

Why are Married Men Working So Much?*

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Beta Version! For NBER Summer Institute only.

July 17, 2005

Abstract

Trends in relative wages and spouse's time allocation in the US over the last 30 years suggest an increase in the bargaining power of wives relative to their husbands. The paper proposes a simple one-period bargaining model of marriage to explore the implications of these trends. The results suggest that the rise in bargaining power that accompanies a higher wage may play a significant role in explaining trends in female labor supply and college attendance.

*Prepared for the NBER Summer Institute, July 20, 2005. I am grateful to Iourii Manovskii, Andrew Postlewaite, Victor Rios-Rull, Stephen Shore and Gustavo Ventura for helpful discussions.

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1 Introduction

In a world where women's wages are rising faster than those of men, where fertility is falling, and home technology improving, divorce rates rising, etc, there is no shortage of potential explanations of the rapid rise we've seen in married women's labor supply over the last 30 years. So many things have changed over the same time period that it is difficult to see how we will ever sort out the competing explanations on the basis of women's behavior alone. One thing that has not changed much however is the leisure time of men married to women younger than age 55. In this paper we argue that this is a surprising fact that is informative not only about women's labor supply but also about women's demand for education and the process by which married couples make decisions.

According to Blau and Kahn (1997), wages of women aged 35-54 grew from slightly less than 60 per cent of men's in 1970 to 76 per cent in 1998 . Consider the theoretical implications for men's leisure in a static model of household labor supply. We show below that if households maximize a weighted sum of the spouse's utilities, a common assumption in economic models, then with log preferences, husband's leisure should have increased by 15% over this period.

Taking total working time to be the sum of market labor hours and hours spent in housework, this prediction is indeed corroborated in the data, but only for men married to women older than 55. For husbands of younger women we see no evidence of a decline in leisure at all. This gap between theory and evidence is, at the very least, quantitatively significant.

It is natural to think that the problem is the excessive simplicity of the

model, perhaps due to log preferences, or the lack of consideration of a home production sector or the failure to incorporate wage dynamics or savings. A recent paper by Jones, Manuelli, and McGrattan (2003) refutes this view. In a dynamic model which relaxes all of the above restrictions, and is calibrated to match US data, husband's leisure is still predicted to increase by 5 hours over this period. Furthermore that paper shows that under the alternative hypothesis that women's labor supply is driven by technical change in the home production sector, the hypothesis promoted by Greenwood, Seshadri, and Yorukoglu (2003), the expected increase in men's leisure is considerably larger.

It is not hard to see why this problem is so robust. Husband's leisure should increase for two reasons, familiar to all victims of intermediate economics instruction. First, if leisure is a normal good, then the fact that higher wages make the household richer should cause both spouses to demand more leisure. Second, the higher relative wage of wives should cause a substitution of wife's labor for men's labor, because husband's leisure has become cheaper relative to wife's leisure. The case of technical progress in home technology is more complex, because of the possibility that home goods are inferior, but since the marginal product of wife's labor has increased, the same basic reasoning applies.

This paper argues that these facts indicate an increase in women's share of household utility. We present a simple model of bargaining between spouses in which the outside option is life as a single person, as in McElroy and Horney (1981). We consider two bargaining solutions, and show that both are capable of matching the lack of response of leisure to women's wages, and are also

consistent with women's leisure rising faster than men's, unlike the unitary model. What determines the sign of the response to changes in women's wage is the quality of life enjoyed by singles. However the relationship depends on the bargaining model employed. This suggests that it is possible to use the data to determine which bargaining model is the most appropriate for predicting labor response to changes in wages and government policies.

It is straightforward to see that in a dynamic context, the bargaining model has other implications for the changes associated with female labor supply, notably education and divorce. Bargaining may imply strong incentives for women to acquire human capital, whether through education or through experience, so it seems likely that, whatever the role of wages or technical change in explaining education, a drop in the cost of divorce, such as the US experienced in the 1970s is going to strengthen the bargaining-related incentives to acquire a higher wage. This suggests an alternative explanation of the increase in women's labor supply and wages.

In bargaining models of the household, such as McElroy and Horney (1981), the weight of each spouse in the household utility function depends on the outside options of both spouses. One might consider a variety of outside options, including a non-co-operative state within the marriage, as in Lundberg and Pollak (1993) but the obvious starting point in a world where marriages are often of short duration is divorce.

It is clear that value of being a divorced person has changed substantially over the time period under consideration, both due to increasing wages and to shifting social attitudes that has freed people from the stigma formerly associated with divorce. Econometric evidence also suggests that the evolu-

tion of divorce laws in the early 1970s has made divorce easier to obtain. In the analysis to follow, we summarize the value of single life as consisting of utility from consumption and leisure plus a non-pecuniary element.

Since our household models involve the threat of divorce, it is clear that the models will have strong implications for time trends in divorce. If separations are efficient, then these implications are independent of the bargaining model under consideration, so the first result is to establish conditions such that a narrowing of the wage gap between husband and wife would lead to an increase in divorce rates. This will be useful for calibrating the dynamic model to U.S. data, where increasing divorce rates among older couples appear to accompany the narrowing of the gender wage gap.

The first bargaining model we consider has a simple solution concept: the spouses split the marital surplus equally between them. This allows us to solve explicitly for the equilibrium allocation. The main question, when is husband's leisure decreasing in the wife's wage, can therefore be answered explicitly.

We then consider the Nash bargaining solution. This allows the share of the marital surplus to depend on the wage, which turns out to lower the marginal value of the wage for wives. We compute solutions for this model, and find that husband's leisure may be invariant to the wife's wage, and that this is consistent with both the wife's increasing and remaining constant as her wage increases. We also show that an increase in women's wages can make marriage more stable; this requires that men have a sufficiently high non-pecuniary benefit of being single compared to that of women.

Finally, we find that for the model to be consistent with both zero re-

sponse of husband's leisure and with the decline over time in the relationship between wife's working hours and divorce requires that women place a relatively low value on single life.

[TO BE COMPLETED].

2 Trends in Time Allocation of Married Couples

In this section we compare over time a representative cross-section of married-couple households in the U.S. The main variables of interest are the market labor time and time spent in housework of each spouse. The sum of these is taken to be total working time, and the remainder of total waking time as free time or leisure.

The data is taken from the 1969-1997 waves of the PSID, excluding those years in which housework data was not collected, such as 1975 and 1982. None of the analysis reported here exploits the panel nature of the study; the PSID is used because it is the only annual cross-sectional dataset in the U.S. that includes housework.

Our sample consists of all wives (or "wives") between the ages of 25 and 80 who report time spent in market labor and house work for both spouses. The sample size grows over time, from 1018 households in 1969, to 3052 in 1997. This results in a total number of annual observations equal to 69,762.

The housework variable is the response to the question: "About how much time does your (wife/"WIFE") spend on housework in an average week? I mean time spent cooking, cleaning, and doing other work around the house."

A similar question is asked for husbands.

Weekly hours worked are taken to be the annual numbers reported, divided by 52. In order to ensure that extreme values of hours do not distort the results, we top-code both market hours and housework hours at 90 hours weekly; this affects only the top percentile in each case.

Table 1 reports averages of these variables, as well as annual labor income, over three periods: 1969-74, 1978-83 and 1988-97. To ensure that the sample is representative, all statistics are weighted using the household's cross-sectional weight for each year. The table shows that market hours are in line with reports based on CPS data: market hours increase from 11.65 in 1969 to 24.8 in 1997 for wives aged 25-35 years, with very similar trends for older women to age 55. For wives aged 55-64, the increase is relatively small, from 12 to 15 hours. Annual means are plotted in Figure 6, which shows hours of the three younger groups climbing steadily from about 1975 until they flatten out in the 1990s.

Husband's market hours decline slightly over the early 1970s, but for those whose wives are younger than 55, the decline slows almost to a halt after that. For the youngest group, market hours actually increase slightly over the later period, while for the other two, the decline is by less than an hour, from 42.3 to 41.6 for wives aged 35-44 years and from 39.9 to 38.8 for the older group. Figure ?? shows the annual means, which, for the three younger groups, are quite flat over the period, after an initial slight decline over the years 1969-1974. Hours do decline substantially for the two older groups, from 35 to 20 weekly hours for the 55-64 group, with a partial recovery in the mid 1990s. This helps reconcile our findings to the well-known observation that

men's labor hours declined over this period; to the extent that husband's labor supply is responsible for this decline, it is the husbands of older women who are implicated, not those with wives aged less than 55 years.

The most dramatic contrast between husband and wives is in hours of housework. A look at Figure 7 shows that for wives, housework hours have been plummeting since the late 1970s, from nearly 30 hours per week in 1979 to less than 20 hours by 1995. A similar drop, from 35 to 30 hours, occurred in the early 1970s for the younger groups. Table 1 shows that the average over the 1978-83 period was, for the pre-retirement groups, roughly 7 hours higher than over the 1988-1997 period, while for the wives aged 65 or higher the decline over that period was much smaller, only about 1.5 hours.

