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# How Gender Identity Determines the Chore Wars

A study of relative wages, gender  
identity and division of household  
labour

**Sanna Ericsson**

DEPARTMENT OF ECONOMICS

NEKN01

SUPERVISOR: ALESSANDRO MARTINELLO

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**LUNDS UNIVERSITET**  
Ekonomihögskolan

# Abstract

Existing theories of how spouses divide the household labour have conflicting implications. Standard models of comparative advantages and bargaining models both predict that when a woman earns more money than her husband she will do less household work. However, identity theory predicts that deviating from prescribed gender behaviour causes discomfort, and therefore a woman could compensate for violating traditional gender roles by increasing her household work when she earns more money than her husband.

Histograms over the distribution of relative wages and households show a discontinuity at the point where the wife starts earning more money than her husband. This finding not only proves that there is self-selection in the data, but it also points at the prominent role gender identity plays within households. By comparing the results of both OLS and FE regressions, I can disentangle the effects of gender-awareness and of relative wages on the division of chores within households. I show that the total amount of household work done in a household depends on the couples' level of gender-awareness. Furthermore, I show that gender identity has stronger explanatory power than comparative advantages and bargaining power on the behaviour of spouses when the woman earns more money than the man, even in the less gender-aware couples.

(Keywords: *gender identity, relative wages, home production, household bargaining, family labour supply*)

# Table of contents

Abstract .....	1
List of figures .....	3
List of tables .....	3
1. Introduction .....	4
1.1 Background .....	4
1.2 Aim and purpose .....	8
1.3 Disposition .....	8
2. Theory .....	9
2.1 Background: home production .....	9
2.2 Family labour supply theory .....	10
2.2.1 Unitary model of comparative advantages .....	11
2.2.2 Non-unitary household bargaining, cooperative and non-cooperative .....	12
2.3 Gender identity theory .....	14
3. Previous empirical research.....	18
4. Method and material.....	23
4.1 Empirical methods .....	23
4.2 Data.....	26
4.2.1 Variables.....	27
4.3 Limitations .....	30
5. Results and analysis .....	31
5.1 Distribution of relative income .....	31
5.2 Empirical results .....	34
5.2.1 Descriptive statistics of variables of main interest .....	34
5.2.2 Econometric results from OLS estimations.....	36
5.2.3 Econometric results from FE estimations .....	40
5.3 Robustness of results .....	43
6. Discussion .....	44
References .....	46
Appendix A: descriptive statistics.....	48
Appendix B: OLS regressions output – others and proportions.....	50
Appendix C: FE regressions output – others and proportions .....	53
Appendix D: robustness tests .....	56

## List of figures

Figure 1: Game tree of appropriate behaviour .....	16
Figure 2: Empirical household behaviour of spouses .....	19
Figure 3: Theoretical household behaviour of spouses .....	20
Figure 4: Histograms of relative earnings .....	31
Figure 5: McCrary density test, balanced subsample.....	32
Figure 6: McCrary density test, when excluding all at 50% .....	33
Figure 7: Histogram of relative earnings, when excluding all at 50% .....	33
Figure 8: Plot of residuals and fitted values .....	57

## List of tables

Table 1: Statistics of McCrary density test .....	32
Table 2: Statistics of McCrary density test, when excluding all at 50% .....	33
Table 3: Descriptive statistics of household chores, balanced subsample .....	34
Table 4: Descriptive statistics of main independent variables, waves separate .....	35
Table 5: Descriptive statistics of main independent variables, appended dataset.....	35
Table 6: Effect on wives' hours spent on household chores, OLS.....	36
Table 7: Effect on husbands' hours spent on household chores, OLS.....	38
Table 8: Effect on wives' hours spent on household chores, FE .....	40
Table 9: Effect on husbands' hours spent on household chores, FE.....	41
Table 10: List of variables.....	48
Table 11: descriptive statistics of variables.....	49
Table 12: Effect on hours and proportions of chores done others, OLS .....	50
Table 13: Effect on wives' proportions of household chores, OLS .....	51
Table 14: Effect on husbands' proportions of household chores, OLS .....	52
Table 15: Effect on hours and proportions of chores done others, FE.....	53
Table 16: Effect on wives' proportions of household chores, FE .....	54
Table 17: Effect on husbands' proportions of household chores, FE .....	55
Table 18: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity.....	56
Table 19: Ramsey RESET test using powers of the fitted values .....	56
Table 20: VIF test of variables .....	56

# 1. Introduction

## 1.1 Background

Female labour force participation has been rising ever since the end of the Second World War. However, the rise in labour force participation slowed down during the mid-90's and even declined a little after 1999 (BLS, 2014). Overall women still work less hours and have a lower participation rate than men, and there is still an unexplained wage gap between men and women. The unexplained, halted progress of female labour force participation has led economists to study less traditional mechanisms when investigating what the determinants of household's labour supply decisions are.

The traditional family labour supply theory can be divided into two branches. The first is the unitary model of comparative advantages, which predicts that the spouses will specialise in the area where they have the comparative advantage. The second is the non-unitary model of household bargaining, which predicts that the spouse with the strongest bargaining power will be able to make the other spouse do more of the housework. Hence, the implication of family labour supply theory, both the unitary and the non-unitary, is that the spouse who earns the higher income will do less of the housework. However, recently the effects of identity and gender ideology on labour market outcomes have been acknowledged. Akerlof and Kranton (2000) propose that deviating from prescribed gender behaviour is costly for individuals and they therefore try to avoid it. Traditionally men have been the *breadwinners* and women have been the *homemakers* and such a division thus aligns with traditional perceptions of how a man and a woman should behave in order to confirm their gender identity. Hochschild (1989) argues that gender ideology causes a man to identify with working in the market and a woman to identify with the home production she performs. Consequently, a woman might increase her home production when she starts working in the market, in order to not lose her "object of identification" (pp. 254-255). Thus, gender identity theory predicts that a woman who earns a higher income than her husband might increase her time spent on housework, in order to compensate for violating prescribed behaviour of traditional gender roles. Furthermore, the husband might decrease his time to "punish" his wife or to maintain his masculinity.

This compensating behaviour causes an inefficient allocation of labour resources. Therefore, one possible cause of the stalled progress of women's labour force opportunities is the difficulty women experience when trying to combine their home life and work life. Consequently, it is important to further investigate the relationship between women's labour

force opportunities and their household work and what effect traditional gender roles have on this. Furthermore, if comparative advantages exist within households it is more efficient if the members of a household specialises in their respective tasks. But if the marriage dissolves the spouse who specialised in household work will have a lot less financial security than the spouse who specialised in market work. Thus, the spouse that specialises in home production has more to lose if the couple separate and therefore this spouse also has lower bargaining power. Hence, if efficiency requires specialisation there is a trade-off between equity and efficiency within a marriage (Pollak, 2013). The fact that female labour force participation is rising indicates that an allocation where one spouse works only in the household and the other spouse works in the market is not what people want. In many households both spouses want to spend at least some time doing market work. But the problem of combining market work and home production is sometimes holding women back. Thus, understanding the determinants of home production division between couples is important, both for the sake of efficiency and of equity.

In order to formulate an efficient labour market policy it is essential to know how households make their labour supply decisions. Since the implications of family labour supply theory and of gender identity theory are in conflict when a woman earns more money than her husband, one simple way to investigate the relative weight of the theories on household behaviour is to see how the division of household chores is affected when wives earn more than husbands. This is what I aim to do in this thesis. However, testing the relative explanatory power of the theories is not straightforward, because there will be unobserved differences between households. Since we are in a time of changes of gender ideology perception and of female labour force participation there might be some households that behave according to theory of comparative advantages and household bargaining, and some that do not. This difference in behaviour likely stems from different perceptions of gender identity. Some households will have firmer beliefs in traditional gender roles than other households, and this will affect how they react to changes in relative wages.

Histograms over relative wages show a clear drop in frequency of households at the 50% threshold, which is where the wife starts to earn more money than her husband. This indicates a selection problem in the data<sup>1</sup>. While overall women earn less money than men, this alone should not cause such a discontinuity in frequency right after the 50% mark. Rather, this suggests that gender identity plays an important role in forming households and the behaviour within them (Bertrand et al, 2013). Apparently, many households prefer to stay in a situation

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<sup>1</sup> A selection problem arises when individuals select themselves to a certain state in a non-random way (Verbeek, 2012, pp. 257).

where the husband makes more money than the wife, or make sure never to encounter a situation where the wife earns more than the husband by using assortative mating when finding a spouse. Whether or not they accept crossing the line to where the wife starts to make more money, when given the opportunity, is likely to be affected by how firm they believe in traditional gender roles of men and women. If they still do cross the 50% threshold in the histogram, it is also reasonable to assume that this will cause different behaviour of households depending on how firmly they believe in the traditional gender roles or not. I define the households that believe firmly in traditional gender roles as more gender-aware and the households that do not as less gender-aware. The more gender-aware households will have a lower likelihood of having a wife that earns more than the husband, and the spouses' compensatory reactions will be stronger if she does.

Therefore it is likely that the households who exist to the right of the discontinuity in the histogram, where the wife makes more money than the husband, consist of a relatively higher number of less gender-aware couples since these, if given the opportunity, have accepted letting the wife earn more money than the husband. The distribution to the left of the drop in the histogram will consist of a mix of more gender-aware households who never encountered a situation where the wife could start earning more money than the husband, less gender-aware ones who never encountered that situation, and more gender-aware ones that encountered the situation but resisted it. Thus, there will be a lot fewer more gender-aware couples where the wife earns more money than the husband since they will try to resist this situation, whereas the less gender-aware might not resist it. The more gender-aware households' resistance to cross the discontinuity can be done in many ways: Bertrand et al (2013) show that earning more money than her husband increases the probability that a wife will eventually step out of the labour force and that it also increases the probability of divorce. Additionally, an increase in the probability that she will earn more money will also increase the probability that she never enters the labour market. These results further substantiates the existence of self-selection and that it is, at least partially, caused by influences of gender identity.

The self-selection in the data implies that there is unobserved heterogeneity among households, which can bias OLS regressions. Because the self-selection is most likely caused by gender-based preferences, the effect on household chores from household's different levels of gender-awareness will be mixed with the effect of changing relative wages. In my study I exploit the panel dimension of the data to disentangle the effect of gender-awareness from the effect of changing relative wages. I do FE estimations as well as OLS estimations, since these exploits only the variation over time, and more closely estimates only the effect of

changes in relative wages. Furthermore, couples that do cross the discontinuity in either direction between the waves of the survey will likely be of the less gender-aware type since they accept having a wife that earns more than the husband. This implies that the estimated effect in the FE regressions is mainly the effect for less gender-aware couples. Moreover, it implies that the OLS estimates consists of both the effect of changing relative wages and the effect of changing from observing a mix of types of households to observing mainly less gender-aware ones. Thus, comparing the results two of the FE estimations and the OLS estimations allows me to disentangle the effects of gender-awareness from the effects of relative wages.

This disentangling of the effects is crucial when investigating whether family labour supply theory or theory of gender identity has the strongest explanatory power on household behaviour, since their effects are predicted to go in different directions. Moreover, knowing which theory has the strongest explanatory power is vital for designing effective policies, since the policy implications of the theories are conflicting. If a more equal division of housework and increased labour market opportunities are the aims of policy making, then how the policy should be designed critically depends on which theory explains the behaviour of households. If households behave according to theory of family labour supply a policy subsidising female market labour would allow for more women to work, and thus increase their comparative advantages in the market and their bargaining power. However, if households behave according to gender identity theory this subsidy could even be counterproductive. Women would start working more in the market, and increase their housework as well to compensate for violating traditional gender roles, hence, working double shifts. This is an inefficient allocation of labour resources and causes an unfair burden for women. If households behave according to gender identity theory, then a more appropriate policy should target the perceptions of gender roles, perhaps through an informational campaign.

## 1.2 Aim and purpose

The aim of this thesis is to investigate whether the family labour supply theory or the gender identity theory has the stronger explanatory power on household behaviour. I do so by investigating what the effects on allocation of household work are when a woman is earning more money than her husband.

Histograms of relative wages confirm that there is self-selection in the data, and a discontinuity in the distribution at the point where the wife starts to earn more money than the husband. I exploit this self-selection for interpretation of my results. I show that the heterogeneity of the households that causes the self-selection is based, at least partially, on perceptions of gender identity. This allows me to interpret the results of ordinary least squares (OLS) estimations as the difference between more and less gender-aware households. I use panel data and with a fixed effects (FE) framework I exploit households whose relative earnings change over time, thus, I use only within household variation to identify the coefficients of interest. The FE estimations will control for the unobserved heterogeneity causing the self-selection and more closely estimate only the actual effect of crossing the discontinuity. Hence, I separate the effect of a wife earning more than her husband from the effect of difference in gender-awareness, under the assumption for my study is that households' level of gender-awareness do not change over time. Thus I contribute to existing literature by disentangling these two effects and by exploiting the gender-based interpretation of the self-selection for the analysis of my results. Moreover, I rigorously test the existence of the discontinuity using a McCrary density test – something that has not been done before.

