Rev Econ Household (2009) 7:159–178
DOI 10.1007/s11150-009-9051-z

Home production and wages: evidence from the American Time Use Survey

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Received: 27 May 2008 / Accepted: 9 January 2009 / Published online: 10 March 2009

Abstract Using data from the American Time Use Survey for the years 2003–2006, this paper finds that housework has a negative relation with wages for both women and men. The negative relation between housework time and wages is not likely to arise from omitted working conditions that are correlated with housework, nor from omitted effort. For women, the negative relation between housework and wages appears in most occupations, including professional and managerial occupations. The connection of housework time to the 'lack of interest' argument proposed by defendants in class action sex discrimination cases is examined and is not supported by the evidence.

Keywords Home production · Housework · Time use · Wage differentials · Lack of interest

JEL Classification D13 · J22 · J31

1 Introduction

Wage rates depend not only on labor market factors but also on time allocation outside the labor market. Much attention has been devoted to the influence of unpaid market-like activities that take place in the household, such as cleaning, cooking, and home maintenance. The total time spent by women on home production activities dominates the time spent by men, with the bulk of women's total home production time devoted to routine housework such as cleaning and cooking. There is considerable evidence that time spent on routine housework has a negative

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relation with wages that is not spuriously due to endogeneity or unobserved individual fixed characteristics, with the impact greatest for women's wages.[1]

This paper makes three distinct contributions to the literature examining the relation between home production and wages. First, I provide new estimates of the relation between wages and home production of various types, using time diary data from the American Time Use Survey (ATUS). The ATUS provides detailed information on all activities performed over a 24-h period. Time use data may provide more reliable values of home production time than the summary measures that have been used in most previous studies of the housework—wage relation. Hersch and Stratton (2002) show that the relation between home production activities and wages differs according to whether the activity is performed almost daily or can be deferred. The great detail in the ATUS allows a thorough examination of how different home production activities that vary in flexibility of timing are associated with wages.

Second, I examine whether the relation between home production and wages differs by occupation in order to provide information on the mechanism by which housework is related to wages. Occupations differ in a number of characteristics that accommodate combining market work with home responsibilities. If the negative housework—wage relation arises from either omitted working conditions correlated with housework that warrant a compensating differential, or from omitted effort, then controlling for occupation should decrease or eliminate the relation between housework and wages.

Third, because wages and housework time may be determined jointly, a key concern in the literature is that the observed negative effect of housework time on wages is actually due to reverse causality. Hersch and Stratton (1997) examine the potential joint endogeneity of housework time and wages and find that housework can be validly treated as exogenous to wages. In this paper, I use the detailed time diary data available in the ATUS to provide additional evidence on whether the negative effect of housework on wages is driven by reverse causality. Specifically, I use information on time devoted to other nonmarket activities to address whether other non-home production uses of time affect wages similarly and whether any negative effect of home production on wages is spuriously induced by the 24-h per day time constraint.

2 Background literature and empirical motivation

To examine the relation between time on home production and wages, I estimate wage equations of the following general form:

[1] Studies that find a significant negative effect of housework on women's wages include the following: Coverman (1983) uses the 1977 Quality of Employment Survey; Hersch (1985) uses data on piece rate workers; Shelton and Firestone (1989) use the 1981 Time Use Survey; Hersch (1991b), Stratton (2001) use a regional wage survey collected by Hersch; Hersch (1991a), Hersch and Stratton (1997), Hundley (2000), and Keith and Malone (2005) use the Panel Study of Income Dynamics; Noonan (2001) and Hersch and Stratton (2002) use the National Survey of Families and Households; Phipps et al. (2001) use the 1995 Statistics Canada General Social Survey; Bonke et al. (2005) use the 1987 Danish Time Use Survey; Bryan and Sevilla-Sanz (2008) use the British Household Panel Survey.

$$\ln W = X\beta + T\delta + J\gamma + \varepsilon,$$

where W is the hourly wage rate, X is a vector of individual characteristics such as education and work history, and T is a vector of time spent on different types of household production and other activities. J is a vector of working conditions, which are proxied by occupational indicators in the estimation.

Jobs that are compatible with extensive household responsibilities may be associated with working conditions such as flexibility in scheduling or light physical demands. Housework time may thereby be a proxy for favorable working conditions that would warrant lower pay as a compensating differential, and failure to control for working conditions may spuriously indicate a negative effect of housework on wages. With the exception of Hersch (1991b), no studies have examined the relation between wages and both working conditions and housework time in the same equation. Home production may alternatively have a direct effect on market productivity by reducing effort or energy available for market work (Becker 1985). An explanation that combines elements of compensating differentials with a direct effect of housework is that housework time impinges on market time or leads to less flexibility in a way that lowers market productivity. For example, if time-sensitive household responsibilities limit ability to stay at work late to complete projects, housework time may have a direct effect on productivity.

A concern widely recognized in the literature is that the causality may be reverse: that higher wages lead to less time on housework. Because time is constrained to 24 h per day, if all time is divided between market work and home production, and if the labor supply curve is positively sloped (that is, the substitution effect dominates the income effect), time on home production would by construction have a negative coefficient in a wage equation. This follows from the conventional model of the labor—leisure tradeoff decision under the assumption of a positively sloped labor supply curve.