For husbands in the younger age groups, however, Figure 8 shows that home hours increased rapidly in the 1970s, from about two to about six and then more slowly through the 1980s to just over seven in 1990.

Putting together the market and home hours, it is clear that younger husbands did not experience an increase in leisure over this period, the predictions of the unitary model notwithstanding. This is evident from both Figure ?? and Table 1. Furthermore, wives total hours of work did not increase, and in fact may have declined slightly. The facts that the decline in home hours is concentrated in younger wives, and that husband's home hours increased so quickly, both suggest that technological change in the household sector is not the whole story.

Another way to put the question is whether the increase in wife's hours of work in the market explains the decline in wife's home hours. At first glance, this appears obviously true, because wife's total hours, shown in Figure 9,

decline by so little.

However the implicit assumption in such an argument is that the elasticity of home hours with respect to market hours equals one. In fact it is likely that this elasticity is much less than one: it is well known that wives who worked full time in the 1970s also worked more total hours than other wives. To get an aggregate measure of the extent to which market hours explain the fall in home hours, we now turn to a regression-based analysis of the annual means of the hours variables.

The question is whether changes in hours worked explains the decline in home hours or if something else is going on. The variables in this analysis are all annual means by category of household. The categories distinguish households where the wife worked from those where she did not, and those where the wife worked 30 hours or more from those where she worked less. The data set therefore consists of 27 years times the number of categories. The variables of central interest are the categorical variables for time period, D_t ; a value of 1 for D_0 indicates a year between 1968 and 1974, while a value of 1 for D_2 indicates 1978-1983, and D_3 indicates 1988-1997. The regression model is otherwise quite standard:

$$n_{it}^h = \alpha_0 + \alpha_1 n_{it}^m + \alpha_2 x_i + \sum_{s=1,2} \delta_s D_s + \varepsilon_{it}$$

The dependent variable n_{it}^h is average home hours of the wife in each category i in year t , and n_{it}^m the number of hours the wife worked in the market sector. Level differences in home hours across categories are reflected by the vector of coefficients α_2 on the categorical variables x_i . Finally, time-related differences that are unexplained by the other variables are reflected in the coefficients

δ_s . The model is estimated separately for each of the age groups discussed in the previous analysis.

Tables 2 and 3 report the results for two specifications. In Table 2, we see the basic specification, which includes the market-labor variables and the time variables. The coefficient (standard error) on wife's market hours ranges from -0.71(0.07) for wives aged 25-34 to -0.31(0.10) for the oldest group. These estimates are clearly less than one: more than four standard deviations below one in the case of the highest coefficient, so it is clear that trends in market hours are not going to explain the declines in home hours. Nor is allowing for non-linearity going to help; women who work full-time actually work more home hours, controlling for the linear effect of market hours. The corollary is that time effects are highly negative. For the three younger groups, average home hours are roughly 3 hours less than predicted in 1978-83 and 7 hours less in 1988-97.

The discussion has so far ignored the decline in average fertility over the same time period. This might be viewed as another component of home time, so breaking out time with kids from free time would magnify the decline in home hours, and much for wives than for husbands, as mothers spend much more time taking care of kids than do fathers. However explaining the fertility decline is beyond the scope of the current analysis. Instead we take a conservative approach, and ask whether the fertility decline can explain the decline in wife's home hours. We do this by adding variables that reflect the average number of kids at home to the regression in Table 3.

The results show that having kids at home is indeed associated with more home hours. For the youngest age group, wives work an additional 6.5 hours

weekly when there are two or fewer kids at home, and 11 additional hours if there more than two kids. Taking this into account however reduces the effect of market hours on home hours to about -0.55. This suggests that a good deal of the apparent effect of market hours on home hours in part(a) was actually due to women with kids working fewer hours in the market and more at home. The time effects do decline slightly when fertility is accounted for, but the basic picture is the same as in part (a).

The conclusions to be drawn from the empirical analysis are that the increase in women’s labor force hours appears to be associated with no decline in husband’s labor hours, despite the prediction of the wage-based explanations of women’s market hours. Furthermore women’s work hours do not increase, despite an increase in her cost of leisure: this is due to a dramatic decline in wife’s home hours.¹ The data is telling us that there is more to wife’s labor hours than the unitary model can account for.

3 A Simple Static Model

The main purpose of the analysis in this section is to explore the ability of a one-period bargaining model to explain how husband’s leisure might fall when the wife’s wage increases relative to that of her husband.

Suppose that preferences of individuals are given by

$$\tilde{u}(c, l, q) = \ln c + \delta (\ln l + \ln q)$$

¹It may be plausible to attribute this decline to technical change in the home sector, but that story must involve some sex-specific technological change, because husband’s home hours were increasing at the same time, and account for the weaker decline in home hours among older wives.

where c is consumption, l is leisure, and q reflects other non-pecuniary enjoyment of life as a single person. For married people, $\ln q = 0$.

Single people face a budget constraint given by

$$c_i + w_i l_i = w_i$$

The optimal decisions are given by

$$\begin{aligned} c_i &= \frac{1}{1 + \delta} w_i \\ l_i &= \frac{\delta}{1 + \delta} \end{aligned}$$

So the value of being single is given by

$$\begin{aligned} R^S(w_i) &= \ln w_i + K_{SW} + \delta \ln q_i \\ K_{Si} &= -(1 + \delta) \ln(1 + \delta) + \ln \delta \end{aligned}$$

Suppose consumption is a public good in the marriage, so that consumption per capita equals ϕc , where c represents expenditures, and $\phi \in [0.5, 1]$ is a constant. The value of being married, given that person i has weight μ_i in the couple's utility function, is given by the solution to the following

$$\max_{l_i, l_j} \{ \ln \phi c + \mu_i \delta \ln l_i + (1 - \mu_i) \delta \ln l_j \} \quad (1)$$

subject to

$$c + w_i l_i + w_j l_j = w_i + w_j$$

Let $\tilde{w} = w_j/w_i$. The optimal decisions are:

$$\begin{aligned} c_i &= \frac{1}{1 + \delta} (w_i + w_j) \\ l_i &= \mu_i \frac{\delta}{1 + \delta} (1 + \tilde{w}) \end{aligned}$$

The value of being married is

$$U^{M_i}(w_i; \mu_i) = (1 + \delta) \ln(w_i + w_j) - \delta \ln w_i + \delta \ln \mu_i + K_M$$

, where $K_{M_i} = \ln \phi - (1 + \delta) \ln(1 + \delta) + \delta \ln \delta$.

Blau and Kahn (1997) report that women's wages rose, as a fraction of men's, from 0.60 to 0.76 over the period 1970 to 1995. The model says that, if the weight μ_i remained constant, then husband's leisure should have increased by

$$\frac{l_i(0.76)}{l_i(0.6)} = \frac{1 + 0.76}{1 + 0.6} = 1.1515$$

. If we take leisure to be non-working awake time, roughly 80 hours per week, then we should see an increase of about 12 hours; if we allow that about half of non-working time is not free time, as per Robinson and Godbey (1997), then we are still looking for a six-hour increase in weekly leisure. Husband's time in home production was about 2 hours weekly in 1970, and increased to around 6 hours by 1995, so we should see a decline of 10 hours or more in other non-leisure activities, of which market labor is by far the largest component.

For older husbands, those married to women aged 55 or older, we do in fact observe a decline of this order in market hours. However for younger men, the predicted decline is so large relative to any observed trend in the data that it seems unlikely that tweaking the preferences or adding home production are going to solve the problem. The results of Jones, Manuelli, and McGrattan (2003) corroborate this conjecture for both wage-based explanations of the rise in women's market hours. It is difficult to see how the problem can be resolved without allowing μ to respond to wages. The reduction in the

husband's weight implied by the zero response of leisure for the under 55 group is

$$\frac{\mu(0.76)}{\mu(0.6)} = \frac{1.6}{1.76} = 0.90$$

, so the corollary is that the wife's weight in the average couple's utility function has increased by 10 per cent since 1970.

To understand household labor supply therefore requires a theory of these weights. We will use bargaining models, in which the solution depends on the gains from marriage. Each person's gain from marriage can be written as

$$\begin{aligned} & U^{Mi}(w_i; \mu_i) - R^{Si}(w_i) \\ = & (1 + \delta) \ln \left(\frac{w_i + w_j}{w_i} \right) + \delta \ln \frac{\mu_i}{q_i} + K_{MSi} \end{aligned}$$

Where

$$K_{MSi} = \ln \phi - (1 - \delta) \ln \delta$$

3.1 The Allocation of the Marital Surplus

How are the weights μ determined? Consider a marriage in which the total surplus is positive. The allocation of the surplus between the two spouses is equivalent to the choice of the weights in the planner problem. This therefore requires a theory of the allocation of the surplus, so we turn to bargaining models. We consider two possibilities: the egalitarian solution in which the marital surplus is split equally between the spouses, and the Nash solution, which maximizes the product of the gains from marriage. We abstract from any consideration of the process by which these solutions are attained. The

advantage of the egalitarian solution is that it is analytically tractable; the Nash solution on the other hand is more commonly used.