## 1.3 Disposition

The remainder of the thesis will be organised as follows. Section 2 explains the concept of home production and describes the two branches of theory I compare: first, unitary and non-unitary theory of family labour supply, and second, theory of gender identity. Section 3 summarises the findings of relevant previous research. Section 4.1 and 4.2 describes and explains the empirical methods and the dataset I use, and motivates the variables utilised in the regressions. Section 4.3 discusses possible limitations of the study. Section 5.1 determines the existence of a discontinuity in the data, Section 5.2 analyses the results of the OLS regressions, and Section 5.3 analyses the results of the FE regressions. Section 5.4 affirms the robustness of my model and the results. Finally, Section 6 concludes with the discussion and interpretation of the results, as well as some recommendations for further research.

## 2. Theory

The theory my research will draw upon is mainly that of economics of families, gender and home production. The theory of home production sees a household as a production unit that produces basic commodities, and individuals will divide their time between market work, home production, and leisure. How this allocation of time is made depends on the theory. I divide this section into family labour supply theory and theory of gender identity, since their different implications is what I aim to test.

The first theory I discuss is family labour supply theory, both unitary and non-unitary, which regards how the allocation of time between market work, home production, and leisure is divided between the members of the family. The division of time allocation, who does what, will in a unitary household be done based on the members' comparative advantages. In a non-unitary household the division is based on the outcome of bargaining between spouses. However, while basing the prediction on different grounds, both these theories would predict that when a wife earns more money than her husband she will decrease her time spent on household work.

The second theory is that of gender identity, which states that violating prescribed behaviour of one's identity will cause discomfort for an individual. If couples are firm believers of traditional gender roles it will appear as violating these gender roles when a woman becomes the breadwinner of the household. Therefore this might cause her to increase her time spent on household work. Consequently, the predictions of family labour supply theory and of gender identity theory are contradicting. This thesis aims to test which theory has the stronger explanatory power.

### 2.1 Background: home production

Gary S. Becker is by many seen as the founder of the theories of family economics and time allocation. In his paper *A theory of the allocation of time* (1965), he discusses that consumption requires time so the previous division between "work" and "leisure" is not entirely correct. To enjoy consumption one must also allocate time to consuming, such that this becomes a commodity. The household is seen as a production unit used to produce basic commodities like comfortable housing, food, child care etc. The production unit combines intermediate goods purchased at the market with time from the household members in order to produce these commodities. Some of the home produced goods can be substituted by goods from the market, so the household is faced with an allocation problem. The household maximises its utility by

allocating its time between household commodity production and market work where it yields the most benefit. In a single person household this would be where the market wage equals the shadow price of time (Becker, 1965).

Becker's theory of time allocation does not distinguish between time spent doing household chores and time spent doing leisure activities. However, Gronau later extended the theory and divided the time use into market work, home production and leisure. He also emphasised that while time used in home production is something one could hire someone else to do, the same is not the case with time spent enjoying leisure. Therefore, home production and market work should be seen as close substitutes whereas there are few market substitutes for leisure (Gronau, 1986, pp. 282).

In a single person household the individual maximises its utility by allocating time between these three possible allocations. The individual derives utility from leisure and goods, and goods can either be bought from the market or produced at home. These two different kinds of goods are assumed to be perfect substitutes. The marginal productivity of home production is assumed to be positive but with diminishing returns, whereas the marginal productivity of market work is the wage which is constant. A person who allocates time to household production and to market work will maximize its utility by allocating its time at the point where the marginal product of one additional hour of home production equals the marginal product of one additional hour of market work, and where these two also equal the marginal rate of substitution between leisure and consumption. Since home produced goods and market goods are seen as perfect substitutes there exists one unique such equilibrium (Gronau, 1977).

## 2.2 Family labour supply theory

If a household consists of more than one person it will still allocate its time to market work, home production and leisure based on utility maximisation – now the family utility. How this division is made depends on how one sees the family and its decision making process. The literature usually discuss three broad ways of viewing the family; as chauvinistic, unitary or non-unitary. In a chauvinistic household the first worker (traditionally the male) chooses his optimal labour supply and then the second worker (traditionally the female) takes the first worker's income as property income and includes it in her budget constraint when making her labour supply decision. In a unitary household family members pool their separate income and maximizes a joint utility function subject to a shared budget constraint. In the non-unitary family model family members maximise their individual utility functions subject to a shared

budget constraint, and base the allocation decision on the outcome of bargaining processes (Bosworth et al, 1996, pp. 54-55). However, both the unitary and the non-unitary model predict that a wife should decrease her time spent on household work when she starts earning more money than her husband.

### 2.2.1 Unitary model of comparative advantages

In the unitary family labour supply model the hours each family member allocates to market work and to household work depend on both the family members' wages and on their respective comparative advantages. This joint maximization usually leads to specialisation within the household; members do more of the task where they have the comparative advantage. In other words, the member who earns the higher wage in the market has a comparative advantage in market work and will allocate more time to that, and the member who earns a lower wage in the market will then have a comparative advantage in home production and will specialise in that. Furthermore, if the wage for one family member goes up it will affect the time allocation of both members (Bosworth et al, 1996, pp. 54-58).

Whether full specialisation (where one spouse works only in the market and one spouse works only in the household) yields higher efficiency or not have been debated. Pollak (2013) investigates theoretically under what assumptions efficiency would require full specialisation within the household. He shows that if the spouses' work time are perfect substitutes, or if household work is "additive"; i.e. that the total output produced is the sum of the spouses' exerted input, and exhibits constant returns to scale then specialisation would increase efficiency in the household. However, if one assumes that household work is characterised by decreasing returns to scale or if one allows for different sectors of household chores this need not hold. If there are  $m$  number of household sectors available, it could be most efficient that one spouse specialises in  $m^*$  household sectors and the other spouse specialises in  $m-m^*$  sectors, and that both allocate some of their time to market work. In addition, when couples use joint utility maximisation and specialisation (but not necessarily full specialisation) the joint utility of the spouses will be higher than the pooled separate utilities they would have had if they maximised their separate utility functions. Thus, specialisation will increase the efficiency of the household, but it need not be full specialisation (Pollak, 2013).

Hence, in a unitary family the conclusions are that the person earning the higher wage in the market should be the one doing the least household work. This is the result of the joint utility maximisation and spouses' different comparative advantages. However, Lundberg

et al (1997) have investigated if couples pool their resources, using the exogenous variation caused by a change in child allowance policies. They, among others, find that couples do not seem to pool their resources, and therefore behave more according to the non-unitary model rather than the unitary.

### 2.2.2 Non-unitary household bargaining, cooperative and non-cooperative

In the non-unitary model family members maximise their individual utility functions subject to a joint family budget constraint. The family members could act like duopolists and make their decisions according to reaction functions that show the optimal reaction of the individual given the choice of its spouse, as in a Cournot oligopoly game. The family could also base its decisions on the outcome of other types of bargaining processes. While in the unitary models it makes no difference who in the family earns the most money, in the bargaining models it is important as the bargaining strength of the individual depends on its earning power and its threat point. The threat point is often seen as the individuals outside option if the bargaining fails and the family dissolves. Hence, the spouse who earns the least tends to have a lower threat point since the outside option might not be very appealing. A low threat point would thus yield less bargaining power to this spouse and therefore cause him/her to receive the “worse” outcome in the bargaining solution (Killingsworth and Heckman, 1986, pp. 131-132).

The idea of bargaining as a way of making household decisions was presented, by McElroy and Horney (1981) among others. They assume the household decides on the allocation of  $x$  (for my purposes  $x$  can here be interpreted as “time doing household work”) by maximising a utility-gain product function, which is a special version of a Nash product function.

$$N = [U^m(x) - V_0^m(p'_m, I_m; \alpha_m)][U^f(x) - V_0^f(p'_f, I_f; \alpha_f)] \quad (1)$$

Each bracket is the gain from marriage over the outside option.  $V_0^j$  is interpreted as the outside option, the threat point of individual  $j$ , where  $j \in [m = male, f = female]$ .  $p'_j$  is a vector of prices of the different options available on the market. These options are market goods, home produced goods, or leisure.  $I_j$  is the individual’s non-wage income. The threat point can shift if components of the outside options for the individual shift, and some of the shift factors are: individual income or the possibilities to find another spouse. These shift parameters are captured by  $\alpha_j$ . Hence, the individual with the higher income tends to have a lower threat point and therefore a stronger bargaining power. Assuming that  $x$  involves a cost and couples prefer to do as little as possible, then the person with the higher income will be the one doing less of

the home production as he or she via stronger bargaining power can force the other spouse to do the greater part of the work (McElroy and Horney, 1981).

Specialisation based on comparative advantages increases efficiency, but whether the bargaining model will yield an efficient outcome is ambiguous. The bargaining of the family can be either cooperative or non-cooperative. In the cooperative models the solution and equilibrium distribution of household chores will be Pareto efficient<sup>2</sup>. However, these models assume that players can communicate freely and engage in binding and costlessly enforceable agreements with each other. Regarding marriage and the division of household chores these binding, costless agreements rarely exist, since family members lack access to institutions that will help them enforce the agreements. Thus, in theories of non-cooperative game theory the family members are not able to enter enforceable contracts but rather focus on agreements that are self-enforcing. That is, agreements the members themselves will choose to follow since doing so is a best response strategy given the strategy of the other member. In this context the outcome of the bargaining is not necessarily Pareto efficient. A famous example of this kind of game is the Prisoners' Dilemma. In the static game the dominating equilibrium is not Pareto efficient. However, if the game is repeated, which is a plausible assumption when the players are spouses, there are multiple equilibria and some will be Pareto efficient and some will not. Hence, Pareto efficiency is feasible without enforcing institutions, as asserted by the Folk theorem of non-cooperative game theory, if players do not discount the future "too much" (Lundberg and Pollak, 1994). Thus, that households do not base time allocation on comparative advantages does not mean that the outcome necessarily is inefficient.

Lundberg and Pollak discusses two examples of bargaining games within a marriage. The first concern the provision of a public household good (such as a clean house or nicely cooked meals), where they assume that the husband and wife act as duopolists. The marriage is assumed to last forever, so the husband and wife maximise infinite streams of utility and they decide simultaneously on how much of the good they will provide. If the game is played just once the equilibrium will be the intersection of the reaction functions of the husband and wife. This is a Cournot-Nash equilibrium and the public good will be under provided, hence, this equilibrium is not Pareto efficient. However, if the game is repeated infinitely and spouses can "punish" each other for deviation from the cooperative equilibrium then a Pareto efficient equilibrium can be achieved and sustained. While an infinite marriage might seem like

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<sup>2</sup> An allocation is Pareto efficient when there is no possible way to make one agent better off without making at least one other agent worse off (Varian, 1992, pp. 225).

an unrealistic assumption, for this theory to hold infinity is not necessary – the assumption can be weakened if the discount factor includes a probability of termination of the marriage.

The second example the authors discuss is the marriage as a coordination game. They assume two public goods require to be provided and that both spouses are better off if they supply one each. This would be the case if there were increasing returns to specialisation or accumulation of specific human capital, as discussed by Pollak (2013). These two goods could for instance be interpreted as goods bought by market work and goods made by home production. This game is like that of the “battle of the sexes”, where both players prefer coordination but both may also prefer one coordinated equilibrium over another. Lundberg and Pollak points out that the choices between these equilibria, who will specialise in what, is sensitive to history and culture, such as traditional gender roles and perceptions of identity (Lundberg and Pollak, 1994).

## 2.3 Gender identity theory

While standard bargaining theory predicts that the spouse earning the higher wage should do the least of the household work, the predictions of the coordinated non-cooperative bargaining models differ. Here the couple might choose a coordinated equilibrium with a division of household work that contradicts the predicted division made by bargaining theories such as that discussed by McElroy and Horney (1981). Traditional gender norms state that women should do the home production and men the market labour and thus both spouses might prefer a coordinated equilibria where these gender roles are upheld.

