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The effect of housework on wages in Sweden

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Abstract

The purpose of this thesis is to examine the effect of housework on wages for women and men in Sweden using both linear and non-linear specifications of the effect. Furthermore, we investigate the effort and selection hypotheses, i.e. whether the effect of housework on wages can be explained by reduced effort and/or selection into jobs which are more compatible with housework. Three methods are applied: OLS, IV regressions and propensity score matching. The latter two methods are used in attempt to reduce potential endogeneity of housework. We find weak support for the effort and selection hypotheses but there is a statistically significant wage penalty for women in the linear specification, while the effect for men is less pronounced. However, in the upper part of the housework scale, which is captured in the non-linear specification, the result is somewhat reversed in that performing housework 18 hours or more per week penalise the wages of men more than those of women. We discuss our results in relation to potential endogeneity of housework, which is an important, although often neglected, issue throughout previous literature on the subject.

Key words: Housework, wages, endogeneity, instrumental variables, matching methods.

Contents

List of Tables

List of Figures

Introduction

Housework is an essential part of most people's life, whether we want it to be or not. Traditionally, women have taken the main responsibility of household tasks while men have engaged in market work in order to economically support the family. The sexual division of labour is evidently nowadays not as divided as it used to be. In Sweden, the female labour force participation is high and most men know how to operate a laundry machine. However, women still do more housework than men and have lower wages on average. The sample used in this study[1] show that women spend on average 13 hours a week on housework compared to 8 hours for men.[2] Furthermore, there is a persistent gender wage gap around 13 % in favour of men in Sweden (Boye et al. 2014).[3]

Several studies (e.g. Hersch 1991a; Hersch and Stratton 2002; Bryan and Sevilla-Sanz 2011) have found a negative effect of housework on wages, an effect that is more pronounced for women than for men. The main underlying theory of why housework affects wages negatively originates from Becker (1985) who formulated, what we call, the effort hypothesis and the selection hypothesis. The effort hypothesis stipulates that executing housework takes effort and thus leaves less effort available for market work which consequently lowers wages. The selection hypothesis stipulates that because women do more housework they also seek jobs which are more compatible with housework, in turn these jobs pay less because of compensating differentials. Despite a more or less intuitive theory, the relation between housework and wages is difficult to entangle because of endogeneity of housework which stems from simultaneous causality and unobserved characteristics which determine both variables. These circumstances are expected to cause a downward bias on the estimated effect of housework on wages in a standard OLS regression, i.e. result in a more negative effect than is actually the case. Another aspect of the housework-wage relation is that the effect may start when

[1] The sample is from the Swedish survey LNU 2010. See data section from more details.

[2] Housework is defined as hours per week spent on cleaning, doing laundry, cooking, food shopping and doing the dishes, a further discussion on the construction of this variable is found in the data section. The difference in means is statistically significant at the 1% level, see Appendix A.

[3] Calculated using the same data as this thesis and adjusted experience, seniority, sector and qualification level.

the time spent on housework is above a certain level since some amount of housework is a necessary part of most people's life, an argument in line with Hersch (1991a) and Stratton (2001).

The purpose of this study is to investigate the effect of time spent on housework on wages for women and men in Sweden. The purpose can be separated into three parts. First, we examine the linear relationship between housework and wages and whether there is support for the effort and selection hypotheses. Second, additional insight into the relationship is provided through a threshold analysis. That is, we specify a non-linear specification which captures the effect of housework above a certain amount of hours spent. Third, we attempt to capture the casual effect of housework on wages by taking the potential endogeneity of housework into account.

The data used in this study comes from a Swedish survey called the level-of-living survey (LNU) from 2010. The data include wage and self-assessed time spent on housework, among many other individual characteristics and assessments. In order to examine the relationship between housework and wages, three methods are applied: ordinary least squares (OLS), instrumental variable (IV) regression and propensity score matching. The two latter methods are used in attempt to reduce the potential endogeneity of housework in the linear and non-linear specification, respectively.

Our results show that there is a statistically significant negative association between housework and wages for women while the association for men is somewhat less negative and not statistically significant. Furthermore, we find weak support for the effort and selection hypotheses, i.e. the significant negative association for women persists even though variables, that are meant to channel the effect according to theory, are added. In the non-linear model, we use 18 hours or more of housework as the threshold and find that men suffer a substantially larger wage penalty than women on this level of housework. When methods which are meant to reduce endogeneity are applied, the estimated wage penalty becomes notably larger for both women and men. This result is obtained from both IV regressions and propensity score matching. However, we cannot rule out that these estimates are biased due to issues with the used instrument and limitations to the matching method.

Even though the validity of the methods can be questioned, the result that the effect of housework on wages is negative for essentially all levels of housework for women while it requires a high level of housework for men before the significant negative effect starts, provide insights to the housework-wage relation in Sweden. The effect of time spent on housework on wages has not been thoroughly investigated within the economic literature using Swedish data before, and hence this thesis contributes by discussing the wage penalty of housework in a Swedish context. The contribution also lies within the methods used in this thesis, where we extend previous research by attempting to reduce the endogeneity problem.

The thesis proceeds as follows, first we present a theoretical discussion on the housework-wage relation. The next section presents and discusses previous literature on the subject and is followed by a section describing and discussing the cross-sectional survey data used. The subsequent section is the methodology section which presents and discusses the three methods used in this study, which is followed by the results section and finally a section devoted to summary and concluding remarks.