Since the motivation for considering a bargaining model involves the observation that husband's leisure is not increasing, it is essential to consider the conditions under which an increase in the wife's wage causes men's leisure to fall. If the weight μ is constant, then this cannot happen, so we require μ to be sufficiently responsive to the relative wage \tilde{w} .

The optimality condition implies the following response of leisure of spouse i to an increase in her relative wage:

$$\frac{d \ln l_i}{d \tilde{w}} = -\frac{d \ln \mu_i}{d \tilde{w}} - \frac{1}{1 + \tilde{w}}$$

If the following condition is satisfied, then husband's leisure falls when the wife's wage increases.

$$\frac{d \ln l_i}{d \tilde{w}} < 0 \Leftrightarrow -\frac{d \ln \mu_i}{d \tilde{w}} < \frac{1}{1 + \tilde{w}} \quad (2)$$

To see under what conditions this might happen, we consider two theories of the weight μ_j .²

3.1.1 The Egalitarian solution

To keep things simple, we assume identical preferences for leisure, so that $K_{MS_j} = K_{MS_i}$.

Suppose that spouses agree to split the gains from marriage evenly, so that the share $\mu_i(w_i, w_j)$ solves

²Note that if this condition is satisfied, then the spouses's leisure will be increasing in her own wage, because of the symmetry of the problem.

$$U^{Mj}(w; \mu_j) - R^{Sj} = U^{Mi}(w; \mu_i) - R^{Si}$$

. Substituting our previous results for the gains from marriage, one can solve for μ :

$$\mu_i(\tilde{w}) = \frac{1}{1 + \tilde{q}\tilde{w}^{\left(\frac{1+\delta}{\delta}\right)}}$$

, where we let $\tilde{q} = \frac{q_j}{q_i}$. The response of μ_i to changes in the relative wage is:

$$-\frac{d}{d\tilde{w}} \ln \mu_i = \frac{\tilde{q}^{\frac{1+\delta}{\delta}} \tilde{w}^{\frac{1}{\delta}}}{1 + \tilde{q}[\tilde{w}]^{\left(\frac{1+\delta}{\delta}\right)}}$$

What does this imply for men's leisure? Let j refer to the wife, so that a rising female wage corresponds to increasing \tilde{w} . The question is whether this will cause l_i to increase.

From condition (2), the leisure of spouse i will fall in response to a decline in \tilde{w} when

$$\begin{aligned} \frac{d \ln l_i}{d\tilde{w}} < 0 &\Leftrightarrow -\frac{d}{d\tilde{w}} \ln \mu_i < \frac{1}{1 + \tilde{w}} \\ &\Leftrightarrow \tilde{q} < \frac{1}{\tilde{w}^{\frac{1}{\delta}} \left(\frac{1+\delta}{\delta} \frac{1+\tilde{w}}{\tilde{w}} - 1 \right)} \end{aligned}$$

For husband's leisure to fall in response to an increase in the wife's wage requires that \tilde{q} be sufficiently low, so that single life is sufficiently less attractive for women than for men. As the wife's wages relative to the husband's, this condition may be violated, and husband's leisure will start increasing. Conversely, the observation of no trend in leisure over this period suggests equality, and that \tilde{q} is declining at the same rate as the right hand side. This means the quality of single life is growing less quickly for women than for men.

3.2 The Nash solution

The egalitarian solution does not allow for the possibility that a spouse's share of the surplus depends on her relative wage. To the extent that the Nash solution has different implications for labor supply, then we may also be able to use the data to distinguish between the different solution concepts.

Consider the generalised Nash bargaining solution, where the husband's bargaining power equals $\gamma \in (0, 1)$. The solution consists of choosing the decision vector D to maximize the product:

$$\max_D [U^{Mi}(D) - R^{Si}(w_i)]^\gamma [U^{Mj}(D) - R^{Sj}(w_j)]^{1-\gamma} \quad (3)$$

The first order condition is:

$$\frac{U^{MH'}}{U^{MW'}} = \frac{1 - \gamma}{\gamma} \frac{U^{MH} - R^{SH}}{U^{MW} - R^{SW}} \quad (4)$$

Note that if the derivatives $\frac{U^{MH'}}{U^{MW'}}$ were constant, then the Nash solution would imply constant shares of the marital surplus, a generalisation of the previous model. This would occur with perfectly transferable utility, an assumption often made in the search literature. However in our case, utility is transferred using the leisure allocation, and utility for leisure is concave, so utility is only partially transferable.

Since the solution is pareto optimal, there exists some weight μ_i such that the Nash solution D^* is the same as the solution from solving equation (1).

Putting together conditions (??) and (4), implies the following

$$\frac{1 - \mu_i}{\mu_i} = \frac{1 - \gamma}{\gamma} \left(\frac{U^{Mi}(D(\mu_i)) - R^{Si}}{U^{Mj}(D(\mu_i)) - R^{Sj}} \right)$$

For the example with the log utility model developed above, μ_i solves the

following non-linear equation:

$$\frac{1 - \mu_i}{\mu_i} = \frac{1 - \gamma}{\gamma} \left(\frac{(1 + \delta) \ln(1 + \tilde{w}) + \delta \ln \frac{\mu_i}{q_i} + K_{MS}}{(1 + \delta) \ln(1 + 1/\tilde{w}) + \delta \ln \frac{1 - \mu_i}{q_j} + K_{MS}} \right)$$

As in the egalitarian solution, wages only matter via the wage ratio \tilde{w} . However the quality of single life now enters in levels rather than just as a ratio.

In Figures 10-12, $\tilde{w} \in [0.5, 2.0]$. We plot the marriage outcomes on the interval of wife's wage for which the marital surplus is positive. We consider three cases, all with identical preferences δ and equal bargaining power γ . What varies in these cases is the benefit of single life, $q = (q_w, q_h)$.

Figure 10 concerns the case where husband and wife have equal non-pecuniary benefit of single life: $q = (q_w, q_h) = (1, 1)$. In this case, the marriage remains viable over the entire range of women's wages. The first panel of Figure 10 confirms that as the wife's wage increases from half of the husband's to double, the husband's weight in the Pareto problem declines, from 0.65 to 0.5 at equal wages. Nevertheless, the husband's share of the marital surplus is increasing, because, from the planner's point of view, an increase in the wife's wage raises the marginal cost of her share. This means the utility weight μ is less responsive to the relative wage than in the egalitarian solution.

The next two panels show that husband's labor remains constant, as does that of the wife. Thus the model with $q_w = q_h = 1$ generates the main feature of the data, the fact that the work week of both husband and wife are relatively constant. We cannot however conclude that this is due to equality across sexes, because in the Nash model, the ratio \tilde{q} is no longer a sufficient statistic for (q_w, q_h) .

The easiest way to summarise the properties of the model is to see what happens to the derivative $\frac{d}{d\tilde{w}}l_h$ as one dimension of q varies and the other is held constant. To find out under what conditions changing relative wages does not affect leisure, we compute solutions holding \tilde{w} fixed. The results show that the derivative $\frac{dl_h}{d\tilde{w}}$ is:

1. increasing slightly in q_h ; the range is on the order of 0.05
2. decreasing rapidly in q_w ; the range is on the order of 0.5
3. tends to zero around $q_w = 1$.
4. increasing q_h makes the effect of q_w much stronger
5. the relationship between $\frac{dl_h}{d\tilde{w}}$ and q relatively insensitive to wage levels and ratios.

In Figure 14, we fix $q_w = 0.44$, so that women suffer in single life, and their wage w_w at 0.65, to approximate the value in the 1970s. We then plot the derivative of husband's leisure with respect to the wage as q_h varies on the interval $[0.01, 1.5]$. The result is that as q_h increases, so does the derivative, which is always positive: men's leisure becomes more responsive to women's wages as men's valuation of single life gets better. Now fixing the men's $q_h = 0.44$ and varying q_w shows the derivative declining throughout, attaining zero at $q_w = 1$.

Now suppose we fix $q_w = 1$ and vary q_h . The derivative remains very small, less than 0.01 in absolute value, for any value of q_h on $[0.4, 1.5]$, so in the case of $q_w = 1$ it is very likely that we will see no response of husband's leisure. The next figure shows that fixing $q_h = 1$ only generates a derivative

of zero when $q_w = 1$; the derivative grows very quickly in absolute value as q_w diverges from one. So what is special about $q_w = 1$?