If total time is allocated between market work and one other nonmarket activity, and if the labor supply curve is positively sloped, the argument that higher wages will lead to less time on the nonmarket activity holds for any use of time. However, in a general model with more than two uses of time, or one in which the labor supply curve may become backward bending at some wage rate, the effect of an increase in wages on time use becomes ambiguous, as both income and substitution effects become relevant. Furthermore, in a framework with multiple time periods, time use in earlier periods may be an investment in future productivity. Consider for instance investments in health capital (Grossman 1972). Health capital is formed by a combination of market goods and time on activities such as exercise. Investments in health capital may raise wages in the future. If market goods and health-enhancing activities are complements, an increase in wages may be associated with an increase in exercise time, as the income effect dominates the substitution effect. Other activities that combine market goods and time as well as an element of long term investment, such as childcare and home maintenance, likewise may have a positive association with wages.

The general point is that, on theoretical grounds, time on home production (as well as other activities) and wages may be jointly determined, and estimates that

assume either that housework time is exogenous to the wage or that the wage is exogenous to housework time may result in biased coefficients. An additional concern is that individual heterogeneity may also result in biased coefficients if individuals with higher innate market productivity spend less time on housework. If workers with higher wages or higher innate market productivity spend less time on housework, the coefficient on housework in wage equations estimated by OLS may be biased downward and show housework to have a greater negative effect on wages than its true effect.

Although recognizing the role of unobserved individual heterogeneity and the possible joint endogeneity of housework time and wages, most of the studies in the literature estimate wage equations by OLS. However, studies that have estimated instrumental variables and/or fixed effects equations find that the negative effect of housework on wages for women estimated in OLS specifications remains. Hersch and Stratton (1997) find coefficient estimates from instrumental variables estimation that are largely similar to those of OLS, and they cannot reject the assumption that housework time is exogenous to wages. Fixed effects estimates likewise show a statistically significant effect of housework time on wages, although the magnitude is smaller in fixed effects estimates than in OLS estimates (Hersch and Stratton 1997; Noonan 2001; Keith and Malone 2005; Bryan and Sevilla-Sanz 2008). Because the measure of housework time available in these studies is a summary measure that could include considerable random measurement error, the fixed effects estimates may be biased toward zero and underestimate the true effect of housework time on wages. Thus, the evidence from previous studies provides consistent empirical support indicating that the coefficient on housework time in wage equations estimated by OLS is not seriously biased.

In this paper I estimate OLS wage equations controlling for time on home production, time on other activities, and other individual characteristics expected to affect wages. This empirical specification implies that the coefficients on home production time in the wage equations are interpreted as the effects of home production on wages rather than as evidence of reverse causality or mere correlation between home production and wages. However, it should be recognized that the coefficients on home production time may be biased by joint endogeneity or individual heterogeneity. The evidence discussed above suggests any such bias is likely to be minor.

3 Data source and variable definitions

The American Time Use Survey (ATUS) is sponsored by the U.S. Bureau of Labor Statistics (BLS) and is the first federally administered, ongoing survey of time use in the U.S. (See Hamermesh et al. 2005). This survey is administered by phone each month to a subsample of respondents to the Current Population Survey (CPS). The designated diary day is the 24-h period starting at 4AM the preceding day. Respondents report each of their activities in order as well as either the duration of each activity or the start and finish time for each activity. The ATUS records activities with a high level of detail, with over 400 categories of time use assigned a

six-digit code. With the exception of time spent on providing secondary childcare, simultaneous activities are not recorded. In addition to the time diary information, the ATUS includes the usual labor market and demographic information available on the monthly CPS.

I use data from the ATUS for the years 2003 through 2006, which provides time diaries for 60,674 observations. The sample analyzed in the wage regressions is restricted to employed respondents ages 18–70 who are not full-time students and are not missing wage information, with hourly wage between $2.00 and $100.00 in 2006 dollars. The resulting sample size is 29,337, with 15,302 women and 14,035 men.[2] Throughout this analysis I use the ATUS final sample weight for each year that takes into account stratification by demographic group in the sampling frame, diary day of week, and differences in response rates by demographic groups, so that the results are representative of the U.S. population. The variables used in the analyses are defined below.

Conceptually, home production activities are those for which there are market substitutes. Because previous work (Hersch and Stratton 2002) shows that the effect of household responsibilities on wages differs by type of activity, I divide time spent on household production into six categories, which I refer to as 'daily housework,' 'maintenance and repair,' 'lawn and garden,' 'pet care,' 'household management,' and 'grocery and gas shopping.'[3] Daily housework includes cleaning, laundry, food preparation, and so forth. I refer to these activities using the term 'daily' because the majority of women in the sample spend at least some time each day on these housework activities. Maintenance and repair includes activities such as interior and exterior maintenance, decoration, and vehicle repair and maintenance. Lawn and garden includes care of lawn and gardens as well as care of ponds, pools, and hot tubs. Pet care includes all activities associated with caring for animals, including using veterinary services. Household management includes bill paying, household organizing and planning, and banking. While all shopping time is recorded in the ATUS, I include only time spent grocery shopping and purchasing gas, as these types of shopping are activities that primarily reflect home production. Within these categories I include own time on these activities as well as time spent using professional or household services and time spent on travel associated with the activity.

I also control for time spent on childcare. The ATUS records a number of activities that involve caring for and helping household children, such as reading, playing, and helping with homework. I adopt a narrow definition of childcare that includes physical care, looking after children as a primary activity, and dropping off and picking up children including for use of childcare services.[4] Other activities that relate to caring for children, such as cleaning and food preparation, will be recorded

[2] Alternatively restricting the sample to those ages 21–65 and working a minimum of 10 h per week yields results virtually identical to those reported. Ninety-five percent of the sample meets these two conditions.

