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February 1, 2014

Abstract

Drawing on German household data from 1992 to 2011, this paper analyzes how couples allocate housework against the backdrop of three questions: (1) Does an individual's contribution to household income - both in absolute and relative terms - influence his or her contribution to housework? (2) If so, does the magnitude of this influence differ by gender? and (3) How important are traditional gender roles on housework allocation? We address these issues by applying a panel quantile regression model and find that as both the share and absolute level of income increase, the amount of housework undertaken decreases, with the latter effect being roughly equal across genders. Nevertheless, traditional gender roles also appear to dictate housework allocation, which is evidenced by women increasing their housework if they earn more than their partner.

Keywords: housework, income, gender, longitudinal study, quantile panel regression

JEL Classification: D13, J16, J22

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1 Introduction

Although housework is not included in standard measures of economic performance, few would dispute its importance in contributing to a nation's well-being and overall level of economic activity. In Germany, housework has been estimated to account for 684 billion Euro (Destatis, 2003), or roughly 33% of GDP.[1] Most of this work is done by women. According to a survey undertaken by the German Federal Statistical Office in 2001, women spent on average 31 hours on unpaid work per week compared to 19.5 hours for men. More than a decade later, although gender parity prevails with respect to total work in most rich countries (Burda et al., 2013), gender disparities remain with respect to chores, raising questions about the effect of spousal and household characteristics on the allocation of household obligations.

Various theories have been proposed to explain the division in housework. Both "unitary" models of household production (e.g. Becker, 1965; Gronau, 1986) and "collective" models (e.g. Apps and Rees, 1997; Browning and Chiappori, 1998) postulate that the allocation of time is linked to the relative earning power of the spouses.[2] A key prediction of these models is that the partner with the higher income in relative terms enjoys stronger bargaining power and consequently dedicates less time to domestic chores.

An alternative view emphasizes the importance of opportunity cost (e.g. Gupta, 2006, 2007; Stratton, 2012), whereby the partner's absolute income is the main determinant of time allocated to housework. Apart from these two resource-based explanations, another line of theory has suggested that women might over proportionally contribute to housework to affirm traditional gender roles, a behavior that sociologists term as *doing gender* (e.g. Brines, 1994; Craig and Bittman, 2008; Akerlof and Kranton, 2000). Which of these three explanations better accounts for intra-household division of labor remains an open question. To our knowledge, no study has considered them all simultaneously, and even those weighing the influence of absolute versus relative income have come up with conflicting findings (Greenstein, 2000; Gupta, 2006, 2007; Gupta and Ash, 2008; Baxter and Hewitt, 2013).

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[1] According to a recent OECD report (Ahmad and Koh, 2011), the value of own account household production differs across countries, ranging from 15% in Canada to 42% in Australia.

[2] The unitary model has sparked criticism for assuming a common household utility function, which does not allow for heterogeneous and individual preferences within one household i.e. individuals aim to maximize the household utility instead of bolstering their own advantage. Collective models attempt to look into the black box by concentrating on the interaction between heterogeneous preferences of partners and the decision-making process within the household.

Drawing on household data from the German Socio-Economic Panel (GSOEP), the present paper contributes to the above three lines of scholarship with an econometric analysis of gender differences with respect to the income-housework relationship. Like in many European countries, major socio-demographic changes are currently underway in Germany that could have far-reaching implications for how households balance work and home life. Declining population has been accompanied by an increase in the labor force participation rate of women, rising from 55.1% in 1995 to 69.6% in 2010 (Destatis, 2012). A common interpretation of these trends is that they reflect a double-burden in the work borne by women, particularly as regards balancing employment, child care and housework (Rosenfeld et al., 2004; Baxter et al., 2008; Craig and Bittman, 2008). Feyrer et al. (2008), for example, suggest that Germany is among a set of high income countries in an intermediate stage of development with respect to the status of women in the workforce and in the household: While women enjoy improved but still unequal labor market opportunities, their household status lags, with one consequence being a higher opportunity cost of having children. Responding to this perception, policymakers have enacted an increasing number of family-related laws in recent years, ranging from family benefits and child welfare payments to parental wage compensation and taxpayer-funded parental leave for fathers.

We analyze the household production dynamics that lie at the heart of these issues with an econometric analysis that has several distinguishing features. First, our data covers a 20-year period spanning 1992, two years following German reunification, to 2011, allowing us to assess gender-specific trajectories in housework hours, employment status, and earnings over an era characterized by profound societal and economic changes. Second, the specification includes a suite of relative- and absolute income measures with which we gauge alternative explanations for how couples allocate housework. Third, we employ a quantile regression approach proposed by Canay (2011) that is suited to panel data. Specifically, the estimator controls for unobserved time-invariant heterogeneity while at the same time allowing us to explore heterogeneity in the effects across the conditional distribution of the response. This approach reveals that the magnitude of many of the housework determinants is dependent on the level of housework undertaken, a pattern that is otherwise obscured by the standard mean regression approach commonly applied to this question.

The paper is structured in five sections. The following section anchors the paper in the broader literature. Section three describes data from the German

Socio-Economic Panel including descriptive statistics on the housework distribution in Germany. The model and the results are presented in sections four and five. Section six closes with some final remarks.

2 Bargaining power, opportunity cost and gender identity

Doing chores is typically considered an unpleasant task, one whose completion requires an understanding between spouses that specifies how the task is shared. While different studies emphasize various processes by which this understanding is reached, existing research in household economics has mainly focused on two factors that influence spousal interaction: bargaining power and opportunity cost. A common element of these foci is a prominent role assigned to control over household resources, measured by income and time. The foci differ according to whether these resources are measured in absolute or relative terms.

Studies that analyze bargaining power are predicated on the idea that an individual's relative control over money and time determines power in negotiations about housework responsibilities. A partner earning a higher share of household income is seen to have more power, making it easier to bargain his or her way out of unpaid domestic work. Using the US Panel Study of Income Dynamics (PSID), Hersch and Stratton (1994) demonstrate the important role of relative resource distribution for housework labor. They find that the higher the male's income share, the more time the female spends on doing the chores. Similar findings have been obtained for other countries including Australia (Baxter, 2002), France (Anxo and Carlin, 2004), the UK (van Klaveren et al., 2008) and Germany (Gwozdz and Sousa-Poza, 2010).

Other studies argue that absolute income, by increasing the opportunity cost of a spouse's time, is the key determinant of effort allocated to housework (e.g. Gupta, 2006, 2007; Gupta and Ash, 2008; Stratton, 2012). Focusing on the U.S. context, Gupta and Ash (2008) critique the bargaining approach for its tendency to examine relative spousal earnings rather than absolute earnings. They demonstrate that women's housework hours decline with their absolute earnings irrespective of the partner's earnings ratio. The authors reason that women with higher earnings have a greater interest in substituting their own time on housework with the purchase of time-saving products and cleaning services, thereby limiting losses in foregone earnings. Using data from the Household, Income

and Labour Dynamics in Australia (HILDA), Baxter and Hewitt (2013) also investigate measures of absolute earnings, but find that the former lose statistical significance when relative earnings are included in the specification. They suggest that the Australian and US results might differ because Australia still displays stronger male breadwinning culture, which would account for bargaining power playing a more pronounced role in the allocation of housework.