Recently economists have started including the concept of identity in economic models. Akerlof and Kranton (2000) incorporate the ideas of identity from psychology and sociology into an economic and game theoretical setting. Gender is usually seen as a universally familiar aspect of identity, consisting of the two categories “man” and “woman”. The identity categories are associated with specific physical and behavioural attributes. To comply with these behavioural guidelines affirms the image of one’s identity, and to violate them causes discomfort. Thus, gender identity changes the payoffs from different actions for the individuals and also causes externalities. If a person of a specific identity behaves in a way that is “unsuitable” for that identity this can also cause discomfort for other individuals since it may threaten their perception of their own identity. The authors propose a utility function of the following form:

$$U_j = U_j(a_j, a_{-j}, I_j) \quad (2)$$

Where  $a_j$  is the actions of individual  $j$ ,  $a_{-j}$  is the actions of everyone else and  $I_j$  is individual  $j$ 's identity or self-image. Since  $U_j(\cdot)$ ,  $a_j$  and  $a_{-j}$  captures all consumption of individual  $j$ , the externalities he or she experiences and the structural form of the utility function, these three arguments suffice to capture the standard economics of  $j$ 's behaviour.  $I_j$  is represented as:

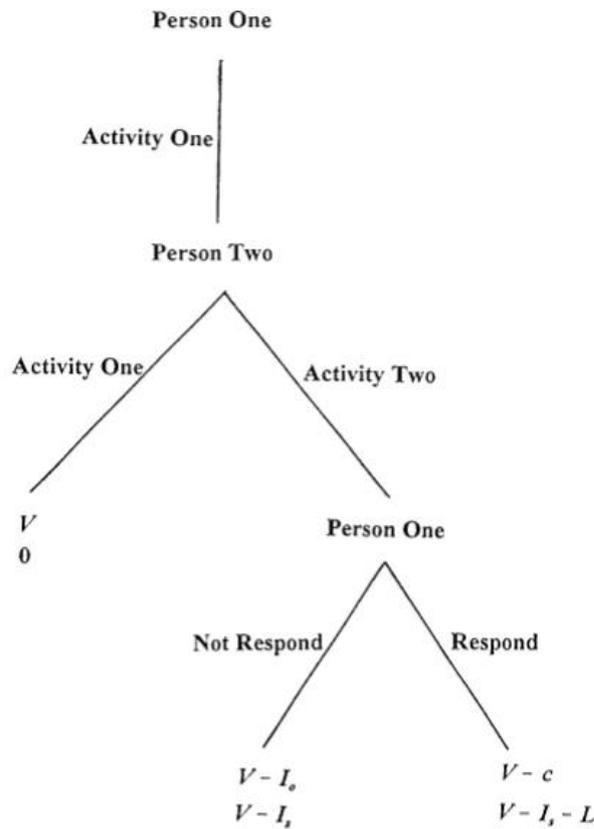
$$I_j = I_j(a_j, a_{-j}, c_j, e_j, P) \quad (3)$$

This can be interpreted as that individual  $j$ 's identity depends on its assigned social category  $c_j$ , and how well its and other people's actions correspond to the prescribed characteristics of this social category. It also depends on how well individual  $j$ 's appearance  $e_j$  corresponds to the preferred appearance of this category.  $P$  describes the prescribed characteristics and appearances. The social status of the identity category is given by  $I_j(\cdot)$ . Gains or losses in utility caused by changes in  $I_j$  are referred to as *gains or losses in identity*.

For example, assume there are two social groups; "man" and "woman" and two activities "one" and "two". Individuals who perform the activity they prefer gets utility  $V$ . Furthermore, assume activity one is deemed more appropriate for a specific social group than the other. Then anyone who performs the activity appropriate for their group experiences a gain in identity, and if they perform the inappropriate activity they experience a loss in identity. Performing the inappropriate activity can also cause externalities on other individuals, and these can either punish or not punish the first individual for performing the inappropriate activity.

Assume activity one is the appropriate activity for both person 1 and person 2, hence, person 1 prefers doing activity 1 and also prefers person 2 to perform activity 1. But person 2 prefers doing activity 2, even if it is the inappropriate activity. If person 1 does activity 1 he gets utility  $V$ , if he does activity 2 he experiences a loss in identity  $I_s$  (where  $s$  stands for "self"), and if person 2 does activity 2 person 1 experiences a loss in identity  $I_o$  (where  $o$  stands for "other"). If person 2 does activity 2 person 1 can choose either to respond at cost  $c$  and thus create a loss  $L$  for person 2, or not respond and take the loss in identity (Akerlof and Kranton, 2000). The game can be represented as in Figure 1:

**Figure 1: Game tree of appropriate behaviour**



(Figure 1, pp. 729, Akerlof and Kranton, 2000)

The game has four possible subgame perfect equilibriums:

1. Person 1 stops person 2 from doing activity two, when  $c < I_o$  and  $I_s < V < I_s + L$
2. Person 1 lets person 2 do activity two but responds, when  $c < I_o$  and  $I_s + L < V$
3. Person 1 does not respond and person 2 does activity two, when  $c > I_o$  and  $I_s < V$
4. Person 2 does not do activity 2, regardless of person 1's actions, when  $I_s > V$

This identity model can be applied to the household. To incorporate the context of this thesis, assume activity 2 is to be a female household breadwinner, which according to traditional gender norms is not an appropriate activity for women. Further assume that person 1 is the husband and person 2 the wife. The wife wants to earn more money than her husband if she is given the opportunity, which would be to perform activity 2. This will cause a loss of identity for the husband, and he can decide to respond or not. Responding could here be interpreted as decreasing his share of the household work, in order to “punish” his wife or in order to compensate for his loss of identity and maintain his “masculinity”. If the husband is more gender-aware he will have a high  $I_j(\cdot)$ , which implies that the loss  $I_o$  will be large. If  $I_o > c$  he will either stop his wife from becoming the breadwinner or punish her if she still does so. If

the wife is more gender-aware as well, and has a high  $I_j(.)$ , her loss of identity  $I_s$  will be large when becoming the breadwinner. Therefore, if  $I_s > V$  or if  $I_s + L > V$ , the wife will actively avoid earning more money than her husband in order to maintain their gender roles. Only in scenario 3, where both spouses have a low  $I_j(.)$  and thus are less gender-aware, will the wife choose to become the breadwinner and the husband will let her and decide not to respond by decreasing his amount of household work.

Hence, how high spouses'  $I_j(.)$  are determines how large their losses in identity will be from deviating from the prescribed behaviour of their social category. Therefore  $I_j(.)$  will affect how the spouses react to changes in relative wages. If they can influence the change in relative wages,  $I_j(.)$  will also affect the self-selection to either side of the discontinuity in the histograms. In my study I refer to the couples where at least one spouse have a high  $I_j(.)$  as more gender-aware, and those couples where both spouses have low  $I_j(.)$  as less gender-aware.

This gender role based alternative to the bargaining theory is explored further by Bittman et al (2003). They argue that gender norms could be internalised by the couple in the household, causing the wife to feel like she wants to do more housework and the husband to feel no need to do so. Therefore the couple choose a coordinated equilibrium where they supply one good each and thus where the husband works more in the market and the wife works more in the household. However, this division might not be as clear if the wife earns a higher income than the husband. In that scenario she has the stronger bargaining power and the comparative advantage in market work, and should according to previously discussed family labour supply theories do less of the household work. But, this also violates the traditional views of gender roles which could create a coordination problem for the couple. In order to affirm the gender roles the man could be even less inclined to do housework in order to avoid being even more "feminised", and the woman could do even more housework in order to compensate for "breaking the rules" (Bittman et al, 2003).

This compensatory behaviour would in the language of Akerlof and Kranton (2000) be the punishing of the other spouse's deviating behaviour. Bittman et al's (2003) hypothesis that the gender norms become internalised suggests that both  $c$  and  $L$  in fact are functions of  $I_j$ . The husband's cost of punishing his wife, who deviates from the prescribed behaviour, by decreasing his time spent on household work is probably lower if he is more gender-aware and feels that household work should be a woman's job. Thus  $c$  is not constant but depending on the level of  $I_j(.)$  of the couple, such that  $c_j \neq c$ .  $c_j$  is plausibly also affected

by the bargaining power of the spouse, if a spouse has a strong bargaining power the cost of punishing the other spouse is lower since less effort is required to “win” a bargaining process.

The models of identity based behaviour predicts that for couples with high  $I_j(.)$  the effect of a wife earning more than her husband will be that he decreases his time spent on household work in order to punish the wife. The wife herself might also increase her time spent on household work to compensate for violating the prescribed gender norms. It is also more likely that couples with high  $I_j(.)$  never encounter the situation where the wife could possibly earn more than her husband, compared to couples with lower  $I_j(.)$ . The predictions of gender identity theory go against the predictions made by the unitary family supply model, where the wife’s comparative advantage in market work would cause her to decrease her time spent on household work. The gender based predictions also go against the predictions made by non-unitary household bargaining models, where the wife’s stronger bargaining power would cause her to decrease her time spent on household work when she earns more money than her husband.

Hence, to investigate the effects on household work caused by changes in relative wages also allows for examination of whether gender identity strategies or levels of bargaining power (or shifts in comparative advantages) seem to be the major force when the family allocates its time between leisure, home production and market work.

### 3. Previous empirical research

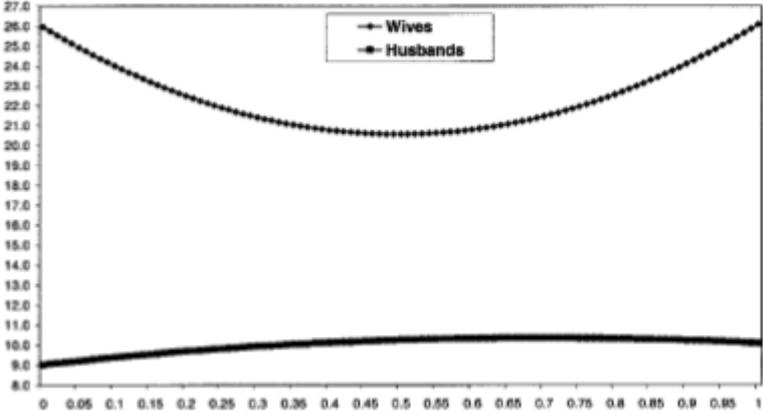
Both sociologists and economists have done studies on how relative wages affect household chores, and if family labour supply theory or gender identity theory have the strongest explanatory power. I will briefly summarise the studies that are most relevant to my study.

First, it should be investigated whether bargaining power between couples is affected by their relative wages. Among others, this has been done by Antman (2014) who investigates the empirical relationship between spouses’ wages and who makes the most of the household decisions. She does FE regressions of spousal employment and decision making and finds that a wife is more likely to be involved in making household decisions if she is employed. Hence, there is support of the hypothesis that increased relative wages increases bargaining power (Antman, 2014). However, she does not investigate the relative weight of bargaining power and gender identity theory.

Bittman et al (2003) evaluate the relative effects of gender norms and bargaining power to see which theory seems to have the strongest explanatory power on the empirical

results of the division of household work within a couple. To test this they investigate the effect of changes in economic dependence on the amount of housework the spouses perform. They use Australian time diary data and run OLS regressions with economic dependence as the independent variable of main interest. They define economic dependence as the wife's earnings subtracted from the husband's, divided by the sum of both their earnings. Hence, -1 means that the wife earns all of the household's income, 0 means the spouses earn equal amounts and 1 means the husband earns all the money. The aim of the paper is to see whether the effect of gender norms outweighs the effect of bargaining power. Their results show that for values of economic dependence between 0 and 1, where the husband earns more than the wife, the couple's behaviour coincides with the predictions of bargaining theory. The wife works most in the household when she is completely economically dependent on her husband and then decreases her hours of housework as her relative income increases. She does the least work when the couple earns equal amounts of the household income. However, after the 50% threshold the behaviour can no longer be explained by bargaining theory. Then the results show that when the wife starts making more money than her husband she also increases her hours of housework. These results could be explained by theories of gender norms and identity, and Figure 2 demonstrates the authors' empirical findings (Bittman et al, 2003).

**Figure 2: Empirical household behaviour of spouses**



Note: weekly hours spent on housework on y-axis, and economic dependence on x-axis

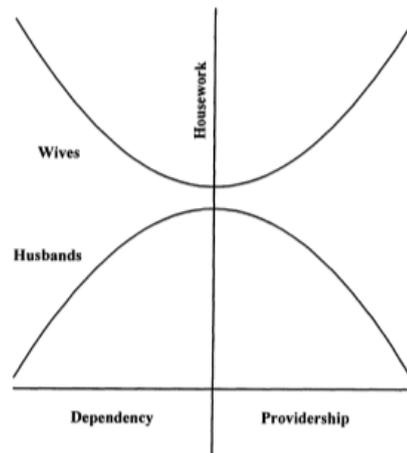
(Figure 1, pp. 202, Bittman et al, 2003)

However, since the authors estimate OLS regressions and do not take into account the self-selection in the data these results cannot be declared to be causal. There could be unobserved heterogeneity between the couples that is not reported or captured by the control variables. A hypothetical example could be that the couple to the farthest right contains a disabled husband who thus does no housework and has no income, and therefore bias the results. Or the difference in results could stem from differences in gender-awareness of the households and not from the

actual effect of the relative wages, therefore these two effects would need to be disentangled. Furthermore, the authors plot no histograms or such to investigate the distribution of households and if there seems to be self-selection in the data.

