.12	0.03	0.17
Building, ground cleaning/maintenance	0.03	0.16	0.02	0.13
Personal care services	0.01	0.08	0.03	0.18
Sales	0.11	0.32	0.11	0.31
Office and administrative support	0.06	0.24	0.27	0.45
Farming, fishing and forestry	0.01	0.08	0.00	0.04
Construction and extraction	0.10	0.30	0.00	0.06
Installation, maintenance and repair	0.08	0.27	0.01	0.07
Production	0.11	0.32	0.06	0.24
Transportation and material moving	0.08	0.28	0.02	0.13
Agriculture, forestry, fishing, hunting	0.01	0.11	0.00	0.06
Mining	0.01	0.09	0.00	0.04
Utilities	0.02	0.13	0.01	0.08
Construction	0.12	0.32	0.02	0.14
Manufacturing	0.21	0.41	0.12	0.32
Wholesale trade	0.06	0.23	0.03	0.17
Retail Trade	0.10	0.30	0.11	0.32
Transportation and Warehousing	0.06	0.24	0.03	0.16
Information	0.03	0.18	0.04	0.19
Finance and Insurance	0.04	0.20	0.09	0.28
Real Estate and Rental and Leasing	0.02	0.13	0.02	0.14

Professional, Scientific, and Technical	0.07	0.26	0.07	0.26
Administrative and Support and Waste Man	0.03	0.16	0.03	0.16
Educational Services	0.04	0.18	0.08	0.27
Health care and social assistance	0.04	0.20	0.20	0.40
Arts, Entertainment and Recreation	0.01	0.12	0.01	0.12
Accomodation and Food Services	0.03	0.16	0.04	0.20
Other Services (exclude Public Administration)	0.04	0.20	0.04	0.20
Public Administration	0.06	0.24	0.06	0.23
Number of Observations	31489615		21461034	

Table A2: Gender differences in earnings across industries, occupation, and marital status
(Full-time, year-round workers, % female/male median **hourly** earnings ratios)

	Management		*Sales*		*Production*	
	married	single	married	single	married	single
Average across all industries	**79**	**96**	**78**	**100**	**82**	**86**
Accommodation and Food	80	96	80	102	82	85
Administrative, Support, Waste mgmt	84	87	89	93	83	87
Arts, Entertainment & Recreation	83	98	86	87	85	90
Construction	76	80	69	84	85	89
Educational Services	86	95	76	108	85	89
Finance and Insurance	71	91	71	90	85	89
Health Care & Social Assistance	74	93	73	107	81	84
Information	79	91	76	93	84	88
Manufacturing	80	93	78	95	69	70
Other Services (no Public Adm.)	83	103	78	110	78	81
Profess, Scientific & Tech. Services	77	94	77	93	85	89
Public Administration	85	105	84	123	86	90
Real Estate and Rental/Leasing	71	105	80	123	86	90
Retail Trade	72	96	73	89	75	77
Transportation and Warehousing	80	97	83	105	85	90
Wholesale Trade	78	107	72	103	82	85

Table A3: Gender differences in earnings across industries, occupation, and marital status. Sample with children in the household

(Full-time, year-round workers, % female/male median earnings ratios)

	Management		*Sales*		*Production*	
	married	single	married	single	married	single
Average across all industries	**69**	**92**	**64**	**97**	**76**	**77**
Accommodation and Food	69	74	47	156	77	78
Administrative, Support, Waste mgmt	73	155	.	.	77	78
Arts, Entertainment & Recreation	72	37	.	.	79	82
Construction	64	75	.	.	79	81
Educational Services	77	137	.	.	78	80
Finance and Insurance	65	60	64	156	79	81
Health Care & Social Assistance	69	100			73	74
Information	68	71	85	79	78	80
Manufacturing	74	134	69	89	63	64
Other Services (no Public Adm.)	71	99	59	40	71	71
Profess, Scientific & Tech. Services	69	83	.	.	77	79
Public Administration	79	77	67	100	79	81
Real Estate and Rental/Leasing	64	116	62	156	79	83
Retail Trade	63	79	54	67	68	68
Transportation and Warehousing	67	109	59	43	79	80
Wholesale Trade	66	70	72	88	75	76

Note: Gender earnings ratios are missing for Administrative, Support and Waste Management, Arts, Entertainment and Recreation, Construction, Educational Services, Finance and Insurance, and Professional Scientific and Technical Services. For these industries we are unable to compute *adjusted* gender earnings gaps for the sample of never married workers in sales occupations. This is because there is not enough variation left in each occupation/industry/marital status cell once we control for differences in age and education across workers.