Still other studies draw no hard and fast division between the bargaining and opportunity cost perspectives. Stratton (2012) suggests that both factors play a role but concentrates on spousal opportunity cost in time. This is also the emphasis of empirical research on time availability, which has focused on the effects of employment status and working hours on the division of housework. These studies tend to find that full and part time employed partners contribute less to domestic chores than the unemployed partner (Bianchi et al., 2000; Noonan et al., 2007). Cunningham (2007), based on longitudinal study in the US,[3] showed that women's employment status has a larger effect on the allocation of housework shares than men's employment status. Additionally, the more time women spend on paid labor, the more time men contribute to domestic chores (Cunningham, 2007; Noonan et al., 2007). Such patterns could be attributed either to the influence of bargaining power or opportunity cost.

A common feature of all of the above studies is that they ascribe no direct influence to the cultural mores associated with gender, itself. Instead, gender is treated as only having an indirect effect inasmuch as women and men have different earnings or employment situations. An alternative stream of literature, rooted primarily in sociology, (e.g. Brines, 1994; Greenstein, 2000; Craig and Bittman, 2008) but also economics (e.g. Akerlof and Kranton, 2000; Alvarez and Miles, 2003) brings gender identity directly into consideration by proposing an inverse relationship between traditional gender roles and an egalitarian division of housework. According to this perspective, women with a relatively high income share undertake disproportionally more housework while men with a relatively low income share undertake disproportionally less housework. Partners thereby accentuate the traditional gender-appropriate roles in order to compensate for reversing roles in labor. Sociologists refer to this behavior as *doing gender* or *gender deviance neutralization*.

Several studies provide support for this influence of gender identity on housework. In line with pure resource-based predictions, Brines (1994) demonstrates

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[3] Cunnigham's survey as is based on sample of approximately 1,100 white couples in the Detroit metropolitan area where the women were contacted in 1962, 1963, 1966, 1977, 1980, 1985, and 1993. Approximately 85% of the families that participated in 1962 also responded in 1992.

that women in the US decrease their housework while men increase their contribution when women's relative income share increases. However, she identifies a turning point once women earn at least as much (or more) than their partner. At this point, men actually decrease their share in household labor, a finding that is used to inform the empirical specification in the present study.

Akerlof and Kranton (2000) introduce identity, i.e. a person's sense of self, into an economic model of behavior so that utility functions account for social and gender-related differences. Their identity model of the household predicts an asymmetric division of housework between men and women. A man's self-image may be challenged if he participates in housework and if the woman earns more than he does. Equality in utility can be regained if the woman contributes over proportionally to housework. Akerlof and Kranton (2000) apply and test their model with respect to gender discrimination in both the workplace and the household. In all tested areas the effects on economic behavior change significantly if identity is incorporated. Similarly, Greenstein (2000) finds that men in the US who earn less than their partners do less housework compared to households where both partners contributed equal earnings. Craig and Bittman (2008) confirm similar findings for the case of Australia. Finally, for a sample of Spanish dual-earner couples, Alvarez and Miles (2003) find that variables capturing gender effects prevail over economic variables.

In sum, empirical findings support multiple explanations for the division of housework. However, no more than two explanations have thus far been considered in any single study, and the relative strength of these explanations, as measured by the magnitudes of the respective coefficients, has not been formally tested. Whether and to what extent gender trumps income – measured either absolutely or relatively – in determining the housework allocation of German households remains an open question.

3   Data

We pursue this question with data drawn from the German Socio-Economic Panel (GSOEP) for the years 1992 to 2011. The data was extracted using the Stata Add-On package PanelWhiz,[4] which facilitates data assembly and the replication of results. Observations are at the level of the household, which for

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[4] PanelWhiz (http://www.PanelWhiz.eu) was written by John P. Haisken-DeNew (john@PanelWhiz.eu). See Haisken-DeNew and Hahn (2010) for details. The Panel-Whiz generated DO-file to retrieve the data used here is available upon request. Any data or computational errors in this paper are our own.

Figure 1: *Females' share of housework*
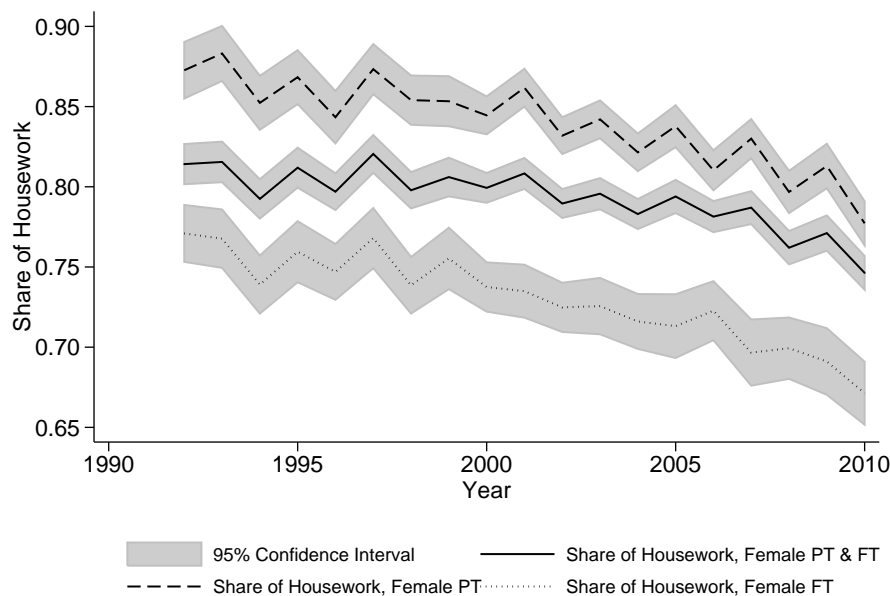
the purpose of this research is defined by the presence of a heterosexual married couple and may include children or other adults. To avoid complexities with corner solutions that may arise when one partner has the status of a fulltime homemaker, the sample is limited to couples in which both partners earn positive wage incomes. The resulting sample comprises 31,499 observations from 4,935 households, which remain in the panel for an average of 6.4 years.

With housework defined to include both in-home tasks such as cooking and cleaning as well as maintenance related shopping (e.g. for groceries), we follow Hersch and Stratton (1994) in constructing three dependent variables: the share of housework time done by the female as well as the absolute daily hours of housework done by the female and the male. Figures 1 and 2 illustrate how these variables, which are measured for a typical working day, have evolved over the past 20 years.

Figure 1 shows some evidence for a decrease in the share of time spent on housework by women. For those women working full time (FT), the share decreased from 78% in 1992 to 67% in 2011, with a corresponding drop from 87% to 77% among part time (PT) working women. Overall, the share of housework done by women fell from 82% to 75%, putting Germany at roughly the level reached in the U.S. in the late 1980s (Hersch and Stratton, 1994). The extent

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Figure 2: *Hours of housework by gender*

to which this decrease represents an absolute reduction in housework by women or an increase in housework by men can be seen in Figure 2.