Theoretical discussion

In this section we offer a theoretical discussion on the relation between housework and wages. Theoretically, the decision to engage in home production, like housework, is in itself related to other joint decisions that are affected by both productivity in the labour market and productivity at home. Therefore, at any given time housework, work effort and the wage rate are potentially jointly determined (conditional on factors such as marital status and the number of children). Earlier theoretical models (see for example Gronau 1977) focused mostly on the home production choices of individuals, based on an exogenous wage rate and home production technology. Particularly in these models the female wage affects the full (shadow) price of goods from home production, and thereby it affects home production choices. On the other hand, other models of female wage determination focus on the importance of time spent on market work, with work experience in particular focus, or market work interruptions (Mincer 1974) and job characteristics (e.g. work flexibility). In later developments, the framework was extended to involve decisions where home production, effort requirements and the wage rate are to be jointly determined (Becker 1985; Gronau 1988).

To date, theory offers two main possible explanations for how housework may reduce wages that both originate from Becker (1985). First, housework could affect wages by affecting the type of work chosen by individuals. More specifically, housework may influence the choice individuals make about work characteristics and thereby wage is affected via work related compensating wage differentials. That is, individuals who spend more time on housework, predominantly during the working week, may seek out jobs that offer more flexible work arrangements, such as greater flexibility in scheduling. These more flexible working arrangements are likely to be costly for firms and so wages may be lower in such jobs to compensate employers (Hersch 1991a; Maani and Cruickshank 2010). The possible selection effect of housework is, in this thesis, denoted the selection hypothesis.

Second, housework may have a direct effect on wages by affecting the allocation of effort at home and at work. This direct link suggests that individuals with the same observable characteristics (such as education, experience, and occupation) but with different housework responsibilities will earn different wages. Becker's (1985) theory of the allocation of effort postulates that individuals have a limited amount of effort available, and that effort used on housework undoubtedly reduces the amount of effort left for market work. Further, the reduced amount of effort left for market work would lower individual labour productivity and thus the wage. Hence, if work effort, productivity and wages are positively correlated, the wages of workers bearing greater housework responsibilities will be lower than the wages of their less-burdened peers, a difference that is expected to persist even after controlling for relevant observable characteristics. The effort reducing effect of housework is, in this thesis, denoted the effort hypothesis.

Both hypotheses on the wage effect of housework can be studied in the context of gender differences and the gender wage gap, a connection that was made by Becker (1985, 1991). The gender wage gap can be explained by women spending more time on housework and childcare than men in the two-or-more-persons household. As previously noted, the effort put on household work leaves less effort available for market work which lowers productivity and thus reduce wages (i.e. the effort hypothesis). In other words, if men and women allocate their effort differently between market and non-market work this would lead to a gender wage gap even though men and women have accumulated the same human capital over time. Moreover, women economise on the situation by seeking jobs that demand less effort and thus occupational differences enhance the wage gap (i.e the selection hypothesis). The initial specialisation, women on housework and men on market work, is a difficult pattern to break according to this theory because as partners become specialised they also become better at doing the tasks and thus gain as a household on the division of labour (we call this the specialisation hypothesis).[4]

[4] Note that an analysis of the specialisation hypothesis lies outside the scope of this thesis.

Literature review

There is a growing literature within both economics and sociology about the relationship between housework and wages. In general, the difference between the two disciplines is the casual direction between housework and wages which is partly based on existing theories within economics and sociology. The remainder of this section is structured as follows, first an overview of studies conducted within the economic literature is presented (studies covering the housework-wage relation, the timing of housework and methodological challenges in previous studies). For a more comprehensive literature review, see for example Maani and Cruickshank (2010). Second, an overview of relevant studies conducted within the sociology literature and studies related to the reversed relationship is presented, including previous studies conducted using Swedish data.

The housework-wage relation

Several studies build on the work of Becker (1985). The two most prominent authors who have studied the topic in an American context are Hersch and Stratton. Two early studies conducted by Hersch (1991a, 1991b) shows that time spent on household work has a negative impact on women's wages but no significant effect on men's wages. Hersch (1991a, 1991b) discusses, although does not prove, reasons for why these results are in line with Becker's (1985) arguments. More specifically, that women suffer from a housework wage penalty because of reduced amount of effort available for market work and that women choose jobs which are more easily combined with household work. Hersch (1991b) refers to this situation as the 'mommy track'. The 'mommy track' suggests that family responsibilities and careers are fundamentally incompatible. Thus, women who have demonstrated that they are taking on household tasks may in fact place themselves on a slower track with respect to promotions. Therefore lower wages accompanying greater household responsibilities could be caused by women being promoted at different rates than men with otherwise similar human capital characteristics.

Later studies have tried to, more thoroughly, control for different working conditions in order to investigate the selection hypothesis. Hersch (2009) controls for occupational types in the housework-wage equation but do not find that differences in the choice of occupation explain the observed negative effect of housework on wages. Bryan and Sevilla-Sanz (2011) study the same mechanism using UK data. They investigate the selection hypothesis of compensating differentials by controlling for occupation in terms of UK standard occupational classification (on one digit level) and find no support for that variation in occupation channels the negative housework effect.

Investigations of the effort hypothesis, which is not channeled through specific job differentials, are more rarely found in the literature, supposedly because of difficulties to find an appropriate measurement of effort. Nevertheless, Stratton (2001) focuses on a version of the effort hypothesis and tries to account for work effort (and job flexibility) in the housework-wage equations. The effort variable is constructed as self-reported job effort divided by self-reported effort watching TV (both on an 11-point scale). This relative job effort measurement is constructed in attempt to normalise job effort and thus make it more comparable between individuals. The inclusion of the innovative effort variable (or job flexibility) does however not change the estimated wage penalty from housework for women.