[3] An appendix listing the activities grouped in each category of time use is available from the author.

[4] Estimates including time on care for household adults and time with children on activities such as reading and playing are virtually identical to those reported.

as daily housework. Note that childcare may have a positive relation with wages via a positive income effect associated with investment in children.

To address whether any estimated effect of housework on wages is merely an artifact of the negative effect any nonmarket time use would have on wages via the labor supply effect, I consider three additional categories of nonmarket time use: personal care, leisure, and exercise. Personal care includes sleeping, grooming, and related personal care activities. Leisure includes activities such as television watching and socializing. Exercise includes participation in athletic activities and sports.[5] Because most leisure activities require little physical effort, in contrast to exercise which typically requires considerable physical effort, considering these categories separately helps identify whether any effect of housework on wage arises because of physical effort constraints.

I define an indicator for whether the diary day includes at least one hour of market work (excluding commuting time) on the main job or on other jobs. This indicator is used to stratify the sample by whether the worker performed market work on the diary day. Seven percent of the sample that report a positive amount of market work on the diary day report working less than one hour. Of this group, 76% report zero time commuting to work. In contrast, only 11% of those reporting at least one hour of market work report no commuting time. Those with minimal market work time on the diary day may be doing flexible activities such as checking email and can be grouped with those reporting zero time on market work.

The dependent variable in the wage equations is the log of the real hourly wage rate in 2006 dollars, calculated by dividing weekly earnings on the main job by usual hours worked per week for those reporting weekly earnings.[6] For those who report that their hours per week vary and that they are paid on an hourly basis, the hourly wage is set equal to the reported hourly wage. Otherwise, workers who report that their usual hours worked per week vary have missing wage data. Earnings are not reported by self-employed workers.

The wage equations include indicators for government employer, whether the worker is a union member or is covered by a union contract or employee association, full-time employment based on usual hours worked per week, whether the worker is paid on an hourly basis, and occupational category (grouped into 11 categories).[7] As actual experience is not reported, I control for potential experience

[5] Within the sample examined in the analyses, on average 87% of the time within a day is accounted for by time on home production, childcare, market work, personal care, leisure, and exercise.

[6] As an alternative to log wage equations, I considered using log of weekly earnings as the dependent variable, including controls for market hours worked and market hours worked squared in addition to the other controls included in the log wage equations. The coefficients on all variables are essentially identical in both sets of analyses, so for brevity only the log wage equation results are reported.

[7] These occupational categories and the corresponding Census 2002 4-digit occupation codes are: management, business, and financial operations (0010–0950); professional and related (1000–3540); healthcare support (3600–3650); protective service (3700–3950); food preparation and serving related (4000–4160); building and grounds cleaning and maintenance (4200–4250); personal care and service (4300–4650); sales and related (4700–4960); office and administrative support (5000–5930); natural resources, construction, and maintenance (6000–7620); production, transportation, and material moving (7700-9750).

(calculated as age − years of education − 6) and its square.[8] I also include indicators for educational attainment, marital status, Hispanic or Latino ethnicity, race, and presence of children in four age groups as well as the total number of children in the household under age 18. Location is controlled with indicators for metropolitan location and residence in the South.

4 Distribution of time on home production

Table 1 reports mean values of time on home production, divided into the six categories defined above, as well as time on primary childcare and market work.[9] Panel A reports mean values by gender and within gender by whether or not the diary day includes market work. Panel B stratifies the sample by gender and marital status (married or not married). Several notable patterns are evident. First, as is universally shown in all countries and all time periods, women spend considerably more time than men on home production (Juster and Stafford 1991; Freeman and Schettkat 2005; Aliaga 2006; Aguiar and Hurst 2007). Overall, women spend 53% more time on total home production than do men. The gender disparity is narrowest on days without market work, in which women spend only 31% more time than men on total home production, and is largest on days with market work, in which women spend 65% more time than men on home production.

Second, the distribution of total home production by type shows a clear gender pattern. In absolute terms, women spend more time than men on daily housework, household management, grocery and gas shopping, and pet care. But as a share of their total home production time, women and men spend a similar share of their household time on household management, shopping, and pet care. Women spend a disproportionate amount of their total home production time on daily housework.

Third, home production time also varies by marital status, with married men and women averaging more total time on total home production than not-married men and women.[10] But daily housework does not differ by marital status for men, who average about 29 min per day on daily housework. In contrast, even not-married women spend a considerable amount of time on daily housework, averaging 67 min, while married women average 97 min of daily housework. However, marital status and the presence of children are not the main source of gender differences in time allocation. Calculations restricted to men and women without children under age 18 in the household show a similar pattern. Among those who are not married and do

[8] Years of education are calculated using information on highest grade completed, highest degree attained, and years spent in a degree program. Estimates controlling for age instead of potential experience are essentially identical to those reported.

[9] Descriptive statistics for the non-home production variables are reported in Appendix 1.

[10] How these gender patterns arise will not be addressed here, but see Lundberg and Pollak (2007) for an overview of models of household behavior that can be used to explain gender differences in the allocation of time. See Grossbard-Shechtman (1984) for a model that demonstrates how the value of time in household production is affected by the marriage market.