Housework hours for women dropped by 17%, from 2.72 hours in 1992 to 2.26 hours in 2011; they increased by about 24% for men, from 0.63 hours to 0.78 hours. Overall, women's housework time decreased by about half an hour while men increased their domestic work by almost ten minutes over these two decades. Similar findings for paid and unpaid work have been documented for a number of industrialized countries (Gimenez-Nadal and Sevilla, 2012).

Table 1 presents descriptive statistics for the explanatory variables, the first four of which capture the alternative explanations for housework described in the previous section. The share of income earned by the wife, *female income share*, as well as the absolute income earned by the wife and the husband, *female income* and *male income*, serve to test the hypotheses that bargaining power and opportunity cost, respectively, influence the allocation of housework. In dual-income households, women earn on average 21,185 € per year, compared to 42,069 € for men, a discrepancy that is largely related to the higher incidence of part time work among women. Figure 3 plots the share of female income over time, limiting the sample to households in which the woman works full time. The share of female income increases modestly, rising from 44% in 1992 to 47%

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in 2011.

Table 1: *Descriptive Statistics*

Variable	Units	Mean	Std. Dev.
female housework share	0 to 1	0.790	0.217
female housework	hours	2.457	1.397
male housework	hours	0.671	0.740
female income share	0 to 1	0.337	0.179
female income	1000s Euros	21.307	15.209
male income	1000s Euros	41.965	25.263
main earner female	0 or 1	0.177	–
other adults present	0 or 1	0.263	–
child 0 to 1	0 or 1	0.021	–
child 2 to 4	0 or 1	0.079	–
child 5 to 7	0 or 1	0.119	–
child 8 to 10	0 or 1	0.144	–
child 11 to 12	0 or 1	0.116	–
child 13 to 15	0 or 1	0.178	–
child 16 to 18	0 or 1	0.178	–
both full time	0 or 1	0.406	–
female full, male part time	0 or 1	0.010	–
male full time, female part time	0 or 1	0.442	–
female full time, male other	0 or 1	0.006	–
male full time, female other	0 or 1	0.115	–
both part time	0 or 1	0.010	–
female part, male other	0 or 1	0.006	–
male part time, female other	0 or 1	0.001	–
both other	0 or 1	0.003	–
female poor health	0 or 1	0.062	–
male poor health	0 or 1	0.067	–

Std. Dev. is for Standard Deviation.

To test whether gender-identity plays a role in housework allocation, we include a dummy variable, *main earner female*, which indicates that the female's income is higher than the male's. Holding fixed the influence of absolute and relative income, we hypothesize that this variable has a coefficient of zero. Following Brines (1994)' finding that men decrease their housework once their spouse earns more, we would interpret rejection of the null to be indicative of the influence of non-economic factors on housework allocation.

The remaining variables are all dummies measuring socioeconomic features whose change over time is expected to additionally affect housework. Three indicators are included in the original data for employment status – full time, part

Figure 3: *Females' share of household income*

time, and 'other' – from which we construct nine dummy variables indicating different combinations of the employment status of the female and male. The 'other' category is a residual group that comprises individuals who are neither full nor part time employed, nor unemployed yet have a job, for example the marginally employed. The descriptive statistics show that the most common arrangement among fully employed households is for the male to work full time and the female part time (44.2%), an arrangement that Figure 4 reveals to have assumed increasing prominence since the early 1990s.

Demographic features of the household are captured by a dummy indicating whether other adults are present as well as a series of dummies indicating the presence of children of various age categories. Dependent children, in particular, have been found to lead to greater gender specialization in paid and unpaid work (Veerle, 2009; OECD, 2012), with mothers reducing their labor market activities to a much larger extent than fathers in order to allocate more time to responsibilities in the home. We also control for the health status of the male and female as measured by two dummies indicating a poor self-assessed health, i.e. three or below on a zero to ten point scale.

The specification is completed with the inclusion of 19 dummies for each year that capture autonomous changes over the observation period.

Figure 4: *Full time and part time shares by gender*
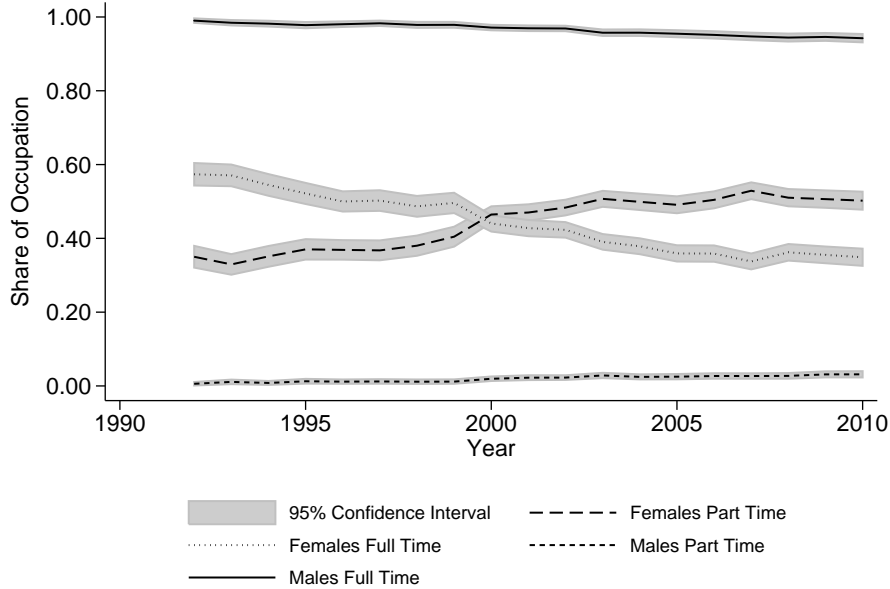
4 The Models

Our point of departure in econometrically estimating the determinants of housework is the specification of a fixed-effects regression:

$$H_{it} = \alpha + \beta \cdot \boldsymbol{x}_{it} + \theta \cdot \boldsymbol{z}_t + \phi_i + \epsilon_{it} \ , \tag{1}$$

where H_{it} measures either the share or absolute hours of housework undertaken by the male and female in household i at time t, $\boldsymbol{x}_{it}$ is a vector of explanatory variables, $\boldsymbol{z}_t$ is a vector of unit-invariant year fixed effects, ϕ_i is a household-level fixed effect, and ϵ_{it} is a stochastic disturbance term. The coefficients α, β, and θ are a set of parameters and parameter vectors to be estimated.

We are particularly interested in the subset of coefficients from the β vector representing the effects of the alternative explanations for the allocation of housework. Whether these effects can be interpreted as causal depends critically on our ability to control for the range of confounding factors that determine housework and are correlated with income. A key virtue of including household fixed effects is to control for those influences that do not vary over time. Although it is not possible to exclude the possibility of relevant time-variant

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unobservables, we believe that the range of explanatory variables included in $\boldsymbol{x}$ provides reasonably good coverage of temporal changes whose absence could otherwise induce biases.