Consider the same experiments, now with the men's wage increased to 1.25, it is possible to attain a zero derivative with a smaller level of q_w , on the order of 0.5, instead of 1 as before. So the level of q_w matters in relation to the wage level, means zero response of leisure at a lower value, and there appears to be nothing special about $q_w = q_h$, or $q_w = 1$.

These results suggests there is a simple, smooth relationship between the quality of single life and the response of men's leisure to wages, but so far we have not been able to show this analytically. Why does q_w seem to play a more important role? We have shown that it is not because women have lower wages; could it be because it is women's wages that are changing?

{TO BE COMPLETED}

3.3 Does labor supply predict divorce?

We know from the results of Johnson and Skinner (1986) that wives who worked more labor hours in the 1970s were more likely to be divorced by 1980. In terms of the unitary model, with an exogenous risk of divorce, this is very easy to explain, given the dependence of women's wages on labor experience, because wage income is far more important for single women than for married. However two results from more recent research are not so easy to accomodate.

The first result is that the returns to experience appear to have increased significantly for women over the last 30 years. This was first documented by Blau and Kahn (1997), and work by Olivetti (2001) and Caucutt, Guner, and

Knowles (2002) suggest this may account for a significant part of the increase in wife's labor hours. In light of the unitary model, this would suggest that the predictive power of labor supply with respect to divorce has increased.

The second result is that, contrary to the above implication, the relation between wife's labor supply and future divorce may have become weaker over time. Sen (2002) uses NLS data to compare two cohorts of women, those born between 1944-1954 and those born between 1957-64, and finds that predictive power of married women's market work on divorce has actually decreased substantially across cohorts, to the point where the relation may actually be negative.

It is typically assumed that when married women work fewer annual hours in the market than single women, that this implies that single women should care more about their wage. An important implication of this assumption is that an increase in divorce risk causes women to work more in the market. In this section we examine conditions for this assumption to be consistent with the model. The main finding is that as divorced life becomes more attractive to women, wife's labor supply becomes less effective in predicting divorce.

Let the wages of spouses (i, j) be given by $w = (w_i, w_j)$. In general, the shadow value of the wage for spouse i is given by

$$\frac{d}{dw_i} U^{Mi}(w; \mu_i) = \frac{1 + \delta}{w_i + w_j} - \frac{\delta}{w_i} + \delta \frac{\frac{d\mu_i}{dw_i}}{\mu_i}$$

For singles, the shadow value of the wage is given by:

$$\frac{d}{dw_i} R^{Si}(w_i) = \frac{1}{w_i}$$

So for wives to care as much about their wages as do singles, we need condi-

tions such that

$$\frac{\frac{d\mu_i}{dw_i}}{\mu_i} > \frac{1 + \delta}{\delta} \frac{w_i/w_j}{w_i + w_j}$$

In the egalitarian solution,

$$\frac{\frac{d\mu_i}{dw_i}}{\mu_i} = \frac{1 + \delta}{\delta} \frac{\frac{q_j}{q_i} \left[\frac{w_j^2}{w_i} \right]^{\left(\frac{1}{\delta}\right)}}{\left[1 + \frac{q_j}{q_i} \left[\frac{w_j}{w_i} \right]^{\left(\frac{1+\delta}{\delta}\right)} \right]}$$

This implies wife i cares more about her wage than if she were single if the following condition is satisfied:

$$\frac{\frac{q_j}{q_i} \left[\frac{w_j^2}{w_i} \right]^{\left(\frac{1}{\delta}\right)}}{1 + \frac{q_j}{q_i} \left[\frac{w_j}{w_i} \right]^{\left(\frac{1+\delta}{\delta}\right)}} > \frac{w_i/w_j}{w_i + w_j}$$

Two results are immediately apparent. First, an increase in $\frac{q_j}{q_i}$ is going to raise the marginal value of w_i to spouse i . Since the units of q are arbitrary, it is quite possible that wives care about own wages than do single women. Second, the weight μ_i depends on the ratio $\frac{w_j}{w_i}$ but not the sum $w_i + w_j$. So the level of wages is important: a proportional increase in both husband's and wives wages makes w_i relatively less important to person i if she is married.

Now consider the Nash solution. Although we cannot solve for an explicit condition, we can explore the effect of the trend in the gender wage gap on the degree to which single women care more about their wage than do married women. We compute the marginal value of the wage by fitting a polynomial in wages to the woman's value function:

$$V(w_w; w_h, q) = \max \{ U^{MW}(w_w; w_h, q), R^{SW}(w_w; w_h, q) \}$$

.

In Figures 13 and 14, we show the effect of a rise in the female wage on the marginal value of the wage for the cases we examined in the previous section, with $w_h = 1$, and the relative value of single life varying. In each figure, we show in the first panel, women's utility from married and single states, in the second the value of the wage, in the third the marginal value of the wage. Finally, we show how the viability of marriage depends on the wage by plotting the minimum and maximum weights for which marriage is rational for both spouses.

With $(q_w, q_h) = (1, 1)$, it is clear that as the relative wage approaches one, that the difference between in the marginal benefit of the wage married and single women is diminishing, although the benefit remains higher for single women. So the bargaining models predicts that labor supply would become less effective in predicting divorce. The result holds true at other parameter values too. The next figure shows that when women like single life more than men do, the marginal value is actually increasing for wives.

In the above cases , the value of the marginal wage is still higher for singles at all wage gaps. That changes if we make women worse off when single. As figure 14 shows, the marginal value of the wage becomes equal as the relative wage approaches one. In this case, leisure of the husband is relatively constant, as in the data, and wife's working hours decline by 10% as the wage gap follows the trend reported by Blau and Kahn (1997). Thus the fitting of the model to the facts suggests that women must suffer more as singles than do men.

4 Conclusion

Analysis of home and market hours in the PSID suggests that men's leisure does not appear to be rising over time, that women's labor hours are not increasing, and that women's time in home production seemed to be falling more than one would expect from the increase in wages. Given that women's wages have been rising relative to men's since the 1970s, we inferred that women are getting a bigger share of household utility.

We created a simple bargaining model based on log preferences. We first considered an egalitarian solution, which allowed us to solve analytically for the outcomes. This showed that what mattered for predicting outcomes were the ratios of wages and quality of single life by sex, not the levels. We were then able to derive conditions such that men's leisure would remain constant as the wage increased.

We then considered the Nash solution, which allows the share of the surplus to vary with the wage. When we computed the outcomes as functions of how the valuation of single life differed by sex. We saw that if the non-pecuniary benefit of single life were zero for both men and women, then men's leisure would not trend. However in this case, the return to wages is higher for single women, and so wife's labor supply should be a good predictor of divorce. If on the other hand, women had disutility for single life, then the return to wages would become independent of marital status as the gender wage gap disappeared.

Set in a dynamic context, the bargaining model would also have implications for marriage rates, divorce and schooling that that could be tested against the time series in US data. Until the 1970s, rising women's wages were

not associated with increased divorce or women's schooling, and men's leisure increased with wife's earnings. If divorce became less costly for wives over the 1970s, then the bargaining power model may explain why men's leisure stopped increasing, and why women increased their college attendance.

In summary, the results of this paper suggest that we are not going to figure out the correct explanation of the rise in working hours of married women on the basis of the unitary model because women's wages in the US appear to be interacting with their bargaining power. If we are going to use the data to distinguish competing explanations of the rise in women's labor supply, then this requires a bargaining model of the household.