The empirical image shown in Figure 2 coincides quite well with the theoretical image showed in Figure 3, which was proposed by Brines (1994):

**Figure 3: Theoretical household behaviour of spouses**



(Figure 6, pp. 667, Brines, 1994)

$$Y = \alpha + \beta X^2, \beta_m < 0, \beta_f > 0 \quad (4)$$

Brines suggests that the provision of housework done by spouses is of the quadratic form of equation (4). She discusses exchange theories of housework; in which the more economically dependent spouse trades household work for economic support – similar to the economic bargaining model of household decisions. But her thesis is that, analogous to that of Bittman et al (2003), once a couple deviate from the traditional norms of husbands as breadwinners and wives as homemakers they will start compensating by engaging in more traditional behaviour in the household. She states:

*“The greater the degree of deviance, the greater the threat to both partners’ gender accountability and, in turn, the greater the likely level of investment in compensatory traditional behaviour.”<sup>3</sup>*

This behaviour is exemplified by Figure 3. Brines uses data from the Panel Study of Income Dynamics (PSID) to analyse how the economic dependency relation between couples affect who does what in the household. She defines economic dependency as Bittman et al (2003) do and sees how this affects the time spent on household chores, by running OLS and Tobit regressions. Her results indicate that wives behave according to the bargaining models, such

<sup>3</sup> Brines, 1994, pp. 666

that wives that earn less money also does more housework and wives that earn more money does less housework. However, this is not the case for the husbands, for them she finds a curvilinear effect as suggested by Figure 3. When the wife starts making more money than the husband the husband decreases his share of the household work (Brines, 1994). This implies that wives behave according to predictions made by bargaining theory but that husbands behave according to gender identity theory. Brines excludes couples where one of the spouses were unable to work for pay from her sample, thus controlling for that specific unobserved heterogeneity. However, she does not run fixed effects regressions to further control for unobservable measures, even though she is working with panel data. Moreover, she does not investigate the distribution of households over relative earnings or discuss what a self-selection in the data would imply for the interpretation of the results.

Greenstein (2000) replicates Brines model and tests the validity of its predictions by using a different data set, the National Survey of Families and Households (NSHF), by including more controls in the regressions, and by using a different estimation technique. He runs *seemingly unrelated regressions*<sup>4</sup> (SUR) which is a more appropriate estimation model when error terms across equations are assumed to be correlated. However this model still suffers from the same identification problems as OLS does. He finds similar results as Brines for the husbands but his results differ with respect to the wives. When he uses *proportion of household work* as the dependent variable instead of *hours of household work* his results coincide more with the theoretical graph of Brines paper (Figure 3) and the empirical results of Bittman et al (Figure 2), where both the husband and the wife exhibit a curvilinear effect on their household work. Thus, when the wife starts earning more money than her husband she also increases her proportion of household work, as predicted by gender identity theory. Proportion of household work might be a more appropriate measure since a household with higher income might purchase substitutes for their household work from the market and therefore both spouses do less hours of work when the wife's income increases (Greenstein, 2000). While Greenstein mentions the possibility of unobserved heterogeneity, he does not control for it or use it for interpretation of the results. Rather he, like previously mentioned authors, assumes the effect of the changes in relative wages to be the causal effect on the amount of housework the spouses perform.

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<sup>4</sup> A SUR system assumes each equation in the system has its own vector of coefficients, as if the equations were unrelated. However, the method exploits the possible correlation between the error terms in different equations as links for the estimation (Woolridge, 2010, pp. 162).

Bertrand et al (2013) use a number of different U.S. datasets to investigate the distribution of relative income within households and how this affects different aspects of the marriage. They plot histograms of relative earnings and households, and find a clear drop in the distribution of households at the point where the wife starts earning more than 50% of the household income. This indicates that gender identity is an important aspect of marriage formation and that there is self-selection in the data. They use both self-reported survey data and administrative data to create these histograms. The drop appears clearly in both histograms which suggests that the discontinuity in the distribution is a robust result and not just a bias from self-reporting. They find that households where the wife earns more money than her husband is associated with lower marriage rates, higher divorce rates, lower labour force participation of women, reporting having a less happy marriage, and that the wife undertakes a larger share of the household work than her husband. They suggest that the explanation for this is that when the wife earns relatively more money the couple feel their gender identities are being threatened and therefore try to compensate for this with more traditional behaviour (for example that the wife quits her job or does more housework). And perhaps they experience more trouble in their marriage due to this compensatory behaviour (Bertrand et al, 2013).

Bertrand et al (2013) run OLS regressions using the American Time Use Survey (ATUS) to investigate the effect on housework. However, the ATUS only includes one respondent per household and does not allow for investigation of relative division of housework within the household. While the authors assert the existence of a discontinuity by using both self-reported data and administrative data, this could have been further substantiated by doing the McCrary density test to statistically prove that there is a discontinuity. Furthermore, running OLS regressions entails the assumption that there are no unobserved differences between couples on either side of the discontinuity in the distribution of relative earnings, such that they have equal preferences and that income distribution is exogenous. However, the self-selection in the distribution suggests that there are unobserved differences such that income distribution is endogenous and therefore that OLS estimates will be biased.

All the discussed papers above have found evidence for the relevance of both bargaining theory and gender identity theory. Bittman et al (2003) concludes that both spouses behave according to bargaining theory until the wife earns more money than the husband, then both spouses start behaving according to gender identity theory. Brines (1994) finds that wives behave according to bargaining models and husbands according to gender identity models. Both Greenstein (2000) and Bertrand et al (2013) find that both spouses' behaviour coincides with the predicted behaviour by the gender identity model. However, that the difference in behaviour

could be due to unobserved differences between households that cause them to self-select to either side of the discontinuity is not discussed in any of the papers. It is reasonable to assume that different couples differ in their level of gender-awareness and in how much they are affected by gender identity theory. The couples that have a low  $I_j(\cdot)$  are less gender-aware and can accept having a wife that earns more than the husband, while couples with a high  $I_j(\cdot)$  might not accept it. My study show that there is self-selection in the data, and indicates that this self-selection have a major impact on the results. Thus the self-selection should be incorporated in the interpretation, and the effect of the selection and the effect of changes in relative wages should be disentangled since they have contradicting policy implications. This disentangling and interpretation of the selection is my main contribution to the research field, as well as rigorously testing the discontinuity using the McCrary density test.

## 4. Method and material

This section describes the data and how it fits the purposes of my study. First, I explain the empirical methods and econometric regressions. Second, which variables I use and why I use them. Third, the limitations of the data and method are briefly discussed.

### 4.1 Empirical methods

In this study I use both ordinary least squares (OLS) estimations and fixed effects (FE) estimations. While OLS assumes that all households have identical preferences and that income distribution is exogenous, the FE regressions will control for unobserved heterogeneity between the households. Under the assumption that gender-awareness is constant over time, comparing the estimations of the two methods allows me to disentangle the different effects of gender-awareness and changes in relative wages.

When running OLS regressions the data is treated as consisting of mutually independent observations, so those observations that are really the same households observed in different waves will be treated as individual households. OLS would be the more efficient method under the assumption that my model does not suffer from any unobserved heterogeneity. But in this case this is not a very plausible assumption. I know there is unobserved heterogeneity since the frequency of relative earnings within households is not normally distributed, and there is bunching at the 50% threshold (see section 5.1). This implies that many households self-select into a division that is just to the left of the threshold rather than one that is just to the right of it. The self-selection to either side of the discontinuity implies

that households that do not have a wife that earns more than their husbands and households that do are different, for example if they are more or less gender-aware, and thus there are unobserved heterogeneity in the model. This unobserved heterogeneity makes OLS a biased estimator of the effect of changes in relative wages.

Therefore I will also use the data as a panel, which is to observe the same households over time and their behaviour from income changes. This allows me to do fixed effects panel regressions, which will control for the unobserved heterogeneity between households that causes the self-selection, and estimate only the effect of changes in relative wages. I want to estimate equation (5), which is what the OLS regressions estimate:

$$y_{it} = x_{it}\beta + \varepsilon_{it} \quad (5)$$

This requires  $E(u_{it}|x_{it}) = 0$  for consistency. But, due to the unobserved differences  $\varepsilon_{it} = \alpha_i + u_{it}$ , and the equation becomes:

$$y_{it} = x_{it}\beta + \alpha_i + u_{it} \quad (6)$$

where  $\alpha_i$  is the unobserved heterogeneity between households. If  $E(\alpha_i|x_{it}) \neq 0$  then the regression will suffer from omitted variable bias since  $\alpha_i$  is part of the error term, and correlated with  $x_{it}$ . The fixed effects estimation solves this problem by demeaning the data. It transforms the data by subtracting the time-invariant average values of each individual, and hence exploits the within variation of the observations such that:

$$(y_{it} - \bar{y}_i) = (x_{it} - \bar{x}_i)\beta + (\alpha_i - \alpha_i) + (u_{it} - \bar{u}_i) \quad (7)$$

Clearly,  $(\alpha_i - \alpha_i) = 0$ , since  $\alpha_i$  is time-invariant. Hence, this term gets excluded from the regression and thus the individual effects, and hopefully the bias, are eliminated. This ensures that  $\beta$  is consistent even if  $\alpha_i$  and  $x_{it}$  are correlated, as long as  $\alpha_i$  is time-invariant, implying  $E((x_{it} - \bar{x}_i)|\alpha_i) = 0$ . This holds even if the explanatory variable suffers from possible endogeneity, which is when it is correlated with the error term or the individual effects term, since  $(x_{it} - \bar{x}_i)$  is a valid instrument for  $x_{it}$ . For T=2 this fixed effects within estimator and the first difference estimator (using variation between two time periods) are identical, assuming that  $u_{it}$  is independently and identically distributed<sup>5</sup> (Wooldridge, 2010, pp. 280-288, 300-304, Verbeek, 2012, pp.435). Since the fixed effects model, contrasting the random effects model, allows for these time-invariant individual effects to be correlated with the explanatory variables, this is the more suiting framework for my model<sup>6</sup>.

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<sup>5</sup> For examination of the regression residuals, see appendix D.

<sup>6</sup> This is confirmed by a Hausman test, see appendix D.

If  $x_{it}$  is the variable indicating that the wife earns more than the husband, then  $\beta$  is the effect of crossing the discontinuity, which could consist of changes in comparative advantages and bargaining power, or compensating behaviour for violating gender norms. While family labour supply theory of comparative advantages or bargaining power predicts that  $\beta < 0$  for the wives, the theory of gender identity predicts that  $\beta > 0$  if the wife compensates for violating traditional gender norms by increasing her amount of housework.  $\alpha_i$  is the unobserved heterogeneity between the households, which I assume contains the level gender-awareness of the couple. Thus a crucial assumption for my study is that gender-awareness is time-invariant. Then, using a fixed effects framework eliminates these unobservable  $\alpha_i$ , and produces a consistent value of  $\beta$  that estimates only the effect of crossing the discontinuity to a situation where the wife earns more than the husband.

As discussed by Akerlof and Kranton (2000), some couples will be more gender-aware, which is to have higher  $I_j(\cdot)$ , and this affects their losses or gains from identity,  $I_j$ , and their cost of “punishing” their spouse from deviating from the prescribed behaviour,  $c$ . I expect the more gender-aware couples to self-select to the left side of the discontinuity where the wife does not make more money than the husband, since their losses from crossing the discontinuity are large. The FE estimations identify  $\beta$  only through households who cross the discontinuity in either direction between the first and the second wave of the survey. Thus, the variation between sides of the discontinuity that the FE regressions exploit consist mainly of couples that are less gender-aware since they are the ones who accept crossing the discontinuity when given the opportunity. This is because the less gender-aware couples have a lower  $I_j(\cdot)$  and their losses of identity will not be as large when the wife starts earning more money than the husband. Furthermore, the gender compensating part of the effect is smaller for these couples. In a less gender-aware couple the wife has less to lose from earning more than her husband, therefore she does not compensate as much by increasing her housework, and the husband feels less threatened and does not punish his wife as much by decreasing his amount of housework. Moreover, these less gender-aware couples probably differ from the more gender-aware ones in other respects than just acceptance of changes in relative wages. For example, they could be assumed to have a more equal original division of household chores than more gender-aware couples, regardless of their relative wage situation.

The OLS regressions will not exclude the unobserved heterogeneity from the estimations and therefore these regressions’ estimates of  $\beta$  will contain both the effect of

changing relative earning status, and the effect of changing from observing more gender-aware couples, or a mix of both types of couples, to observing mostly less gender-aware couples.

The FE regressions will exclude the unobserved heterogeneity  $\alpha_i$ , which entails the differences in  $I_j(\cdot)$ , and estimate only the effect of changes in relative wages. However, mainly the couples with lower levels of  $I_j(\cdot)$  will cross the discontinuity, and therefore only the effect for these couples will be captured by the FE estimates. A lower  $I_j(\cdot)$  probably decreases the gender identity aspect of the effect, thus these estimates are expected to be small or statistically insignificant, or coinciding with the predictions made by bargaining theory (which would be negative). The results regarding which theory has the strongest explanatory power found by previous studies (see Section 3) are ambiguous and conclusions differ between authors. However, most of them have found that gender identity theory seems to have the strongest explanatory power on the results when the wife earns more than half of the household income. Thus, since the gender identity effect is expected to be smaller for the less gender-aware couples, who are the ones the FE regressions observe, the FE estimates ought to be positive - but still small or insignificant.