One potentially restrictive feature of the fixed-effect estimation method is its focus on the conditional expectation function, which precludes the ability to estimate differential effects of an explanatory variable at different points in the conditional distribution of the dependent variable. The quantile regression estimator, introduced by Koenker and Bassett (1978), avoids this restriction by allowing estimation of the impact of a regressor at any point in the conditional distribution of the response, not just the conditional mean. Beyond this advantage, quantile regression is more robust to outliers than mean regression, it avoids assumptions about the parametric distribution of the error process, and the estimates are easy to compute, requiring straightforward linear programming methods.

As demonstrated by Canay (2011), an additional advantage of quantile regression, and one which we exploit here, is that it can be readily adapted to panel data. Specifically, Canay proposes a simple transformation of the data that removes the fixed effects under the assumption that these effects have a uniform impact across all the quantiles. The estimator is comprised of two steps, the first of which calculates the fixed effect from the estimation of equation (1):

$$\hat{u}_i = H_{it} - \hat{H}_{it} \; . \tag{2}$$

The second step transforms the response variable by subtracting the fixed effect in (2) from each observation:

$$\hat{H}_{it} = H_{it} - \hat{u}_i \tag{3}$$

Using the fixed effects model in (1) as a basis for comparison, we implement the transformation in (3) and proceed to apply the standard quantile regression of Koenker and Bassett (1978) to the modeling of $\hat{H}_{it}$.

5   Results

5.1   Mean regression fixed effects

We begin with the estimates from the fixed effects models, presented in Table 2, and subsequently present the results for the quantile fixed effects regressions.

As one of our aims is to compare the bargaining power and opportunity cost explanations of housework allocation, we standardize the variables measuring the share and absolute income levels to have a mean of zero and a standard deviation of one, thereby ensuring comparability in testing whether their magnitudes are equal. Our interpretation of the estimates is accordingly in terms of one standard deviation change in the explanatory variable.

Starting with the coefficients presented in column 1, three main results emerge. First, there is evidence that both bargaining power and opportunity cost bear on the share of housework done by the female: Increases in her share of total income decrease her share of housework, while increases in her absolute income and that of her partner have negative and positive effects, respectively. Second, tests for the equality of the coefficients on the absolute level of income, presented in the final rows, indicate them to be statistically indistinguishable in magnitude, suggesting that the effect of opportunity cost is the same across genders. Third, the strength of these effects is in turn the same as those of bargaining power, as evidenced by the failure to reject equal magnitudes of the coefficients on the share of income and the corresponding absolute income measures.

The remaining statistically significant coefficients in column 1 have signs that confirm intuition. Additional adults in the household increase the female's share of housework, as does the presence of children across all age categories, confirming similar findings from Australia (Baxter et al., 2008; Craig and Bittman, 2008) and Germany (Rosenfeld et al., 2004). Employment status also has an impact, one that appears to be qualitatively symmetric across genders. When only one partner works full time, the housework share of the other partner increases. Also, individuals having an employment status of "other" generally do a higher share of housework when their partner has a different status, likely reflecting the greater flexibility associated with this category.

Table 2: *Fixed effects results*

Variable	Share Female	Abs. female	Abs. male
female income share	−0.008∗	−0.091∗∗	0.032∗
	(0.004)	(0.021)	(0.013)
female income	−0.008∗	−0.080∗∗	−0.007
	(0.004)	(0.021)	(0.013)
male income	0.011∗∗	−0.002	−0.037∗∗
	(0.003)	(0.018)	(0.011)
main earner female	−0.002	0.082∗∗	−0.005
	(0.005)	(0.027)	(0.017)
other adults present	0.009∗∗	0.091∗∗	−0.010
	(0.003)	(0.020)	(0.013)
child 0 to 1	0.033∗∗	0.710∗∗	0.043
	(0.008)	(0.047)	(0.030)
child 2 to 4	0.023∗∗	0.358∗∗	0.013
	(0.005)	(0.029)	(0.019)
child 5 to 7	0.019∗∗	0.320∗∗	0.007
	(0.004)	(0.023)	(0.015)
child 8 to 10	0.013∗∗	0.266∗∗	0.012
	(0.004)	(0.021)	(0.014)
child 11 to 12	0.020∗∗	0.208∗∗	−0.018
	(0.004)	(0.021)	(0.014)
child 13 to 15	0.013∗∗	0.171∗∗	−0.009
	(0.003)	(0.019)	(0.012)
child 16 to 18	0.015∗∗	0.154∗∗	−0.023
	(0.003)	(0.018)	(0.012)
female full, male part time	−0.062∗∗	−0.054	0.227∗∗
	(0.014)	(0.078)	(0.050)
male full, female part time	0.046∗∗	0.370∗∗	−0.087∗∗
	(0.004)	(0.024)	(0.015)
female full time, male other	−0.145∗∗	−0.152	0.739∗∗
	(0.015)	(0.086)	(0.055)
male full time, female other	0.071∗∗	0.778∗∗	−0.148∗∗
	(0.006)	(0.034)	(0.022)
both part time	−0.012	0.306∗∗	0.187∗∗
	(0.014)	(0.082)	(0.053)
female part, male other	−0.102∗∗	0.382∗∗	0.570∗∗
	(0.015)	(0.087)	(0.056)
male part time, female other	0.022	0.785∗∗	0.220
	(0.031)	(0.178)	(0.114)
both other	−0.029	0.750∗∗	0.308∗∗
	(0.022)	(0.125)	(0.080)
female poor health	0.001	0.075∗∗	0.014
	(0.005)	(0.026)	(0.017)
male poor health	−0.007	0.007	0.051∗∗
	(0.005)	(0.026)	(0.017)
F-Tests on the equality of coefficients			
female income = - male income	0.670	14.890∗∗	10.440∗∗
female income share = female income	0.000	0.080	2.570
female income share = - male income	0.330	7.970∗∗	0.050

Standard errors in parentheses. ∗∗ (∗) indicates significance at the 1% (5%) level. Abs. is for absolute housework (hours). Regressions include year dummies not included in the table.

Columns 2 and 3 present the coefficients corresponding to the absolute amount of housework by the female and male, respectively. Evidence for bargaining power is seen in both models: a higher share of income earned by the female decreases her absolute amount of housework by 5.5 minutes (= $0.0914 \cdot 60 = 5.484$) while increasing the male's absolute contribution by 1.9 minutes. Although the magnitude of the effect for females is nearly three times that for males, a test for the equivalence of the magnitudes of the coefficients across the two models indicates that the difference is not statistically significant (not presented).[5]

A negative influence of opportunity cost, as measured by absolute income, is also seen, but only own-opportunity cost appears to matter and not that of the partner. Moreover, the influence is modest: a one standard deviation increase in female income, corresponding to about 15,500 €, lowers her absolute housework contribution by 4.8 minutes, which is statistically indistinguishable from the effect of the female income share. From column 3, a one standard deviation increase in male income also has a negative – albeit weaker – effect of reducing his housework by 2.22 minutes, which is likewise statistically indistinguishable from the effect of the female income share. Moreover, a test for the equivalence of the coefficients on female and male income across the two models is not rejected, suggesting that the effect of opportunity cost in reducing housework is the same for females and males (not presented).