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Table 1: Married Couple's Hours and Earnings in PSID

| Age of Wife | Years | N | Wife's Weekly Hours | | | Husband's Weekly Hours | | | Annual Labor Income Earnings Ratio | | |
|-------------|-----------|-------|---------------------|--------|-------|------------------------|--------|-------|------------------------------------|----------|--------------|
| | | | Home | Market | Total | Home | Market | Total | Wife | Husband | Wife/Husband |
| 25-34 | 1969-1975 | 2091 | 34.86 | 11.65 | 48.01 | 2.36 | 44.26 | 47.98 | \$4,271 | \$25,816 | 0.17 |
| | 1978-1983 | 5449 | 27.75 | 18.25 | 46.75 | 6.70 | 41.59 | 49.06 | \$6,668 | \$22,659 | 0.29 |
| | 1988-1997 | 12237 | 20.87 | 24.82 | 46.18 | 7.44 | 41.71 | 49.83 | \$10,052 | \$23,241 | 0.43 |
| 35-44 | 1969-1975 | 1955 | 34.28 | 12.43 | 47.57 | 1.91 | 44.02 | 46.92 | \$4,061 | \$30,977 | 0.13 |
| | 1978-1983 | 2345 | 29.31 | 17.70 | 47.71 | 5.59 | 42.35 | 49.02 | \$6,574 | \$28,212 | 0.23 |
| | 1988-1997 | 12146 | 21.10 | 25.31 | 46.69 | 7.46 | 41.56 | 49.74 | \$11,888 | \$28,742 | 0.41 |
| 45-54 | 1969-1975 | 1173 | 32.12 | 13.71 | 46.54 | 1.78 | 43.26 | 45.80 | \$4,981 | \$27,712 | 0.18 |
| | 1978-1983 | 2011 | 27.91 | 17.25 | 45.62 | 6.24 | 39.56 | 46.54 | \$6,196 | \$28,491 | 0.22 |
| | 1988-1997 | 5617 | 20.75 | 24.67 | 45.62 | 6.44 | 38.78 | 45.95 | \$11,230 | \$29,835 | 0.38 |
| 55-64 | 1969-1975 | 386 | 27.89 | 12.23 | 40.27 | 3.31 | 35.19 | 38.73 | \$4,605 | \$21,124 | 0.22 |
| | 1978-1983 | 1121 | 29.13 | 10.29 | 39.83 | 7.18 | 28.95 | 36.48 | \$3,617 | \$16,901 | 0.21 |
| | 1988-1997 | 3650 | 22.84 | 15.05 | 38.09 | 7.56 | 23.62 | 31.56 | \$6,447 | \$17,679 | 0.36 |
| 65-80 | 1969-1975 | 53 | 29.71 | 1.94 | 31.74 | 4.48 | 20.02 | 24.50 | \$395 | \$14,917 | 0.03 |
| | 1978-1983 | 372 | 27.05 | 3.26 | 30.62 | 8.35 | 11.44 | 19.75 | \$1,138 | \$6,095 | 0.19 |
| | 1988-1997 | 2345 | 25.49 | 2.95 | 28.65 | 7.93 | 6.12 | 14.14 | \$1,250 | \$3,084 | 0.41 |

Figure 1: Summary statistics for married couples in the PSID.

| Variable | Statistic | Age of Wife | | | |
|---------------------|--------------------|-------------|--------|--------|--------|
| | | 25-34 | 35-44 | 45-54 | 54-65 |
| Intercept | Parameter Estimate | 41.65 | 40.52 | 38.31 | 32.10 |
| | Standard Error | (1.43) | (0.99) | (1.03) | (1.48) |
| | t Value | 29.07 | 41.02 | 37.05 | 21.67 |
| | Pr > t | <0.01 | <0.01 | <0.01 | <0.01 |
| 1978-83 | Parameter Estimate | -3.80 | -2.71 | -2.62 | 0.82 |
| | Standard Error | (1.60) | (1.25) | (1.22) | (1.68) |
| | t Value | -2.38 | -2.16 | -2.14 | 0.49 |
| | Pr > t | 0.02 | 0.03 | 0.04 | 0.63 |
| 1988-97 | Parameter Estimate | -7.29 | -7.74 | -7.22 | -4.02 |
| | Standard Error | (1.50) | (1.04) | (1.10) | (1.53) |
| | t Value | -4.84 | -7.47 | -6.56 | -2.63 |
| | Pr > t | <0.01 | <0.01 | <0.01 | 0.01 |
| Wife's Market Hours | Parameter Estimate | -0.70 | -0.59 | -0.53 | -0.41 |
| | Standard Error | (0.07) | (0.05) | (0.05) | (0.06) |
| | t Value | -9.46 | -11.02 | -9.80 | -6.75 |
| | Pr > t | <0.01 | <0.01 | <0.01 | <0.01 |
| Market Hours > 25 | Parameter Estimate | 8.11 | 6.69 | 5.92 | 4.61 |
| | Standard Error | (2.38) | (1.68) | (1.77) | (2.25) |
| | t Value | 3.40 | 3.98 | 3.35 | 2.05 |
| | Pr > t | <0.01 | <0.01 | <0.01 | 0.04 |

Figure 2: Regression of Annual Means of Wife's Weekly Housework Hours in PSID

| Variable | Statistic | Age of Wife | | | | |
|---------------------|--------------------|-------------|--------|--------|--------|--------|
| | | 25-34 | 35-44 | 45-54 | 54-65 | 65-80 |
| Intercept | Parameter Estimate | 32.76 | 36.20 | 35.92 | 31.00 | 30.17 |
| | Standard Error | (0.93) | (0.94) | (0.95) | (1.13) | (2.88) |
| | t Value | 35.38 | 38.42 | 37.91 | 27.47 | 10.47 |
| | Pr > t | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 1978-83 | Parameter Estimate | -3.08 | -2.10 | -2.14 | 0.83 | -2.76 |
| | Standard Error | (0.79) | (0.92) | (1.02) | (1.27) | (3.08) |
| | t Value | -3.90 | -2.30 | -2.09 | 0.66 | -0.90 |
| | Pr > t | 0.00 | 0.02 | 0.04 | 0.51 | 0.38 |
| 1988-97 | Parameter Estimate | -6.75 | -6.76 | -6.28 | -3.66 | -3.90 |
| | Standard Error | (0.74) | (0.76) | (0.93) | (1.15) | (2.91) |
| | t Value | -9.08 | -8.86 | -6.74 | -3.18 | -1.34 |
| | Pr > t | 0.00 | 0.00 | 0.00 | 0.00 | 0.19 |
| Wife's Market Hours | Parameter Estimate | -0.55 | -0.55 | -0.52 | -0.40 | -0.31 |
| | Standard Error | (0.04) | (0.04) | (0.05) | (0.05) | (0.10) |
| | t Value | -14.87 | -14.14 | -11.55 | -8.57 | -3.13 |
| | Pr > t | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Market Hours > 25 | Parameter Estimate | 5.99 | 6.34 | 5.90 | 4.08 | 3.13 |
| | Standard Error | (1.18) | (1.22) | (1.47) | (1.69) | (4.09) |
| | t Value | 5.08 | 5.19 | 4.02 | 2.41 | 0.77 |
| | Pr > t | 0.00 | 0.00 | 0.00 | 0.02 | 0.45 |
| Kids At Home | Parameter Estimate | 6.43 | 2.31 | 3.11 | 6.36 | 4.96 |
| | Standard Error | (0.59) | (0.63) | (0.63) | (0.99) | (2.38) |
| | t Value | 10.98 | 3.67 | 4.94 | 6.42 | 2.09 |
| | Pr > t | 0.00 | 0.00 | 0.00 | 0.00 | 0.05 |
| More than Two Kids | Parameter Estimate | 4.58 | 3.58 | 2.38 | -0.63 | 0.19 |
| | Standard Error | (0.54) | (0.56) | (1.28) | (2.60) | (5.90) |
| | t Value | 8.43 | 6.36 | 1.86 | -0.24 | 0.03 |
| | Pr > t | 0.00 | 0.00 | 0.07 | 0.81 | 0.97 |

Figure 3: Regression of Annual Means of Wife's Weekly Housework Hours in PSID; With Controls for Family Size.

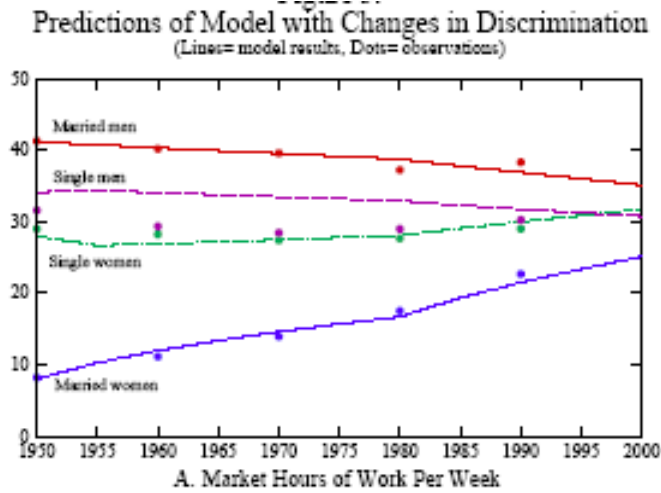


Figure 4: Spouse's labor supply in calibrated model with rising female wages. From Figure 5 in Jones, Manuelli, and McGrattan (2003).

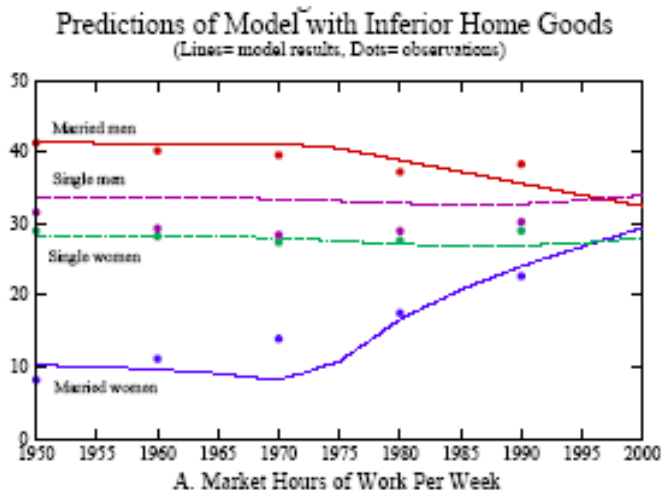


Figure 5: Spouse's labor supply in calibrated model with rising home productivity. From Figure 4 in Jones, Manuelli, and McGrattan (2003).

