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Why Are Married Men Working So Much? Home Production, Household Bargaining and Per-Capita Hours

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ABSTRACT

Why Are Married Men Working So Much? Home Production, Household Bargaining and Per-Capita Hours*

Empirical patterns of labor supply at the micro level tend to reject the unitary model assumption implicit in most macro theories, where households are the deemed to be rational agents. This paper examines the rise in per-capita labor since 1975 and asks how the inclusion of bargaining between spouses in a standard macro model would alter the analysis of recent trends in aggregate labor supply. The main findings are that the stationarity of married men's work hours reflects weakening of men's bargaining position as women's wages rose, and that the unitary model seriously overstates the response of aggregate labor to trends in relative wages.

JEL Classification: E13, J12, J16, J20, J22

Keywords: general aggregative models: neoclassical, time allocation and labor supply, economics of gender, marriage, marital dissolution

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1 Introduction

The role of intra-household interactions on aggregate variables has received little attention in the macro literature; despite the insistence of neoclassical macroeconomists on the hypothesis of rationality, the standard model remains one of rational households rather than rational people. Macro models that allow for the existence of married people, as opposed to a married household, such as Jones, Manuelli, and McGrattan (2003), tend to follow a "unitary" approach, meaning that the household is assumed to behave as a rational entity with a stable utility function. In the labor literature, a host of papers have argued that this approach is inconsistent with empirical patterns in married-couple's labor supply, and as a result, models of household bargaining, based on the seminal work of McElroy and Horney (1981) and Manser and Brown (1980), have become increasingly influential.[1]

This paper asks whether the incorporation into the macro model of bargaining between spouses is likely to have a significant effect on our understanding of aggregate labor trends. This is a useful test of the relevance of the bargaining model because labor supply has been the predominant focus of the micro literature on household bargaining. Furthermore, it is well-known that wages of women relative to those of men have increased significantly over the last thirty years, as has married-women's labor supply. Trends that affect the economic well-being of women relative to men, such as trends in the gender gap or in the productivity of home labor, are likely to affect the bargaining position of men relative to men, and hence the effect of the wage trend on aggregate labor would seem to be a natural starting point to look for such macroeconomic effects.

Indeed, labor supply per capita has been increasing over the last 30 years, which poses a challenge to the standard neoclassical models, not only in growth theory but also in business cycle theory, which rely on the assumption that economies tend to a balanced growth path where labor supply is stationary. This assumption is usually justified by the statement, as in Prescott (1986), that there has been no observed trend in working time per capita. Figure 1(a), based on the March Current Population Survey, shows annual observations of weekly hours worked per capita since 1962 for the civilian population aged 18-65. Until 1972, average weekly paid working time remained just above 25 hours; between 1977 and 2001, the average rose, despite three major recessions, to a peak of nearly 29 hours. Other papers that remark on the rise in per-capita working hours include Prescott (2004), which argues for the effect of tax reform in the 1980s, and Galí (2005), which sees a challenge to the view that technology shocks cause business cycles.

It is interesting that the period of the increase in per-capita hours coincides with a rapid rise in female wages relative to male wages, as shown by the mean wages of CPS workers in Figure 1(b),

[1] The best-known demonstration of the failure of the unitary model is the finding by Lundberg, Pollak, and Wales (1997) that consumption patterns depend on the distribution of income betwen spouses. Furthermore, Chiappori, Fortin, and Lacroix (2002) have shown that married-couple's labor supply patterns appear to be strongly affected by inter-state variation in divorce laws and in the ratio of single men to women. Mazzocco (2007), shows that models of co-operative bargaining between spouses are not rejected by the empirical tests that reject the unitary model.

where wages are averaged over the CPS subsample that worked 10 or more hours weekly. The figure also indicates that the gender gap in wages was relatively constant prior to the mid 1970s, another well-known fact[2]. The trend in hours per capita is decomposed in Figure 1(c), which suggests that the trend is entirely due to an increase in married-women's hours, from an average of 12 hours per week in 1965 to about 23 by the year 2000.

An essential feature of macro economic models is separability between non-working time and goods in the utility function; otherwise it is difficult for models to match the long-run stationarity of growth rates of GDP per capita.[3] Jones, Manuelli, and McGrattan (2003) have shown that a unitary household model with this restriction can explain the rise in married women's labor supply since 1950 in response to either the trend in the female-male wage ratio or in response to rising productivity at home, as in Greenwood, Seshadri, and Yorukoglu (2005). In both cases however, they find that calibration to US data implies that married men's labor supply should have fallen, by somewhere between 5-8 hours weekly.

It is easy to see why rising women's wages has this effect: the unitary household should respond to a rise in the relative price of the wife's time by reallocating spending to cheaper goods, such as husband's non-working time, and by substituting husband's time inputs for the wife's time in home production. Furthermore, if non-working time is a normal good, the income effect of the wage increase should cause husband's leisure to increase further. All of these effects will tend to reduce husband's paid labor, so this result is robust with respect to the standard specifications of preferences used in the macro literature. However Figure 1(c) shows that married men's hours, after a significant decline in the 1960s, remained relatively stationary over the 1972-2006 period. Those of single men and women are essentially stationary throughout. The question therefore is why the predicted trend does not appear in the data.

This paper develops a simple model of household labor supply and equilibrium bargaining that is both tractable and consistent with the trends in aggregate labor. The mapping from relative wage to bargaining position is determined by equilibrium in the marriage market. The main theoretical result is that, with bargaining between spouses, relative non-working time need not fall when one's own wage increases. This is contrary to the unitary model, but consistent with the trends as described above, as well as with the results of Burda, Hamermesh, and Weil (2007), who find that relative wages have little relationship to the average non-working time of spouses across countries.

Theoretically, the key feature is that the bargaining position of the spouses depends on the relative wage, a standard assumption in the labor literature. This feature is essential for reconciling the standard macro model with the main empirical result, that the ratio of married women's non-working time to that of husbands was stationary over the period 1975-2003. The unitary version of the model predicts a 27% decline in this ratio over this period, in response to the changes in relative

[2]Goldin (1986) shows that women's wages rose relative to mens over the period 1890- 1960. The stationarity around the 1960s is therefore somewhat anomalous.

[3]Because the term "leisure" is defined as a residual in macroeconomics, it differs from the standard usage in labor economics. This paper therefore uses the term "non-working time" for the residual variable.

wages and in the marginal tax schedule. This conflict between theory and data might seem to be the result of the simplifying assumptions in the model. However the fact that the predicted decline of husband's paid hours in Jones, Manuelli, and McGrattan (2003) is in line with the results of this simple model suggests that the theoretical implication is robust to the standard ways of tweaking the model, such as assuming constant-elasticity preferences over non-working time and home goods.

Calibration of the model to US data suggests that failing to account for bargaining can result in very large prediction errors for weekly paid work, on the order ten hours for husbands, and 16 for wives. To match the married-women's paid work trend with a unitary model would require a lower labor-supply elasticity, but the prediction error in men's labor would still be severe, for the reasons discussed above. With respect to per-capita hours, the unitary version of the model results in a prediction error of roughly two hours weekly, about 50% of the trend, so even if macroeconomists were unconcerned about the allocation of work between men and women, this might still justify an interest in modelling intra-household allocation.

The results also imply that the trend in relative wages accounts for 66% of the total increase in per capita hours between 1975 and 2003. By contrast, the decline of the relative price of home equipment accounts for 7%. Nevertheless, the effect of this relative price change is significant, reducing unpaid labor in 2003 by 7 hours for married couples and by two for singles. This does not translate into market work because the wealth effect induces an offsetting reduction in non-working time. This finding implies that for understanding the effect of rising home productivity on paid work hours, it is critical to model the labor-leisure margin. This is the first paper to draw a connection between rising hours per capita and relative wages, so these results should be of general interest.

The mechanism of the rise in per capita hours clearly involves interactions among these changes, as holding constant the effective tax rate on married women's earnings reduces the change by about 1.5 hours, 40% of the total trend. This result supports the conjecture of Prescott (2004), but the mechanism is quite different, as it relies on changes in relative wages magnifying the effect of the tax reform.

Because the model allows for non-homotheticity through the home-production constraints, it is possible that the stationary hours property of balanced-growth paths does not hold. Numerically, this effect is very small however; if the only change over the last 30 years had been a proportional increase in wages and non-labor income equal to the observed 26% rise in the average real wage, per-capita hours in the model would have risen by less than ten minutes. We conclude therefore that the trend in per capita hours is consistent with the long-term stationarity implied by the standard growth and business cycle models.

The current paper is closely related to Chade and Ventura (2002) who develop a simple equilibrium-marriage model to examine implications of the marriage tax penalty for marriage rates and labor supply; as in the current paper, the emphasis is on aggregate analysis. The only other paper that spells out the implications of bargaining for analysis at the macro level is Lise and

Seitz (2005), who find that accounting for trends in intra-household inequality substantially reduces the apparent increase in consumption inequality over the last 30 years. Other papers on the equilibrium analysis of marriage and female labor supply include Caucutt, Guner, and Knowles (2002),Greenwood, Guner, and Knowles (2003), and Regalia and Ríos-Rull (1999); these papers focus on implications for wage inequality and fertility, and ignore per-capita implications.

The rest of the paper is divided into seven parts: presentation of a simple version of the unitary model, an empirical analysis of time-allocation trends in the US, followed by an analysis of the allocation of relative non-working time when marriage, divorce and bargaining are added to the model. Then the home-production technology is introduced, followed by the results of calibrating the model to US data. The discussion deals with generalizations and extensions of the analysis, and the conclusion contains a summary of the results.

2 A Simple Unitary Model

The goal of this section is to develop a simplified version of the unitary household model that will remain tractable when nested into an equilibrium marriage model. It is standard in macroeconomics, to restrict preferences are to the separable CRRA class; the model assumes log preferences as a simple example of this class. The main non-standard simplification is that home goods appear as a minimum-consumption constraint, and do not enter the utility function.

Suppose that preferences of individuals are represented by the following utility function:

$$\widetilde{u}\left(c_P, c_i, l_i\right) = \phi \ln c_P + (1-\phi) \ln c_i + \delta \ln l_i$$

where c^h is household consumption (a public good), c_i is the private consumption of person i, l_i is her non-working time and ϕ is a constant.[4]

The unitary household is assumed to maximize a household utility function consisting of a weighted sum of the utility of each spouse $i \in \{H, W\}$, corresponding to the husband and wife. We represent this by assigning to the husband a Pareto-weight μ in the household utility function.

There is also a home good that is produced using inputs of housework time (h_H, h_W) , as well as a flow of home equipment e_q, according to a production function G. Married couples are constrained to produce a minimum level of the home good. Since home goods do not enter the utility function, this constraint always binds:

$$\underline{g}^m = G\left(e_q, h_H, h_W\right)$$

Each spouse i has a time endowment of one unit of time, which is allocated across three competing uses: non-working time l_i, market work, n_i and housework h_i. Suppose that the optimum has both spouses working. The time constraint for each spouse i is:

$$l_i + n_i + h_i = 1$$

[4]The distinction between the two types of consumption plays no role in the current section, but will be relevant later in the paper.

A person of sex i gets wage w_i per unit of market labor and, pays a tax τ^i per unit of earned income. Non-labor income is equal to y_a^m.The household buys home appliances e_q at price p per unit, so the budget constraint of the household is given by

$$c_P + c_H + \left(1-\tau^H\right) + c_W + \left(1-\tau^W\right) w_W l_W + w_H l_H = I\left(h_H, h_W, e_q | w_H, w_W, p, \tau^H, \tau^W, y_a^m\right)$$

where

$$I\left(h_H, h_W, e_q | w_H, w_W, p, \tau^H, \tau^W\right) = \left(w_H\left(1-\tau^H\right) + \left(1-\tau^W\right) w_W\right) + y_a^m - w_W h_W - w_H h_H - p e_q$$

Suppose that the household's optimal allocation is on the interior of the choice set. Then we can represent this as the solution to a two-stage problem; first maximize full income through the choice of (h_H, h_W, e_q), and then maximize the household utility function via the allocation of non-working time and consumption.

Define full income as the solution to the income maximization problem:

$$Y^m\left(w_H, w_W, p, \tau^H, \tau^W, y_a^m\right) = \max_{h_H, h_W, e_q} \left\{I\left(\left(h_H, h_W, e_q\right) | w_H, w_W, p, \tau^H, \tau^W, y_a^m\right)\right\}$$

subject to the above constraints.