Robustness

We have conducted robustness checks by performing our analysis for a finer set of, 1-digit, occupation categories (Professionals, Managers, Sales, Clerical, Craftsmen, Operatives, Laborers and Services.)

A recent study by Lemieux, MacLeod and Parent (2007) provides information on the fraction of jobs, within each 1-digit occupation, associated with pay for performance. They find that the fraction of workers in performance pay jobs is more prevalent in managerial and sales occupations. The fraction is lowest for laborers, operatives and craftsmen (that is, production workers). We use their findings to ‘rank’ 1-digit occupational categories according to the severity of the incentive problem (again, assuming that the incidence of incentive pay jobs measures the severity of the incentive problem in that occupation.) These categories can be easily obtained by using the Census variable OCC1950, which applies the 1950 Census Bureau occupational classification system to occupational data. Note that this set of occupations is also broadly consistent with the ones used in our PSID analysis.

Table A4 reports the results. The statistics on the fraction of incentive pay by occupation reported in column 1 are from Lemieux, MacLeod and Parent (2007, Table 2) based on the PSID. We report residual gender earnings ratios (controlling for education, age and industry) by marital status in column 2 and 3. Column 4 reports the difference in gender ratios by marital status. Once again, differences by marital status in gender earnings gaps tend to be highest in sales occupations where the severity of the incentive problem is most severe. These results confirm those reported in Table 1.

Table A4: Gender differences in earnings across occupation, and marital status
(Full-time, year-round workers, % female/male median earnings ratios)

	% receiving pay for performance	F/M Residual Earnings Ratios		
		Married	Never Married	Difference
Sales	54	65	93	28
Managers	22	67	93	25
Professionals	11	75	96	21
Services	9	69	90	21
Clerical	9	73	91	18
Craftsmen	9	70	87	17
Operatives	10	63	80	17
Laborers	8	68	85	17

2. PSID Samples

Our PSID sample pools together all the individuals in the 1994 to 2001 waves. Hence, the summary statistics can be interpreted as medium run averages of the relevant variables. The sample includes all white men and women between 25 and 54 years of age who are not in school, who are not in the armed forces, and who worked at least 30 hours per week and 50 weeks per year. We exclude workers with real weekly earnings below $67 in 1982 dollars from the sample. We deflate nominal variables using the CPI with base year 2000. The information on the demographic variable is from the Family and Individual files. The information on hours worked, income, bonus, and commission is from the Income Plus files. Information on bonuses and commission is only available for 824 women out of approximately 3,000 women in the sample. Of these, 270 are never married, 426 are divorced and only 13 are married. Information on incentive pay is available for most of the men in the sample (5,427 out of 5,452 observations of which 4,349 are married.) We consider the following occupational categories: management positions in administration, management positions in banking, finance and in the clerical sector, lower level management occupations, professional occupations (engineers, architects, lawyers, and medical doctors), technical occupations (in the health sector, engineering, and social sciences), occupations in community/social services, social scientists and university professors, teachers other than college professors, occupations in arts and entertainment, design, sports and the media, sales occupations, clerical occupations, craftsmen, operatives, physical laborers, in services excluding private households. We exclude from the analysis the category of laborers working in private households because no male reports to be employed in this occupation.