In a series of papers Hersch and Stratton (1994, 1997, 2000 and 2002) further provide key insights into the housework-wage relation. Hersch and Stratton (1994) partly focus on the allocation of housework within households and find that wives do more housework than their husbands, in part because they earn less on average than their husbands. The authors argue that anticipation of greater household responsibilities for women over their lifetime leads to different investment decisions or outcomes than for men of equal market ability. Consequently women earn less than men on average because they invest less in the human capital necessary to increase earnings. The authors find that even after controlling for gender differences in human capital and other wage-related characteristics, the time spent on housework is found to have a direct negative effect on earnings, an effect which is most prominent for women.

Kühhirt and Ludwig (2012) are interested in a similar argument, they examine whether household tasks prohibit women from unfolding their full earning potential because of reduced work effort and limited time flexibility. They investigate whether differences in housework can explain the wage gap between mothers and non-mothers in West Germany. The authors use fixed effects models and self-reported information on time use and earnings as well as monthly family and work histories from the German Socio-Economic Panel (1985–2007). Kühhirt and Ludwig (2012) find that the domestic workload is a central contributing factor for mothers' wage disadvantages compared to non-mothers. A result worth to note is that the mothers in their sample did not earn less than equally skilled non-mothers if both held the same jobs and performed only a moderate amount of household tasks.

In Hersch and Stratton (1997) the authors expand the methodology used in their previous work (ordinary least squares (OLS)) to now include, instrumental variables (IV), and fixed effects wage equations to estimate the housework-wage relation. The cross-sectional estimates, OLS and IV show a robust negative relation between wages and housework for wives. The fixed effects estimates reduce, but do not eliminate the negative relation. For husbands the authors find a more vague relation, OLS estimates suggest a negative relation between housework and wages, but the effect is statistically insignificant in the IV and fixed effects specifications. However, the results found in Hersch and Stratton (1997) provide evidence, that for wives, not only does housework have a negative effect on earnings but this is neither due solely to unobserved characteristics nor due to observable human capital measures. Given the substantial differences in housework time by gender, the contribution of time spent on housework in explaining the gender wage gap is, in the words of Hersch and Stratton (1997), considerable.

Hersch and Stratton (2000, 2002) focus on the specialisation hypothesis which originates from Becker (1985). This hypothesis is closely related to the observed marriage premium for men which is often credited to either the selection of more productive men into marriage or to enhanced productivity resulting from the specialisation possible within the household. In the sample examined by the authors, marriage does seem to have made men more productive in the market. But, this enhanced productivity does not seem to have resulted from household specialisation. A similar conclusion is presented by Lincoln (2008) who finds strong evidence for the gendered division

of labour, but little support for the wage effects predicted by the specialisation hypothesis.

Hersch and Stratton (2002) show that the difference by marital status in the total amount of time men spent on home production is small, although there are differences in the type of housework activities (whether they are traditionally 'male', 'female' or neutral activities). The married men spent less time than unmarried men on tasks such as cooking and cleaning (traditionally 'female tasks').[5] With little difference in the total time spent on housework, Hersch and Stratton (2000) argue that the only way specialisation can explain the marriage premium is if different types of housework have different effects on wages. Hersch and Stratton (2002) argues that traditionally 'female tasks' which generally must be attended to on a daily or almost daily basis, are more likely to interfere with the work performance and thus have a greater negative impact on wages.

The timing and thresholds of housework

As mentioned in the previous subsection, the timing of household tasks may have a substantial impact on the housework wage penalty. This idea have been discussed in Hersch (1991a) and Stratton (2001) in relation to differences between which household tasks women and men perform. For men, it might be that the negative effects of housework on earnings may start at a point beyond the number of hours typically spent on housework. Furthermore, the timing of housework done by men and women may be different. For example, women may be more involved than their husbands in getting children ready for school, or may be more likely than men to hurry home from work because of child care needs or meal preparation, whereas men may engage in their share of household responsibilities after work and on weekends. Any reduction of effort available for market work caused by housework should be more pronounced if housework is timed closely with market work.

[5] In Hersch and Stratton (2000) traditionally 'male' tasks are maintenance and repair while neutral tasks are paying bills and chauffeuring children.

The timing aspect of housework is closely related to potential threshold effects of housework, i.e. small amounts of housework may fit into any schedule, but substantial amount of housework may disrupt market work performance. Threshold effects can be examined by changing the housework-wage equation to allow for non-linear effects. Hersch and Stratton (1997) investigates potential threshold effects by stratifying the housework variable into three intervals. They find that the significant wage penalty from housework starts at 10 hours per week for women, while for men the wage penalty is similar across the intervals. Hersch (2009) examines the housework threshold of one hour per week and concludes that the significant negative impact of housework on wages does indeed require at least one hour of housework in order to kick in.

Bonke et al (2005) have extended the analysis of housework and wages in the context of timing of housework and flexibility of market work. They use quantile regressions on Danish data from 1987-1991 and find that housework has a negative impact on female wages and a positive impact on male wages. However, the effect is reversed for persons in the upper part of the conditional wage distribution, primarily high-wage men receive the largest negative effect of housework on wages. Moreover, the authors find that flexibility and timing of housework affect wages more than the amount of time spent on housework. Females (and to some extent males) who have inflexible working conditions and whose household tasks require larger blocks of continuous time have lower wages. Bryan and Sevilla-Sanz (2011) also investigates the flexibility aspect and find no evidence of that these circumstances impact the effect of housework on wages. In general they find that housework has a negative impact on both the wage of men and women (married and single, full-time workers).

Keith and Malone (2005) considers the timing of housework over the life-cycle using a sample of young, middle-aged, and older married workers from the Panel Study of Income Dynamics (1983–93 waves). Keith and Malone (2005) find using OLS, fixed effects, and panel data instrumental variables that young and middle-aged wives are the only groups for which there are consistent evidence of a housework effect on wages. The authors find that each additional hour of housework reduces the wages of young and middle-aged wives by 0.1–0.4 %. Additionally, the authors find evidence that for young workers, housework time is an important determinant of the wage gap

between men and women.