## 4.2 Data

Information on how individuals spend their time is usually collected in national censuses. Time use surveys are done as either questionnaires or via time diaries. Under the questionnaire approach people are asked to estimate the number of hours they spend on each activity during a certain time period. This approach provides a simple and inexpensive way of collecting data on time use, which can also be combined with collection of other types of information (Birch et al, 2009, pp. 3-4).

I use data from the National Survey of Families and Households (NSFH). It is a questionnaire survey that was done by the University of Wisconsin, and it consists of three waves, from 1987 to 2002, and of 13,017 respondents. The relevant time use fragment of the NSFH survey asks the respondents about the number of hours they spend in a week on nine different household chores. In the cases where the respondents had a spouse a self-administered survey was distributed to the spouses, and in my sample I use only households consisting of two adults, a man and a woman. I use only data from the first wave (1987-1988) and the second wave (1992-1994) since the third wave is based on a different sampling rule and differs substantially from the first two waves, due to budget restrictions.

While there are a few possible datasets that can be used for the type of analysis that I am doing, the NSFH has many important advantages. First, it is distributed to both spouses in a household and is therefore to be preferred (for my study) over the American Time Use Survey (ATUS) that only surveys one of the spouses. Second, as Greenstein (2000) highlights, the NSFH contains measures over nine different household chores and could therefore be preferred over the Panel Study of Income Dynamics (PSID) that only asks one question about how much housework the respondents perform. Third, the NSFH asks respondents about their attitudes to gender ideology which is an interesting measure to include in my regressions since it could help capture the respondents' feelings about gender norms.

All households are matched by gender, and I drop all observations where the household does not consist of a man and a woman that are married; i.e. a wife and a husband. The data entails quite a few non-usable answers (such as when respondents refused to answer or the questions was deemed inapplicable), which were coded as missing values. In order to avoid bias, observations who had only missing values of at least one of the variables of interest were dropped. Consequently, the final dataset consists of an unbalanced panel of 5339 observations, since only some households completed the survey in both waves. To increase internal validity and to be able to compare my OLS regressions and my panel regressions I use a balanced subpanel, i.e. data consisting of only households that completed the survey in both waves, for the regressions. There are 2081 households that have completed the survey in both the first and the second wave, which yields a balanced panel of 4162 observations.

#### 4.2.1 Variables

The survey asks questions to both the respondent and the spouse, but who of these are male or female differs for different households. Since gender differences is what I investigate I recoded all variables such that they are divided by gender instead of respondent and spouse. A list of all variables I use, and their descriptive statistics, can be found in appendix A.

##### 4.2.1.1 *Dependent variables*

The dependent variables are the household chores done by the wife (*Wife's chores*) and the husband (*Husband's chores*), respectively. The respondents are asked about how many hours a week they spend on nine different household chores and these different household chores are merged into one variable indicating the sum of hours spent each week on chores – for the wife, the husband, and for chores done by others. Following the example of Greenstein (2000) I also computed the proportion of household chores done by the husband and the wife, and use these to test the robustness of my results. I use *Chores by others* as a dependent variable to see if, for

example, an increase in the time a wife spends on chores is compensated by a decrease in the time a husband spends on chores or a decrease in the time others spends on chores. The NSFH questionnaire asks the respondents to estimate how much time people below the age of 19 spends on household chores and how much time people aged 19 and upwards spends on chores. I add these two measures together to create the variable *Chores by others*, which is also computed as a proportion of the total hours spent on chores, to use for robustness checks.

#### 4.2.1.2 Independent variables of main interest

The independent variable of main interest is the dummy variable *Wife earns more* that indicates that the wife earns more than half of the household income, i.e. more than her husband. Using the earnings of the wife and the husband I define *Relative earnings* as the wife's share of the total households' earnings, as follows:

$$RelativeEarnings_{it} = \frac{WifeEarnings_{it}}{WifeEarnings_{it} + HusbEarnings_{it}}. \quad (8)$$

The dummy variable *Wife earns more* that takes the value 1 if *Relative earnings* > 0,5. This variable captures the effect of going from having the husband earning 50% or more of the total household income to having the wife earning more than 50%, hence, crossing the discontinuity in the histograms.

To further investigate the effect of gender ideology on the households I include a variable that measures the traditionalism of the respondents and their spouses. In the survey the respondents and spouses are asked to state how much they agree with the statement "It is better that men work and women care for the home and the family". 22 % reported that they strongly agree and 23,2 % reported that they agree.<sup>7</sup> The dummy variable *Gender-awareness* takes the value 1 if the respondents answered that they agree or strongly agree and 0 otherwise, and this variable is meant to represent whether the couple is more or less gender-aware. Thus it also aims to capture some of the unobserved heterogeneity;  $\alpha_i$ . When I include this variable in the OLS regressions I expect it to make my results closer to the ones obtained from the FE regressions since it captures some of the effect of having a high or a low  $I_j(\cdot)$ .

I also interact the variable *Gender-awareness* and the variable *Wife earns more* and the estimated coefficient of this interaction can be interpreted as the additional effect on chores for the households that are more gender-aware but still have a wife earning more money than her husband.

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<sup>7</sup>See <https://nesstar.ssc.wisc.edu/webview/index.jsp>

#### 4.2.1.3 Control variables

The purpose of the control variables is to try to avoid omitted variable bias in the regressions and to obtain more efficient estimates by excluding unexplained variation. Omitted variable bias arises when a variable affecting the depended variable is omitted from the model specification. If the omitted variable is correlated with one or more of the independent variables its effect will be captured by the error term and thus make the error term and the dependent variable correlated, causing the estimates of the regressions to be biased (Verbeek, 2012, pp. 62-63).

Since Greenstein (2000), Brines (1994), Bertrand et al (2013) and Bittman et al (2003) have conducted studies similar to mine, I follow their example when I decide which controls to include, as well as adding a few of my own. I include a variable measuring the logarithm of the total household income, since this will capture the possible income effect of an increase in the wife's income. If the wife starts earning more money, and not just relatively, this will increase the household income. And this total increase could cause both spouses to do less household work since they can now afford to purchase more substitutes for home production from the market. I want to isolate this income effect, and therefore control for any changes in total household income. I also include the number of hours both spouses report that they are working for pay each week to control for the fact that people who work more simply have less time available for household work.

In addition, I include several demographic and economic control variables. There might not be a causal effect of these variables on the amount of household chores performed, but they can capture other unobserved differences between individuals (Verbeek, 2012, pp. 396). These controls are level of education, household wealth, number of children in the household and fixed effects for ethnicity and year. I also include a squared term of the number of children since the effect of additional children on household chores may be non-linear. It seems plausible that the marginal effect of an extra child on the amount of household chores is not constant but may depend on how many children there already are in the household (Greenstein, 2000).

All variables are utilised in the OLS regressions, but since the FE specification uses the within variation of the variables, the estimated effects will be identified only by those variables that vary between waves. Therefore those that do not vary between waves, such as ethnicity and number of big children, are automatically omitted. The NSFH survey only asks if the respondents have had any additional children since the first wave, which I add to the measure *Small children*, thus only that measure of children will vary between waves.

### 4.3 Limitations

My analysis is based on the assumption that households do not change level of gender-awareness over time. If this does not hold then  $\alpha_i$  is not time-invariant and thus all unobserved heterogeneity will not be excluded from the FE estimations. However, even if gender role perceptions can change over time they tend to do so slowly, and I therefore believe that over the four years between the waves of the survey not many households will have changed their level of gender-awareness. Thus, I believe my assumption of time-invariant gender-awareness holds.

Furthermore, a limitation of questionnaire time use surveys is that they may be prone to errors. One main possible error is recall errors; the respondents are asked to recall how much time they spend on things and this could be difficult to do on the spot. This could cause oversight of activities that take up little time and perhaps exaggeration of activities that are perceived as important or major (Birch et al, 2009, pp. 4). Another issue with my research is that not all households completed the survey in both waves, which yields an unbalanced panel. This is not a very big problem if the missing observations are missing at random, but in my case that is probably not a plausible assumption (Verbeek, 2012, pp. 425). There might be unobserved characteristics that cause some households to not fulfil both survey waves. Therefore I drop the households that exist only in one wave and use only the balanced subpanel for my panel regressions. This will cause a loss of possible information and efficiency, but I still believe it to be the best option in order to increase internal validity of my research.

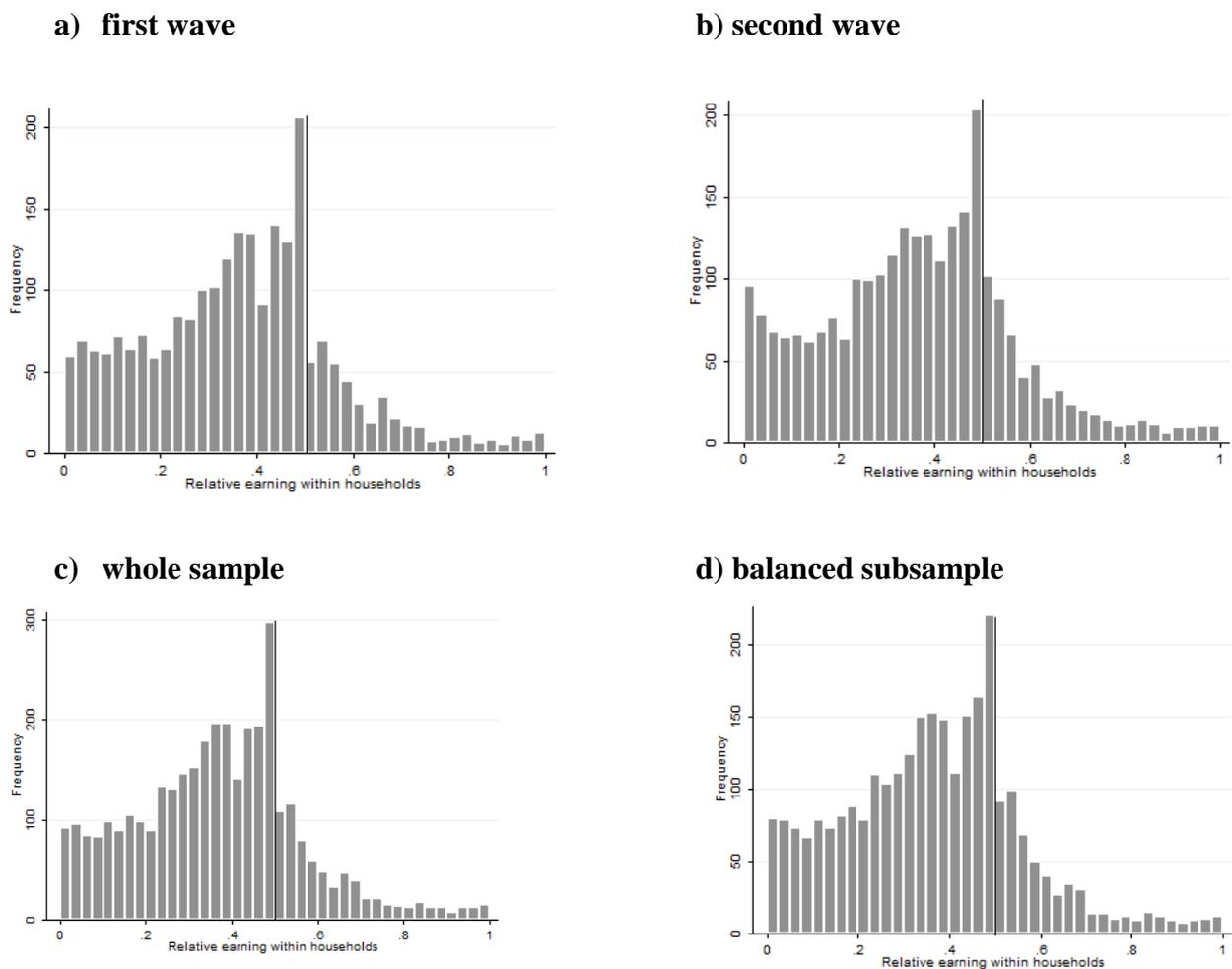
Another limitation is that the data I use is quite old, and the results and predictions I make from it might not be representative for the present. There is also a large number of missing values in the data. When a respondent failed to answer a question or when the question was deemed to be inapplicable it becomes a missing value in the data, and therefore the number of observations where at least one variable contained a missing value is large. Thus the appended dataset that originally consisted of around 15 000 observations was narrowed down to just 2081 unique households observed in two waves which yields a total of 4162 observations. Once more possible information was lost, but it is preferable over converting all the missing values to numeric values since that would yield misleading results and damage the internal validity of the study.