Given the relatively low magnitude on the estimates for the partner's incomes in columns 2 and 3, contrasted by the substantially larger estimates on own income, it is perhaps not surprising that some of the F-tests in the final rows indicate statistically significant differences. Focusing specifically on those tests involving absolute own income and the income share, however, we continue to find that the magnitudes of the estimates are statistically indistinguishable.

In addition to bargaining power and opportunity cost, gender identity also appears to play a role in determining housework, as evidenced by the positive coefficient in column 2 on the dummy indicating that the female earns more than the male. This circumstance is associated with an almost five-minute increase in female housework per day, lending support to the notion of a compensating behavior that attempts to reclaim a traditional gender identity lost by virtue of the female earning higher income. The demographic control variables provide further evidence for a division of housework that is based on traditional gender

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[5] The statistical tests for results based on comparisons across the models are available upon request.

conceptions: the presence of other adults as well as children of all age categories increases the female's absolute contribution (columns 1 and 2), but are uniformly insignificant in the model of male housework (column 3).

Conversely, the employment dummies provide evidence for an allocation of housework that is influenced by time availability. Part time workers or those categorized as 'other', be they male or female, do more housework than their spouse when the spouse is full-time employed. However, when both spouse have the status of part time or 'other,' the effects of the employment dummies are uniformly positive.

Finally, a somewhat perplexing finding is the positive coefficients on the bad health indicators in both models. One possible explanation is that it reflects a consequence of more time spent in the home on sick leave, and hence more opportunity to do housework.

5.2 Quantile panel regression

Table 3 presents coefficient estimates obtained from a fixed-effects quantile regression for the 50% quantile, alternatively referred to as a median regression (estimates for the other quantiles are found in the appendix in Tables 4, 5, and 6). The results are largely in line with those of Table 2, with one exception being that the dummy indicating higher female earnings is now negative and statistically significant in the model of absolute male housework (column 3). The effect, however, is small – less than a minute – and, as noted below, is statistically significant over only a limited range of the quantiles.

Another divergence from the mean regression results of Table 2 is evident on the coefficients of the dummies indicating the presence of children in the regression of male housework (column 3). Young children are now seen to increase the housework of men, but a reversal in this relationship takes place for older children, whose presence decreases male housework. A negative effect is also obtained for the presence of other adults in the household. These patterns may reflect a proclivity of older household members to take on tasks – like taking out the garbage – that might otherwise be done by the male spouse.

Moving beyond a focus on the 50% quantile, Figure 5 presents a graphical depiction of the estimates over the entire range of quantiles for each of the three models and for the four key variables of interest, namely, *female income share*, *female income*, *male income* and *main earner female*. In Figure 5a the negative impact of the share of female income on her share of housework is fairly constant,

tracking slightly upward and becoming statistically insignificant in the highest quantiles. More pronounced patterns are seen for the case of female and male absolute income in the two graphs just below (5d, 5g), indicating negative and positive effects, respectively, with magnitudes becoming weaker in the higher quantiles. Taken together, these results suggest that households in which the woman does a high share of the housework do not alter this allocation markedly in response to increases in either the share or the absolute income of either spouse.

Table 3: *Results for the median from quantile panel regression*

Variable	Share Female	Abs. female	Abs. male
female income share	−0.008∗∗	−0.080∗∗	0.029∗∗
	(0.001)	(0.010)	(0.003)
female income	−0.009∗∗	−0.080∗∗	−0.002
	(0.001)	(0.006)	(0.002)
male income	0.011∗∗	0.000	−0.036∗∗
	(0.001)	(0.006)	(0.002)
main earner female	−0.001	0.065∗∗	−0.010∗∗
	(0.002)	(0.012)	(0.004)
other adults present	0.009∗∗	0.095∗∗	−0.012∗∗
	(0.001)	(0.009)	(0.002)
child 0 to 1	0.034∗∗	0.562∗∗	0.033∗∗
	(0.005)	(0.047)	(0.010)
child 2 to 4	0.020∗∗	0.312∗∗	0.014∗∗
	(0.002)	(0.018)	(0.004)
child 5 to 7	0.018∗∗	0.310∗∗	0.007∗∗
	(0.002)	(0.013)	(0.003)
child 8 to 10	0.015∗∗	0.255∗∗	0.003
	(0.001)	(0.014)	(0.003)
child 11 to 12	0.015∗∗	0.198∗∗	−0.009∗∗
	(0.001)	(0.015)	(0.003)
child 13 to 15	0.013∗∗	0.152∗∗	−0.011∗∗
	(0.001)	(0.013)	(0.002)
child 16 to 18	0.014∗∗	0.139∗∗	−0.017∗∗
	(0.001)	(0.013)	(0.003)
female full, male part time	−0.064∗∗	−0.042	0.195∗∗
	(0.007)	(0.035)	(0.037)
male full, female part time	0.048∗∗	0.371∗∗	−0.084∗∗
	(0.001)	(0.010)	(0.003)
female full time, male other	−0.172∗∗	−0.140∗∗	0.643∗∗
	(0.014)	(0.042)	(0.064)
male full time, female other	0.069∗∗	0.759∗∗	−0.131∗∗
	(0.002)	(0.022)	(0.005)
both part time	−0.012	0.352∗∗	0.146∗∗
	(0.011)	(0.024)	(0.028)
female part, male other	−0.101∗∗	0.342∗∗	0.496∗∗
	(0.015)	(0.057)	(0.076)
male part time, female other	0.023	0.812∗∗	0.058
	(0.023)	(0.131)	(0.089)
both other	−0.033∗∗	0.755∗∗	0.311∗∗
	(0.009)	(0.054)	(0.038)
female poor health	−0.001	0.048∗∗	0.015∗∗
	(0.002)	(0.017)	(0.003)
male poor health	−0.002	0.003	0.022∗∗
	(0.002)	(0.017)	(0.004)
F-Tests on the equality of coefficients			
female income = - male income	2.590	338.760∗∗	641.820∗∗
female income share = female income	0.510	0.000	52.160∗∗
female income share = - male income	2.900	30.920∗∗	3.130

Standard errors in parentheses. ∗∗ (∗) indicates significance at the 1% (5%) level. Abs. is for absolute housework (hours). Regressions include year dummies not included in the table.