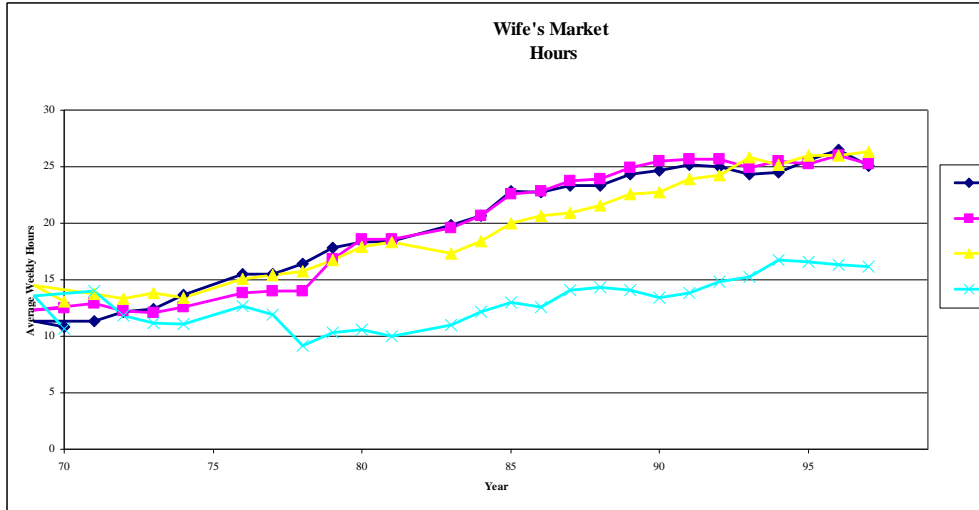


Figure 6: Average weekly hours of market labor in the PSID.



Figure 7: Average weekly hours of house work in the PSID

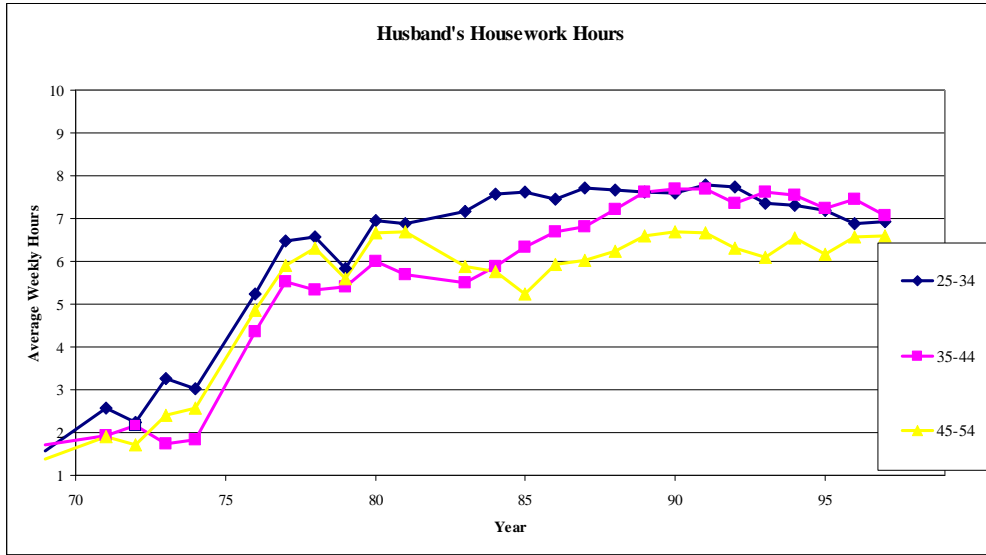


Figure 8: Average weekly hours of housework in the PSID

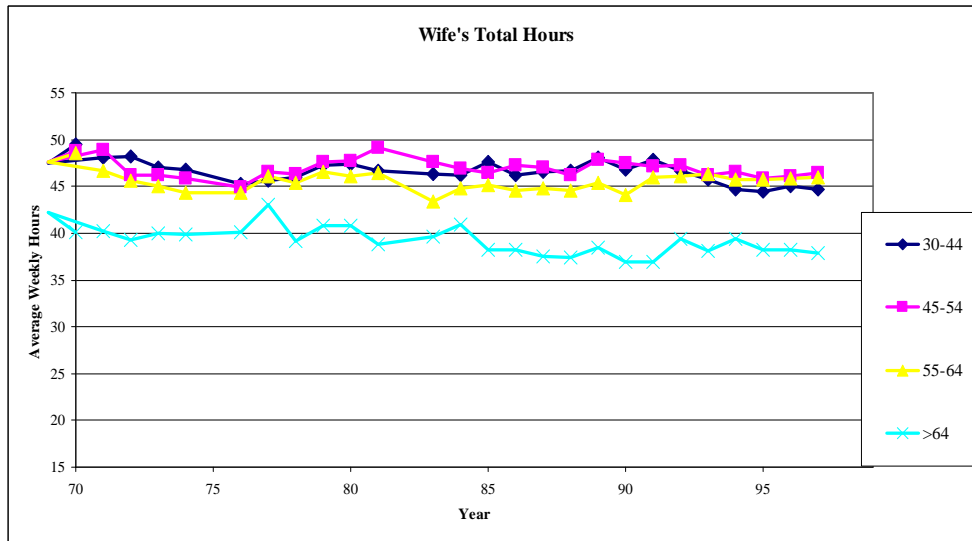


Figure 9: Sum of wife's market and housework hours in the PSID.