Table 1 Average minutes per day on home production, childcare, and market work, by gender and marital status

	Female			Male		
	All days	Market workday	Not market workday	All days	Market workday	Not market workday
Panel A: All marital statuses						
Total home production	133.34	89.68	210.28	86.95	54.33	159.74
Daily housework	84.62	59.52	134.16	28.76	18.78	51.04
Maintenance and repair	8.21	4.05	15.53	20.73	10.86	42.74
Lawn and garden	6.67	3.35	12.52	13.47	6.95	28.04
Pet care	5.98	5.55	6.75	3.97	3.42	5.18
Household management	14.86	11.27	21.18	11.59	8.89	17.63
Grocery and gas shopping	12.99	8.93	20.14	8.43	5.43	15.12
Childcare	24.13	21.39	28.95	11.39	9.98	14.54
Market work	295.55	461.83	2.47	355.29	513.21	2.98
Observations	15,302	7,675	7,627	14,035	7,886	6,149

	Female		Male	
	Married	Not married	Married	Not married
Panel B: By marital status				
Total home production	147.56	112.63	93.60	74.86
Daily housework	96.66	67.11	28.91	28.49
Maintenance and repair	8.79	7.37	23.31	16.04
Lawn and garden	7.30	5.75	16.50	7.98
Pet care	5.90	6.11	4.29	3.38
Household management	14.79	14.96	11.94	10.96
Grocery and gas shopping	14.13	11.33	8.65	8.02
Childcare	28.76	17.37	15.67	3.60
Market work	284.90	311.05	360.29	346.21
Observations	8,329	6,973	9,292	4,743

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics

not have children under age 18 in the household, women average 59 min on daily housework and men average 28 min per day (not reported in tables).

Differences in timing of home production over the week may account for much of the gender disparity in the relation between housework time and wages found in other studies. Many of the estimates of the housework—wage relation in the literature are based on data that provide a summary measure of time on home production for a full week, rather than reporting time for specific days. However, any relation between home production and wages may relate to the timing of activities rather than just the total amount of housework. Table 2 reports whether workers spend any time on each type of household production on days with and

Table 2 Percent performing home production activity

	Female			Male		
	All days	Market workday	Not market workday	All days	Market workday	Not market workday
Any daily housework	77.44	74.12	83.30	45.49	42.18	52.87
Any maintenance and repair	7.78	5.48	11.84	15.76	11.71	24.80
Any lawn and garden	7.03	4.88	10.83	10.90	7.79	17.85
Any pet care	17.00	18.41	14.52	11.62	11.84	11.14
Any household management	32.33	31.45	33.87	24.23	23.04	26.88
Any grocery and gas shopping	21.56	17.60	28.53	14.76	11.50	22.02
Observations	15,302	7,675	7,627	14,035	7,886	6,149

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics. The columns report percent spending any time on the indicated activity on the diary day

without market work. As this table indicates, 74% of women, but only 42% of men, spend some time on daily housework on days with market work. The activities 'maintenance and repair' and 'lawn and garden' are far more likely to be performed on days without market work and are more likely to be performed by men. The empirical analysis stratifies the sample by whether market work is performed on the diary day to identify whether timing of activities influences the association of home production with wages.

5 Regression results

Table 3 summarizes the coefficients on nonmarket time separately for female and male workers for all days, as well as stratified by whether the diary day includes market work. For the full samples of female and male workers, the coefficient on daily housework in the wage equation is negative and statistically significant at the 1% level for female workers and at the 5% level for male workers. For women, an extra hour of daily housework lowers the hourly wage by 1.4% (about 24 cents per hour on average). For men, an extra hour of daily housework lowers the hourly wage by 1.0% (about 21 cents per hour on average). For men, all non-daily home production activities other than shopping are associated with higher wages. In contrast, none of the non-daily home production activities are associated with women's wages. The positive relation for men between wages and non-daily home production activities may arise from an income effect, as discussed earlier.

For women, the coefficient on daily housework is considerably larger for the sample with market work on the diary day than for the sample without market work on the diary day. For men, the opposite is true: time on daily housework has the largest effect on wages when performed on days without market work, and there is no relation between wages and daily housework performed on days with market

Table 3 Coefficients on daily hours of home production in wage regressions, by gender

	Female			Male		
	All days	Market workday	Not market workday	All days	Market workday	Not market workday
Daily housework	−0.014** (0.002)	−0.025** (0.005)	−0.007** (0.003)	−0.010* (0.004)	−0.007 (0.009)	−0.011** (0.004)
Maintenance and repair	0.001 (0.005)	0.003 (0.012)	0.002 (0.005)	0.007* (0.003)	0.012^{+} (0.007)	0.005^{+} (0.003)
Lawn and garden	−0.007 (0.006)	−0.019 (0.013)	0.001 (0.006)	0.008^{+} (0.004)	0.012 (0.010)	0.006 (0.004)
Pet care	0.015 (0.010)	0.029^{+} (0.017)	0.008 (0.011)	0.030* (0.013)	0.055** (0.021)	0.009 (0.015)
Household management	0.006 (0.006)	−0.005 (0.011)	0.013* (0.006)	0.019** (0.007)	0.025* (0.011)	0.014* (0.007)
Grocery and gas shopping	0.001 (0.007)	−0.013 (0.013)	0.011 (0.008)	−0.005 (0.008)	0.021 (0.015)	−0.015^{+} (0.008)
Childcare	0.019** (0.005)	0.006 (0.008)	0.028** (0.006)	0.012^{+} (0.007)	0.008 (0.011)	0.015 (0.008)
Adjusted R-squared	0.37	0.39	0.35	0.40	0.40	0.41
Observations	15,302	7,675	7,627	14,035	7,886	6,149