Figure 5: *Quantile plots for Share Female (col. 1), Absolute Female (col. 2) and Absolute Male (col. 3)*

(a) *female income share*   **(b)** *female income share*   **(c)** *female income share*

(d) *female income*   **(e)** *female income*   **(f)** *female income*

(g) *male income*   **(h)** *male income*   **(i)** *male income*

(j) *main earner female*   **(k)** *main earner female*   **(l)** *main earner female*
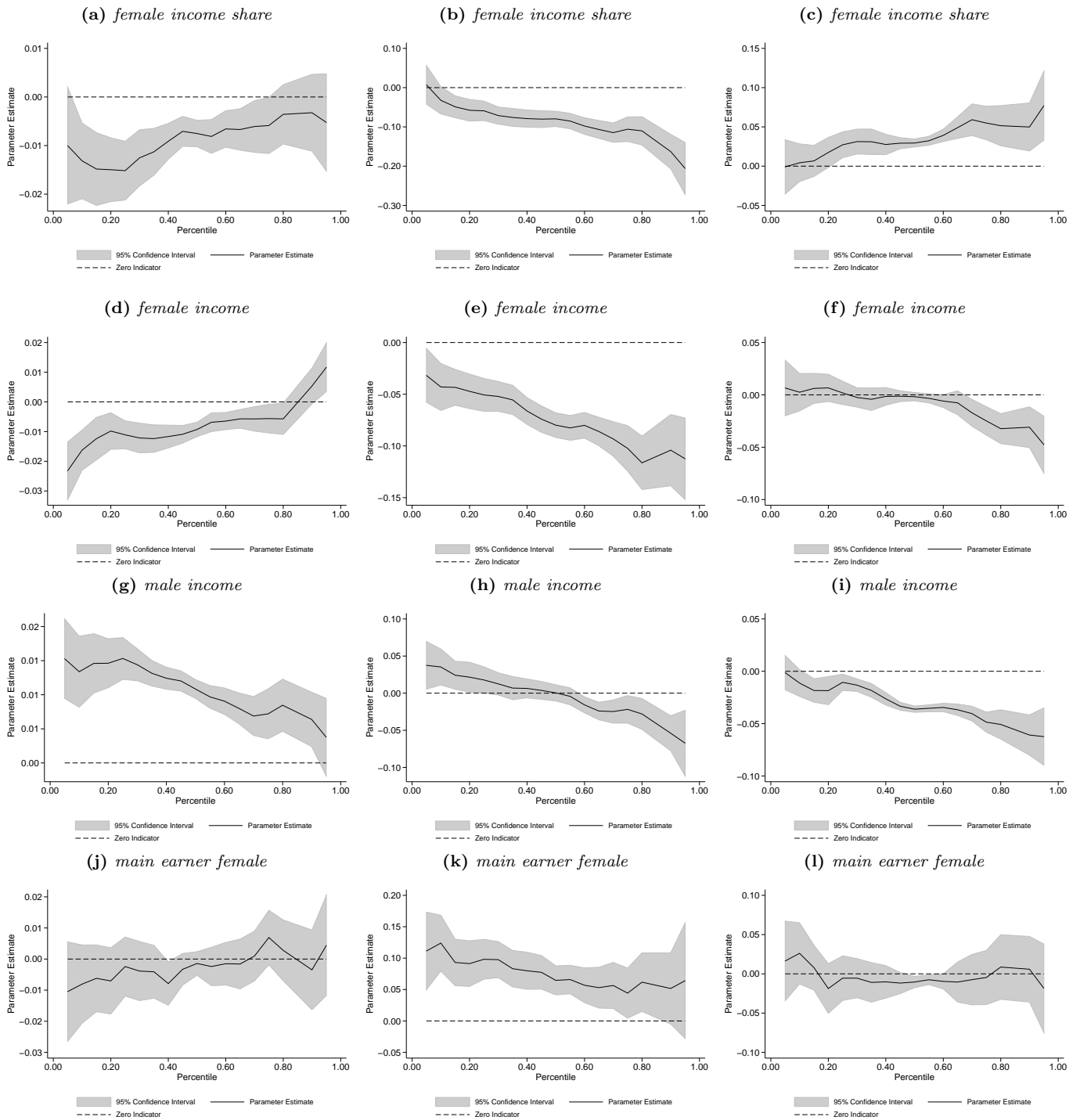
A rather different pattern emerges from the models of absolute housework (columns 2 and 3). As in the mean regression results, increases in the female income share have opposing effects on the hours of housework done by the female (5b) and male (5c), decreasing the former and increasing the latter. The magnitude of these effects, however, varies markedly, ranging from 0 to -0.2 for females and from 0 to 0.1 for males. Unlike the share model, these models suggest a stronger effect of bargaining power among individuals engaged in large amounts of housework.

The negative effect of opportunity cost is likewise higher among such individuals, as evidenced by increases in the magnitude of the coefficients on own-absolute income over the quantiles. For females in the 10% quantile, a one standard deviation increase in income decreases housework by about 2.6 minutes, an effect that reaches 6.2 minutes by the 90% quantile (5e). The corresponding estimates for men are somewhat smaller in magnitude but also increase substantially over the quantiles, ranging between 0.7 and 3.7 minutes (5i).

Contrasting with the estimates of the mean regression, the quantile results additionally indicate a significant role of the partner's income (5h and 5i). Among females engaged in small amounts of housework, an increase in the spouse's income has a positive effect, increasing housework by almost two minutes (5h). This effect is reversed by the 60% quantile, after which it becomes increasingly negative. Likewise, men who do a lot of housework decrease their effort when the income of the spouse increases (5l). Taken together, these results suggest a greater responsiveness to changes in absolute income – whether own income or that of the spouse – among individuals engaged in high absolute levels of housework.

Lastly, an effect of gender identity is again in evidence in the model of female housework (5k). The dummy indicating that the female earns more than the male is associated with about a 4 to 5 minute increase in her housework, an effect that is statistically significant over most of the quantiles. By contrast, the coefficient on this dummy straddles zero in the model of male housework (5l), save for a narrow stretch between the 50% and 60% quantile where it is slightly negative.

6 Conclusion

Drawing on longitudinal data on married couples, this paper has documented, descriptively and with the use of panel econometric methods, gender divisions in housework over a 20 year period in Germany. We were particularly interested in exploring both economic and identity-based explanations for how couples allocate housework, and to this end focused on the roles of opportunity cost, bargaining power, and gender identity. The relative strength of these explanations is relevant not only to equity in housework, but to a range of related issues that impact household economics, including family planning and labor market decisions.

Working women today are often said to face a double burden in the home in that they are not only expected to contribute to household income, but to simultaneously undertake a disproportionate share of housework responsibilities. Attributing this circumstance to the ongoing plunge in Germany's fertility rate, policy-makers have responded with measures to support working mothers, including funding for family subsidies and legislating the provision of day care services (Daly and Kulish, 2013). The effectiveness of such measures will depend partly on whether gender equality prevails in how households allocate resources and responsibilities. To the extent that this allocation is governed by patriarchal conceptions of traditional gender roles, household responsiveness to economic incentives may be muted. In this regard, the data analyzed here offers a mixed picture.