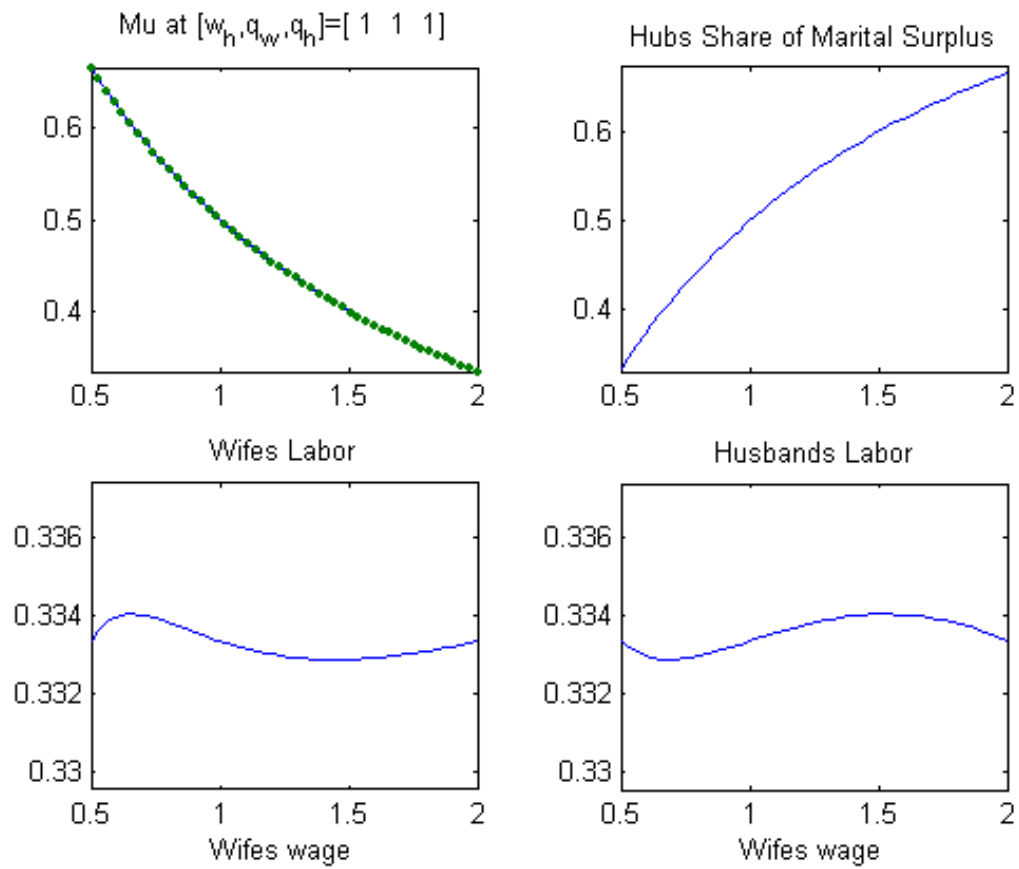


Figure 10: Labor supply when there is no benefit of single life

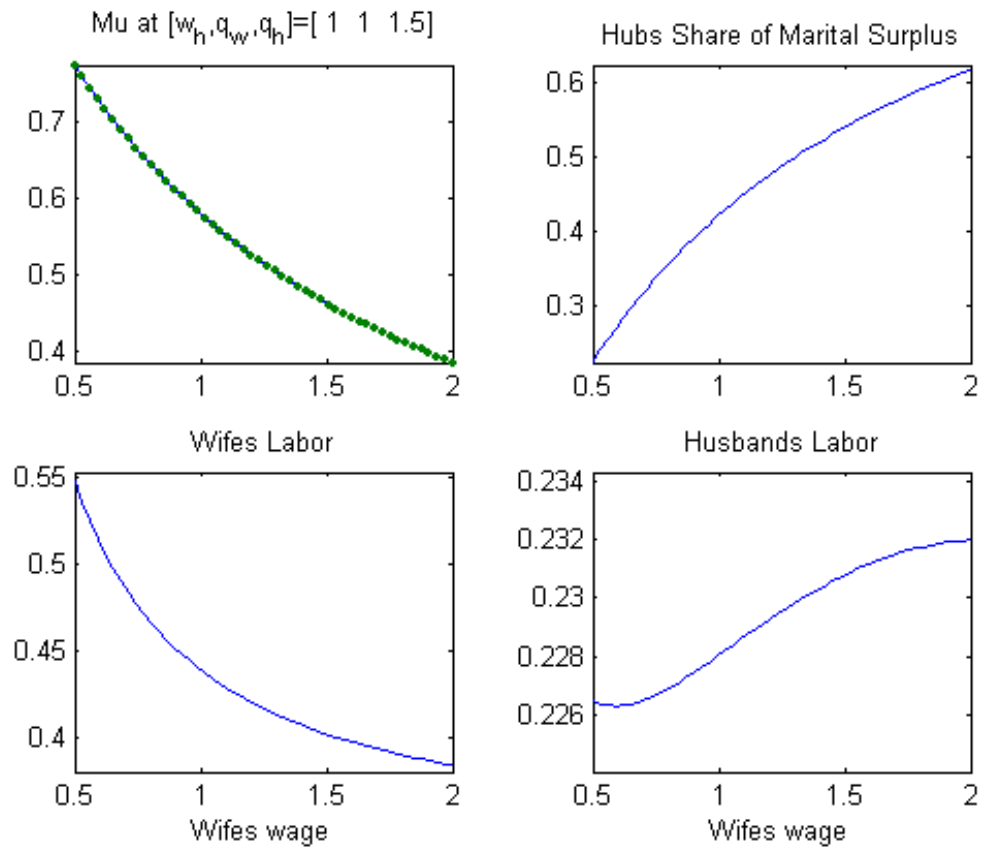


Figure 11: Labor supply when men enjoy single life

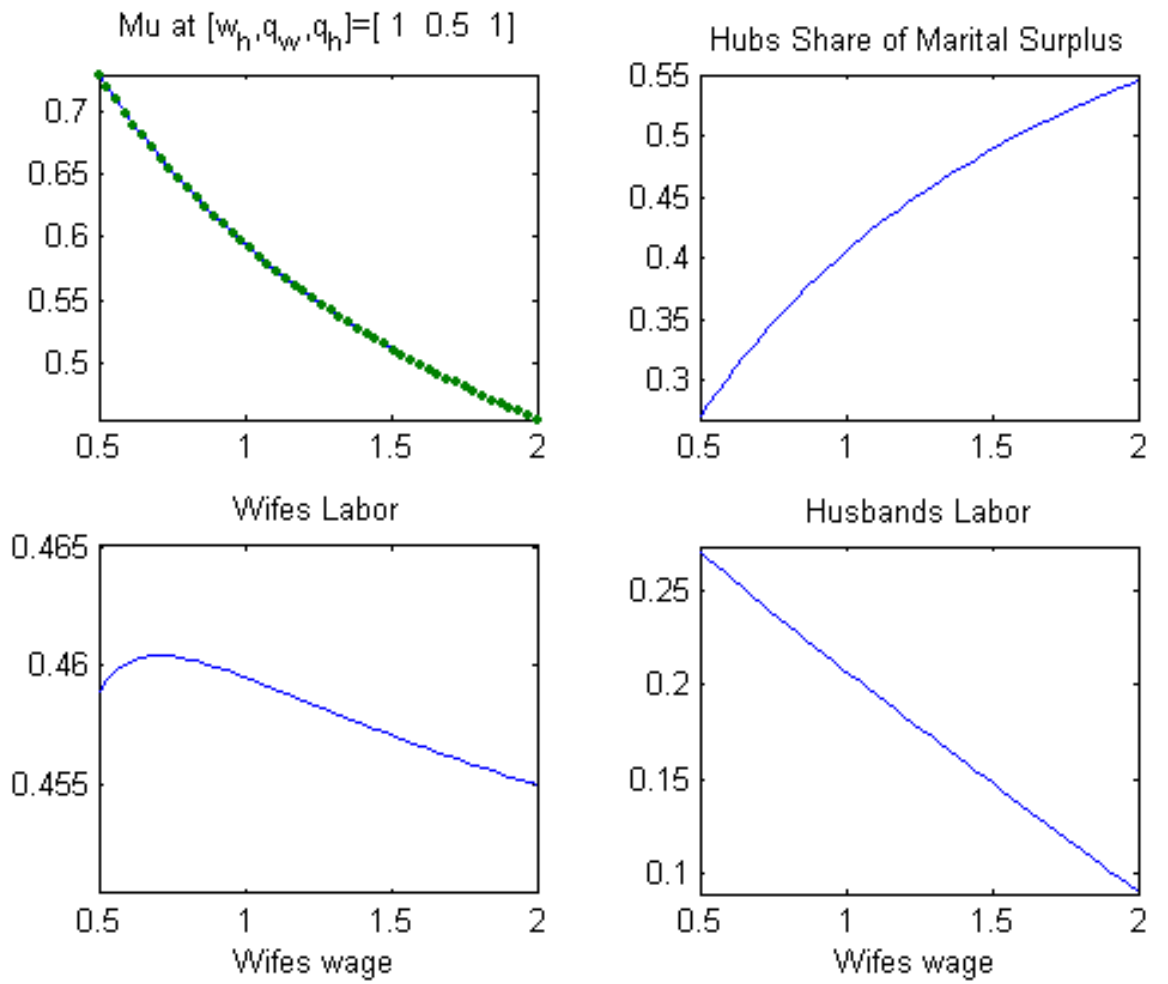
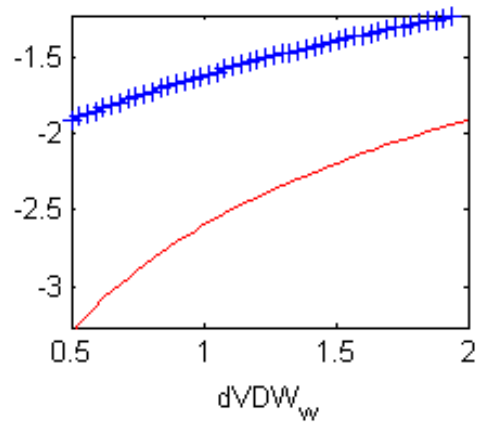
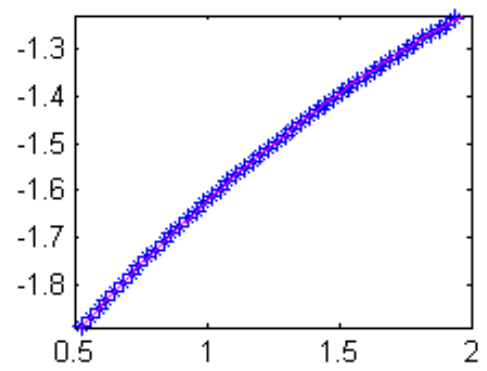


Figure 12: Labor supply when women detest single life

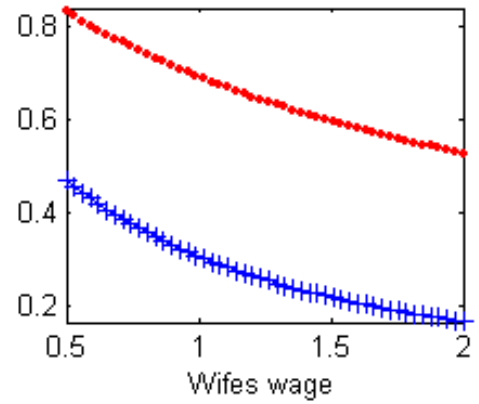
V_w and R_w : $[w_h, q_w, q_h]=[1 \ 1 \ 1]$



Value of W_w



Hub wght: min(+),max(.)