Let $\left(h_i^*, h_j^*, e_q^*\right)$ represent the solution to this problem, so that

$$Y^m\left(w_H, w_W, p, \tau^H, \tau^W, y_a^m\right) = I\left(h_i^*, h_j^*, e_q^* | w_H, w_W, p, \tau^W, y_a^m\right)$$

. Now the optimal choice of private goods solves this sub-problem:

$$\max_{l_i, l_j c, i c_j, c_p} \left\{\phi \ln c_P + (1-\phi)\left[\mu \ln c_H + (1-\mu)\ln c_W\right] + \delta\left[\mu \ln l_H + (1-\mu)\ln l_W\right]\right\} \tag{1}$$

subject to:

$$c_P + c_H + c_W + \left(1-\tau^W\right) w_W l_W + \left(1-\tau^H\right) w_H l_H = Y^m\left(w_H, w_W, p, \tau^H, \tau^W, y_a^m\right)$$

Let $\mu_W = 1-\mu$.Since the solution is interior by assumption, the optimal decisions are:

$$\begin{aligned} c_P &= \frac{\phi}{1+\delta} Y^m\left(w_H, w_W, p, \tau^H, \tau^W, y_a^m\right) \\ c_i &= \mu_i \frac{1-\phi}{1+\delta} Y^m\left(w_H, w_W, p, \tau^H, \tau^W, y_a^m\right) \\ l_i &= \frac{\mu_i}{\left(1-\tau^i\right) w_i} \frac{\delta}{1+\delta} Y^m\left(w_H, w_W, p, \tau^H, \tau^W, y_a^m\right) \end{aligned} \tag{2}$$

This is an instance of the well-known result that expenditure shares are constant with Cobb-Douglas preferences.

2.1 Leisure in the Unitary Household

For any variable x, let relative quantities x_W/x_H be represented by $\widetilde{x}$.Normalize the tax on earnings to zero for singles and married men. The optimality conditions above imply that the leisure of the spouses is related by

$$\widetilde{l}\left(\widetilde{w},\tau^W\right) = l_W/l_H = \frac{1}{\widetilde{w}}\frac{1-\mu\left(\widetilde{w}\right)}{\mu\left(\widetilde{w}\right)}\frac{1}{\left(1-\tau^W\right)} \tag{3}$$

Blau and Kahn (1997) report that the average wages of women working full time rose, as a fraction of men's, from 0.60 to 0.76 over the period 1975 to 1995. In the appendix, Table A1 shows that the effective surtax on earnings fell from 0.21 to 0.15 for the woman married to a husband with the average male wage If the weight μ remained constant, then wife's relative leisure $\widetilde{l}$ should have decreased by 27%:

$$\frac{\widetilde{l}\left(0.76,0.15\right)}{\widetilde{l}\left(0.6,0.21\right)} = \frac{0.6}{0.76}\frac{1-.21}{1-.15} = 0.73$$

Even in the absence of a tax trend, the implication is a decline of 21%.

3 Trends in Time Allocation

According to the theoretical analysis, what matters for distinguishing different versions of the household model is not the allocation of paid working time, but rather the response of total work time, including unpaid time, to changes in relative wages of men and women. The goal of this section is to document these changes. The strategy is to use the CPS to document the trends in paid labor and relative wages and show that the trends are driven by the behavior of married people. Since unpaid work time is not documented in the CPS, we then turn to time-use surveys and show that mean paid work hours for married couples in these data sets are very similar over the years to the numbers in the CPS. This allows us to base the rest of the analysis on the time-use surveys.

3.1 Paid-Labor Supply Trends: CPS

Figure 1 , which shows the per-capita hours trend as well as the trend by sex and marital status and the trend in relative wages, is based on the March Supplement of the CPS, from 1962 to 2006. The population is restricted to civilians age 18 to 65, a standard definition of working-age adulthood. Younger people are likely to be constrained by compulsory schooling, and older people by mandatory retirement, social security rules, and disabilities. The weekly hours variable is the reported hours worked last week. [5] Average hours worked per person in 1971 was 24.7, slightly lower than in 1962. Figure 1(a) shows that, over the next 28 years, average hours rose steadily to 29.3 in 2000, an increase of nearly 18% .

[5] Similar results obtain if instead we multiply usual weekly hours by number of weeks worked.

To filter out the role of cyclical fluctuations, Table 1 averages the data over several years. For married women it is clear that average weekly hours of paid labor increased steadily, from an average of 11.8 in the 1962-66 period to 22.97 in 1994-2001. For single women, there is no trend, hours fluctuate between 22 and 26 over these periods. For single men, the pattern is similar, a stationary series that fluctuates between 24 and 28 weekly hours. For married men, hours are essentially constant at 36 from 1976-2003.

The wage trend shown in Figure 1(b) is computed by dividing annual earnings by annualized hours worked, as given by the hours worked last week response. To avoid noise from people with low hours, the sample for this calculation is restricted to people who worked at least 10 hours.

Figure 2 shows age-hours profiles for 10-year birth cohorts of married men and women. Those for women rise significantly with each successive cohort; by 3 hours at age 30 when we move from the 1930s to the 1940s cohorts, by an additional 7 hours to the 1950s cohort, and by another 3 hours from the 1950s to the 1960s cohort. In contrast, the age-hours profiles of married men are essentially identical over all cohorts. This also means that there is no question here of substitution of labor time across the lifecycle in response to changes in married women's roles: the shape of the men's profiles do not change systematically as we move across cohorts.

It may be interesting to explore the possibility that the lack of trend in husband's hours is driven by conflicting trends between households where the wife works and those where she doesn't, or by a rise in household where the wife works. In the appendix, Figure A1 shows that for wives aged less than 50 years, husband's hours are stationary after 1974 for both household types. In all cases, husbands work more in households where the wife is also working. For households where the wife is older than 50, there is decline in husband's hours until 1984 for households where the wife is not working, and stationarity thereafter. The stationarity of husband's paid working hours therefore holds even when age and labor force status are accounted for, except that, for the oldest group, the stationary period starts somewhat later.

Another possibility is that paid work hours are fixed by custom at a rigid number, such as 40 hours per week. Figure A2(a) shows that indeed at all age groups, the median in the 1990s is 40, and for men older than 25, the 25th percentile is also close to 40. However the model implies that if this constraint is binding, the household can respond by adjusting unpaid work hours.

3.2 Non-Working time: The Time-Use Surveys

To track trends in unpaid work and hence non-working time, we follow the existing literature in relying on a collection of cross-sectional time-use surveys beginning in 1965 and culminating in the first wave of the American Time Use Survey in 2003. These appear to be the only representative source of data on home production time apart from cooking and cleaning, notably child care and shopping time, as well as unpaid work time and leisure activities. This is important because it is well-known (see Gershuny and Robinson (1988)) that married-couple's allocation of home-production time has shifted since the 1960s, with husbands apparently bearing a larger share of

house work than in the past.

Because of inconsistent design over the years, comparison of variables from the time-use surveys requires standardization of activities into broader categories. Results for this type of exercise are reported by Robinson and Godbey (1997) and Aguiar and Hurst (2007); from the regression methods of the latter, for instance, we learn that, over the period 1965-2003, leisure for men increased by roughly 6 to 9 hours per week (driven by a decline in market work hours) and for women by roughly 4 to 8 hours per week. Robinson and Godbey (1997) also finds that women's total work declined over the 1965-1985 period. For the purposes of the current paper, however, a closer look at the data is warranted for three reasons. First, while the existing results concern the population as a whole, we need to examine the time allocation of married people. Second, the results reported in previous papers concern trends since 1965, with little information on the period that is critical for the analysis here, 1975 to the end of the 1990s. Finally, while the labor literature analyses trends in leisure, defined as time in specified non-work activities such as attending social functions or watching TV, in the macro literature it is standard to divide discretionary time into paid work, home-production and non-working time.

Of the 168 hours available each week, it is assumed that the minimum time required for sleep and personal care is 50 hours, which turns out to be the first percentile in the pooled data for 1965, 1975, 1985 and 2003. The exact number assigned to this minimum time is without consequence for the analysis. The important point is that time spent in sleep and personal care includes a discretionary component, as documented by Biddle and Hamermesh (1990). This paper assumes discretionary time is allocated between paid work and unpaid work; the residual is taken to be non-working time. The variables making up each of these categories are taken from the definitions of Aguiar and Hurst (2007).

Table 2(a) reports the time allocation of married people aged 18-65 according to these surveys. The table shows that working time did decline over the longer period since 1965, but all of this decline was before the period of interest begins in 1975. Since then the working time of both married men and women has increased, due to a rise in unpaid work for men and in paid work for women. The main point however is that while non-working time has declined slightly for both husbands and wives since 1975, the ratio of married women's non-working time to that of married men has remained stable; 1.073 in 1975, 1.073 in 2003. Even after accounting for unpaid working time therefore, married women's non-working time is not responding relative wages in the way predicted by the unitary model.

Part (b) of the table shows that unpaid working time is composed largely of time spent cooking and cleaning in the case of the women; while this component has increased 50% for men, it was still only 3.33 hours weekly on average in 2003, compared to 14.9 hours for wives. Commuting and Job-related time declined for both men and women, even though time in paid work did not. The 2.5 hour decline for men in time spent in Job-related was largely offset by small increases in other categories. One category that increased for both men and women was child care (excluding time

spent playing with children); the effect is small however relative to the other changes, so it does not appear worth worrying how time spent in this category might be mis-measured. Overall, men in 2003 were spending two more hours in "Other home production" per week, and one more in "Cooking and Other Indoor Chores" than in 1975. The lack of trend in relative non-working time therefore is robust to how we treat child-care time.

Table 2(c) shows that while non-working time remained constant over the 1975-2003 period, there was a small reallocation of this time from leisure activities to personal care for wives and from personal care to leisure activities for husbands. Thus married women's relative time spent in leisure activities does fall, but non-working time does not. Could this be driven by the increase in women's paid work? This would be hard to reconcile with the three hour decline in men's personal care time, given that their paid time declined less than 5%. Indeed, when the sample is censored to exclude the top percentile of market labor, the table shows no trend in men's market labor, but the fall of personal care time remains unchanged. As Biddle and Hamermesh (1990) find that the elasticity of sleep time with respect to paid work hours is significantly negative, and sleep is the main component of personal care time, the reallocation of non-working time for women appears to have the wrong sign for their rise in personal care to be driven by rising labor force participation of wives. Hence, it appears that this is indeed a relabeling or reallocation of non-working time.

Finally, Table 3 shows that conditioning on observables such as age, education and labor force status does not explain the stationarity of relative non-working time. The relative wages of the sub-samples are shown in Table 3(a), which gives the female/male wage ratios for people working 10 hours more per week. For the 25-54 age group, the ratio of mean wages rises from 0.6 in the 1967-74 period to 0.76 in the 1995-2000 period. For the 55-65 age group, the wage ratio is the same in both periods. For those with less than a bachelor's degree (BA), the ratio evolves from 0.6 to 0.76; for those with a BA or more , the trend is weaker, from 0.66 to 0.72, falling back to 0.69 in the 2000-2006 period. Table 3(b) shows that, over the 1975-2003 period, only one group of husbands gets an increase in relative non-working time; those with educational attainment equal to 12 years, the equivalent to a high-school diploma. The wife's relative non-working time falls in this case from 1.14 to 1.06. For all other groups, wife's relative non-working time increases or stays constant. Most significantly, when the sample is restricted to spouses who are working, the wife's relative non-working time increases from 0.97 to 1.04. The effect appears to be strongest among younger couples; the increase for married people aged 25-55 is from 0.94 to 1.04. Among the 55-70 age group the rise in wife's relative non-working time is much weaker, from 1.01 to 1.06, which may be due to the fact that the wage change is much smaller for this group as shown in Table 3, from 0.66 to 0.69. Far from accounting for the failure of husband's non-working time to rise, the observables seem to exacerbate the issue by revealing that in fact it is the wife's relative non-working time that is increasing within most groups.

Could it be that there is a rigidity, perhaps due to social norms, that restricts married couples from freely adjusting non-working time? It is generally difficult to examine this in the time-use

surveys because they sample individuals, rather than households. However in 1985, the sample includes 531 married couples. Figure A2(b) shows the husband-wife ratios of nonworking time for this sample. While it is clear that the distribution is centered around one considerable dispersion exists. A similar result for Australia, Germany and the US is obtained by Burda, Hamermesh, and Weil (2007). While analyzing the source of this dispersion is outside the scope of the current paper, it seems to indicate that there is no lack of flexibility in the allocation of non-working time.

3.3 Implication for Unitary Model

In the empirical analysis above, we saw that the ratio of non-working time of wives to that of husbands over 1975-2003 period was about 1.07. The model we just developed predicted a decline in wife's relative non-working time of 27%. Given that married women's working time grew from 52 to 54 hours over the period, the model implies we should have seen a decline of men's working time on the order of 14 hours per week. Instead, men's working time increased by nearly 3 hours, after accounting for unpaid work. If the decline had been spread evenly between home and market work, aggregate paid work by men would have fallen by more than 10 hours weekly. The predicted decline is so large relative to any observed trend in the data that it seems unlikely that tweaking the preferences or the home production technology is going to solve the problem.[6]

The results of Jones, Manuelli, and McGrattan (2003) not only corroborate this conjecture for wage-based explanations of the rise in women's market hours, but also shows that if improvements in home productivity are to explain the rise in women's labor supply, then the implied fall in married men's working hours is even larger. Their model has all the standard features that are missing from the model in this section: constant-elasticity preferences, home goods in the utility function, and human capital accumulation. They calibrate the model to US data and still they end up with predicted declines in married men's labor supply on the order of 5-8 hours weekly.