The sample of married couples refer to male-headed households where the head of the household is 25-44, both spouses are white and they both work full-time year-round. There is a substantial variation in the number of repeated observations for each couple in our sample across waves of the PSID (for example only a third of the married couples that we observe in 1994 are still in the sample in 1995.) This entry/exit behavior can be due to a variety of reasons: divorce, attrition from the overall PSID sample, a change in the employment status of one of the two partners or lack of information on one of the variables of interest for our analysis. Hence, it is not meaningful to either pool together all the waves of the PSID or to take averages over the set of repeated observations across waves. Each cross-section of data that satisfies the sample selection criteria only includes a small number of observations in each wave. In order to maximize the size of the cross-section, we include one data point for each married couple, corresponding to the first year in which the couple satisfies our sample selection criteria for waves 1994-2001. We experimented with different sample selection criteria. For example, we considered all the observations in one wave, say 1999, and then added married couples from adjacent waves. The results obtained for these alternative samples are consistent with the ones reported in the paper.

Table A5: Summary Statistics for the PSID overall sample

	Males		Females	
	mean	st. dev.	mean	st. dev.
Age	37.88	7.94	38.10	8.09
Years of education	13.13	2.92	12.91	3.88
Married	0.80	0.40	0.69	0.46
Never married	0.09	0.29	0.10	0.31
Widowed	0.00	0.05	0.01	0.12
Divorced	0.09	0.28	0.16	0.37
Separated	0.02	0.13	0.03	0.17
Number of children	1.11	1.14	0.90	1.04
Salary (annual)	45601	40303	28104	20889
Log hourly earnings	2.74	0.62	2.40	0.57
Market Hours (annual)	2,453	513	2,159	410
Weekly hours worked	46.47	8.70	41.39	7.18
Weeks worked	50.82	0.75	50.72	0.73
Arts & Entertainment	0.01	0.12	0.02	0.14
Clerical	0.05	0.21	0.29	0.46
Social services	0.01	0.11	0.02	0.13
Craftsmen	0.25	0.43	0.03	0.18
Laborers (physical)	0.04	0.19	0.02	0.12
Laborers (services)	0.06	0.23	0.14	0.34
Lower mngmt	0.06	0.24	0.06	0.24
Mgmt Administrative	0.13	0.33	0.06	0.24
Mngmt bank/finance	0.01	0.08	0.04	0.19
Operatives	0.16	0.37	0.06	0.23
Professionals	0.10	0.30	0.06	0.24
Sales	0.07	0.25	0.05	0.22
Social Scientists/Univ. Prof.	0.01	0.11	0.01	0.12
Teachers	0.02	0.13	0.06	0.23
Technicians	0.03	0.18	0.08	0.27
Number of Observations	5452		3046	

Observations with non missing incentive pay	5428		826	
Average incentive pay share	0.01	0.05	0.01	0.04
Observations with positive incentive pay	564		88	
Average incentive pay share	0.10	0.13	0.07	0.11
Share with positive incentive pay, by occupation				
Arts & Entertainment	0.02	0.13	0.00	0.00
Clerical	0.04	0.20	0.31	0.46
Social services	0.01	0.08	0.00	0.00
Craftsmen	0.20	0.40	0.05	0.21
Laborers (physical)	0.02	0.14	0.00	0.00
Laborers (services)	0.02	0.16	0.08	0.27
Lower mngmt	0.08	0.27	0.08	0.27
Mgmt Administrative	0.21	0.40	0.11	0.32
Mngmt bank/finance	0.01	0.10	0.08	0.27
Operatives	0.12	0.33	0.03	0.18
Professionals	0.15	0.35	0.11	0.32
Sales	0.10	0.30	0.07	0.25
Social Scientists/Univ. Prof.	0.01	0.10	0.02	0.15
Teachers	0.00	0.00	0.00	0.00
Technicians	0.02	0.15	0.06	0.23

Table A6: Summary Statistics for the PSID sample of married couples

	mean	st. dev.
Age of husband	34.15	5.87
Age of wife	32.46	6.30
Weekly home hours of husband	8.26	9.73
Weekly home hours of wife	16.15	10.49
Weeks worked, husband	50.74	0.73
Weeks worked, wife	50.70	0.71
Weekly market hours of husband	45.87	7.98
Weekly market hours of wife	41.60	9.83
Labor income of husband	39615	28083
Labor income of wife	25224	21040
Wife/husband ratio of home hours	2.32	2.62
Wife/husband earnings ratio	0.63	0.49
Husband/Wife difference incentive share	-0.002	0.01
Number of children	1.03	1.13
Number of Observations	300	