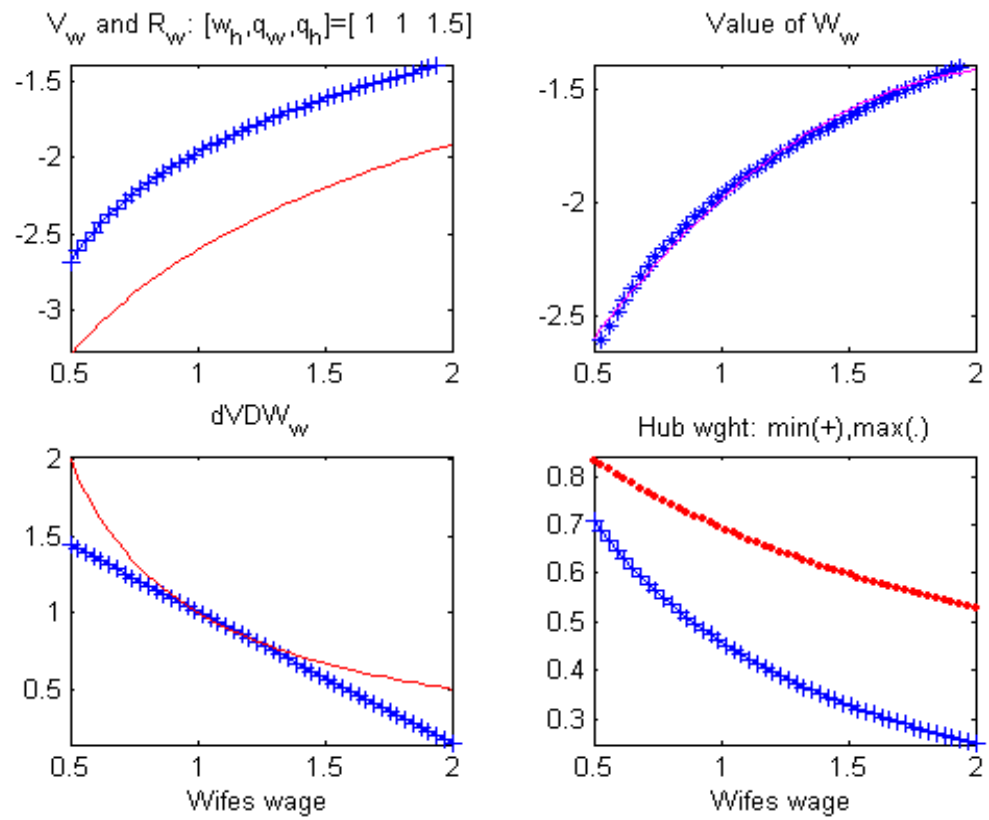


Figure 13: Returns to wife's wage when men enjoy single life

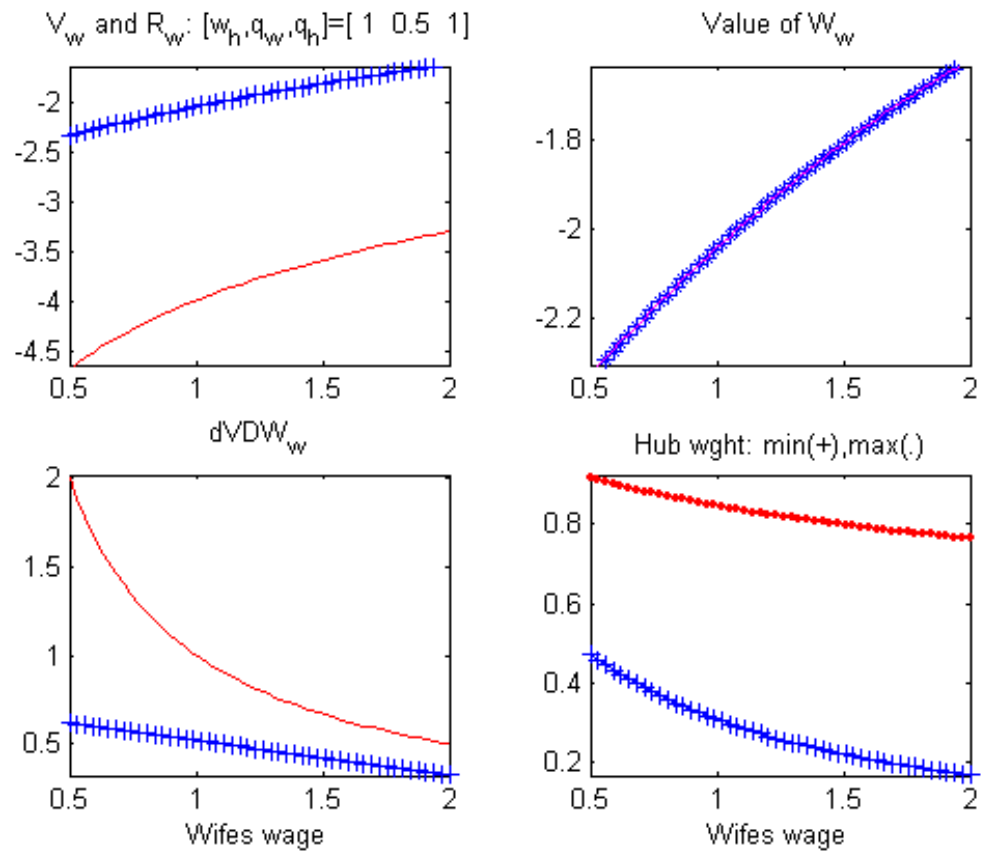


Figure 14: Return to wage when women detest single life

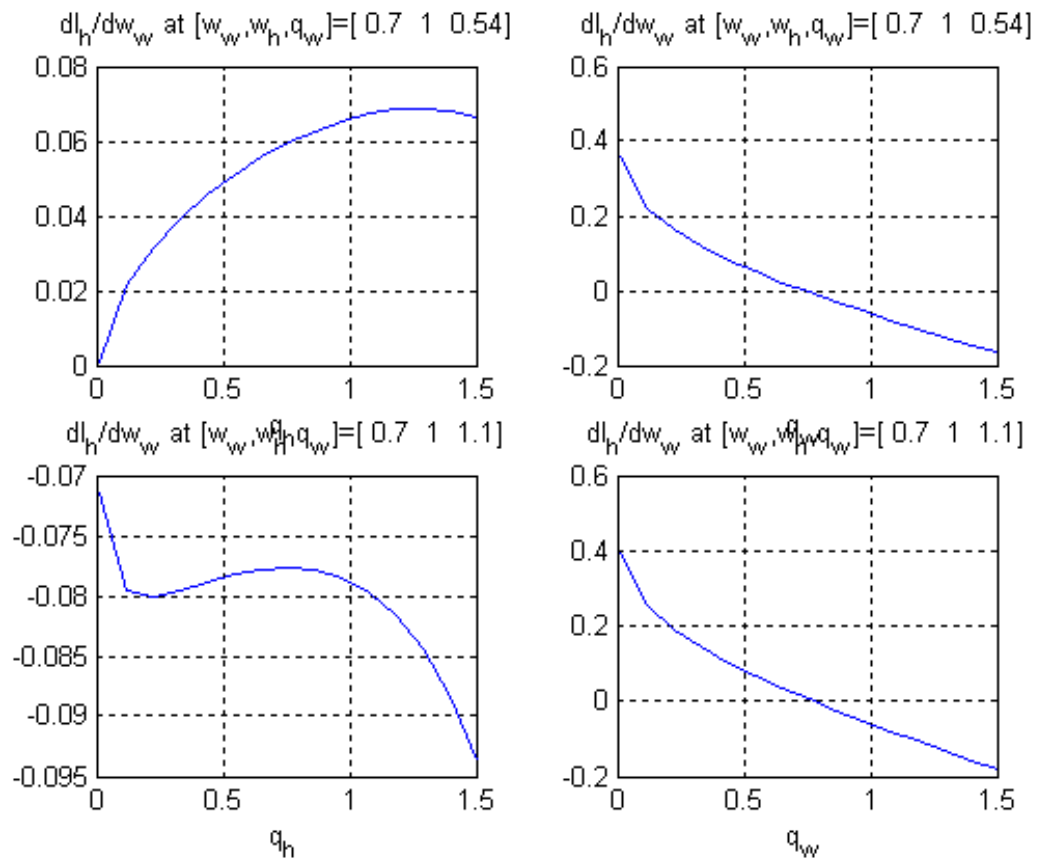


Figure 15: Derivative of men's leisure with respect to woman's wage when men's wage equals one.