In summary, there is a reason to believe that household tasks which are performed on a daily basis (typical 'female tasks') interfere with market work and thus have a tendency to lower wages. Moreover, the relationship between housework and wages is not necessarily linear since some amount of housework is compatible with most working schedules.

Methodological challenges in previous studies

In the literature about housework and wages, the potential endogeneity of housework is a substantial methodological challenge for estimating the causal effect of housework on wages. The potential endogeneity problem is briefly mentioned here and more thoroughly discussed in the methodology section. Problems with endogeneity can arise because of omitted variables, simultaneous causality and measurement errors. First, there could be unobserved characteristics that affect both time spent on housework and wages, such as individual ability. Second, it is clear that there is possible simultaneous causality between housework and wages. Housework is assumed to have an effect on wages but at the same time wages likely effect time spent on housework as well. Thirdly, the housework variable is commonly obtained from surveys as self-assessed time spent on housework and thus there can be measurement errors, for a discussion on measurement errors see the data section.

Previous studies have tried to address the endogeneity of housework by applying methods that fully or partially solve the problem. The two main methods used are fixed effects (FE) models and instrumental variable (IV) regression. The fixed effects model can be applied when panel data is available, for example data on individuals over time. The idea is to use the panel to control for unobserved heterogeneity which is constant for individuals over time and thus reduce the omitted variable bias.

Nevertheless, the FE approach does not deal with the problem of reverse causality. Instrumental variable regressions with valid instruments account for the entire endogeneity issue. The problem is that it is very difficult to find valid instruments. The requirements for a valid instrument are that the instrument is correlated with the endogenous independent variable of interest (the first stage exists) and that the instrument is uncorrelated with any other

determinants of the dependent variable (exclusion restriction). The latter requirement is an identifying assumption which is solely based on motivation which in many cases can be questioned. For example Bonke et al (2005) acknowledge the possibility of endogeniety of household work variables and try to address the problem using instrumental variable regression, but do not succeed in finding valid instruments.

Many studies that have applied either FE and/or IV have concluded that housework is in fact exogenous by the means of Hausman tests. Among these are Hersch and Stratton (1997) who use the instruments non-labour income, spousal characteristics and earnings, information on the number and ages of children in the household and information on the size, type, and ownership status of the residence. Bryan and Sevilla-Sanz (2011) use IV FE, as a robustness check, with the spouse's labour participation, hourly wage and work hours, and number of employed household members as instruments. The identifying assumption is that the working circumstances of the partner affect the other partner's time spent on housework but is unrelated to any shock to that partner's wage. They find that the instruments are only valid for married men. They use a Hausman test of IV FE against FE and finds that housework is exogenous in the FE specification, thus the authors see no need for IV. According to us, it is bold to draw this conclusion based on invalid instruments (except for married men).

In contrast to the many studies based on OLS (e.g. Hersch and Stratton 1994), studies that have attempted to account for the endogeneity of housework have found no evidence of a housework wage effect. McLennan (2000) investigates the wage penalty of housework for women based on US data from 1980s. The effect is examined by applying OLS but is complemented with an IV approach which is meant to eliminate the endogeneity of housework. The instruments are non-labour household income, a dummy for whether the ideal number of children exceeds two (asked in 1971), spouse's education, the average number of housework and market hours reported by the respondent's sister. The results from the OLS regression show a significant negative effect of housework on wages for white married women. When corrections for endogeniety are made, there is no housework effect on wages for any subgroup.

Similar results are obtained by Hirsh and Koneitzko (2013) who examine the impact of housework on wages with data from Germany. They use two different datasets, a survey panel from 2000-2009 and a time diary data from 2001/2002. They apply a fixed effects model on the panel and OLS regression on the cross-sectional dataset. In contrast to many earlier studies, the authors find no significant negative effect of housework on wages (for any subgroup). Housework is instrumented in the OLS regressions to deal with potential endogeneity. This robustness check confirms the initial results. The instruments used follow previous studies (Hersch and Startton 1997, Bryan and Sevilla-Sanz 2011) and include a dummy for house/flat, a dummy for ownership of the residence and the size of the residence. The authors acknowledge that some endogeneity may still prevail using these instruments since for example a positive wage shock may be followed by moving to a larger house.

Deloach and Hoffman (2002) investigates women's allocation of time spent on housework and the effect on wages in Russia 1994-1996. The authors use IV regressions where household work is instrumented by family income, number of children under five, number of adult women in the household, number of adult men in the household, ownership of washing machine and automobile. They find no evidence of an effect of housework on wages for women.

The fact that many studies which attempt to account for endogeneity of housework find no evidence of a wage penalty must be viewed with some caution. The reason for this is that the instruments used in previous literature can be questioned with regard to failure of fulfilling the exclusion restriction. The exogeneity of housework is most certainly uncertain and we provide a more thorough discussion of problems regarding instruments used in previous studies in the methodological description of IV (see Methodology - IV regression).

Sociology and the reverse relationship

The relation between housework and wages, has as mentioned also been investigated within sociology, where there are three main theories that have been examined (resource-bargaining, gender display and the absolute earnings theories). Two of these theories (resource-bargaining and gender display) have been developed as a critique against the 'functionalist' model (Becker 1991, Lopata 1993) in which the common goal of household members is to maximise household utility, and in doing so the woman and man specialises on different tasks, men work because they have higher wages and women do housework since they are better at it (Gupta 2007). A feminist critique of the 'functionalist' model focuses on the household not being a common force but rather a unit of conflicting interest where women have less bargaining power because of their lower wages (Blumberg and Coleman 1989; England and Budig 1998). Originating from this idea, the first theory is the resource-bargaining perspective which builds on the notion that women's housework is affected by the economic dependence of women on men.[6] Specifically, there is an imbalance in bargaining power within couples, the person with the highest income and human capital have a superior position to negotiate away housework.