On the one hand, there are some indications for the influence of traditional gender conceptions on housework allocation. For starters, the descriptive findings demonstrate that women in working couples continue to do between 70 and 80% of the housework, an allocation which suggests that women indeed take on a double burden. The reduction in this share over the past decades – to the limited extent it has occurred – has been more a result of women doing less housework rather than men doing more. Moreover, the econometric results suggest that higher earning power does not necessarily reduce female housework. To the contrary, women who earn more than their spouse actually do more housework relative to those earning equal or less, which supports the gender identity perspective. Finally, the role of household demographic composition revealed by the coefficients conjures the impression that more family members equate to more housework for women. While the presence of other adults and children in the household, irrespective of their age, unequivocally increases the

housework of women, men reduce their housework when adults or older children are present.

On the other hand, we find that the share of income earned by the female, which is interpreted as a reflection of bargaining power, has statistically indistinguishable effects in decreasing the absolute housework of the female and increasing that of the male. Similarly, the absolute income earned, which captures opportunity cost, has equal effects for women and men in reducing their housework load. Lastly, our analysis of employment status suggests that both spouses take on more work at home when they are employed part time or have a flexible work schedule.

These similarities in the effects of income and employment status suggest that the continuation of the modest decline in women's housework documented here will be fostered by an increase in women's income and/or an increase in the incidence of female full time employment. Policy can contribute to the latter process through measures that facilitate women's balancing of work and home life, particularly among working mothers. Of late, much of the discussion in this regard has addressed the expansion of day care services for young children, but there is also considerable scope to expand this support for mothers of older children. For example, schools in Germany typically close in the early afternoon, and social pressure is high on mothers to tend to their children after school. This pressure could be substantially relieved by programs, such as sports and tutoring services, that would extend school hours.

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Appendix

Table 4: *Quantile panel results: Womens' share of housework*

Variable	Percentiles				
	10th	25th	50th	75th	90th
female income share	−0.013**	−0.015**	−0.008**	−0.006	−0.003
	(0.004)	(0.003)	(0.001)	(0.003)	(0.004)
female income	−0.016**	−0.011**	−0.009**	−0.006*	0.005
	(0.003)	(0.002)	(0.001)	(0.002)	(0.003)
male income	0.013**	0.015**	0.011**	0.007**	0.006**
	(0.003)	(0.002)	(0.001)	(0.002)	(0.002)
main earner female	−0.008	−0.002	−0.001	0.007	−0.003
	(0.006)	(0.005)	(0.002)	(0.004)	(0.007)
other adults present	0.025**	0.019**	0.009**	−0.002	−0.013**
	(0.004)	(0.003)	(0.001)	(0.003)	(0.004)
child 0 to 1	0.021*	0.015**	0.034**	0.038**	0.043**
	(0.009)	(0.007)	(0.005)	(0.007)	(0.012)
child 2 to 4	0.024**	0.015**	0.020**	0.026**	0.029**
	(0.006)	(0.005)	(0.002)	(0.004)	(0.006)
child 5 to 7	0.019**	0.014**	0.018**	0.019**	0.022**
	(0.005)	(0.005)	(0.002)	(0.003)	(0.004)
child 8 to 10	0.014**	0.011**	0.015**	0.014**	0.008
	(0.005)	(0.004)	(0.001)	(0.003)	(0.004)
child 11 to 12	0.040**	0.023**	0.015**	0.011**	0.008
	(0.004)	(0.004)	(0.001)	(0.003)	(0.005)
child 13 to 15	0.021**	0.014**	0.013**	0.009**	0.000
	(0.004)	(0.003)	(0.001)	(0.002)	(0.004)
child 16 to 18	0.020**	0.014**	0.014**	0.013**	0.016**
	(0.005)	(0.003)	(0.001)	(0.003)	(0.004)
female full, male part time	0.000	−0.028	−0.064**	−0.084**	−0.128**
	(0.021)	(0.013)	(0.006)	(0.009)	(0.012)
male full, female part time	0.080**	0.071**	0.048**	0.030**	0.007
	(0.005)	(0.004)	(0.001)	(0.003)	(0.004)
female full time, male other	−0.136**	−0.162**	−0.172**	−0.151**	−0.118**
	(0.020)	(0.019)	(0.015)	(0.022)	(0.030)
male full time, female other	0.128**	0.109**	0.069**	0.041**	0.015*
	(0.007)	(0.005)	(0.002)	(0.005)	(0.006)
both part time	0.027	0.023*	−0.012	−0.019	−0.065**
	(0.016)	(0.011)	(0.011)	(0.010)	(0.011)
female part, male other	−0.099**	−0.105**	−0.101**	−0.097**	−0.120**
	(0.029)	(0.013)	(0.015)	(0.012)	(0.021)
male part, female other	0.034	0.004	0.023	0.031	0.005
	(0.037)	(0.039)	(0.025)	(0.034)	(0.026)
both other	0.040	−0.020	−0.033**	−0.074**	−0.090**
	(0.022)	(0.024)	(0.009)	(0.019)	(0.029)
female poor health	−0.002	−0.004	−0.001	0.006	−0.003
	(0.006)	(0.005)	(0.002)	(0.005)	(0.007)
male poor health	0.000	−0.003	−0.002	−0.007	−0.018**
	(0.008)	(0.005)	(0.002)	(0.004)	(0.006)
intercept	0.545**	0.664**	0.754**	0.843**	0.953**
	(0.009)	(0.009)	(0.002)	(0.007)	(0.012)

Standard errors in parentheses. ** (*) indicates significance at the 1% (5%) level. Regressions include year dummies not included in the table.