One of the benefits of the simple model presented above is that it is easy to solve for the Pareto weight given the observed leisure and relative wages. We observed in Table 2 that wives's relative non-working time in the 1970s, was $\widetilde{l}_{1970} = 1.07$. The effective surtax on wive's earnings, computed in appendix A1, was about 21% in the 1970s.We can represent the 1970s situation here by setting the tax rate on wive's income to 21%, and zero for husbands.[7]

Setting $\widetilde{w}_{1970} = 0.60$, and inverting the optimality condition for leisure gives us

$$\mu^{1970} = \frac{1}{1 + \left(1 - \tau^W_{1970}\right) \widetilde{w}_{1970} \widetilde{l}_{1970}} = \frac{1}{1 + 0.79 \times 0.60 \times 1.07} = 0.66$$

, implying that husbands are getting a larger share of the utility in the marriage.

[6] The wage ratios here are based on pre-tax data. Suppose we follow Prescott in arguing that the 1986 tax reform effectively reduced the marginal tax rate on wife's income from 40% to 20%, which is the rate faced by men and single women. The wage ratio for the 1970s becomes even smaller: $\widetilde{w}_{1970} = \left(\frac{1-0.4}{1-0.2}\right) \times 0.6 = 0.4$. The predicted 1990s/1970s ratio of wife's relative leisure is now $0.4/0.76 = 0.53$.

[7] Since we are ignoring the tax everyone pays, we need $\left(1 - \tau^W\right)(1 - 0.2) = 1 - 0.4$ so $\left(1 - \tau^W\right) = \frac{0.6}{0.8} = 0.75$

How do the results change for the 1990s when we plug in the changes in wages, effective tax rate and relative non-working time? The effective surtax on wive's earnings, as computed in appendix A1, fell to 15%, while the wife's relative wage rose to 0.76 and relative non-working time was again 1.07. Solving for the implied Pareto weight:

$$\mu^{1990} = \frac{1}{1 + \left(1 - \tau^{W}_{1990}\right) \widetilde{w}_{1990} \widetilde{l}_{1990}} = \frac{1}{1 + 0.85 \times 0.76 \times 1.07} = 0.59$$

The Pareto weight of the husband would have to fall from 0.66 to 0.59 to explain the lack of trend in wive's relative non-working time. The required deviation from the unitary model may appear small, but it is clear from the model that the implications for labor supply will be large. If the preferences in the model were altered to make labor supply less sensitive to small changes in μ, the only impact on the analysis would be to magnify the required change in μ. In this sense, the log specification, with its implied unitary elasticity of substitution, is without consequence.

4 The Allocation of the Marital Surplus

In a recent literature review, Pollak (2005) says that cooperative bargaining models of the married couple "have become the standard tool for analyzing intrafamily allocation". In this section, we apply such a model to analyzing how the Pareto weights might evolve over time. We restrict attention to solution concepts that map the gains from marriage of each spouse onto a point on the Pareto frontier. This is the key assumption of the paper. There is a long tradition of models using this approach in the literature on intra-household allocations, beginning with Manser and Brown (1980) and McElroy and Horney (1981). More recent applications that rely on the assumption that allocations are determined by the gains from marriage include models based on 'distribution factors', such as Browning, Bourguignon, Chiappori, and Lechene (1994). Empirical evidence for this assumption includes Chiappori, Fortin, and Lacroix (2002), who find that marriage-market conditions and divorce laws are correlated with labor supply patterns of married couples. [8]

This paper relies on an "egalitarian" solution concept, in which the marital surplus is split equally between the spouses. When utility is perfectly transferable, which is not the case here, this is equivalent to the Nash solution, which maximizes the product of the gains from marriage. The advantage of the egalitarian solution is that it is analytically tractable, as well as simple and plausible.[9]

The response to a rise in the wife's wage under this egalitarian solution is illustrated in Figure 3. Part (a) of the diagram plots the attainable allocations in the space of the indirect utilities of husband and wife. The curved line represents the Pareto frontier, the tangent line the indifference

[8] In contrast, the "separate spheres" model of Lundberg and Pollak (1993) assumes marriage allocations depend on the gains to co-operation within marriage; this model would also be consistent with the analysis below, provided that an increase in one's wage reduces the gains to co-operation.

[9] The egalitarian solution is a particular case of the proportional solution introduced in Kalai (1977).

curve of a household planner who puts weight μ on the husband's utility. The origin represents the reservation utilities of the spouses .Obviously we can trace out the entire Pareto frontier by varying μ.

In Figure 3(b) we see how the allocation response to a rise in the wife's wage under the unitary model.. This modeled as a shift in the Pareto frontier; the skewness of the shift reflects the fact that the impact of the wage is greater when the wife does not get much time for leisure. The unitary model implies that the wife is worse off under the wage increase. Figure 3(c) shows that the under the egalitarian solution, tangency occurs along the 45 degree ray from the origin. The wage increases shifts this line to the right indicates that the planner views the egalitarian solution as optimal.[10] This requires the magnitude of the slope of the tangent to increase, which is inconsistent with the unitary model. In what follows, we propose a theory of movements of μ over time based on this requirement that the Egalitarian solution solve the planner's problem indexed by μ.

4.1 A Model of Marriage

We begin by outlining a simple equilibrium marriage model. We first work out the equilibrium leisure allocations, taking the marriage rate as given; in the appendix we work out how the equilibrium marriage rates depend on full income by marital status.

We assume there is a very large marriage population with equal number of both sexes, that people live forever and that time is divided into discrete periods. People of a given sex are identical. At the beginning of each period, people are either married or single. Married people learn their realization of a match-quality shock ε, and then choose whether to stay together or to divorce. If they divorce, they must then wait until the next period to meet a new potential spouse. All people who entered the period as singles are then randomly paired with a single of the opposite sex. The new pairs then learn their match quality and decide whether to marry. After the marriage decisions, all married couples choose their time allocations over market and house work, and get utility from leisure, match quality and consumption of household earnings.

We assume that divorce and marriage are costless, and that the process for match quality is independent of marital status. Finally, we require that wages and the quality of single life do not change over time.

4.1.1 Single People

Suppose that when people are single they get some additional utility q_i which is sex-specific; the preferences of individuals are given by:

$$\widetilde{u}\left(c_i, l_i, q_i\right) = \ln c_i + \delta \ln l_i + \delta \ln q_i$$

[10] To preserve tractability, it is critical that each spouse get exactly half of the surplus; this causes any utility term that is equal for both spouses to drop out of the problem.

, where l_i is the fraction of time devoted to leisure and $\delta \ln q_i$ is the joy from being single. The total time endowment, is again normalized to one. Non-labor income is y_a^i.A single person of sex i faces budget, time and home-production constraints given by:

$$\begin{aligned} c + w_i l_i &\leq w_i (1 - h_i) + a - pe_q = I^S \left(h_i, k | w_i, p, y_a^i\right) \\ n_i + l_i &= 1 \\ G(e_q, h_i) &\geq \underline{g}^s \end{aligned}$$

Define full income from the solution to the income-maximization problem:

$$Y^s \left(p, w_i, y_a^i\right) = \max_{h_i, e_{qi}} I^S \left(h_i, e_{q_i} | w_i, p, y_a^i\right)$$

subject to

$$G(e_{q11}, h_i) \geq \underline{g}^s$$

Optimal decisions for single people are given by

$$\begin{aligned} c_i &= \frac{1}{1+\delta} Y^s \left(p, w_i, y_a^i\right) \\ l_i &= \frac{\delta}{1+\delta} \frac{Y^s \left(p, w_i, y_a^i\right)}{w_i} \end{aligned}$$

4.1.2 Equilibrium Marriage Rates and Allocations

There is a unique equilibrium marriage rate equal to the probability that the match quality exceeds ε^M, where this marriage threshold is given by:

$$\varepsilon^M = K \left[\left(\frac{Y_i^s}{Y^m} \right)^b q_i^a + \left(\frac{Y_j^s}{Y^m} \right)^b q_j^a \right]^{1/a} \tag{4}$$

. (The proof is in the appendix). In this expression, K, $p_{0,}$ and p_1 are positive constants whose values depend on ϕ and δ. Note that this implies the marriage rate is given by $1 - F\left(\varepsilon^M\right)$, where F is the CDF of ε.What matters for marriage rates, according to this expression, is a weighted average of the income of singles relative to the income of married couples. The income-ratio of sex j is more important than that of sex i to the extent that $q_j > q_{i.}$ This means that if sex j needs marriage less, then the marriage rate is more dependent on her income than on that of sex i. In terms of the gender gap, a trend towards equality could cause marriage rates to rise or fall, depending on the extent to which the low-wage sex enjoys single life more than the high-wage sex.

Suppose that spouses agree to split the gains from marriage evenly. This implies that the Pareto weight μ_i solves

$$W_H (w, q, \varepsilon | \mu) = W_W (w, q, \varepsilon | 1 - \mu)$$

, where $W_i(w, q, \varepsilon|\mu_i)$ is the gain from marriage for a person of sex i given that he has Pareto weight μ_i in the household utility function..

We show in the appendix that this egalitarian solution equates the gains in flow utility from marriage. Solving this condition yields the equilibrium allocation, which we represent, in accordance with Figure 5a, by the husband's Pareto weight:

$$\mu(\widetilde{y}, \widetilde{q}, \varepsilon) = \frac{1}{1 + [(1-\tau^W)\widetilde{q}]^a \widetilde{y}^b}$$

, where

$$\widetilde{y} = \frac{Y_W^s(p, w_W, y_a^W)}{Y_H^s(p, w_H, y_a^H)}, \widetilde{q} = \frac{q_W}{q_H}, a = \frac{\delta}{1-\phi+\delta} \text{ and } b = \frac{1+\delta}{1-\phi+\delta}$$

.

. This says that the bargaining position of spouse j is summarized by the product of her relative taste for single life and her relative full income as a single. Notice that ε does not enter; this is because with the egalitarian solution, factors that are common to both spouses drop out of the determination of μ.

The Pareto weight depends on the relative wage through the ratio of full incomes when single.

$$\widetilde{l} = \frac{1-\mu}{\mu}\frac{1}{\widetilde{w}(1-\tau^W)} = \left(1-\tau^W\right)^{a-1}\widetilde{q}^a\frac{\widetilde{y}^b}{\widetilde{w}}$$

Suppose that this is given by the ratio of wages, $\widetilde{w}$. Then relative non-working time is given by:

$$\widetilde{l} = \left(1-\tau^W\right)^{a-1}\widetilde{q}^a\widetilde{w}^{b-1}$$

Therefore the non-working time of husbands will fall in response to a rise in women's wages whenever $b > 1$. This in turn implies

$$b = \frac{1+\delta}{1-\phi+\delta} > 1 \text{ if } \phi > 0 \tag{5}$$

This implies literally that relative non-working time falls whenever there is some public good aspect to consumption that prevents all of the response to changing wages being made through consumption. Hence the model predicts that in response to an increase in women's wages, relative to men's, wive's non-working time will weakly increase, relative to that of their husbands. With bargaining, therefore, the model is consistent with the fact that married men's non-working time did not increase in response to the rise in women's wages in the data, contrary to the predictions of the unitary version of the model. More generally, the results will depend on whether non-labor income is greater than or less than zero, net of home-production costs, and on the elasticity of home production costs to wages, as determined by the home technology.

5 The Decline in Home Hours

So far the results have been in terms of non-working time, but one of the most interesting features of the data is that total household time spent on home production declined while working time remained constant. Therefore to examine the implications of the model for paid work, we need to specify the home technology. We know that if women's wages rise then husband's relative non-working time can actually fall, contrary to the standard model. This does not tell us however whether market labor rises or falls, because home production time of the husband will also respond.

Table 2 showed that over the period 1965-2003 , married women's time unpaid work declined by about 35%, from 45 hours to 32.3 hours weekly. While it is undoubtedly the case, as argued by Greenwood and Guner (2004) that improvements in home technology played a large role, as evidenced by a dramatic fall in the price of home equipment, we also observe an increase in the husband's time input, from 17.9 hours weekly in the 1970s to 20.3 hours by 2003. These facts suggest substitution of inputs is indeed significant over this period. So we first specify a home technology that is consistent with substitution among spouse's time and purchased labor-savings inputs ("home equipment"), and then calibrate the technology to match the time allocations in the data.