The second theory, gender display, is that women who earn more than what is normatively expected also do more housework to compensate for their normative deviation. This theory is based on the concept that doing tasks that are associated with ones gender, creates the gender. So, high earning women may do more traditionally female housework in order to enhance their gender identification (Gupta 2007; Evertsson and Nermo 2004). Both of these theories are about how women's relative earnings (to their partners) affect the housework. Gupta (2007) specifies the third theory, the absolute earnings theory, which is that women's time spent on housework is affected by their own wage, independent of the partner's wage. Gupta and Ash (2008) extend the analyses made by Gupta (2007), they show that a person's own earnings affect own housework, especially for women.

[6] The bargaining theory is not exclusively investigated within sociology, there exists an extensive literature regarding bargaining within economics as well.

The gender display theory is examined by Thébaud (2010), who uses the International Social Survey Program with data on 18 countries to investigate cross-national differences in what effect men's income relative to their spouse's income has on men's involvement in housework. The hypothesis is that gender expectations will be more prominent in men's household bargaining in contexts where the traditionally masculine and breadwinning-related activities of paid work are highly valued. Thébaud (2010) employs a hierarchical linear model (HLM) and finds that gendered expectations play a larger role in men's contributions to housework in countries where cultural norms strongly endorse paid work and earning a high income. The results provide support for the gender display theory, that individuals are persistently held accountable for their gender in interactions, if not by themselves, then by others. Thébaud (2010) concludes that the prevalent gender expectation of male breadwinners provides a way of understanding how gender expectations play themselves out in implicit spousal exchanges between housework and income.

Although the reverse relationship is predominantly studied within sociology, it has also been investigated within economics by Bloemen and Stancanelli (2014) who analyse how wages affect the allocation of time including time spent on housework. An interesting feature of this study is that the authors take the simultaneity of housework decisions into account so that conclusions on the effect of partners' wage on partners' time allocation can be drawn. Using a ten simultaneous equations model applied on a French dataset from 1998-99, the authors find that wage rate affects market work hours positively and housework hours negatively. Moreover, the male partner's wage rate has a significantly negative effect on the female partner's market work hours, also the female partner's wage rate has a significantly positive effect on the male partner's housework hours. To deal with the endogeneity of wages, Bloemen and Stancanelli (2014) instrument wage using past and current occupational types. The exclusion restriction that occupational type do not affect the allocation of time other than through wages is motivated by French working hour regulations, thus occupation would not determine working hours. According to us, this may be true in France, but in the case of many other countries it would not hold since evidently different occupations demand more or less working hours. Furthermore, some occupations demand inconvenient working hours (e.g. night shift) which also could have an effect on the amount of time spent on household work and childcare.

Swedish studies

The relation between housework and wages has been examined in Sweden, predominantly within a sociological context. The gendered division of labour between housework and market work in Sweden have been examined with the same data used in this thesis by Boye and Evertsson (2014) who show that women's time in market work has increased significantly between 1974-2010 while the time spent on housework has decreased. For men, the time in market work has been more or less constant during the studied period, but their time in housework has increased but at a decreasing rate (the increase mainly occurred between 1974-1991). For this reason, even though the time spent on housework is equally distributed between men and women in approximately 20 % of the households in 2010, the authors are skeptical about a large increase of this fraction in the near future. Furthermore, the authors find no support for the resource-bargaining hypothesis or the absolute earnings hypothesis (Gupta 2007). Instead, their results indicate that women with high wages have stable preferences of doing less housework (in a FE analysis).

The same dataset is used in Boye et al (2014) which focus on whether the gender wage gap in Sweden can be explained by gender differences in time spent on housework. The general observation is that the gender wage gap in Sweden has been more or less constant around 12-15 % for the last 20 years (controlling for experience, seniority, sector and qualification level). The OLS analysis of the data from 2010 shows that housework does not explain the gender wage gap, neither for persons with qualified jobs nor for persons with unqualified jobs. It should however be noted that this analysis does not take the issue of endogeneity of housework into account and is thus merely descriptive.

Evertsson and Nermo (2004) evaluate the relative resource-bargaining perspective and the gender display theory in the context of division of housework in the US and Sweden 1970-2000. The method used is separate OLS regressions for all years, where the dependent variable is hours of housework a week, the main independent variable of interest is economic dependence (resource-bargaining perspective) and the square of economic dependence (gender display approach). Their analyses show that the resource-bargaining theory receives more support in Sweden, while the gender display theory receives support in the US.

In summary, the Swedish sociological studies about housework and wages indicate that there is a gender wage gap in Sweden which is unaffected by variations in housework. Moreover, there is no support for the gender display theory. In contrary, women with high wages seem to prefer doing less housework. The results from the sociological field provide insights to the reverse relation between housework and wages which is of importance to this study in order to understand the potential endogeneity of housework. The effect of time spent on housework on wages has not been extensively investigated within the economic literature using Swedish data before, and hence this thesis will attempt to fill that void by discussing the wage effect of housework in a Swedish context. The contribution also lies within the methods used in this thesis, where we will extend previous research by investigating the endogeneity problem more thoroughly.

Data and descriptive statistics

The data used in this study is the Swedish level-of-living survey from 2010, henceforth LNU, which is collected by the Swedish Institute for Social Research (SOFI).[7] LNU is one of the longest running longitudinal social science surveys in the world which was first conducted in 1968 and has since then been replicated five times. This thesis only uses the survey from 2010, the most recent one, and is hence a cross-sectional study. Had a panel data set been used one could have dealt with possible endogeneity problems with fixed effects methods, instead other methods are applied in this thesis in attempt to solve endogeneity problems, as described in the methodology section.