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics. The dependent variable is the log of real hourly wage in 2006$. In addition to the variables indicated in the table, the equations also control for potential experience, potential experience squared, number of children under age 18, and indicators for high school graduate, some college or associate's degree, bachelor's degree or higher, government employer, union or employee association, paid hourly, Hispanic/Latino, race (Black/African American, American Indian/Alaskan Native, Asian, more than one race reported), metropolitan location, South, full-time, married, presence of children ages 0–2, 3–5, 6–13, and 14–17, and indicator variables for occupation in 11 categories (management, business, and financial operations; professional and related; healthcare support; protective service; food preparation and serving related; building and grounds cleaning and maintenance; personal care and service; sales and related; office and administrative support; natural resources, construction, and maintenance; production, transportation, and material moving). Results for 'all days' also include an indicator for market work on diary day

Standard errors in parentheses; $^{+}$ significant at 10%; * significant at 5%; ** significant at 1%

work. This may reflect men's success at minimizing their home production activities on market workdays to a level that does not interfere with market work. The possibility of threshold effects is examined later.

To examine whether the negative coefficient on housework time is driven by the 24 h per day time constraint coupled with a positively sloped labor supply curve, I estimate equations that add time on personal care, leisure, and exercise to the specifications reported in Table 3. The results (not reported in tables) are similar to those reported in Table 3. The coefficients on daily housework remain negative and statistically significant, with a slightly larger magnitude when these additional uses of time are included. For women, time on personal care and leisure have significant negative associations with wages for the full sample and on days with market work. The coefficients on personal care and leisure are much smaller than the coefficient on daily housework for the corresponding sample, and the differences between the housework and personal care coefficients, and between the housework and leisure coefficients, are statistically significant at the 1% level. On days without market work, leisure time has a significant negative coefficient that is smaller than the corresponding housework coefficient, but the difference between the coefficients is not statistically significant.

For men, time on personal care and leisure have a negative association with wages in all specifications, with coefficients that are smaller than the coefficient on housework. The differences between the coefficients on housework, personal care, and leisure are not statistically significant, except on days without market work, in which the difference between the coefficients of housework and personal care has a *p*-value of 0.07.

Exercise has a positive relation with wages for both women and men, although the coefficient is statistically significant only for men. This positive relation suggests that effort constraints are unlikely to be binding, and that exercise as an investment in health capital may have a positive income elasticity.

Overall, the findings suggest that the relation between housework and wages differs from that of other nonmarket uses of time, and that the relation between housework and wages is not merely a result of an upward sloping labor supply function. Because the coefficients on housework as well as on the other home production variables in wage equations are similar whether or not the other nonmarket uses of time are included in the equations, the remainder of the paper presents results that control for home production and childcare, but not for personal care, leisure, and exercise.

Table 4 summarizes the results of a standard Blinder-Oaxaca wage decomposition of the male–female wage disparity into the amount explained by differences in average measured characteristics and the amount explained by differences in returns to characteristics. Columns 1 and 2 report the coefficients on daily housework for females and males for the indicated sample or specification. Columns 3 and 4 report the percent explained by characteristics in the wage regressions with and without home production measures. The first and second rows reproduce the corresponding results reported in Table 3. Rows 3 through 6 summarize results for full-time workers, married, those with children under 18 in the household, and including daily housework as the only home production variable. Row 7 summarizes the results

Table 4 Coefficients on daily housework and percentage of wage gap explained by home production, alternative samples and specifications

	Coefficient (standard error) on daily housework hours		Percentage explained by characteristics[a]	
	(1) Female	(2) Male	(3) Without home production	(4) With home production
All workers	−0.0135** (0.0024)	−0.0104* (0.0042)	23.4	27.7
Market work on diary day	−0.0254** (0.0047)	−0.0075 (0.0086)	27.5	27.9
Full-time	−0.0139** (0.0027)	−0.0087* (0.0041)	14.1	18.7
Married	−0.0149** (0.0032)	−0.0145** (0.0050)	27.1	34.9
Children in household	−0.0156** (0.0031)	−0.0099^{+} (0.0053)	24.2	28.6
Daily housework only home production variable	−0.0136** (0.0024)	−0.0107* (0.0042)	23.4	28.2
Without occupation indicators	−0.0165** (0.0025)	−0.0117** (0.0043)	20.0	24.6

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics. The dependent variable is the log of real hourly wage in 2006$. The results in column 3 are based on equations that also control for potential experience, potential experience squared, and indicators for high school graduate, some college or associate's degree, bachelor's degree or higher, government employer, union or employee association, paid hourly, Hispanic/Latino, race (Black/African American, American Indian/Alaskan Native, Asian, more than one race reported), metropolitan location, and South. Additional variables in all equations except when the variable identifies the sample are number of children under age 18 and indicators for market work on diary day, full-time, married, and presence of children ages 0–2, 3–5, 6–13, and 14–17, and indicator variables for occupation in 11 categories (management, business, and financial operations; professional and related; healthcare support; protective service; food preparation and serving related; building and grounds cleaning and maintenance; personal care and service; sales and related; office and administrative support; natural resources, construction, and maintenance; production, transportation, and material moving). The results in column 4 and the coefficients reported in columns 1 and 2 are based on regressions that control for all variables listed above as well as for time on maintenance and repair, lawn and garden, pet care, household management, grocery and gas shopping, and childcare (except for row 6). Row 7 excludes indicator variables for occupation

[a] The decomposition uses the Blinder-Oaxaca method and is based on the male coefficients

Standard errors in parentheses; $^{+}$ significant at 10%; * significant at 5%; ** significant at 1%

excluding indicators for occupational categories. Comparison of the results with and without occupational indicators suggests that occupation may be correlated with housework time, as the coefficients on housework time are somewhat larger when occupational indicators are excluded.