Let the home technology for household type $s \in \{i, j, m\}$ be given by a function that is Cobb-Douglas in market goods e_q and total labor input H_s :

$$g_s = e_q^{1-\alpha} H_s^{\alpha}$$

The effective labor input is a CES function of the labor of men and women:

$$H_m(h_i, h_j) = \left[z_i h_i^{1-\rho} + z_j h_j^{1-\rho} \right]^{1/(1-\rho)}$$

For singles of sex i, labor input is $H_i = z_i h_i$, where z_i gives the productivity of sex i at home, and h_i the time input.

For singles this implies a home labor time given by:

$$h_i = h_i^0 \frac{\overline{g}_i}{z_i} \left(\frac{p}{w_i} \right)^{\alpha}$$

where $h_i^0 = \left[\frac{1-\alpha}{\alpha} \right]^{\alpha}$ .Note that if $\alpha = 1$, the ratio of full incomes of singles is proportional to the wage, as in the simple example in the previous section.

$$\widetilde{y}(\widetilde{w}) = \widetilde{w} \frac{1 - \left(\overline{g}_j / z_j \right)^{\rho}}{1 - \left(\overline{g}_i / z_i \right)^{\rho}} = \widetilde{w} \widetilde{g}$$

For married couples, where ρ is the elasticity of substitution between the labor inputs of the wife and the husband. If $\rho > 0$ then rising spouse wage increases own share of home time:

$$\frac{h_i}{h_j} = \left(\frac{w_i / z_i}{w_j / z_j} \right)^{-\rho}$$

, so this fits with the rise in husband's home hours. Note that the price p has no impact on the ratio of home hours. This means the role of trend in p for explaining relative leisure will be limited, as it will also have a similar effect on singles, thus leaving the bargaining positions unchanged.

6 Quantitative Analysis

We now calibrate the technology and the home-goods requirement to match home hours in the 1970s and the 1990s by sex and marital status. The calibration involves parametrizing two objects: the home goods constraint $\underline{g}^m(n_k)$ as a function of household type and number of kids n_k, and the home-production technology $G(e_q, h_W, h_H)$. Once we know the full income of the households, the model is fully identified, and we can then infer the role of bargaining in the household from the data on relative leisure.

The exogenous variables that change between the two periods are relative wages, the price of home equipment, the tax penalty on working wives, and family size. The wages in 1970 are set to $[0.61, 1.0]$ for women and men, respectively, and to $1.26 \times [0.76, 1.0]$ to match wage growth in the CPS, and the decline of the gender gap. The tax penalty is set to 0.21 for 1970s, and to 0.15 for the 1990s, based on the analysis of Congressional Budget Office tax data in the appendix

The relative price p of home equipment is assumed to fall by 50% between the two periods, to match the trend in the ratio of the NIPA furniture and household equipment price index to the CPI, shown in Figure 4(b). For married couples in the model, this could affect both the attractiveness of single life and hence the bargaining positions of the spouses, as well as the opportunity cost of market labor.

The calibration targets for married-couple's hours are taken from Table 2(a), discussed previously. Those for singles are taken from the same dataset, as summarized in the Appendix, Table A3(a). Non-working time is much higher in the data for singles than for married people; to match this with log preferences requires imputation of non-labor income to singles. As shown in the Appendix in Table A2, a large fraction of singles are parents or children of the household head, unlike married people who are almost all either heads or spouses of head. The fraction of single men 18-65 who were not household heads fell from 80% in 1962-65 to 52% in 1994-99, according to the CPS. For women, the numbers are similar, a decline from 70% to 43%. The table shows that these singles work about 70% of the hours of those who are heads. It seems plausible that these singles work less because they receive transfers from the household head. The magnitude of such transfers is however intrinsically difficult to measure. Therefore non-labor income for singles in each period will be set to whatever values equate non-working time in the model with the means in the data, given the taste parameter δ. For married people, non-labor income is normalized to zero for the 1990s, and set for the 1970s so that the model can match the change in the expenditure share of non-working time of married people, which would otherwise be constant under log preferences.[11]

[11] The calibration strategy is consistent with much higher levels of non-labor income. However, since this is difficult

In order to identify the role of a falling price of home equipment, we need to use data from both periods. To distinguish between changes in home hours due to the wage trend and changes due to the price trend, the change in home hours of single women will play an important role. One anomaly in the table is that single men's unpaid work time actually increased slightly; this is difficult to reconcile with the wage and price trends, so instead we'll allow single men's requirement for home goods to be slightly higher in the 1990s.

The home-goods requirement is parameterized as the following function of number of adults n_a and kids n_k :

$$\underline{g}^m(n_a, n_k) = \omega_m n_k^{\omega}$$

, where $\omega_m \in \left\{g^m, g^w, g^h\right\}$, and ω are parameters, which along with the production function, will determine how unpaid hours depend on family composition.

Family size fell quite significantly over this period; in the CPS sample, the average number of children in married couple households fell from 1.54 to 1.02. For single women, the average fell from .91 to 0.69 and for single men from 0.29 to 0.14. Family size also varies due to adults present of course, but this does not seem to have resulted in any additional change between the periods. To identify the role of family composition, we estimate a regression model of total housework hours on family size, controlling for marital status and year effects. The model is required to match the coefficients on being a parent and on number of children. The estimates, which appear in Table A4, imply that married women spend 27% more home hours when they have a child, with an additional 25% for families with more than one child. These families have an average of 2.5 children, so this amounts to an additional 10% per child. The table shows that while education and work status of the parent, as well age of the child, are also important in the determination of work hours, that these do not change the basic relation between hours and number of kids.

The remaining statistic used to calibrate the home technology is the expenditure share of home equipment. We set the expenditure share in the model for the 1970s equal to 4.0%. This corresponds to the NIPA series for equipment and furniture spending, which, as shown in Figure 4(a) appears to fluctuate between 4 and 5 per cent of total consumption.[12]

The calibration targets are all shown in Table 4(a), along with the corresponding statistics from the parameterized "benchmark" model. Once the parameters implied by the unpaid-work targets have been found, the leisure targets are matched by the choice of δ and non-labor income y_a^W, y_a^H and y_a^M. As one might expect, the model generates a very precise fit to the targets. The parameters required to do this are shown in Table 4(b). In terms of required home good, a married couple without kids required more home good than two singles, so economies of scale are non-existent.

These parameters imply that $\widetilde{q} = 1.10$; holding income constant, women are slightly more attracted to single life than men are. The reason for this outcome is that wives had more non-working time than husbands did in the 1970s, indicating lower gains from marriage, despite much

to measure, and without apparent relevance for the argument normalization seems to be in order.

[12] However the implicit assumption of full annual depreciation may understate the importance of home equipment.

lower wages of women; only part of this is accounted for by the surtax on married women's earnings; hence the non-pecuniary benefit of single life must have been higher for women. The degree of substitutability between men and women's labor is quite low, as implied by the coefficient $\rho = 1.755$. Under perfect substitutability, this coefficient would equal zero. Thus the ability of the household to meet the home good constraint with less labor from the wife relies on the ability to purchase market substitutes for her time, i.e. home equipment.

6.1 Computational Results

Table 5 shows the results of the calibrated benchmark model for the 1990s, along with the results for 5 computational experiments. Since the calibration of the home technology resulted in a very close match for home hours in both periods, the time allocations for the benchmark model are essentially identical to those of the data.

Per capita paid hours are shown in two rows: the first takes the marital status to be that prevailing in the 1970s, when 80% of the 18-65 population was married; underneath, the same statistics are given based on the 1990s distribution, when the fraction married had fallen to 60%. Since average hours are higher for married people in the 1990s than for singles, the decline of marriage actually reduces per capita paid work by about 0.3 weekly hours. Recall that in the 1970s the level of per capita paid hours was 25.4, so relative to the total increase of 3.76 hours, the effect of changing marital composition is negligible.

The benchmark model implies that in the 1970s the husband's weight in the married utility function was 0.69, and that by the 1990s it had fallen to 0.59, as discussed in the model section. What would have happened to labor supply if the utility weight had instead remained constant at 0.69, as in the unitary model? Experiment 1 shows that the paid labor of married men would have fallen by more than ten hours to 28 hours weekly, while that of wives would have risen by 16 hours to 37 hours weekly. In terms of per-capita hours, the resulting error would be on the order of 2 hours, more than half of the total change of 3.76 hours. Even though the effects of bargaining are distributional, the over-prediction of wive's hours by the unitary model is only partly offset by the under-prediction of husbands's hours. Abstraction from bargaining therefore appears to result in significant errors even at this higher level of aggregation.

Experiments 2 to 4 examine three potential causes of the trend in per capita hours: the closing of the gender gap, the fall in the price of home goods, and the flattening of the marginal tax schedule. In each case, the variable in question is held fixed at its 1970s level, and the steady state for the 1990s is recomputed. The results indicate the trend in the relative wage is the main driving force of the rise in per capita hours: when the relative wage is fixed in Experiment 2, per capita hours increase by only one hour, even though all other parameters are set to their 1990s levels. Hence the change in the relative wage accounts for 2/3 of the trend in per capita hours. This is interesting because the role of relative wages on aggregate labor trends have not been previously

analyzed.[13]

Given the predominant role of the relative wage in the hours trend, it is natural to infer that the effects of the equipment price and the tax reform are negligible. Indeed, as Experiment 3 shows, holding the equipment price constant, the per-capita hours trend ends up only half an hour lower than in the benchmark model. But a number of papers, such as Greenwood, Seshadri, and Yorukoglu (2005) suggest the effect on women's paid work of a fall in equipment price should be quite strong. Furthermore, interaction effects with relative wages should magnify this effect, as suggested by Bar and Leukhina (2007), who argue that the closing of the gender gap gives rise to a 'home-appliance revolution' as households substitute equipment for the wife's home labor.

The key to understanding this result is in Table 5(b), which shows the unpaid work hours under the various experiments. The unpaid hours do indeed respond strongly to the fall in equipment price; when the price is held fixed, home hours are 3 hours higher for married men, 4 hours higher for married women, and two hours higher for singles. Why does this not show up in paid work? Because the income effect of higher prices for home equipment implies that households choose lower non-working time. While most analysis in macroeconomics ignores the distinction between home production and non-working time, this is not a useful abstraction in cases where the home technology is evolving, and thus changing the relationship between the two.

Experiment 4 shows that holding the effective tax rate constant leaves per capita work nearly 2 hours lower in the 1990s. This supports the conjecture of Prescott (2004) that rising paid hours in the US has something to do with the flattening of the tax schedule associated with the 1986 tax reform. However the fact that the result of Experiment 2 accounted for all but 1 hour of the trend implies that the mechanism underlying the role of the tax is as much an effect of interactions with the relative wage, as it is a direct effect of the tax.

Where does all this leave the balanced-growth-path hypothesis?According to the Bureau of Labor Statistics, multifactor productivity in manufacturing was 30% higher in the 1990s than in the 1970s; average wages in the CPS were also about 30 % higher. In the standard model with balanced growth, if this increase were all permanent, this would have resulted in no change in hours worked. How closely does the current model conform to this? In Experiment 5, all parameters are fixed at their levels for the 1970s calibration, except that average wages are allowed to increase by 26%, the increase in the average real wage in the CPS. Per capita paid hours end up virtually unchanged, with only a 0.17 increase in hours per capita, about 10 minutes. With the fall in marriage rates however, the effect is tiny relative to the trend that motivated the critique of real business cycle theory in Galí (2005). From the point of view of modelling growth and business cycles,

[13] In Jones, Manuelli, and McGrattan (2003), per capita hours do not increase, because their calibration implies that the representative husband does not work in the home. Since they assume a unitary household, it must be that husband's leisure increases relative to the wife's when the wife's wage increases. In the absence of home work for the husband, this implies that husband's paid hours will fall. Therefore with respect to the trend in per capita hours, the critical difference between the two models is not the bargaining, but rather the role of the husband in home production.

the model implies therefore that the implication of constant hours along the balanced growth path is roughly consistent with the rise in per capita hours observed since the 1970s.

7 Discussion

The bargaining model proposed here relies on the Egalitarian solution with divorce threatpoints, but the same argument could apply to Nash bargaining, or to non-cooperative threatpoints, provided that the bargaining positions of the spouses are increasing in their own wages. It should also be noted that there are two strong empirical justifications for divorce threatpoints. First, data about the lives of singles, such as labor supply, wages and marriage rates, can be used, in combination with a suitable model of single life, to estimate the threatpoints. In this paper, these threatpoints are determined in the marriage-market equilibrium, as remarriage plays an important role in the value of being single. Second, the estimation results of Chiappori, Fortin, and Lacroix (2002) imply that household labor supply at the individual level is well described by a bargaining model with divorce threatpoints.