## 5. Results and analysis

### 5.1 Distribution of relative income

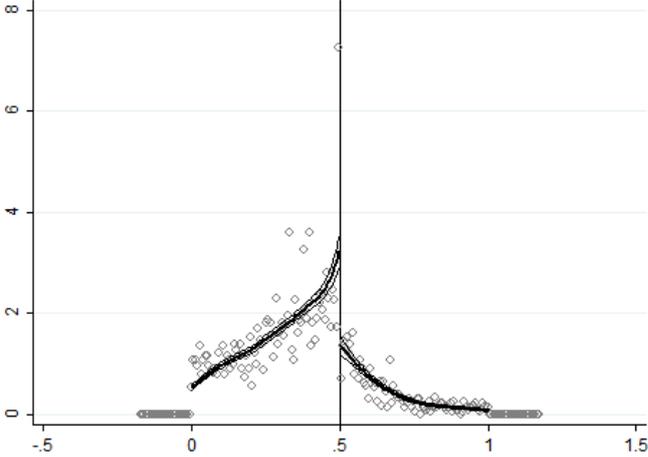
I define *Relative earnings* as the share of the household income that is earned by the wife, as equation (7) shows. When computing the histograms I restrict my sample to only include couples where both spouses earn a positive income, which excludes relative earnings equal to 0 or 1. The histograms of relative earnings show a clear drop in the distribution at the 50% threshold, which is where the wife starts earning more than her husband. For the appended data both the full sample of 5339 households, and the set containing only the balanced subsample of 4162 households are plotted. When I restrict the sample to only those households where both spouses have a positive income this yields 3493 households in the whole sample and 2822 households in the balanced subsample. The frequency of households for each level of relative earning is shown in Figure 4.

**Figure 4: Histograms of relative earnings**



All histograms show substantial drops in frequency at the 50 % threshold, which is where the wife starts earning more money than the husband. In other words there is a discontinuity in the distribution of relative earnings. The discontinuous threshold is marked by the black vertical line in the histograms. This drop suggests gender identity influences; that couples might have aversive feelings towards the wife earning more money than the husband. The gender identity influences implies a self-selection mechanism; many couples seem to want to avoid having a wife earning more than her husband and therefore choose to stay on the left side of the discontinuity. While the drop in frequency is clearly visible, I perform a McCrary density test<sup>8</sup> to rigorously test the existence of a discontinuity. As can be seen in Figure 5 and Table 1 there is a statistically significant discontinuity in the distribution of *Relative earnings* within households, such that the frequency drops by 87 % at the 50% threshold.

**Figure 5: McCrary density test, balanced subsample**



**Table 1: Statistics of McCrary density test**

Discontinuity estimate (log difference in height)	Standard error	t-value
<b>-0.8794 ***</b>	0.0921	9.5517

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

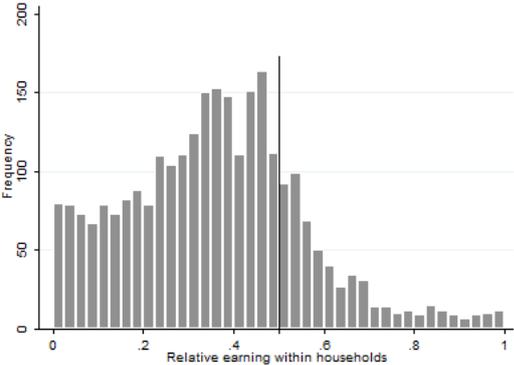
A large share of the people in the survey have reported earning exactly equal amounts. This could be due to the self-selection; that people want to avoid crossing the discontinuity and therefore cause bunching of households just to the left of the 50% threshold, since they actively work against situations where the wife earns more than the husband. However, it could also be caused by some aspect of the survey method, or that people who do not know the exact amount they or their spouse earns might guess for equal amounts. Bertrand et al (2013) got similar

<sup>8</sup> To read more about the test, see McCrary (2008).

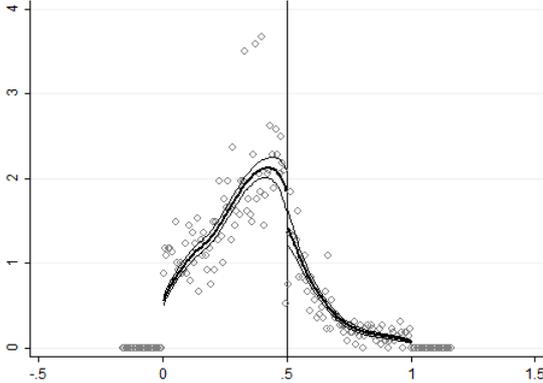
“spikes” in their distribution of relative earnings and came to the conclusion that it is due to the survey method. They plot the distribution of relative earnings using administrative data from the US and Canada and find that a lot less couples have exactly equal earnings when the data is not self-reported, indicating that the spike is due to the survey method.

To test the robustness of the discontinuity in my data I compute a histogram of the balanced subsample where I exclude all observations who reported earning exactly equal amount, see Figure 7. This histogram does not show a clear drop in frequency as before. However, the McCrary density test is still significant, thus arguing that there is a discontinuity, and a drop in frequency of 24 %, even if all observations who reported earning exactly equal amounts are dropped. Consequently, the discontinuity is not just a bias from the survey method.

**Figure 7: Histogram of relative earnings, when excluding all at 50%**



**Figure 6: McCrary density test, when excluding all at 50%**



**Table 2: Statistics of McCrary density test, when excluding all at 50%**

Discontinuity estimate (log difference in height)	Standard error	t-value
<b>-0.2424 **</b>	0.1057	2,2390

Note: \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

These histograms, and the McCrary density test, proves that there is a discontinuity in the distribution of relative earnings within households, and thus that there is self-selection in the data. Furthermore, the self-selection can be assumed to be influenced by gender identity. The existence of a discontinuity and of self-selection validates the purpose of my research and the interpretation of my results.

## 5.2 Empirical results

### 5.2.1 Descriptive statistics of variables of main interest

Below are descriptive statistics over the household chores and over the most relevant independent variables presented. The descriptive statistics for the rest of the variables are presented in Table 10 in appendix A. There are some unrealistically high outliers in the variables measuring the hours spent on household chores, probably due to reporting bias or that people multitask chores. However, excluding these do not change the main results and they are therefore kept in the sample. The measures in the table are reported hours per week spent on all nine chores that have been asked about in the survey, for the balanced subsample used for regressions. As can be seen in the table wives do the greater part of the household work, and the reported time spent on chores by others than the spouses is quite low.

**Table 3: Descriptive statistics of household chores, balanced subsample**

Variables	Households	Mean	Median	Std. Dev.
Total chores	4162	60.44	52	36.34
Wife's chores	4162	35.82	30	24.54
Husband's chores	4162	19.94	16	19.51
Chores by others	4162	4.67	0	11.55
Proportion wife's chores	4160	0.59	0.61	0.19
Proportion husband's chores	4160	0.34	0.32	0.18

Table 4 and 5 show descriptive statistics of the variables *Wife earns more*, *Gender-awareness* and *Relative earnings*. In order to see the changes between waves and between the whole sample and the subsample, these are reported separately. As can be seen from the tables; in the balanced subsample the wife makes more money than her husband in 30% of the households, on average the wives earn 41% of the household income, and 19% of the households reported that they agree with the traditional gender roles that a man should work and the woman should care for the household.

In the first wave there were 1304 households where the wife earned more money than the husband, and 948 who reported believing in traditional gender norms. In the second wave the wife earned more than her husband in 1197 households and 812 reported believing in

traditional gender norms. Hence, the total number of households with a wife who earned more money than her husband decreased between the waves, and this variation between waves is what will be used in the fixed effects analysis. In addition, in the balanced subsample there are 208 observations, 5%, who both reported believing in traditional gender roles but also have a wife who earns more money than the husband.

**Table 4: Descriptive statistics of main independent variables, waves separate**

	First wave			Second wave		
	Households	Mean	Std. Dev.	Households	Mean	Std. Dev.
Wife earns more	3952	<b>0.33</b>	0.47	4277	<b>0.28</b>	0.45
Gender-awareness	3952	<b>0.24</b>	0.43	4277	<b>0.19</b>	0.39
Relative earnings	3952	<b>0.44</b>	0.36	4277	<b>0.37</b>	0.34

**Table 5: Descriptive statistics of main independent variables, appended dataset**

	Whole sample			Balanced Subsample		
	Households	Mean	Std. Dev.	Households	Mean	Std. Dev.
Wife earns more	5339	<b>0.31</b>	0.46	4162	<b>0.3</b>	0.46
Gender-awareness	5339	<b>0.2</b>	0.4	4162	<b>0.19</b>	0.39
Relative earnings	5339	<b>0.42</b>	0.34	4162	<b>0.41</b>	0.33

The estimates are very similar in the unbalanced sample and the balanced subsample. This implies that dropping some observations in order to get the balanced subsample does not change the variables or the results much. Thus, the external validity of the study is not compromised by using only the subsample for regressions.

## 5.2.2 Econometric results from OLS estimations

**Table 6: Effect on wives' hours spent on household chores, OLS**

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	-1.883** (0.819)	-4.079*** (0.845)	-3.459*** (0.843)	-2.809*** (0.906)
Gender-awareness				5.518*** (1.180)
Wife earns more # Gender-awareness				-2.592 (2.093)
Log of total earnings		-4.642*** (0.518)	-3.928*** (0.548)	-3.729*** (0.544)
Wife's work hours		-0.084*** (0.022)	-0.091*** (0.023)	-0.081*** (0.023)
Husband's work hours		0.041** (0.019)	0.044** (0.021)	0.043** (0.021)
# Small children			7.383*** (1.383)	7.450*** (1.382)
# Big children			3.558*** (0.829)	3.563*** (0.826)
(#Big children) <sup>2</sup>			-0.0907 (0.259)	-0.125 (0.258)
(#Small children) <sup>2</sup>			-0.962 (0.638)	-1.055* (0.639)
Household wealth			-0.854*** (0.168)	-0.838*** (0.168)
Wife' years of education			-0.205 (0.140)	-0.186 (0.140)
Husband's years of education			-0.349*** (0.130)	-0.316** (0.130)
Constant	36.38*** (0.459)	85.65*** (5.485)	68.47*** (15.96)	65.19*** (15.63)
Observations	4,162	4,162	3,976	3,976
R-squared	0.001	0.032	0.108	0.114

Robust standard errors in parentheses.<sup>9</sup> \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Column (1) shows the raw correlation between the dependent variable and the independent variable of main interest. Column (2) includes a few controls: a measure of the total earnings of the household and the working hours of the husband and the wife. This decreases the estimate for *Wife earns more* and adds significance to it. In column (3) I add demographic and more

<sup>9</sup> Robust standard errors are used for all regressions since heteroskedasticity was detected in the data, see Section 5.3 and appendix D for further information.

economic controls, such as education, children and household wealth, and fixed effects for ethnicity of both spouses and year. This specification is the one I believe to be the most accurate, when not taking the variable *Gender-awareness* that measures belief in traditional gender roles into account. This variable is added to the regression showed in column (4), both on its own and interacted with *Wife earns more*. Adding the variable *Gender-awareness* is supposed to capture the effect of being a more or a less gender-aware couple and isolate its extra effect on chores. Therefore, the effect when this variable is included should be closer to that in the fixed effects regressions.

As can be seen from Table 6, the estimated coefficient for *Wife earns more* is negative and statistically significant in all specifications, even when more controls are added, which suggests that this result is fairly robust. An increase in household wealth, more paid working hours and a higher education of the husband all have statistically negative effects on the number of hours the wife spends on household chores. Children, both big and small, have a significant positive effect, as has more paid working hours of the husband. Reporting to have a belief in traditional gender roles has a significant positive effect on the time wives spend on household chores, which is not a surprising result. The coefficient of the interacted term is negative, but not statistically significant. This seems like a plausible result since this extra effect applies only to the couples that have reported believing in traditional gender roles, and therefore are more gender-aware, but still have a wife who earns more than her husband. For these couples the negative effect might not be as prominent. In the balanced subsample this situation applies only to 208 observations.

That crossing the discontinuity of relative earnings has a significantly negative effect on the wife's time spent on household chores is more controversial, compared to the results of previous papers. This could be interpreted as that the wives behave according to bargaining theory, and decrease their time spent on chores when they earn more money due to their increased bargaining power. However, due to the self-selection in the data the estimated effect is rather that of changing from observing more gender-aware couples to less gender-aware couples. Therefore the negative effect is not surprising, it is reasonable that the couples with lower  $I_j(\cdot)$  also have a more equal division of household chores between the spouses, since they do not feel strongly that the woman has to be the homemaker. Furthermore, it is possible that on top of a more equal division, the couples also perform less household chores overall. For example, a woman with a high  $I_j(\cdot)$  will connect her identity to the home production she performs, as suggested by Hochschild (1989), and therefore she might perform more, and more

advanced, household work than a woman who does not connect her identity to home production. If that holds, the total time spent on household work is less for a woman who is less gender-aware.