Table 5: *Quantile panel results: Womens' absolute housework*

Variable	Percentiles				
	10th	25th	50th	75th	90th
female income share	−0.032	−0.059∗∗	−0.080∗∗	−0.106∗∗	−0.163∗∗
	(0.018)	(0.013)	(0.010)	(0.016)	(0.022)
female income	−0.043∗∗	−0.051∗∗	−0.080∗∗	−0.102∗∗	−0.104∗∗
	(0.012)	(0.008)	(0.006)	(0.011)	(0.018)
male income	0.035∗∗	0.018∗	0.000	−0.022∗	−0.054∗∗
	(0.012)	(0.009)	(0.006)	(0.009)	(0.012)
main earner female	0.124∗∗	0.098∗∗	0.065∗∗	0.044∗	0.052
	(0.023)	(0.016)	(0.012)	(0.020)	(0.029)
other adults present	0.046∗∗	0.060∗∗	0.095∗∗	0.138∗∗	0.136∗∗
	(0.017)	(0.011)	(0.009)	(0.013)	(0.023)
child 0 to 1	0.471∗∗	0.489∗∗	0.562∗∗	0.797∗∗	1.063∗∗
	(0.059)	(0.040)	(0.046)	(0.065)	(0.209)
child 2 to 4	0.323∗∗	0.320∗∗	0.312∗∗	0.349∗∗	0.487∗∗
	(0.031)	(0.019)	(0.017)	(0.028)	(0.052)
child 5 to 7	0.277∗∗	0.285∗∗	0.310∗∗	0.324∗∗	0.352∗∗
	(0.022)	(0.017)	(0.014)	(0.021)	(0.032)
child 8 to 10	0.185∗∗	0.229∗∗	0.255∗∗	0.311∗∗	0.326∗∗
	(0.024)	(0.016)	(0.014)	(0.019)	(0.033)
child 11 to 12	0.147∗∗	0.180∗∗	0.198∗∗	0.246∗∗	0.244∗∗
	(0.024)	(0.017)	(0.015)	(0.020)	(0.035)
child 13 to 15	0.137∗∗	0.149∗∗	0.152∗∗	0.209∗∗	0.215∗∗
	(0.020)	(0.013)	(0.014)	(0.017)	(0.028)
child 16 to 18	0.105∗∗	0.134∗∗	0.139∗∗	0.173∗∗	0.227∗∗
	(0.020)	(0.013)	(0.012)	(0.016)	(0.028)
female full, male part time	−0.129∗	0.020	−0.042	−0.066	−0.165∗∗
	(0.061)	(0.040)	(0.035)	(0.047)	(0.063)
male full, female part time	0.286∗∗	0.331∗∗	0.371∗∗	0.411∗∗	0.434∗∗
	(0.017)	(0.013)	(0.010)	(0.015)	(0.026)
female full time, male other	−0.287∗	−0.203∗∗	−0.140∗∗	−0.122	−0.168
	(0.121)	(0.055)	(0.040)	(0.071)	(0.154)
male full time, female other	0.569∗∗	0.624∗∗	0.759∗∗	0.897∗∗	1.036∗∗
	(0.031)	(0.027)	(0.021)	(0.031)	(0.056)
both part time	0.195∗	0.333∗∗	0.352∗∗	0.329∗∗	0.440∗∗
	(0.079)	(0.038)	(0.024)	(0.062)	(0.089)
female part, male other	0.158∗	0.320∗∗	0.342∗∗	0.464∗∗	0.669∗∗
	(0.076)	(0.074)	(0.059)	(0.068)	(0.153)
male part, female other	0.832∗∗	0.752∗∗	0.812∗∗	0.722∗∗	0.927∗∗
	(0.233)	(0.091)	(0.128)	(0.166)	(0.321)
both other	0.670∗∗	0.770∗∗	0.755∗∗	0.761∗∗	1.190∗∗
	(0.137)	(0.101)	(0.055)	(0.120)	(0.242)
female poor health	0.006	0.015	0.048∗∗	0.119∗∗	0.182∗∗
	(0.028)	(0.021)	(0.017)	(0.027)	(0.042)
male poor health	−0.027	−0.015	0.003	0.009	0.063
	(0.033)	(0.019)	(0.017)	(0.030)	(0.033)
intercept	1.214∗∗	1.582∗∗	2.053∗∗	2.425∗∗	2.901∗∗
	(0.039)	(0.029)	(0.017)	(0.034)	(0.058)

Standard errors in parentheses. ∗∗ (∗) indicates significance at the 1% (5%) level. Regressions include year dummies not included in the table.

Table 6: *Quantile panel results: Mens' absoluste housework*

Variable	Percentiles				
	10th	25th	50th	75th	90th
female income share	0.004	0.027∗∗	0.029∗∗	0.055∗∗	0.050∗∗
	(0.012)	(0.008)	(0.003)	(0.011)	(0.016)
female income	0.003	0.002	−0.002	−0.025∗∗	−0.031∗∗
	(0.009)	(0.006)	(0.002)	(0.007)	(0.010)
male income	−0.011	−0.011∗∗	−0.036∗∗	−0.049∗∗	−0.061∗∗
	(0.007)	(0.004)	(0.002)	(0.005)	(0.010)
main earner female	0.026	−0.005	−0.010∗∗	−0.005	0.006
	(0.020)	(0.014)	(0.004)	(0.018)	(0.021)
other adults present	−0.015	−0.004	−0.012∗∗	−0.034∗∗	−0.019
	(0.013)	(0.009)	(0.002)	(0.012)	(0.014)
child 0 to 1	−0.069	−0.016	0.033∗∗	0.083∗	0.075
	(0.044)	(0.026)	(0.009)	(0.035)	(0.047)
child 2 to 4	−0.036	−0.026	0.014∗∗	0.042∗	0.026
	(0.020)	(0.014)	(0.004)	(0.019)	(0.022)
child 5 to 7	−0.047∗∗	−0.013	0.007	0.037∗	0.041∗
	(0.017)	(0.011)	(0.003)	(0.017)	(0.019)
child 8 to 10	−0.030∗	−0.005	0.003	0.022	0.053∗∗
	(0.015)	(0.011)	(0.003)	(0.015)	(0.017)
child 11 to 12	−0.030	−0.016	−0.009∗∗	−0.017	−0.042∗
	(0.017)	(0.011)	(0.004)	(0.015)	(0.018)
child 13 to 15	−0.020	−0.014	−0.011∗∗	−0.015	0.001
	(0.014)	(0.009)	(0.003)	(0.012)	(0.015)
child 16 to 18	−0.057∗∗	−0.040∗∗	−0.017∗∗	−0.003	0.011
	(0.014)	(0.010)	(0.003)	(0.012)	(0.015)
female full, male part time	0.118	0.174∗∗	0.195∗∗	0.193∗∗	0.229∗∗
	(0.085)	(0.043)	(0.036)	(0.044)	(0.071)
male full, female part time	−0.033∗	−0.062∗∗	−0.084∗∗	−0.125∗∗	−0.113∗∗
	(0.013)	(0.010)	(0.003)	(0.014)	(0.015)
female full time, male other	0.426∗∗	0.460∗∗	0.643∗∗	0.853∗∗	1.278∗∗
	(0.082)	(0.084)	(0.066)	(0.120)	(0.121)
male full time, female other	−0.081∗∗	−0.095∗∗	−0.131∗∗	−0.221∗∗	−0.196∗∗
	(0.021)	(0.017)	(0.005)	(0.022)	(0.026)
both part time	0.127∗	0.136∗∗	0.146∗∗	0.119	0.235∗∗
	(0.056)	(0.037)	(0.030)	(0.064)	(0.077)
female part, male other	0.387∗∗	0.385∗∗	0.496∗∗	0.676∗∗	0.947∗∗
	(0.061)	(0.040)	(0.077)	(0.090)	(0.155)
male part, female other	0.006	0.149	0.058	0.234	0.906∗
	(0.163)	(0.090)	(0.088)	(0.187)	(0.383)
both other	0.391∗∗	0.305∗∗	0.311∗∗	0.348∗∗	0.276
	(0.127)	(0.073)	(0.035)	(0.078)	(0.164)
female poor health	0.031	0.007	0.015∗∗	0.050∗	0.013
	(0.020)	(0.018)	(0.003)	(0.021)	(0.021)
male poor health	0.043∗	0.029∗	0.022∗∗	0.048∗	0.081∗∗
	(0.019)	(0.012)	(0.004)	(0.023)	(0.023)
intercept	0.117∗∗	0.441∗∗	0.702∗∗	0.977∗∗	1.368∗∗
	(0.033)	(0.021)	(0.005)	(0.034)	(0.029)

Standard errors in parentheses. ∗∗ (∗) indicates significance at the 1% (5%) level. Regressions include year dummies not included in the table.