It is of importance to note that the data used is survey data, thus measurement errors may occur due to respondents over- or under-reporting their time spent on housework. Other studies (e.g. Hersch 2009; Hirsch and Konietzko 2013) have used time-diary data to examine housework, where individuals have reported more or less exactly how much time they spend on different activities during a day (for some amount of days). Kan (2008) compare British time-diary and survey data and concludes that there are systematic errors in survey data, in particular both men and women over-reports time spent on housework in surveys but men over-reports significantly more than women. In Nordic countries, similar analyses contradicts Kan's (2008) findings. Using Danish data, Bonke (2005) finds that both men and women under-reports time spent on housework in surveys and women under-reports more than men do but the gender difference is quite small. Using Norwegian data, Kitterød and Lyngstad (2005) also find that respondent in general under-report time spent on housework in surveys and find no evidence of any gender differences. Boye (2008) suggests that these conflicting geographical results can be due to that social desirability to act according to gender norms is less of a problem in Scandinavian countries. Based on these results, we believe that the survey data used in this thesis do not suffer from systematic housework reporting errors due to gender. However, we cannot rule out the possibility of other systematic errors, for example that young people over-reports housework while old people under-reports housework (see Kitterød and Lyngstad 2005). There is, however, no reason to believe that the po-

[7] The interested reader can find more information on LNU at http://www.sofi.su.se/english/research/three-research-departments/lnu-level-of-living

tential measurement errors will severely impact the results, at least not as much as the the other potential endogeneity problems which we try to account for with methods complementary to OLS (and which to some extent also account for measurement errors).

The random sample in LNU 2010 uses 1/1000 of the Swedish population between 18 and 75 years of age. The respondents are asked questions about their living conditions in several areas. The areas of interest for this thesis are the ones covering the individuals' time spent on housework, income, education, health and similar individual characteristics. Information on how much time the respondents devote to housework is a sum of answers collected from the following three questions: *"How many hours per week do you spend on cleaning?"*, *"How many hours per week do you spend on cooking, doing the dishes and food shopping?"* and *"How many hours per week do you spend on doing the laundry and/or ironing clothes?"*. We expect that the accuracy of the housework variable is improved by the fact that time spent on housework is based on three separate questions because it is easier for respondents to assess time spent on specific tasks separately instead of a sole assessment of housework in general.

The data also contains information on time spent on repairs and maintenance of properties such as the respondent's house and car. Including this information would decrease the housework gender gap slightly.[8] However, we choose to omit this information from the housework variable for three reasons. First, repair and maintenance activities are less likely part of the every day housework which interferes with market work. This argument is in line with Hersch and Stratton (2000, 2002) who found that these kind of household tasks which are 'typically female' influence wages more than other types of household tasks because of the characteristics and timing. Second, this type of housework is heavily influenced by seasons and thus contain irregularities depending on when during the year the respondents provided their answers (Boye and Evertsson 2014). Third, adding this information to the housework variable induces a great loss of number of observations (approximately 550) due to missing values in the repair and maintenance information. One further restriction that we impose is not to include time

[8] The gap between the average time spent on housework decreases from approximately 4.5 hours to 3 hours, however the difference in mean is still statistically significant.

spent on childcare (such as picking up children from day care/school). The inclusion of childcare would lead to an analysis based only on individuals with young children. The aim of this thesis is to comment on the wage effect of housework for women and men in general, not just the effect on parents of young children. Moreover it should also be noted that only 741 individuals answered the questions regarding childcare.

In order to estimate wage equations we construct a set of standard wage determinants from the variables in LNU 2010. First there is Education which is defined as the total years of education, next is Experience which is defined as total years of paid employment. Following, there are five dummy variables: Children, Cohabiting, Full time, Public sector and Qualified work. These dummy variables take the value 1 if, respectively, the individual has children, is married or cohabitant, was employed full time during 2009, currently works in the public sector and if the individual's occupation is qualified work.

The sample used in this thesis is restricted to working individuals of age 18-65 that had reported an hourly before-tax wage (in SEK) in the interval [50,750]. Furthermore, the sample only includes respondents who do housework in the interval [0,40] hours per week to avoid unrealistic answers.[9] The fact that we only use information from individuals who reported a wage can cause selection bias. That is, persons who do not earn a wage may have very different characteristics than persons who earn a wage, which leads to a non-representative sample. Our restricted sample (in terms of age and housework) contains 344 individuals with missing values of wage (13 % of the total sample). If the potential wages of these individuals are affected differently by housework than individuals with an actual wage, our estimates will be biased. The reasons for the missing values of wage are unknown, but we do know that 127 out of the 344 individuals are self-employed and are thus expected to earn an income by different means than a wage. Given this fact and that the fraction is relatively low, we do not expect that the exclusion of individuals with missing values on wage severely impact our estimates. Although, the conservative reader may want to limit the validity of the results to the part of the population which earn a traditional wage. The sample size, after imposing all restrictions, is 1180 men and 1100 women.

[9] The wage and housework restriction leads to 10 and 26 omitted observations, respectively. The restrictions do not cause any major differences in the baseline results.