**Table 7: Effect on husbands' hours spent on household chores, OLS**

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	-0.239 (0.639)	-0.310 (0.688)	-0.0496 (0.689)	0.177 (0.756)
Gender-awareness				-2.052** (0.830)
Wife earns more # Gender-awareness				-1.989 (1.352)
Log of total earnings		-0.131 (0.398)	-0.485 (0.443)	-0.619 (0.440)
Wife's work hours		0.015 (0.018)	0.033 (0.022)	0.027 (0.023)
Husband's work hours		0.024 (0.016)	0.021 (0.017)	0.022 (0.017)
# Small children			2.076** (0.984)	2.038** (0.984)
# Big children			1.205* (0.638)	1.168* (0.635)
(#Big children) <sup>2</sup>			-0.269 (0.166)	-0.240 (0.164)
(#Small children) <sup>2</sup>			-0.537 (0.425)	-0.480 (0.425)
Household wealth			-0.187 (0.140)	-0.190 (0.140)
Wife' years of education			0.0346 (0.109)	0.0265 (0.109)
Husband's years of education			0.076 (0.098)	0.059 (0.098)
Constant	20.01*** (0.370)	20.38*** (4.163)	44.75*** (11.93)	46.81*** (12.09)
Observations	4,162	4,162	3,976	3,976
R-squared	0.000	0.001	0.041	0.044

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

If the negative effect is due to a more equal division between the spouses one would expect a positive, significant effect when running the same regression on the husbands' hours spent on chores. However, as can be seen in Table 7, the estimated effect for husbands are small, mostly

negative, and statistically insignificant. Hence, the husbands do not behave differently in less gender-aware couples than in more gender-aware couples. Consequently, the negative effect for wives is not due to a more equal division of household chores between the spouses. Either the couple purchase more substitutes for home production from the market (such as prepared meals, cleaning services etc.) or they let the quality of household production decay as less hours in total are spent on it. The coefficient for *Gender-awareness* is negative, meaning that the husbands who reported believing in traditional gender roles do less housework.

The regressions with *chores by others* as the dependent variable show no increase in the time others spend on chores.<sup>10</sup> Thus it appears that in the less gender-aware couples the wife spends less time on household work, but the husbands do not spend more time, such that the total time spent on household work is less than in more gender-aware couples. This implies a decay in quality or an increase in purchases of market substitutes. However, due to data limitations, I was unable to see if the expenditure on restaurant meals, dry cleaning or other market supplied substitutes for home production increased.

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<sup>10</sup> Regression output for chores by others can be seen in appendix B.

### 5.2.3 Econometric results from FE estimations

**Table 8: Effect on wives' hours spent on household chores, FE**

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	1.543 (1.149)	1.321 (1.162)	0.698 (1.206)	1.001 (1.357)
Gender-awareness				2.529 (1.736)
Wife earns more # Gender-awareness				-1.652 (2.465)
Log of total earnings		-0.417 (0.603)	-0.160 (0.635)	-0.155 (0.634)
# Small children			3.433* (2.083)	3.440* (2.087)
(#Small children) <sup>2</sup>			0.770 (0.874)	0.760 (0.875)
Household wealth			-0.479 (0.307)	-0.490 (0.308)
Wife's years of education			0.065 (1.367)	0.086 (1.368)
Husband's years of education			-1.569 (1.357)	-1.574 (1.357)
Constant	35.37*** (0.339)	39.78*** (6.344)	49.14*** (18.80)	48.56*** (18.82)
Observations	4,162	4,162	4,017	4,017
R-squared	0.001	0.001	0.033	0.034
Number of households	2,081	2,081	2,070	2,070

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

Similar model specifications are used for the FE regressions as for the OLS regressions. However, the variables that do not change between the waves are omitted from the FE regressions since they do not vary over time and thus are differenced out. As can be seen from Table 8 very few estimates are statistically significant when I use the FE method. These statistically insignificant results support my hypothesis that the variation over time of *Wife earns more* comes mainly from less gender-aware couples with lower  $I_j(\cdot)$ , since these couples are not as affected by traditional gender roles and therefore experience a smaller identity loss and “punishment” effect if the wife starts earning more money than the husband. Thus, the more gender-aware couples with a high  $I_j(\cdot)$ , who suffers larger identity losses from crossing the discontinuity, will self-select to the left side of it and thus cause no variation over time. Similar

conclusions comes from interpreting Table 9 which presents the FE estimates for the husbands' hours spent on household chores. Only small children seem to have a significant positive effect on the number of hours wives spend on household chores.

Furthermore, in the FE framework the coefficient for *Wife earns more* is positive in all specifications of the model for the wife. This suggests that the pure treatment effect of having a wife earning more money than her husband is positive for the time the wife spends on household chores. These results coincides with what is predicted by gender identity theory; that the wife compensates for violating the perceptions of the appropriate behaviour for her gender. However, the estimates are not statistically different from zero and should therefore be interpreted with caution.

**Table 9: Effect on husbands' hours spent on household chores, FE**

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	-1.689*	-1.397	-0.849	0.223
	(0.864)	(0.942)	(1.011)	(1.095)
Gender-awareness				1.165
				(1.446)
Wife earns more # Gender-awareness				-5.009**
				(2.040)
Log of total earnings		0.548	0.475	0.488
		(0.555)	(0.587)	(0.583)
# Small children			-1.220	-1.177
			(1.670)	(1.667)
(#Small children) <sup>2</sup>			0.705	0.701
			(0.696)	(0.694)
Household wealth			-0.304	-0.307
			(0.237)	(0.236)
Wife's years of education			2.003	2.008
			(1.776)	(1.774)
Husband's years of education			3.423*	3.415*
			(1.816)	(1.813)
Constant	20.44***	14.65**	-24.23	-24.63
	(0.255)	(5.900)	(26.18)	(26.13)
Observations	4,162	4,162	4,017	4,017
R-squared	0.002	0.002	0.010	0.012
Number of households	2,081	2,081	2,070	2,070

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

The coefficients for *Wife earns more* for husbands are small, negative, and mostly statistically insignificant, as in the OLS regressions. Thus, husbands do not change their behaviour much if their wives starts earning more money than them, even when controlling for unobserved heterogeneity. Remember that as with the wives the FE estimates mainly captures the effect for the less gender-aware couples, as these are the ones who accept crossing the discontinuity of *Relative earnings*. For these couples a small or insignificant effect is what is expected since they do not compensate as much, or have a more equal division originally. The effect on hours that others spend on chores is small and statistically insignificant as well.<sup>11</sup>

The coefficient for the interaction variable of *Gender-awareness* and *Wife earns more* is negative and significant for the husbands, even when controlling for unobserved heterogeneity using a FE framework. This suggests a heterogeneity of effects, that for those households who reported agreeing with traditional gender roles, but still consists of a wife who earns more money than the husband, the compensatory effect on husbands' time spent on household chores is stronger than for households who did not report believing in traditional gender roles. This is a realistic result since these couples are more gender-aware and have a higher  $I_j(\cdot)$ , which causes larger losses of identity that gives stronger incentive for husbands to “punish” their wives by decreasing their time spent on housework.

The effect of crossing the discontinuity, when controlling for the unobserved heterogeneity, is small. One interpretation is that this is due to selection in the data, and the fact that variation comes mainly from less gender-aware couples. These couples might have a more equal division of household chores, or perform less chores in total, or they do not react as strongly to violated traditional gender roles as more gender-aware couple do. Furthermore, one important result is that even the less gender-aware couples do not seem to behave according to bargaining theory when deciding on the allocation of household chores, since neither the wives nor the husbands showed an effect that coincides with the predictions of bargaining theory. Those predictions are that the wife would decrease her time spent on chores and the husband would increase his time, which is not what my results show. Thus, even for the less gender-aware couples the effects of gender identity seem to outweigh the effects of household bargaining or changing comparative advantages.

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<sup>11</sup> The regression output of effect on *chores by others* is shown in appendix C.

### 5.3 Robustness of results

For robustness, I also perform an analysis using the proportion of household work that is done by the wife, the husband and by others as the dependent variables.<sup>12</sup> The signs of the coefficients do not change, indicating that the results from my above demonstrated estimations are robust. The coefficients for *Wife earns more* for the wives are negative and statistically significant as before. But the coefficients for *Wife earns more* for the husbands are positive and statistically significant when the proportion of household chores are used as the dependent variable. This aligns with the results of Table 6: that in a less gender-aware household the wife does less household work and this makes the total hours of household work done in the household fewer. Then, even if the husband does more or less the same number of hours his proportion of the total household work will increase as total hours of household work decrease.

A necessary assumption for consistency of the regression estimates is that the residuals are independently distributed with a constant variance and an expected value of zero (Verbeek, 2012, pp. 19). I plot the residuals and the fitted values of my regression, and the plot confirms that this consistency assumption holds for my data.<sup>13</sup> To ensure that the fixed effects method is preferable over the random effects method I performed a Hausman test. The output from the test show that the fixed effects method is the correct specification for my study.

I perform a VIF (Variable Inflation Factor) test to ensure none of the included variables suffer from multicollinearity. If correlation between the variables is too high this causes problems, the matrix  $X'X$  becomes close to invertible and this leads to unreliable estimates with large standard errors. A VIF test measures the factor by which the variance of a variable is inflated, compared to a situation where there exists no correlation between the variables (Verbeek, 2012, pp. 44-46). There is no stated limit on how high a VIF can be without giving cause for worry, but a rule of thumb is usually that a VIF below 10 indicates that the variables are useable (Kennedy, 2008, s. 199). The variables with the highest VIF were number of small children and number of big children. However, excluding them from the regressions do not alter the results, and I therefore conclude that the inflation caused by number of small big children do not damage the robustness of my results. Hence, I include them since they can be assumed to be important for the time the parents spend on household chores.

I also test for heteroskedasticity in the residuals, using a Breusch-Pagan test. This test shows that one or more of the model's independent variables do suffer from

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<sup>12</sup> The results of the OLS regressions are shown in appendix A, and results of the FE regressions in appendix B.

<sup>13</sup> All output of the robustness tests are shown in appendix C.

heteroskedasticity, which is why I run all regressions using robust standard errors. These are automatically clustered in the FE specifications, thus controlling for possible autocorrelation as well. The Ramsey RESET test tests whether the model is correctly specified or not, and if there are any omitted variables that ought to be included (Verbeek, 2012, pp. 71). I perform this test on the final specification of the model for both the husbands' chores and for the wives' chores, and cannot reject the null hypothesis of no omitted variables in any of the regressions. Therefore I conclude that my model is robustly specified.

## 6. Discussion

The OLS estimates show that a wife decreases her hours spent on household work when she earns more than her husband. Running both OLS and FE regressions allows me to view the difference between when controlling for the heterogeneity causing the self-selection, and when not controlling for this. When incorporating the self-selection in the interpretation of the results it is more likely that the decrease is actually an effect of changing from observing a mix of types of households on the left of the discontinuity, to observing mainly less gender-aware households on the right of the discontinuity. Thus the results show that a wife spends less hours on household work in a less gender-aware household than she does in a more gender-aware household.

Furthermore, since there were no positive effects on the husbands' hours it seems that the decrease of the wives' hours is not due to a more equal division of chores between the spouses, but rather due to the fact that a less gender-aware household does less housework overall. The result indicates that the difference between more and less gender-aware couples is mainly the amount of housework the wife performs, regardless of the relative earning status. This could be since a less gender-aware wife identifies less with the household work than a more gender-aware wife, and therefore does less in total. Thus, my results suggests that the total amount of chores performed in a household is a function of  $I_j$ , which is an individual's perception of its identity.

The FE estimations capture the pure effect of changes in relative wages, but mainly estimated on less gender-aware households - since these are the ones accepting to change relative earning status between waves. While small and insignificant results are expected, it is of more interest that bargaining theory does not seem to have any explanatory power even on the behaviour of less gender-aware couples. Since these couples have a lower

$I_j(\cdot)$  they suffer smaller losses of identity when violating the traditional gender norms. Thus one hypothesis could be that differences in bargaining power or comparative advantages would determine the division of household chores within these less gender-aware households, but that is not what my results show. Rather, they show that gender identity theory has stronger explanatory power on both more and less gender-aware couples when the wife earns more than the husband. And this result is in line with the results of previous studies.

Histograms of relative earnings within households, and the McCrary density test, show that there is a considerable amount of self-selection in the data. Furthermore, that this self-selection stems from differences in gender role perceptions is a plausible assumption. Thus, my empirical results substantiate the hypothesis that the total hours of chores within a household is a function of  $I_j$ . This hypothesis is further supported by the fact that changing from observing more gender-aware households to less gender-aware households only had an effect on the wives' hours spent on housework and not on the husbands'. Since traditional gender roles state that household work is a woman's job and the woman is the spouse experiencing an effect from crossing the discontinuity, this implies that the cause of the self-selection and the discontinuity is in fact gender-based. If it was based on other things than gender there is no explanation for why there was only an effect on the wives' hours and not both the hours' of both spouses.

For further research I recommend looking further into the heterogeneous effects of changes in relative wages, as suggested by the significantly negative interaction term in the FE regression on husbands' time spent on chores. This implies that there is a difference in reaction to relative wage changes between more or less gender-aware husbands, which is not captured by the unobserved heterogeneity between households.

For a policy aimed to improve women's labour market opportunities I recommend one designed to affect households' level of gender-awareness. My study show that gender identity and level of belief in traditional gender roles have the strongest explanatory power on household behaviour. The traditional gender roles could cause an unfair burden for women when they join the labour market, and a difficulty to combine market work and household work, which implies a suboptimal allocation of resources within households. Thus, to change perceptions of gender roles would improve both efficiency and equity of households.