The model is simple enough that it is easily extended to accommodate concerns outside the scope of the current paper. For instance, with respect to marriage rates, the current model could "explain" the decline in marriage via a fall in income of married couples relative to singles, as in equation (4), or a rise in the joy of single life, q. According to the calibration however, the rise in ε^M due to the rise in the income of single women relative to married couples is swamped by the rise in the attractiveness to single men of marriage to today's higher-wage single women. From the model's point of view, all of the decline in marriage is therefore due to a rise in the level of q because the gender gap has offsetting effects on marriage rates. Since the results of the previous sections are unaffected by the marriage rate, the question that remains is how to interpret the rise in q implied by the model.

According to Ventura and Bachrach (2000), the fraction of child births accounted for by unmarried women has increased from 10 per cent in 1970 to nearly 35 per cent today. This suggests a big part of the trend in q may be due to child costs falling for single women relative to married women. This trend may be due to pecuniary factors, such as welfare transfers to single mothers, or to non-pecuniary, such as a decline in the stigma associated with single motherhood.

A closely related paper, Knowles (2007) , shows that by adding utility for children to the model, and the assumption that the costs of children are largely in terms of the parent's time, the model can replicate the rise in single women's fertility and the decline of married people's share of births. The idea there is that rising female wages raise the cost of fertility relative to family income more for married couples than for single women. This mechanism can account for about a half of the decline in married fertility. For single women, on the other hand, the model implies that the cost of child raising has fallen significantly. More to the point for the current paper, the fall in marital fertility implies a fall in the gains from marriage, and hence a decline in marriage rates. This

mechanism is similar to that discussed in Becker (1981).

Goldin (1986) reports that, except for the 1950-70 period, women's wages have been rising, relative to men's, over the period since 1820, when women's wages averaged 30 percent of men's. If we take the bargaining model presented here at face value, then given that relative leisure in the 1970s was about 1, we should expect to see that in 1820, married women had about one third the leisure of their husbands. This is not implausible, but hard to verify. If the arguments presented in the previous section do not apply, then what is it that makes the past so different from the present?

With respect to bargaining, the key assumption was that variations in women's outside option were correlated with their wages. However there are two reasons this relationship might not hold in the long-run: the non-pecuniary utility q_W of single life, particularly for divorced women, might have changed drastically over this longer period, and second, the availability of divorce was probably much lower in the 19th century than today. By the 1970s, the increasing prevalence of divorce, combined with reforms making divorce easier on wives and tighter restrictions on sex discrimination in the workplace combined to make divorce a much more realistic option for women than in preceding years. In the earlier years when this option was relatively unattractive, non-cooperative marriage may have been the more realistic option, as suggested by Lundberg and Pollak (1993). Hence the bargaining impact of relative wages may be a comparatively new phenomenon.

Similarly, the calibration results suggest that per-capita paid labor should have been much lower in the early 19th century than today, but the received wisdom is that this has either declined or remained roughly constant, with the shortening of the workweek and earlier age of retirement being offset by rising labor force participation of unmarried women. In relation to per-capita hours, we saw in the previous section that home equipment was important for the magnitude of the effect; a rise in women's wages is irrelevant for married couples if the wife is not at the margin between market and housework, and if it is not possible to substitute market goods and husband's time for the wife's inputs. An interesting example of how this may have changed over time is the work of Albanesi and Olivetti (2006), who explore how the development of infant formula in the 1930s made working life more compatible with the demands of motherhood.

Finally, this paper has taken as given the trend in the gender gap in wages. It seems likely that this development is not entirely exogenous with respect to the labor-supply decisions explored here. The explanations of this trend are still a contentious issue in the literature, and too complex to be considered in the scope of this paper. However the essential point of the current paper is that whatever the cause of the increase in women's relative wages, the standard macroeconomic approach would have difficulty in accounting for the failure of men's work hours to decline.

8 Conclusion

The main results of this paper are that intra-household allocation appears to play an important role in how the macroeconomy responds to changes in relative wages of men and women. In a model

of the allocation of non-working time between spouses, bargaining was essential for explaining the trend in per capita hours. The standard macro approach using stable household preferences would have over-predicted the rise in per capita hours, and implied a strong negative trend in paid work hours of married men. The results also showed that it was critical to model the distinction between home production and non-working time to understand the role of trends in the relative price of home equipment. Although the main driving force behind the trend in per capita hours appears to be the trend in the relative wage, the 1986 tax reform may have also played an important role in magnifying the response of per capita hours. The results of this paper suggest the existence of significant gains to macroeconomists to using models of intra-household allocation to study these variables, rather than the current standard models.

A Appendix

A.1 Effective Tax Rates on Married Women's Income

The tax rates used in the calibration of the model were computed from the Congressional Budget Office publication, *Effective Federal Tax Rates, 1979–1997* (October 2001). [14] This computation is summarized in Table A1. The table shows the sum of federal and social security taxes paid by a single-earner family whose mean income equals the labor income of the average male in 1980 and in 2000. According to the March CPS, earnings were at $38,700 in 2001 dollars, which would be taxed at an effective rate of 25%. With a second earner whose labor income equals 0.61 times that of the primary earner, this would have resulted in an effective tax rate of 31% on household earnings, according to the CBO tables; the tax bill would have risen from $9,675 to $19,315, implying an effective tax rate on the second income of 41%, which is equivalent to a surtax of 21%. Repeating the calculation for the year 2000, when the wife's wage is taken to be 0.76 of the husband's, results in an effective tax rate on the wife's income of 37%, implying a surtax of 15%.

A.2 Equilibrium in the Marriage Market

Under the assumptions that there is no commitment and that match quality is iid both over time and across pairings, there is no dynamic component to the gains from marriage. Marriage is the efficient outcome if and only if the flow gains are positive. Since this condition need hold only at the optimal allocation between spouses, however, we cannot just add up the individual gains at some arbitrary allocation. Instead we define the minimum Pareto weight $\underline{\mu}_i$ that makes marriage acceptable to person i.Marriage is the efficient outcome if and only the minimum weights sum to less than one.

Let $\widetilde{U}_i^M(\mu_i)$ represent the indirect utility function of person i being married. It's easy to show that this is given by:

$$\widetilde{U}_i^M(\mu_i, \varepsilon) = D_M + (1+\delta)\ln Y^m\left(w, p, \tau^W\right) - \delta\ln\left(1-\tau^i\right)w_i + (1-\phi+\delta)\ln\mu + \delta\ln\varepsilon$$

, where D_M is given by

$$K_M = \phi\ln\phi + (1-\phi)\ln(1-\phi) + D_S$$

It is convenient to break out the Pareto weight from the flow utility:

$$\widetilde{U}_i^M(\mu_i, \varepsilon) = U_i^M + (1-\phi+\delta)\ln\mu_i + \delta\ln\varepsilon$$

where

$$U_i^M = K_M + (1+\delta)\ln Y^m(w, p) - \delta\ln w_i - \delta\ln\left(1-\tau^i\right)$$

The flow utility from being single is given by the indirect utility function:

$$U_i^s(p, w_i, q_i) = D_S + (1+\delta)\ln Y^s(p, w_i) - \delta\ln w_i + \delta\ln q_i$$

[14] Available as a web publication at http://www.cbo.gov/ftpdoc.cfm?index=3089&type=0&sequence=0

where $D_S = \delta \ln \delta - (1+\delta) \ln (1+\delta)$.

The difference in flow utilities, excluding the marital share and the match quality, is

$$\begin{aligned} \Delta_i (p, w, q_i) &= U_i^M - U_i^s \\ &= K_{MS} + (1+\delta) \ln \frac{Y^m (w,p)}{Y^s (p, w_i)} - \delta \ln q_i - \delta \ln \left(1 - \tau^i\right) \end{aligned}$$

where

$$K_{MS} = K_M - K_S = \phi \ln \phi + (1-\phi) \ln (1-\phi)$$

. The minimum Pareto weight $\underline{\mu}_i$ is the solution to the following equation:

$$\begin{aligned} 0 &= \Delta_i (p, w_i, q_i) + (1 - \phi + \delta) \ln \underline{\mu}_i + \delta \ln \varepsilon \\ &\Rightarrow \ln \underline{\mu}_i = -\frac{\Delta_i (p, w_i, q_i) + \delta \ln \varepsilon}{1 - \phi + \delta} \\ &\Rightarrow \underline{\mu}_i = K \left(\frac{Y_i^s}{Y^m} \right)^{p_1} q_i^{p_0} \varepsilon^{-p_0} \end{aligned}$$

where

$$K_{MS} = K_M - K_S = \phi \ln \phi + (1-\phi) \ln (1-\phi)$$

and

$$\begin{aligned} K &= \exp \left(\frac{K_{MS}}{1 - \phi + \delta} \right) \\ p_0 &= \frac{\delta}{1 - \phi + \delta} \\ p_1 &= \frac{1+\delta}{1 - \phi + \delta} \end{aligned}$$

Marriage is efficient is and only if:

$$\underline{\mu}_i + \underline{\mu}_j \leq 1$$

Under the assumption that μ is not a function of ε, we can define the threshold marriage quality ε^M as the lowest value of match quality for which marriage is the efficient outcome:

$$\begin{aligned} 1 &= K \left(\frac{Y_i^s}{Y^m} \right)^{p_1} q_i^{p_0} \left(\varepsilon^M \right)^{-p_0} + K \left(\frac{Y_j^s}{Y^m} \right)^{p_1} q_j^{p_0} \left(\varepsilon^M \right) \\ &\Rightarrow \varepsilon^M = K^{\frac{1}{p_0}} \left[\left(\frac{Y_i^s}{Y^m} \right)^{p_1} q_i^{p_0} + \left(\frac{Y_j^s}{Y^m} \right)^{p_1} q_j^{p_0} \right]^{1/p_0} \end{aligned}$$

Therefore the equilibrium marriage rate is given by

$$\Pr \left(\varepsilon > \varepsilon^M \right) = 1 - F \left(\varepsilon^M \right)$$

.

A.3 Determination of the Pareto Weights

The solution here takes the surtax τ_W to be zero. It is trivial to extend the argument for the non-zero case.

Proposition 1 *Under the egalitarian solution, the Pareto weight of spouse W in the household utility function is given by*

$$\mu_H = \frac{1}{1 + \widetilde{qy}^{\frac{1+\delta}{\delta}}}$$

Proof. The solution equates the gains from marriage:

$$W_H(\varepsilon|\mu_H) = W_W(\varepsilon|1-\mu_H)$$

Given the expression (**??**) for $W_i(\varepsilon|\mu_i)$, this implies

$$\begin{aligned} & \delta \ln \mu_H - (1+\delta)\ln Y_H^s - \delta \ln q_H \\ = \;& \delta \ln (1-\mu_H) - (1+\delta)\ln Y_W^s - \delta \ln q_W \\ \Rightarrow \;& \mu_H = \frac{1}{1 + \frac{q_W}{q_H}\left(\frac{Y_W^s}{Y_H^s}\right)^{\frac{1+\delta}{\delta}}} = \frac{1}{1+\widetilde{qy}^{\frac{1+\delta}{\delta}}} \end{aligned}$$

■

A.4 Hours Worked By Singles

Table A2 shows the average paid hours of singles in the March CPS. The significance is that many singles are neither head nor spouse of household head, and these singles work much less in paid jobs. This has some implications for the interpretation of averages over all singles; in the calibration this is dealt with by imputing non-labor income to the singles who are not heads or spouses. It is also significant that the fraction of singles who are heads or spouses has increased significantly over time; in the case of men from 24% in 1965 to 48% in 1994-99. , and in the case of women from 35% to 67%. This means that in terms of the analysis presented here, the population of singles is not strictly comparable over time; whereas the meaning of married has remained more or less constant, single status encompasses a margin that is not in the model, that between living with parents and setting up a separate household as a single. Table A3 shows the time allocation of singles between paid work, unpaid work, non-working time and personal care. ***

A.5 Calibration of Family-Size Parameters

Table A4 shows the determination of partial effects by estimation of a regression equation of (log) unpaid work hours on household data from the time-use surveys for 1975 and 2003. These effects were used to calibrate the family-size function in the benchmark version of the model. We measured

the various effects associated with the trend in housework hours by running an OLS regression in which the dependent variable is the log of the unpaid work hours of married women.

The table reports the results when the excluded group is married with zero kids. Five specifications are reported, the simplest of which shows that parents of one child spend 27% more time on unpaid work, while those with more children spend an additional 23%. The average number of children of this latter group is 2.5; dividing the parameter estimate by this number gives 0.10, the number matched by the calibration. The other specifications in Table A4 investigate the robustness of this specification. Because the added variables, such as education and work status may be driven by family size, these specifications are difficult to interpret in terms of time costs, but the stability of the coefficients on Parent and More Than One Kid suggest that the effect of family size is of the order estimated in the first equation. Whatever the reason for the parameter shifts in the other specifications, they are small enough that the calibration results are not going to be drastically affected.