For descriptive statistics on the variables included, see Table 1. Starting with the dependent variable it becomes clear from Table 1 that the mean hourly wage is lower for women than for men, 153.95 SEK compared 180.91 SEK. The difference in mean hourly wage for men and women is statistically significant at the 1 % level, see Appendix A for t-tests. Table 1 also displays the variables included in the standard wage equations, such as Experience and Education. Next is the main variable of interest, Housework. The difference in mean hours spent on housework between men and women is quite large (and statistically significant, see Appendix A), 8.10 hours compared to 12.81 hours. The next type of variables are the ones stemming from Becker's (1985) effort hypothesis and include variables that are assumed to affect individuals' effort. The second channel are variables stemming from the selection hypothesis and include variables reflecting working conditions [10]. Table 1 also shows descriptive statistics for the instrumental variable, Equality opinion, where 56.09 % of women and 46.10 % of men strongly supported the question *"What do you think about the suggestion of committing to a society where men take the same amount of responsibility for children and housework as women?"*.

[10] Descriptive statistics of two digit profession identification is omitted from Table 1 due to lack of space.

Table 1: Descriptive Statistics

VARIABLES	Females		Males	
Dependent variable	Mean	Std.Dev.	Mean	Std.Dev
Wage	153.9493	50.0836	180.9051	73.4482
Standard wage determinants				
Cohabiting	0.7309	0 .4437	0.7085	0.4547
Education	14.0227	3.1340	13.5898	2.9410
Experience	21.0364	12.3416	21.3576	13.1788
City	0.3636	0 .4813	0.3200	0.4668
Full time	0.9782	0.1462	0.9703	0.1697
Public sector	0.5573	0.4969	0.2534	0.4351
Children	0.5236	0.4997	0.4703	0.4993
Qualified work	0.4809	0.4999	0.4559	0.4983
Explanatory variable of interest				
Housework	12.8109	6.5419	8.1072	4.7970
Housework dummy	0.1964	0.3974	0.0466	0.2109
Health channel - effort hypothesis				
Fatigue	0.2718	0.4451	0.1602	0.3669
Stomach	0.2073	0.4055	0.1288	0.3351
Headache	0.5182	0.4999	0.3805	0.4857
Sleep	0.2191	0.4138	0.1305	0.3370
Overwork	0.0718	0.2583	0.0407	0.1976
Working conditions channel - selection hypothesis				
High flexibility*	0.3178	0.4660	0.4483	0.4976
Heavy lift	0.0791	0.2700	0.1915	0.3937
Physically demanding	0.4427	0.4969	0.4051	0.4911
Mentally demanding	0.6364	0.4813	0.5711	0.4951
Stressful work	0.7673	0.4228	0.7322	0.4430
Monotonous work	0.1746	0.3798	0.1966	0.3976
Mental work	0.3036	0.4600	0.2271	0.4192
Emotionally demanding	0.2273	0.4193	0.0525	0.2232
Instrument				
Equality opinion	0.5609	0.4965	0.4610	0.4987
Sample size	1100		1180	

*number of observations: 664 for women and 774 for men.

Methodology

The greatest methodological challenge of estimating the causal effect of housework on wages is the potential endogeneity of housework. Three reasons are often used to describe why a variable is endogenous in the standard OLS regression: omitted variables, simultaneous causality and measurement errors. In fact, all of these are potential problems when estimating the effect of housework on wages. First, most often there are unobserved characteristics that affect both time spent on housework and wages. This could for example be individual ability such that low ability workers may have both low wages and spend more time on housework. Failure of controlling for ability will thus cause a downward bias of the effect of housework (it will enhance the presumed negative effect). Second, it is evident that there can be simultaneous causality between housework and wages. Housework is presumed to have an effect on wages (the direction of causality examined in this study) but at the same time wages likely affect time spent on housework as well (the direction of causality examined in most sociological studies on the topic). Consider workers with a high market wage, for these individuals the opportunity cost for spending time on housework is high, and as Hersch and Stratton (1997) argue these workers may be more likely to substitute market solutions for housework which will reduce their time spent on housework. If this is the case, then the housework time that we observe could be correlated with the error term, and the OLS estimate will be downward biased (Hirsh and Koneitzko 2013). That is, housework will appear to have a greater negative effect on wages than it actually has. Thirdly, the housework variable is most often obtained through surveys as self-assessed time spent on housework and can thus be inflicted by measurement errors. This is of less concern in this study as discussed in relation to the data type in the data section.

In order to shed light on the relationship between housework and wages in Sweden, we apply three different methods. In this section, the application of the methods are described and discussed. The basic approach is to use OLS as a foundation for the analysis and use two other methods which partly deal with the endogeneity of housework as a complementary analysis. Following previous studies (e.g. Hersch and Stratton 2002; Bryan and Sevilla-Sanz 2011; Hirsh and Koneitzko 2013) the main analysis throughout this thesis is conducted for females and men separately.

OLS regression

In earlier studies about housework and wages the most commonly used method is ordinary least squares (OLS). The advantage of using OLS is that the method provides an intuitive way of examining potential channels of the housework wage penalty. The disadvantage is, as previously mentioned, that housework may be endogenous and thus the estimated effect in the OLS regression will be biased. In applying OLS, we estimate the following wage equation in a similar vein as Hersch (1991a) and Hersch and Stratton (1997):

$$W = \beta_1' X + \beta_2' H + \varepsilon \tag{1}$$

Where W is the logarithm of before-tax hourly wage, X is a vector of measurable characteristics assumed to affect wages. The standard wage determinants in X, in what we call the baseline regression, are Education, Experience and its square, City, Full time, Public sector, Children and Qualified work (see Appendix B for a comprehensive description of the variables). H is hours per week spent on housework and ε is the error term. Becker's (1985) theory postulates that housework has a negative effect on wages and accordingly β_2 is expected to be negative.