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## Appendix A: descriptive statistics

*Table 10: List of variables*

<b>Dependent variables</b>	Wife's chores <sub>it</sub>
	Husband's chores <sub>it</sub>
	Chores by others <sub>it</sub>
	Proportion wife's chores <sub>it</sub>
	Proportion husband's chores <sub>it</sub>
	Proportion chores by others <sub>it</sub>
<b>Independent variables</b>	Wife earns more <sub>it</sub>
	Gender-awareness <sub>it</sub>
<b>Control Variables</b>	Log of total earnings <sub>it</sub>
	Wives' work hours <sub>it</sub>
	Husbands' work hours <sub>it</sub>
	Household wealth <sub>it</sub>
	# Small children <sub>it</sub> (age 0-4)
	# Big children <sub>i</sub> (age 5-18)
	(#Small children <sub>it</sub> ) <sup>2</sup>
	(#Big children <sub>i</sub> ) <sup>2</sup>
	Wife's years of education <sub>it</sub>
	Husband's years of education <sub>it</sub>
	FE: Wife's ethnicity <sub>i</sub>
	FE: Husband's ethnicity <sub>i</sub>
	FE: Year <sub>t</sub>

*Note: i indexes household and t indexes wave*

*Table 11: descriptive statistics of variables*

VARIABLES	(1) N	(2) Mean	(3) Std.Dev.	(4) min	(5) max
Household wealth	4,017	3.732	2.416	0	9
Wife earns more	4,162	0.295	0.456	0	1
Wife's chores	4,162	35.83	24.54	0	330
Husband's chores	4,162	19.94	19.51	0	355
Gender-awareness	4,162	0.187	0.390	0	1
Chores by others	4,162	4.668	11.55	0	235
# big children	4,162	0.859	1.097	0	7
# small children	4,162	0.390	0.681	0	4
Log of total earning	4,162	10.41	0.807	4.605	13.82
Wife's years of education	4,162	6.747	6.805	0	25
Husband's years of education	4,162	7.959	6.835	0	21
Wife's work hours	4,162	18.92	19.88	0	100
Husband's work hours	4,162	31.19	22.17	0	85
Proportion wife's chores	4,160	0.598	0.192	0	1
Proportion husband's chores	4,160	0.340	0.184	0	1
Proportion chores by others	4,160	0.0614	0.108	0	0.846

## Appendix B: OLS regressions output – others and proportions

*Table 12: Effect on hours and proportions of chores done others, OLS*

VARIABLES	(1) hours	(2) hours	(3) proportions	(4) proportions
Wife earns more	-0.174 (0.461)	0.00266 (0.485)	-0.00169 (0.00354)	-0.00104 (0.00387)
Gender-awareness		0.619 (0.512)		0.00264 (0.00473)
Wife earns more # Gender-awareness		-0.945 (1.001)		-0.00338 (0.00807)
Log of total earnings	0.00576 (0.253)	0.0149 (0.249)	0.00150 (0.00219)	0.00155 (0.00220)
Wife's work hours	0.0212* (0.0124)	0.0218* (0.0123)	0.000172* (0.000103)	0.000175* (0.000104)
Husband's work hours	0.0285*** (0.0109)	0.0283*** (0.0109)	0.000209** (9.10e-05)	0.000209** (9.10e-05)
# Small children	-0.908* (0.473)	-0.904* (0.474)	-0.0162*** (0.00484)	-0.0162*** (0.00485)
# Big children	2.315*** (0.523)	2.308*** (0.524)	0.0449*** (0.00409)	0.0448*** (0.00409)
(#Big children) <sup>2</sup>	0.360* (0.207)	0.360* (0.208)	-0.00121 (0.00142)	-0.00122 (0.00142)
(#Small children) <sup>2</sup>	0.227 (0.196)	0.221 (0.196)	0.00375* (0.00206)	0.00372* (0.00207)
Household wealth	-0.260*** (0.0707)	-0.257*** (0.0709)	-0.00135** (0.000682)	-0.00134** (0.000682)
Wife' years of education	-0.0331 (0.0677)	-0.0311 (0.0681)	-0.000800 (0.000567)	-0.000791 (0.000569)
Husband's years of education	-0.0623 (0.0632)	-0.0593 (0.0640)	-0.000957* (0.000550)	-0.000944* (0.000554)
Constant	14.63 (12.13)	14.45 (12.15)	0.196* (0.115)	0.195* (0.115)
Observations	3,976	3,976	3,974	3,974
R-squared	0.162	0.163	0.232	0.232

Robust standard errors in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 13: Effect on wives' proportions of household chores, OLS**

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	-0.00775 (0.00657)	-0.0211*** (0.00687)	-0.0227*** (0.00688)	-0.0239*** (0.00748)
Gender-awareness				0.0442*** (0.00840)
Wife earns more # Gender-awareness				0.0200 (0.0160)
Log of total earnings		-0.0285*** (0.00414)	-0.0236*** (0.00430)	-0.0212*** (0.00429)
Wife's work hours		-0.000669*** (0.000176)	-0.000882*** (0.000192)	-0.000775*** (0.000192)
Husband's work hours		1.26e-05 (0.000156)	3.44e-05 (0.000168)	2.27e-05 (0.000167)
# Small children			0.0342*** (0.0103)	0.0349*** (0.0103)
# Big children			-0.00858 (0.00642)	-0.00810 (0.00634)
(#Big children) <sup>2</sup>			-0.000927 (0.00187)	-0.00141 (0.00184)
(#Small children) <sup>2</sup>			-0.00287 (0.00453)	-0.00391 (0.00451)
Household wealth			-0.000712 (0.00133)	-0.000635 (0.00132)
Wife' years of education			-0.00190* (0.00102)	-0.00174* (0.00101)
Husband's years of education			-0.00256*** (0.000991)	-0.00225** (0.000990)
Constant	0.601*** (0.00352)	0.914*** (0.0441)	0.550*** (0.0702)	0.510*** (0.0722)
Observations	4,160	4,160	3,974	3,974
R-squared	0.000	0.019	0.080	0.090

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Table 14: Effect on husbands' proportions of household chores, OLS*

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	0.0125** (0.00632)	0.0244*** (0.00664)	0.0244*** (0.00656)	0.0249*** (0.00710)
Gender-awareness				-0.0468*** (0.00799)
Wife earns more # Gender-awareness				-0.0166 (0.0154)
Log of total earnings		0.0255*** (0.00405)	0.0221*** (0.00420)	0.0197*** (0.00419)
Wife's work hours		0.000640*** (0.000171)	0.000711*** (0.000182)	0.000600*** (0.000182)
Husband's work hours		-0.000201 (0.000151)	-0.000244 (0.000158)	-0.000231 (0.000156)
# Small children			-0.0180* (0.00977)	-0.0187* (0.00975)
# Big children			-0.0363*** (0.00578)	-0.0367*** (0.00569)
(#Big children) <sup>2</sup>			0.00214 (0.00153)	0.00263* (0.00148)
(#Small children) <sup>2</sup>			-0.000881 (0.00422)	0.000183 (0.00422)
Household wealth			0.00207 (0.00127)	0.00198 (0.00126)
Wife' years of education			0.00270*** (0.000956)	0.00253*** (0.000952)
Husband's years of education			0.00352*** (0.000931)	0.00320*** (0.000930)
Constant	0.337*** (0.00338)	0.0621 (0.0430)	0.254** (0.113)	0.294*** (0.114)
Observations	4,160	4,160	3,974	3,974
R-squared	0.001	0.020	0.090	0.102

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Appendix C: FE regressions output – others and proportions

*Table 15: Effect on hours and proportions of chores done others, FE*

VARIABLES	(1) hours	(2) hours	(3) proportions	(4) proportions
Wife earns more	-0.154 (0.495)	0.0402 (0.528)	-0.00272 (0.00359)	-0.00207 (0.00398)
Gender-awareness		0.630 (0.510)		0.00248 (0.00474)
Wife earns more # Gender-awareness		-1.032 (0.997)		-0.00333 (0.00808)
Log of total earnings	0.00938 (0.262)	0.0179 (0.259)	0.00143 (0.00231)	0.00147 (0.00232)
Wife's work hours	0.0206 (0.0132)	0.0211 (0.0131)	0.000168 (0.000111)	0.000171 (0.000111)
Husband's work hours	0.0287** (0.0115)	0.0286** (0.0115)	0.000213** (9.63e-05)	0.000212** (9.62e-05)
# Small children	-0.977** (0.464)	-0.974** (0.464)	-0.0175*** (0.00483)	-0.0175*** (0.00483)
# Big children	2.275*** (0.632)	2.267*** (0.633)	0.0443*** (0.00492)	0.0443*** (0.00493)
(#Big children) <sup>2</sup>	0.367 (0.252)	0.367 (0.252)	-0.00110 (0.00180)	-0.00111 (0.00180)
(#Small children) <sup>2</sup>	0.211 (0.178)	0.207 (0.178)	0.00373* (0.00195)	0.00371* (0.00195)
Household wealth	-0.248*** (0.0754)	-0.246*** (0.0755)	-0.00114 (0.000702)	-0.00114 (0.000703)
Wife' years of education	-0.0344 (0.0722)	-0.0324 (0.0727)	-0.000819 (0.000587)	-0.000811 (0.000590)
Husband's years of education	-0.0633 (0.0675)	-0.0603 (0.0683)	-0.000967* (0.000573)	-0.000955* (0.000576)
Constant	9.499 (11.34)	9.325 (11.38)	0.154 (0.108)	0.153 (0.108)
Observations	3,976	3,976	3,974	3,974
Number of households	2,049	2,049	2,049	2,049

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

**Table 16: Effect on wives' proportions of household chores, FE**

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	0.0284*** (0.00884)	0.0215** (0.00950)	0.0131 (0.00972)	0.00161 (0.0105)
Gender-awareness				-0.00307 (0.0128)
Wife earns more # Gender-awareness				0.0535** (0.0208)
Log of total earnings		-0.0130** (0.00594)	-0.0115* (0.00603)	-0.0116* (0.00600)
# Small children			0.0467*** (0.0137)	0.0463*** (0.0136)
(#Small children) <sup>2</sup>			-0.00558 (0.00595)	-0.00558 (0.00592)
Household wealth			0.000593 (0.00244)	0.000578 (0.00244)
Wife's years of education			-0.0173 (0.0127)	-0.0173 (0.0127)
Husband's years of education			-0.0433*** (0.0126)	-0.0432*** (0.0125)
Constant	0.590*** (0.00261)	0.727*** (0.0629)	1.155*** (0.179)	1.157*** (0.178)
Observations	4,160	4,160	4,015	4,015
R-squared	0.005	0.008	0.048	0.052
Number of households	2,081	2,081	2,070	2,070

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

*Table 17: Effect on husbands' proportions of household chores, FE*

VARIABLES	(1)	(2)	(3)	(4)
Wife earns more	0.00482 (0.00637)	0.0156** (0.00675)	-0.00584 (0.00936)	0.00438 (0.0101)
Gender-awareness				0.00359 (0.0121)
Wife earns more # Gender-awareness				-0.0475** (0.0199)
Log of total earnings		0.0212*** (0.00412)	0.00409 (0.00584)	0.00420 (0.00580)
# Small children			-0.0157 (0.0136)	-0.0153 (0.0136)
(#Small children) <sup>2</sup>			-0.00150 (0.00591)	-0.00149 (0.00590)
Household wealth			-0.00179 (0.00226)	-0.00178 (0.00226)
Wife's years of education			0.00760 (0.0123)	0.00759 (0.0122)
Husband's years of education			0.0333*** (0.0122)	0.0332*** (0.0121)
Constant	0.339*** (0.00373)	0.115*** (0.0439)	4.74e-05 (0.172)	-0.00200 (0.170)
Observations	4,160	4,160	4,015	4,015
R-squared			0.030	0.033
Number of households	2,081	2,081	2,070	2,070

Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

## Appendix D: robustness tests

**Table 18: Breusch-Pagan / Cook-Weisberg test for heteroskedasticity**

H <sub>0</sub> : Constant variance	
Chi2(12)	434.68
Prob > chi2	0.0000

**Table 19: Ramsey RESET test using powers of the fitted values**

H <sub>0</sub> : model has no omitted variables			
Dep. variable: wives' chores		Dep. variable: husbands' chores	
F(3, 3942)	1.19	F(3, 3942)	0.85
Prob > F	0.3111	Prob > F	0.4681

**Table 20: VIF test of variables**

Variables	VIF
# Small children	7.13
# Small children <sup>2</sup>	6.95
# Big children	5.71
# Big children <sup>2</sup>	5.55
Wife's years of education	5.07
Husband's years of education	4.78
Husband's work hours	1.63
Wife's work hours	1.63
Log of total earning	1.24
Household wealth	1.16
Wife earns more	1.1
Gender-awareness	1.03
Mean VIF: 3.58	

*Figure 8: Plot of residuals and fitted values*