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Years	Sample		Weekly Hours	Per-Capita
1962-66	Women	Single	24.22	25.24
		Married	11.79	
	Men	Single	25.71	
		Married	39.44	
1967-75	Women	Single	22.54	25.37
		Married	13.76	
	Men	Single	24.52	
		Married	38.60	
1976-85	Women	Single	23.07	25.45
		Married	16.73	
	Men	Single	25.13	
		Married	35.74	
1986-96	Women	Single	24.89	27.69
		Married	21.36	
	Men	Single	27.20	
		Married	36.20	
1997-2001	Women	Single	25.95	29.01
		Married	23.47	
	Men	Single	28.22	
		Married	37.30	
2002-2006	Women	Single	24.67	27.84
		Married	22.97	
	Men	Single	26.52	
		Married	36.01	

Table 1*: Trends in Paid Hours Per Capita, March CPS ages 18-65*

Variables	1965		1975		1985		2003	
	Wives	Husbands	Wives	Husbands	Wives	Husbands	Wives	Husbands
Discretionary Time	118	118	118	118	118	118	118	118
Market Work	11.54	42.07	14.8	38.17	17.6	35.51	21.82	38.2
Total Unpaid Work	45.28	19.4	36.79	17.91	35.6	21.32	32.32	20.29
Total Working Time	56.82	61.47	51.59	56.08	53.2	56.83	54.14	58.49
Non-Working Time	61.18	56.53	66.41	61.92	64.8	61.17	63.86	59.51
Sample Size	739	696	697	655	1122	966	4116	3774

Table 2(a). *Time allocation of married couples* . Author's computations from married people aged 18-65 in time-use surveys. Observations with more than 4 weekly hours unaccounted for excluded.

Variables	1975		2003	
	Wives	Husbands	Wives	Husbands
Commute+Job-Related	2.71	6.54	2.02	4.06
Cooking and Indoor Chores	21.31	1.98	14.86	3.33
Shopping	6.18	3.8	6.55	4.24
Other Home Production	2.36	4.53	4.06	7.01
Child Care	4.23	1.06	4.83	1.65
Total Unpaid Work	36.79	17.91	32.32	20.29

Table 2(b) *Composition of Unpaid Work* . Author's computations from married people aged 18-65 in time-use surveys.

Variables	1975		2003	
	Wives	Husbands	Wives	Husbands
"Leisure 1"	34.5	33.07	32.43	35.51
Net Personal Care	25.4	23.31	24.44	20.12
Other Non-Working Time	6.51	5.54	6.99	3.88
Total Non-Working Time	66.41	61.92	63.86	59.51

Table 2(c) *Composition of Unpaid Work.* Author's computations from married people aged 18-65 in time-use surveys. "Leisure 1" refers to variable defined in Aguiar & Hurst (2006).

Age	Years					
	62-66	**67-74**	**75-84**	**85-94**	**95-00**	**2000-06**
18-24	0.83	0.81	0.84	0.92	0.91	0.90
25-54	0.59	0.60	0.63	0.74	0.76	0.75
55-56	0.65	0.65	0.60	0.64	0.63	0.66
Education						
< HS	0.59	0.58	0.61	0.71	0.74	0.75
HS	0.61	0.61	0.64	0.73	0.76	0.76
College	0.58	0.60	0.66	0.75	0.76	0.75
BA	0.64	0.66	0.66	0.73	0.72	0.69

Table 3(a): *Female-Male Wage Ratios by Age and Education* . Author's computations from the CPS population of people aged 18-65 who worked at least 10 hours weekly on average.

Subsample		Wife-Husband Ratios of Non-Working Time			
		1965	**1975**	**1985**	**2003**
Years of Education	Less than 12	1.08	1.02	1.08	1.01
	12 Years	1.06	1.14	1.03	1.06
	13-15 years	1.20	0.98	1.03	1.08
	16 or more	1.01	1.07	1.11	1.10
Working		0.89	0.97	1.01	1.04
Age	25-55	0.83	0.94	1.03	1.04
	55-70	1.12	1.01	0.95	1.06

Table 3(b): *Non-Working Time of Married People* . Author's Computations from the time-use surveys.

Statistic			Data	Model
Unpaid Work Hours	Married	Men 1970s	17.91	17.95
		Women 1970s	36.79	36.76
		Men 1990s	20.29	20.23
		Women 1990s	32.32	32.33
	Singles	Men 1970s	14.68	14.82
		Women 1970s	27.99	28.04
		Men 1990s	15.55	15.33
		Women 1990s	23.17	23.18
% Extra Hours per Mom			27.0%	27.1%
% Extra Hours per Child			10.0%	11.0%
Expenditure Share of Home Equipment			4.0%	3.8%
Non-Working Hours	Married 1970s	Men	61.92	61.91
		Women	66.41	66.41
	Wife/Hub 1990s		1.070	1.094
	Singles 1970s	Men	75.85	75.85
		Women	70.77	70.76
Per-capita Paid Hours, 1970s			25.40	25.58

Table 4(a)*: Calibration Targets for Benchmark Model*

Value	Parameter	
3.4697	g^m	base size married
1.3144	g^w	base size single female
1.2846	g^h_{1970}	base size single male 1970s
0	ω_0	size per additional kid
0.0424	ω_1	family size curvature parameter
1.3466	g^h_{1970}	base size single male 1990s
0.1695	θ	equipment share of output
1.5243	z_H	men's productivity 1970s
1.755	ρ	substitutabilty
1.2056	z_H	men's productivity 1990s
0.9529	z_W	women's productivity 1990s
2.2919	δ	leisure utility
1.1022	q_W/q_H	women's relative taste for single life
0	α	utility for public goods
0.08	y_nl	non-labor income of singles
0.04	y_nl_90	non-labor income of single men in 1990s
0.0264	y_nl_m	non-labor income of married couples in 1970s

Table 4(b)*: Parameters for Benchmark Model*

Household Time Allocation			Benchmark Model 1990s	Experiments 1 Mu Fixed	2 Relative Wage Fixed	3 Equipment Price Fixed	4 Tax Fixed	5 TFP Growth only
Non-Working Time	Married	Men	59.12	69.53	59.44	56.68	60.23	62.54
		Women	64.48	48.36	65.80	60.95	66.50	67.51
	Singles	Men	72.16	*No Effect*	72.16	70.40	*No Effect*	76.32
		Women	70.00		71.05	67.34		71.67
Paid Labor	Married	Men	38.66	28.25	42.94	38.33	39.14	38.21
		Women	21.20	37.32	10.56	20.31	16.19	15.15
	Singles	Men	30.50	*No Effect*	30.50	30.17	*No Effect*	27.42
		Women	24.82		22.89	24.31		19.36
Per Capita Labor in 1990s		1970s Dist.*	29.28	31.75	26.47	28.71	27.38	25.77
		1990s Dist.	28.96	30.85	26.58	28.42	27.40	25.29

Table 5(a). *Computational results for Paid Work and Non-Working Time in the 1990s.* *Marital status distribution as of the 1970s

Household Time Allocation			Benchmark Model 1990s	Experiments 1 Mu Fixed	2 Relative Wage Fixed	3 Equipment Price Fixed	4 Tax Fixed	5 TFP Growth only
Unpaid-Work Hours	Married	Men	20.23	*No Effect*	15.62	23.00	18.63	17.25
		Women	32.33		41.64	36.76	35.31	35.34
	Singles	Men	15.33		15.33	17.43	*No Effect*	22.96
		Women	23.18		24.06	26.36		71.05
Full Income Ratio of Singles to Married		Men	0.69	*No Effect*	0.74	0.70	0.69	0.75
		Women	0.47		0.40	0.48	0.47	0.39
Women/Men Singles Income Ratio			0.69		0.55	0.68	0.69	0.52

Table 5(b). *Computational results for Unpaid Work and Full Income in the 1990s.*

		One Earner	Wife works	Difference
1980	Mean Labor Income	$38,700	$62,307	$23,607
	effective tax rate	25%	31%	
	tax paid	$9,675	$19,315	$9,640
	Effective Tax Rate on Wife's Income			0.41
	Implied Surtax on Wife's Income			0.21
2000	Mean Labor Income	$38,700	$68,112	$29,412
	effective tax rate	25%	30%	
	tax paid	$9,675	$20,434	$10,759
	Effective Tax Rate on Wife's Income			0.37
	Implied Surtax on Wife's Income			0.15

Table A1: *Effective Tax Rates for One and Two-Earner Households* , based on Congressional Budget Office, *Effective Federal Tax Rates* , 1979–1997 (October 2001). Amounts converted to 2001 dollars.

Sample	Years	Household Head?	Average Weekly Hours Paid Work	Hours Worked Ratio	Non-H/S Share of Population
Single Women Ages 18-65	62-65	Other	21.80	0.71	0.70
		Head	30.61		
	69-72	Other	18.87	0.65	0.65
		Head	29.04		
	84-90	Other	20.95	0.72	0.52
		Head	29.14		
	94-99	Other	20.62	0.71	0.43
		Head	28.85		
Single Men Ages 18-65	62-65	Other	23.97	0.70	0.80
		Head	34.23		
	69-72	Other	21.27	0.64	0.76
		Head	33.04		
	84-90	Other	23.05	0.67	0.61
		Head	34.51		
	94-99	Other	23.24	0.68	0.52
		Head	34.10		

Table A2: *Paid Hours worked by Singles by Relation to Household Head.* Author's computations from March CPS.

Variables	1965		1975		1985		2003	
	Women	Men	Women	Men	Women	Men	Women	Men
Discretionary Time	118	118	118	118	118	118	118	118
Total Market	38.42	47.55	22.96	32.33	28.79	34.32	27.46	33.96
Total HouseWork	23.93	9.52	24.27	9.82	21.01	12.13	20.53	11.88
Total Working Time	62.34	57.07	47.23	42.15	49.8	46.45	47.99	45.83
Non-Working Time	55.66	60.93	70.77	75.85	68.2	71.55	70.01	72.17
Sample Size	231	122	250	149	719	559	3347	2405

Table A3: *Time Allocation of Singles in Time-Use Surveys.* Author's computations from representative sample of single people aged 18-65 in time-use surveys. Observations with more than 4 weekly hours unaccounted were dropped

Variable	Model				
	1	**2**	**3**	**4**	**5**
Intercept	2.153	2.500	2.105	2.117	2.404
	(0.028)	(0.032)	(0.033)	(0.029)	(0.039)
Age	0.012	0.011	0.013	0.012	0.011
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Parent	0.276	0.276	0.213	0.278	0.226
	(0.020)	(0.020)	(0.025)	(0.020)	(0.024)
More than One Kid	0.281	0.264	0.244	0.280	0.231
	(0.022)	(0.022)	(0.026)	(0.022)	(0.026)
Attended College	.	.	.	0.064	0.107
	.	.	.	(0.015)	(0.017)
Working	.	-0.385	.	.	-0.390
	.	(0.018)	.	.	(0.021)
Child Under 4 Years Old	.	.	0.263	.	0.227
	.	.	(0.028)	.	(0.027)
R-Squared	0.058	0.081	0.064	0.059	0.089
N	18091	18091	13087	18091	13087

Table A4: Effect of Family Composition on *Married Women's Unpaid Work*. Dependent variable is log of weekly unpaid work hours. Sample is married women in time-use surveys for 1975 and 2003

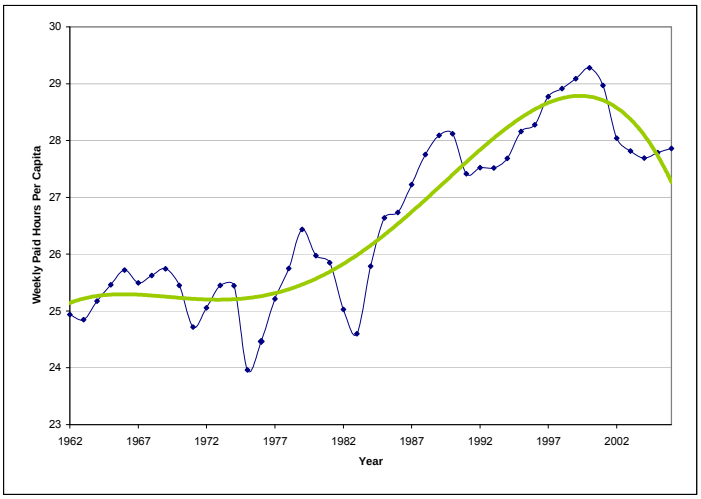

Figure 1(a): *Per-capita hours in the March CPS.* Based on author's computations from reported hours worked in previous week by persons aged 18-65. With fitted quartic trend line.