Overall, it is notable that the coefficient on daily housework time is fairly similar in all specifications. The magnitude is largest for women who worked for pay on the diary day but is otherwise similar to the full sample results when restricted to those working full time, married, with children under age 18 in the household, or when including housework time as the only home production variable. The magnitude is smallest for men who worked for pay on the diary day, but otherwise the coefficient on housework time is similar across samples and specifications.

As Table 4 indicates, the addition of time on home production increases the amount of the gender wage gap explained by characteristics by less than one

percentage point (for the sample with market work on the diary day) to 7.8 percentage points (for the sample who are married). Other studies have shown a greater increase in the explanatory power of characteristics when housework is included, for example, from 8 to 11 percentage points in Hersch and Stratton (1997), 14 percentage points in Hersch and Stratton (2002), and 17–27 percentage points in Bryan and Sevilla-Sanz (2008).

There are at least three reasons for the relatively low improvement in explanatory power reported here. First, most studies control for time on daily housework as the only home production activity. Because men's wages are positively related to non-daily home production activities, it is possible that inclusion of other non-daily home production activities offsets the amount of the gender wage gap that would be explained by inclusion of daily housework as the only home production activity. However, regressions excluding all home production activities except daily housework (reported in row 6) yield a similar improvement in the explanatory power as that reported in row 1 which includes all home production activities. Second, the current results show statistically significant negative coefficients on housework time for men, unlike most findings in the literature. The increase in the explanatory power of characteristics from inclusion of time on housework is driven primarily by the difference between men and women in average household time rather than by the difference in the size of the housework coefficients. Even a large difference by gender in average housework time will result in a small increase in the explanatory power of characteristics if the coefficients on housework are similar for men and women. Third, many of these studies are based on summary measures of housework time rather than time diary data. These summary measures typically request time on activities predominantly performed by women, again causing a greater share of the gender pay gap to appear to be explained by housework.

6 Occupation, job characteristics, and home production

If occupations differ in characteristics that allow accommodation of market work with home production, we would expect the effect of housework on wages to likewise differ by occupation. For example, occupations differ in the flexibility of hours, availability of part-time work, and work schedules that allow coordination with a spouse or partner. Workers sort into occupations depending on their preferences for home production and market work, and such sorting would be expected to mitigate any relation between home production and wages.

To examine whether the effect of housework on wages differs by occupation, I estimate wage equations controlling for the 11 occupational categories included in the earlier regressions and for the interaction of daily housework with occupation, in addition to the remaining variables in the wage equations reported in Table 3. The coefficients on the interaction of daily housework with occupation for the full sample stratified by gender are reported in Table 5.

Starting with the results for women, note that the coefficient on housework is negative and statistically significant at least at the 10% level in the following occupations: management, business, and financial operations; professional and

Table 5 Coefficients on daily housework by occupation in wage equations

Coefficient on the interaction of daily housework with	Female	Male
Management, business, and financial operations	−0.011^{+} (0.006)	−0.018^{+} (0.010)
Professional and related	−0.011* (0.004)	−0.015 (0.010)
Healthcare support	−0.009 (0.010)	0.000 (0.071)
Protective service	0.023 (0.026)	0.013 (0.018)
Food preparation and serving related	−0.026** (0.010)	0.049^{+} (0.028)
Building and grounds cleaning and maintenance	0.004 (0.010)	−0.033 (0.021)
Personal care and service	−0.017^{+} (0.010)	0.036 (0.036)
Sales and related	−0.022** (0.007)	−0.029* (0.011)
Office and administrative support	−0.017** (0.005)	0.007 (0.015)
Natural resources, construction, and maintenance	−0.082** (0.021)	−0.006 (0.010)
Production, transportation, and material moving	−0.006 (0.008)	−0.011 (0.010)
Adjusted *R*-squared	0.37	0.40
Observations	15,302	14,035

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics. The dependent variable is the log of real hourly wage in 2006$. The equations include indicator variables for occupational category as well as time on maintenance and repair, lawn and garden, pet care, household management, grocery and gas shopping, childcare, and the additional variables listed in Table 3 note

Standard errors in parentheses;$^{+}$ significant at 10%; * significant at 5%; ** significant at 1%

related; food preparation and serving related; personal care and service; sales and related; office and administrative support; and natural resources, construction, and maintenance.[11] These seven occupations employ 85% of the women in the sample, which explains why the overall effect of housework on wages for women is negative.

In contrast, for men, the coefficient on housework is negative and statistically significant at the 10% level only in management, business, and financial operations occupations and in sales and related occupations. These occupations employ only 24% of the men in the sample, which explains why the overall effect for men is smaller than for women. Housework has a positive relation with wages for men in food preparation and serving related occupations. Perhaps men in these occupations enjoy cooking and are productive in both home and the market, although note that the coefficient is of the opposite sign for women and fairly large.

The most surprising finding of this analysis by occupation is the prevalence of the negative relation between housework and wages for women, with an effect spanning most of the occupations in which women are employed. As these occupations differ extensively in their job characteristics and the characteristics of workers, the general similarity of the negative housework coefficient makes it unlikely that omitted working conditions correlated with housework are the source of the negative housework effect for women. In addition, as there are large differences in the

[11] The hypothesis that the daily housework coefficients are equal across all occupations can be rejected at the 1% level.

amount of effort required in these different occupations, whether physical or mental, it is also unlikely that the negative relation between housework and wages is a consequence of allocating limited effort to housework rather than to the market.

One question is whether workers avail themselves of market substitutes for own housework time. Freeman and Schettkat (2005) document greater use of market substitutes for own housework time in the U.S. than in the EU and relate the disparity in women's hours worked between the U.S. and the EU to the use of market substitutes. Although the ATUS does not report expenditures or usage of commercial housework services, the frequency of non-zero time using housework services provides an indication of frequency of use. Within the category of housework services are cleaning, meal preparation, and clothing repair and cleaning services. Calculations from the data show that only 0.7% of women and 0.5% of men report spending any time using daily housework services. This percentage is doubtlessly lower than the share that would report use over a longer time period such as a week. Housework services generally are not used on a daily basis. In addition, using such services will ideally take little time, so some users of housework services will report zero time. But the rarity in which time is spent on housework services suggests that use of such market substitutes for own daily housework time is not widespread.

7 Threshold effects, work-related socializing, and lack of interest

Given the large disparities in average time on daily housework between women and men, threshold effects may be important, imparting a nonlinear relation between housework and wages. In addition, both socializing as part of the job and spending non-work time with coworkers, customers, and clients can be an important part of networking and may thereby contribute to higher pay. In this section I examine the relation between wages and both threshold effects and work-related socializing, and discuss the implications for the 'lack of interest' argument used in employment discrimination lawsuits.

The 'lack of interest' defense is that women are less interested in managerial or demanding jobs because of family responsibilities (e.g., Schultz 1990; Selmi 2005). This claim is frequently made in large class action discrimination cases, ranging from *EEOC v. Sears* (filed in 1973) to *Dukes v. Wal-Mart* (filed in 2001). Similarly, firms that expect client contact and socializing, such as law firms and stock brokerage firms, claim that women's failure to advance to partnership positions derives from household responsibilities that make them less available to clients than are men.

Firms may use time spent socializing with clients and coworkers as an indicator of interest. The ATUS allows direct examination of time spent socializing as part of the job as well as non-work time spent with coworkers, customers, and clients ('coworkers' for brevity).[12] Table 6 reports by gender and occupation (in minutes):

[12] The ATUS reports separate codes for 'socializing, relaxing, and leisure as part of job' and for 'eating and drinking as part of job.' I use the expression 'socializing as part of the job' to refer to the sum of these two categories. Time spent with customers or clients as part of the job will be reported as a market work activity.

Table 6 Average minutes on daily housework, socializing as part of job, and time with coworkers not as part of job, by occupation and gender

Occupation	Daily housework		Socializing as part of job		With coworkers not as part of job	
	Female	Male	Female	Male	Female	Male
Management, business, and financial operations	70.73	29.30	0.81	1.39	17.39	18.75
Professional and related	80.78	30.85	0.44	0.67	17.20	19.63
Healthcare support	95.87	22.06	0.00	0.00	15.05	26.04
Protective service	72.96	39.54	3.68	2.25	27.65	16.12
Food preparation and serving related	97.47	22.07	0.00	0.00	9.34	11.63
Building and grounds cleaning and maintenance	114.78	29.65	0.03	0.87	13.43	26.02
Personal care and service	95.78	36.06	0.56	4.81	12.87	11.13
Sales and related	84.22	27.13	0.72	1.11	12.87	16.47
Office and administrative support	83.70	31.08	0.31	0.29	15.71	22.97
Natural resources, construction, and maintenance	92.46	27.33	0.26	0.17	34.10	29.46
Production, transportation, and material moving	97.19	26.51	0.14	0.14	22.24	21.84
All workers	84.62	28.76	0.44	0.67	16.32	21.54

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics

time on daily housework, time socializing as part of the job, and time with coworkers other than while working. As Table 6 shows, in all occupations women average more than an hour per day on daily housework, while the maximum average among men is 40 min for men in protective service occupations. Note that while workers spend some non-work time with coworkers, they spend very little time socializing as part of the job. Specifically, women spend an average of 16 min a day of non-work time with coworkers, while men spend an average of 22 min a day. However, the average time spent socializing as part of the job is less than a minute per day for both women and men, and calculations show that only 0.6% of the women and 1% of the men report any time socializing as part of the job. Of course, as with the use of housework services, it is likely that a larger share would report socializing as part of work over a longer time period.

Table 7 summarizes the coefficients from wage regressions that control for threshold effects and time spent socializing. The effect of daily housework time is permitted to differ based on whether the amount of time is under 30 min, from 30 min to less than one hour, and one hour or more. The equation also includes variables for time socializing as part of the job and non-work time with coworkers. First, note the strong evidence of a threshold effect. The coefficient on housework is not statistically significant until the amount of time is at least one hour. Calculations show that 49% of women in the sample spend one hour or more on daily housework, in contrast to 17% of the men.