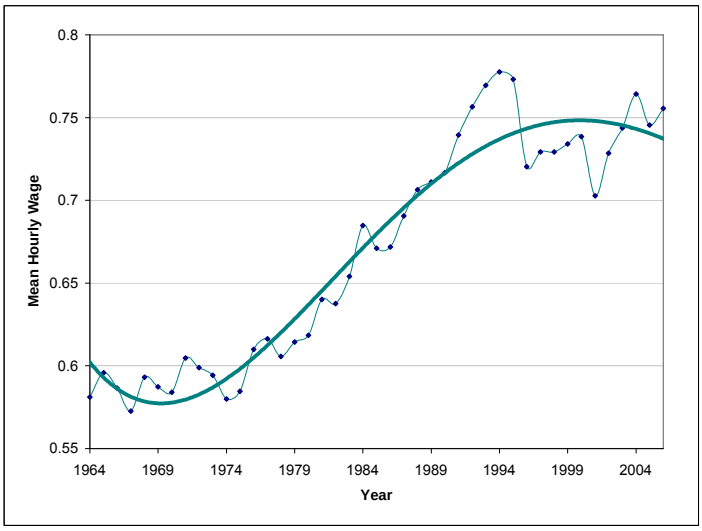

Figure 1(b): *Ratio of Mean Wages of Men to those of Women.* Author's computations from the March CPS for population 18-65 years old working 10 hours or more weekly at paid employment

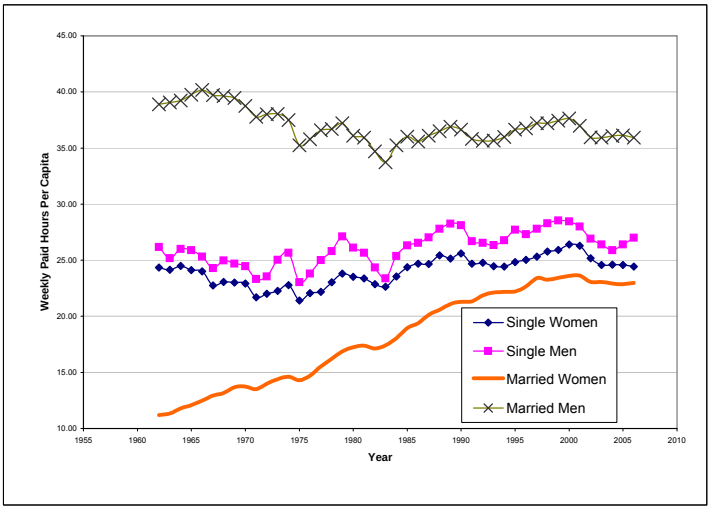

Figure 1(c): *Per-capita hours by sex and marital status*. Based on author's computations from March CPS, persons aged 18-65