Second, non-work time with coworkers has a positive association with wages of almost the same magnitude for men and women. But socializing as part of the job is not associated with wages. Even if the positive relation between non-work time with

Table 7 Coefficients on daily housework in wage regressions with threshold effects and occupational characteristics, by gender

	Female	Male
Daily housework < 30 min	−0.035 (0.046)	0.007 (0.046)
Daily housework 30–59 min	−0.032 (0.064)	−0.034 (0.077)
Daily housework 60 min or more	−0.012** (0.003)	−0.017** (0.007)
Socializing as part of job	0.019 (0.028)	0.013 (0.026)
With coworkers not as part of job	0.012* (0.006)	0.011* (0.005)
Adjusted *R*-squared	0.37	0.40
Observations	15,302	14,035

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics. The dependent variable is the log of real hourly wage in 2006$. Intercepts for indicators for housework time category are included but not reported. See Table 3 note for the list of additional variables

Standard errors in parentheses; * significant at 5%; ** significant at 1%

coworkers and wages arises because such time is productive, the gender difference in average time is small, so non-work time explains only a small part of the wage disparity (specifically, 0.07%). Thus, the gender disparity in wages does not seem to arise because household responsibilities limit women's availability for socializing and networking.

Finally, consider the relation between wages and housework for those in management, business, and financial operations occupations. As indicated in Table 5, the relation between housework and wages for both men and women in these occupations is negative and statistically significant at the 10% level, with the magnitude of the coefficient somewhat larger for men (although the difference by gender is not statistically significant). Evaluated at the average values of housework by gender of those in managerial, business, and financial operations occupations, housework accounts for wages that are 1.3% lower for women and 0.9% lower for men than for comparable workers in these occupations who perform no housework. This small difference does not explain the strong lack of interest arguments advanced in litigation.

8 Conclusion

Using data from the American Time Use Survey for the years 2003–2006, this study finds that time spent on daily housework activities has a negative relation with wages, with the magnitude of the relation larger for women than for men. This finding is consistent with the findings of numerous studies that document an inverse relation between housework time and wages. An extra hour on daily housework is associated with average wages that are about 24 cents per hour lower for women and about 21 cents per hour lower for men. While the magnitudes may seem minor, it is notable that the sex discrimination lawsuit *Dukes v. Wal-Mart* involves a gender pay disparity of 9 cents per hour among the hourly employees.

For women, housework performed on a daily basis or on days with market work has a stronger association with wages than home production activities that can be deferred. There is evidence of a threshold effect of housework on wages, with the negative association appearing only for those spending one hour or more on daily housework. A far greater share of women than men spend one hour or more per day on housework, explaining the generally larger relation between housework and wages observed for women.

The negative relation between housework and wages does not seem to be due to a compensating differential for working conditions that better accommodate housework. Nor does it seem to be a tradeoff between market effort and housework effort. This is because the negative relation between housework and wages appears for women across almost all occupations, and these occupations vary widely in their working conditions and effort requirements. Furthermore, effort-intensive time on exercise has a positive relation with wages.

A final possible mechanism examined in this paper is whether time on housework may be a proxy for 'lack of interest,' in the sense used in class action litigation to explain women's lower representation in higher paying and managerial positions. According to this argument, women earn less or are not promoted because of family responsibilities that are incompatible with demanding jobs. However, this study shows that observable indicators of interest, such as time spent socializing with clients and networking, are not responsible for the observed gender disparity in wages. Furthermore, time on housework has a significant negative relation with wages for both men and women in managerial, business, and financial operations occupations. The difference in housework time by gender within these occupations likewise cannot explain the observed gender disparity in wages.

Acknowledgments Many thanks to Shoshana Grossbard, Dan Hamermesh, Amy Nickens, and anonymous referees for helpful suggestions.

Appendix 1

Table 8 Descriptive statistics for non-home production variables included in wage regressions mean (standard deviation) or percent

	Female	Male
Hourly wage (2006$)	17.15 (11.15)	20.87 (13.08)
Log of hourly wage (2006$)	2.72 (0.58)	2.91 (0.59)
Potential experience	21.70 (12.34)	20.78 (11.79)
High school graduate	30.05	32.17
Some college or associate's degree	28.97	24.69
Bachelor's degree or higher	33.81	31.69
Government employer	21.76	14.39
Union or employee association	14.38	16.42

Table 8 continued

	Female	Male
Full-time	78.89	94.01
Paid hourly rate	60.87	54.36
Married	59.28	64.51
Number of children under 18	0.80 (1.08)	0.86 (1.15)
Any child age 0–2	8.12	11.37
Any child age 3–5	9.19	11.67
Any child age 6–13	21.77	20.35
Any child age 14–17	13.89	11.85
Hispanic/Latino	10.96	15.52
White	82.59	85.07
Black/African American	12.36	9.28
American Indian/Alaskan native	0.60	0.61
Asian	3.14	3.38
More than one race reported	1.31	1.66
Metropolitan location	70.29	70.62
South	34.26	33.48
Market workday	66.84	71.91
Personal care (hours)	9.28 (2.13)	8.80 (2.24)
Leisure (hours)	3.39 (2.58)	3.86 (2.89)
Exercise (hours)	0.18 (0.61)	0.31 (1.03)
Observations	15,302	14,035

Author's calculations from the American Time Use Survey (ATUS) 2003–2006, U.S. Bureau of Labor Statistics

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