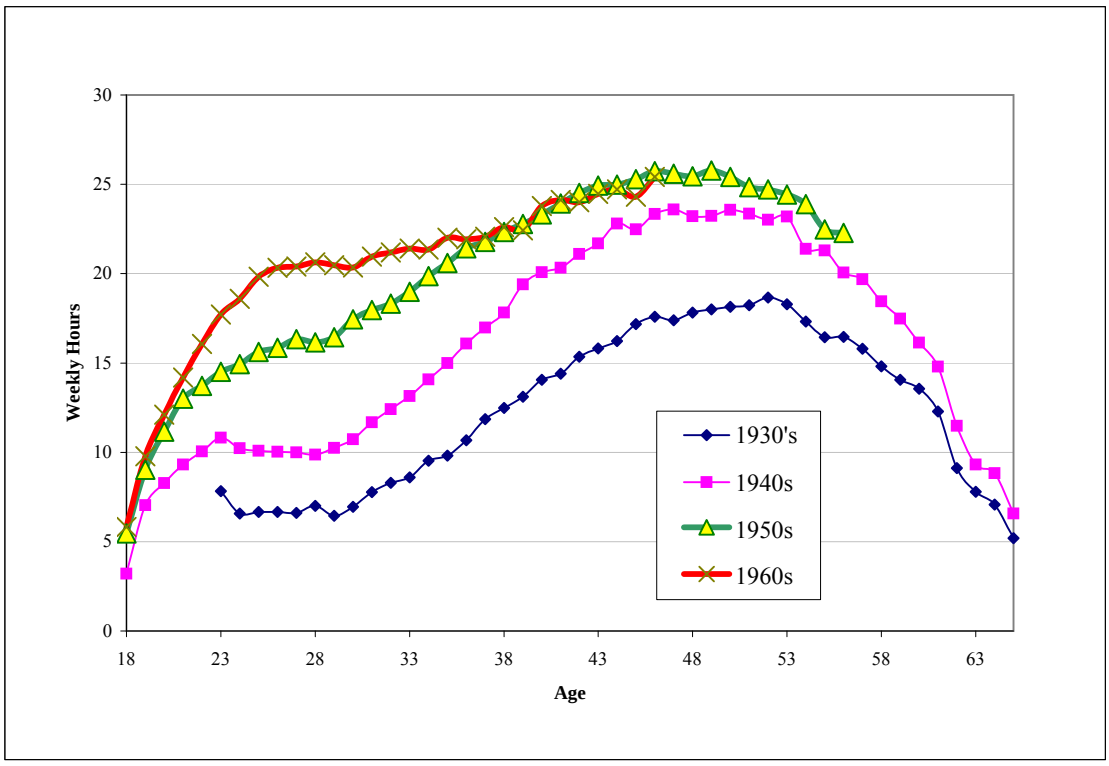

Figure 2a: Weekly Paid Hours of Married Women by Birth Cohort in the March CPS

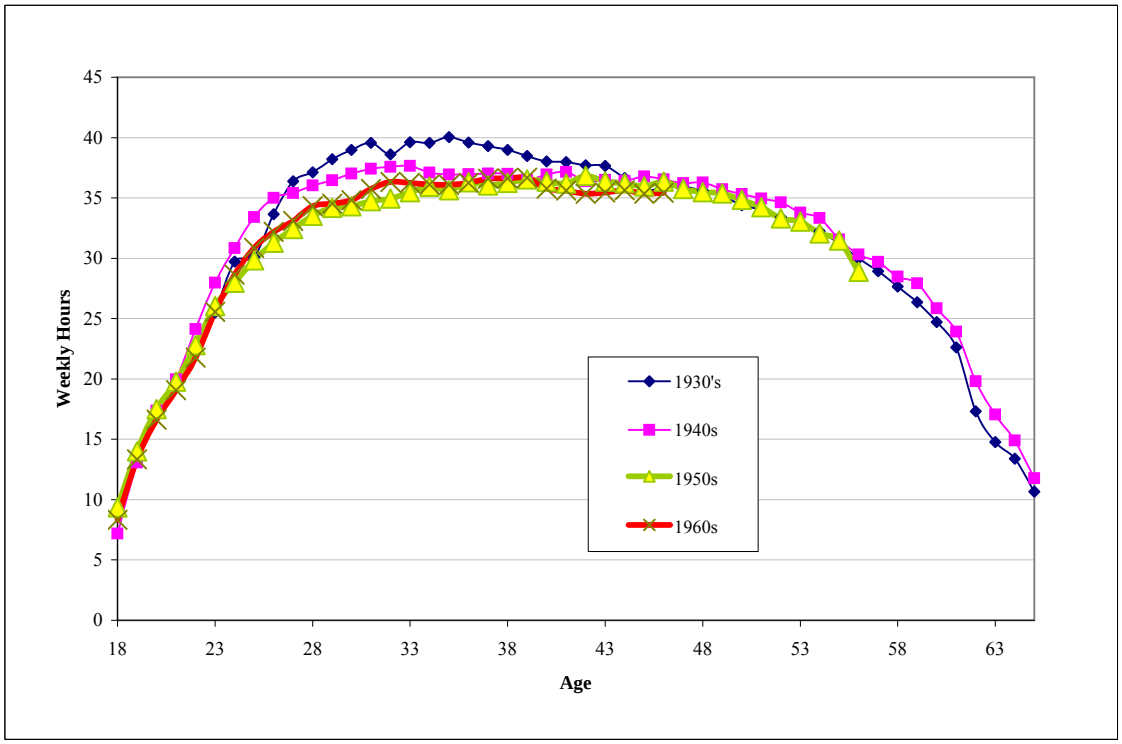

Figure 2b: Weekly Paid Hours of Married Men by Birth Cohort in the March CPS

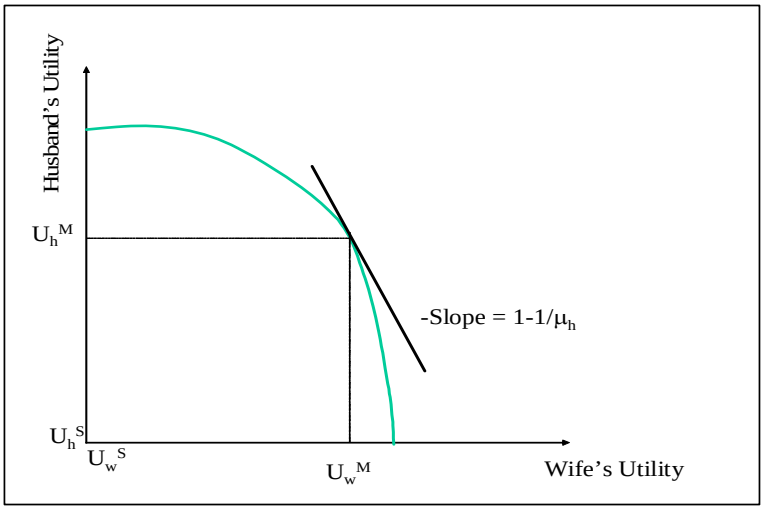

Figure 3a: *Equivalence between Pareto-optimal solution and utility weight.*

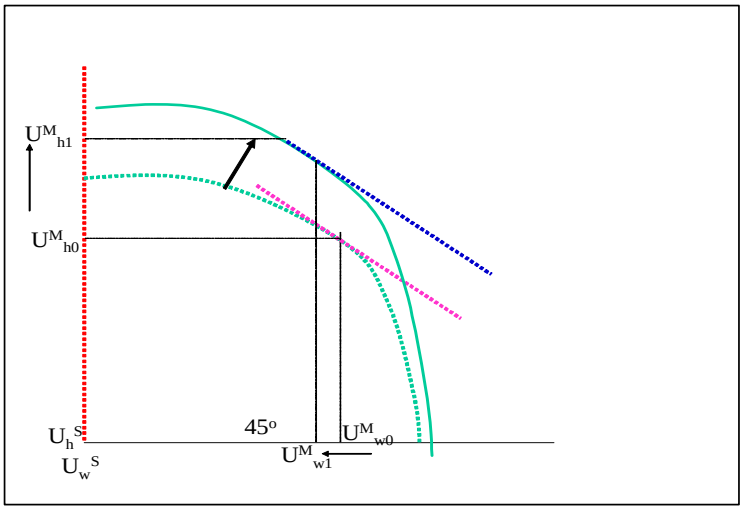

Figure 3b: *Response of Unitary Household to rise in wife's wage*

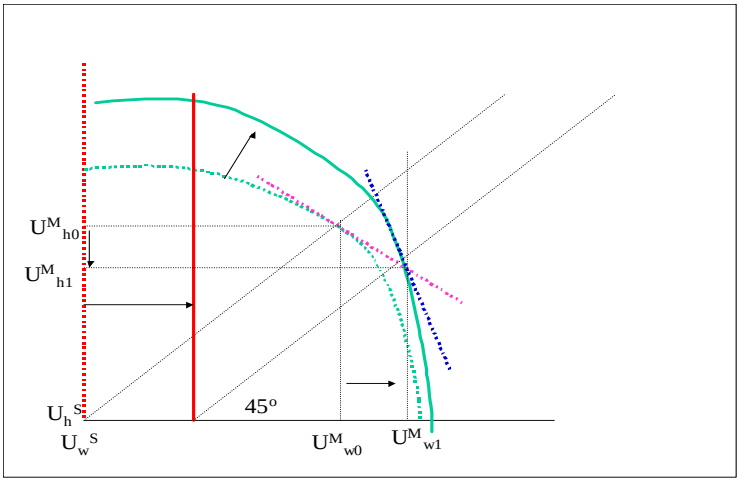

Figure 3c: *Response of Egalitarian Household to rise in wife's wage*

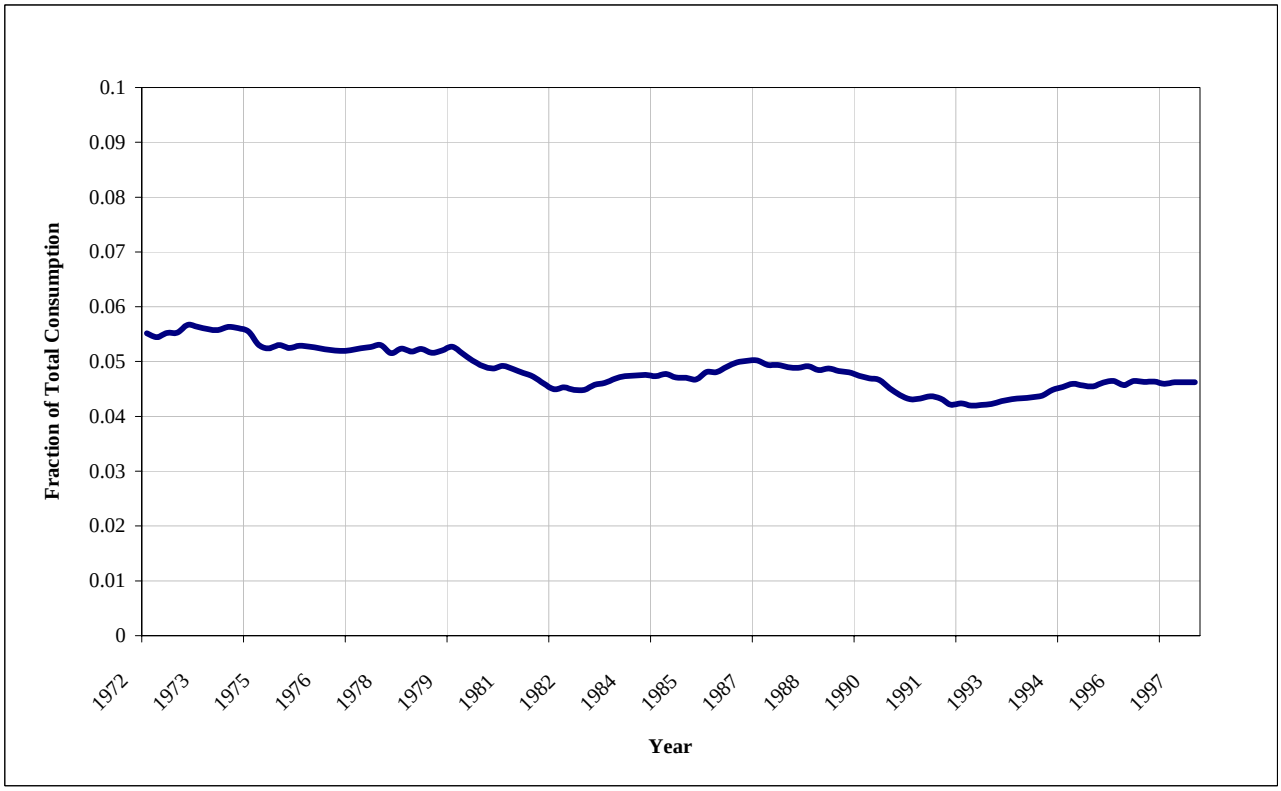

Figure 4(a): *Spending share of Home Equipment in the NIPA* , 1972-1997. Source: BEA Table 2.3.3. Real Personal Consumption Expenditures by Major Type of Product, Quantity Indexes

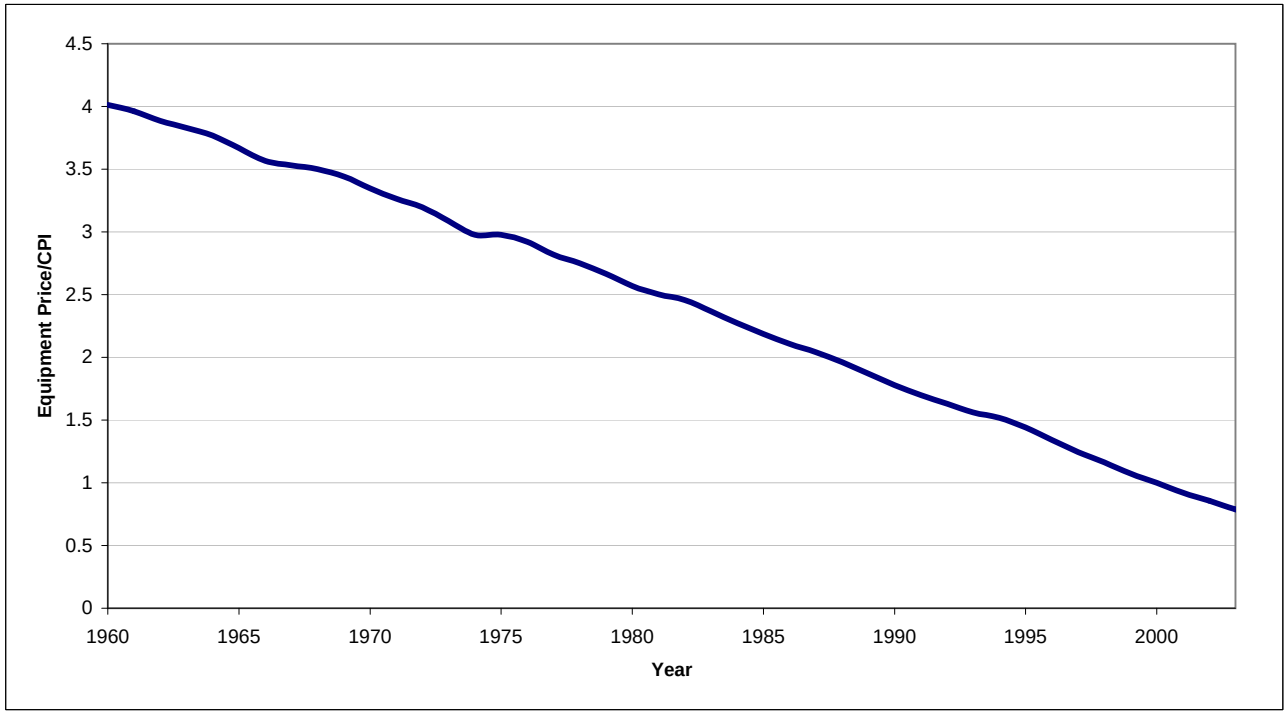

Figure 4(b): *Relative Price of Home Equipment and Furniture. Source:* BEA Table 2.3.4. Price Indexes for Personal Consumption Expenditures by Major Type of Product . http://www.bea.gov/bea/dn/nipaweb

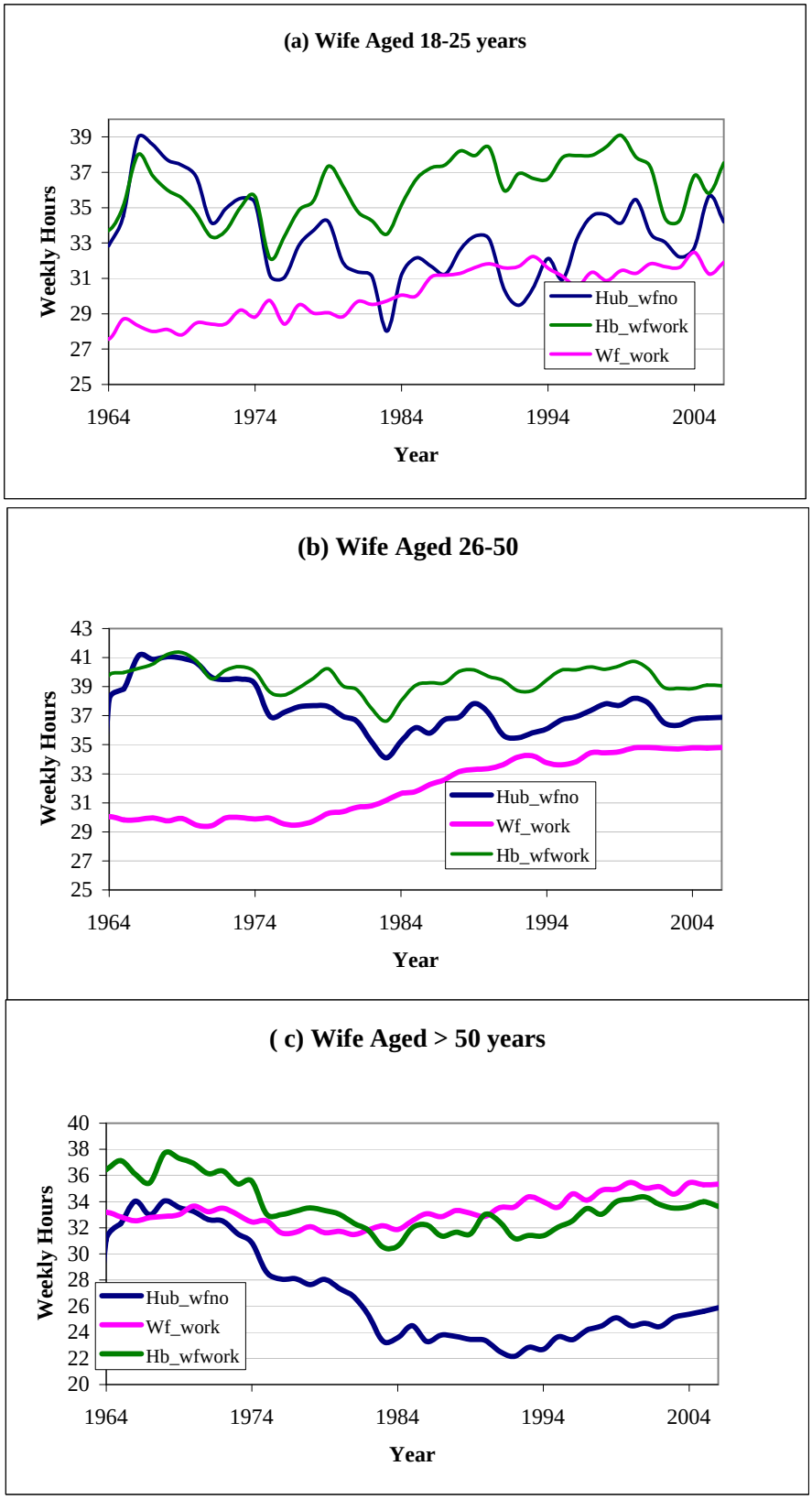

Figure A1: *Weekly Paid Hours From March CPS, by age sex and work staus of wife.*

Figure A2(a): *Dispersion in paid hours per worker,* March CPS, 1994-1997

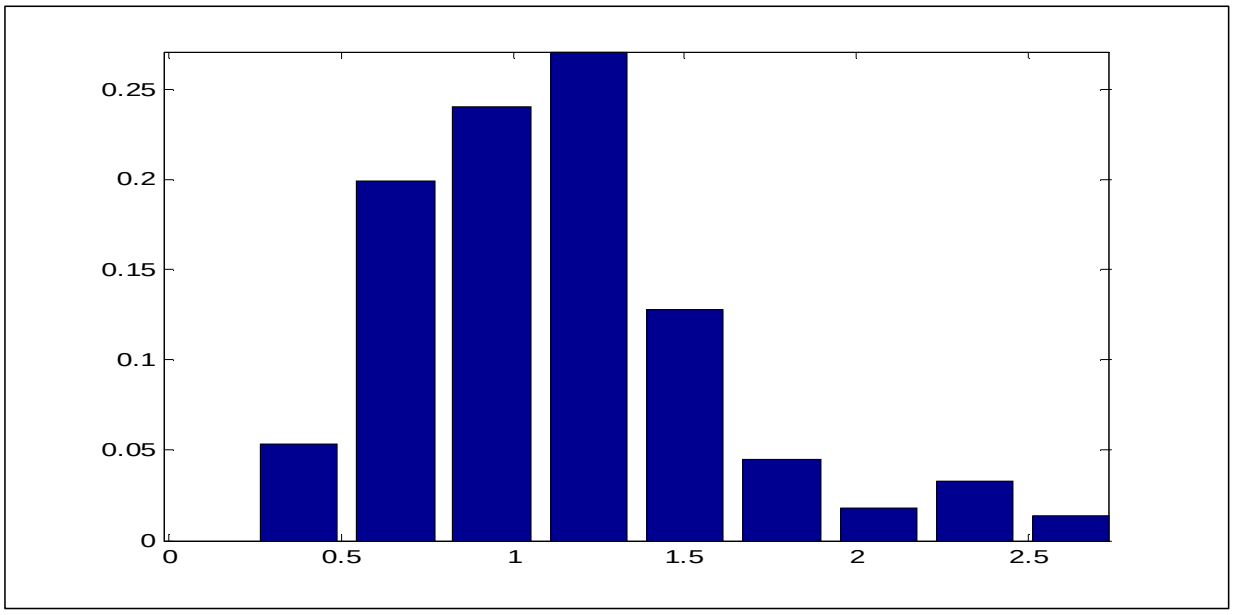

Figure A2(b): *Husband-Wife Ratios of Non-working time* . Based on computations from the survey,*Americans' Use of Time, 1985*