As mentioned before, there are two main channels through which housework may effect the wage; by reducing the amount of effort left for market work and by influencing the type of work chosen. We start by investigating these two channels with OLS. Our first specification covers the selection hypothesis investigated through the working conditions channel, where the argument is that individuals who take on greater household responsibilities may seek jobs that are easier to combine with a higher share of housework. For example jobs with a high degree of flexibility may be associated with a wage penalty since they are costly for employers. Thus, we add variables to the baseline regression which reflect working conditions (for a complete list and description of variables included see Appendix B) which are expected to reduce the negative effect of housework on wages. The second specification will cover the effort hypothesis, where the line of reasoning is that individuals that take on greater household responsibilities will have less effort left for market work which in turn reduces their labour productivity and thus their wage. Where the reduced effort would manifest itself as a worsening of individuals' health in stress related areas such as fatigue, headaches and a sense of overwork. Therefore, in the second specification we add variables to the baseline regression which measures individual health, concerning symptoms of stress, which are expected to reduce the negative effect of housework on wages. Both of these channels offer explanations to why the gender wage gap persists. That is, since women perform a greater share of housework their wages will be reduced either because of working conditions or because of a reduction of effort.

Further, OLS is used in order to estimate a non-linear specification of the housework-wage equation. Initially, the housework variable is broken down into 20 dummy variables, each representing a 2 hours interval in the span [0,40]. The following model is then estimated:

$$W = \alpha_1' X + \alpha_2' H^{2-4} + \cdots + \alpha_{20}' H^{38-40} + \varepsilon \tag{2}$$

Where W and X are defined in the same way as in equation (1) but the effect of housework is estimated for each level of housework in comparison to the 0-2 hours category.

Based on the results from equation (2)[11], the main non-linear specification is defined as follows:

$$W = \gamma_1' X + \gamma_2' H^{18-40} + \varepsilon \tag{3}$$

Equation (3) is identical to equation (2), except that it only includes one dummy variable, H^{18-40}, which captures the effect of doing 18 hours or more housework per week in comparison to doing less than 18 hours of housework per week. That is, it captures the threshold of 18 hours per week which we are interested in.

IV regression

As initially described, if the time spent on housework is correlated with the error term then the estimates from OLS will be biased. In attempt to correct for the endogeneity problem we will use instrumental variable (IV) regressions. In IV regressions, the endogenous explanatory variable of interest is instrumented by a variable which fulfills two requirements, it should be correlated with the explanatory variable of interest (the existence of a first stage) and uncorrelated with the dependent variable and any other determinants of the dependent variable (the exclusion restriction). By using IV regression, only the part of the variation in the explanatory variable of interest which is not endogenous is utilised.

In order to perform the IV regressions one needs a valid instrument which fulfills the two requirements. To find a valid instrument is, to say the least, challenging. It is usually the exclusion restriction, which is an identifying assumption, that is most difficult to motivate. A number of instruments used in previous studies where considered, such as house characteristics (e.g. number of rooms) and partner characteristics (e.g. the partner's wage, work time and education). The house characteristics where ruled out as instrument because the exclusion restriction cannot be properly motivated, it is evident that for example the size of ones house is related to ones wage in other ways than through the time spent on housework. A similar argument can be made for partner characteristics, for example highly educated persons

[11] See Figure 1 in the Results section.

often couple with other highly educated persons thus the partner's education affects the other partner's wage through other channels than time spent on housework. Other instruments considered, not used in any other studies of our knowledge, where sibling position, age when moving away from home and years of cohabiting in current relationship. These instruments where ruled out primarily due to re-markedly weak correlation with housework[12] but also due to insufficient motivation of the exclusion restriction.

In this study we introduce the instrument Equality opinion, not used in any other study of our knowledge. The instrument is based on individuals' attitudes towards gender equality within the family and is formed from the question in LNU: *"What do you think about the suggestion of committing to a society where men take the same amount of responsibility for children and housework as women?"*. The variable Equality opinion is constructed as a dummy variable where the individuals who have answered that the suggestion is very good are given the value 1, while the rest are given the value 0.[13] The existence of a first stage is not difficult to motivate, if individuals agree with the statement, then the instrument should be correlated with the time they spend on housework.

Regarding the exclusion restriction, we argue that one's opinion about equality within the family should not effect wage through any other channels than housework. This is because the question relates to what kind of society one wants to live in (it is to large degree a hypothetical question) and the opinion of the ideal society in terms of gender equality is not necessarily related to ones wage or unobserved characteristics. For example, persons with high wages may spend few hours doing housework because it is compatible with their family organisation, however this does not mean that they in fact think that their family organisation is ideal. This line of argument does not exclude the existence of a first stage since a positive opinion may still increase or decrease the time spent on housework to some extent. Similarly, persons with an unrevealed preference for spending time on housework, may still have

[12] The first-stage F-values for these other instruments where for sibling position F= 1.32 for women and F= 0.46 for men, for age when moving away from home F= 3.17 for women and F= 1.85 for men, and for years of cohabiting in current relationship F= 4.88 for women and F= 23.96 for men.

[13] The remaining available evaluations of the suggestion are 'Pretty good', 'Neither good or bad', 'Pretty bad', 'Very bad' and 'Do not know'.

a different idea of gender equality within families in general. Thus an important aspect of the instrument is that the underlying question does not refer to ones own family but families in general. Nevertheless, we do acknowledge the possibility that Equality opinion can be affected by persons' unrevealed preferences and characteristics and thus the endogeneity of housework will prevail. It may also be that the amount of housework a person does determines how the person answers the question, for example a woman who does the majority of housework in a household may chose to disapprove the suggestion in order to justify her own living circumstances.

In order to understand potential biases in the IV estimate of housework with the chosen instrument, we take a look at the instrumental variable regression procedure. Equation (4) is a simplified version of the OLS equation (1) where W is (hourly) wage and H is Housework, which here is endogenous so that H and the error term ε are correlated. Equation (5) shows the first stage (simplified without baseline covariates) where the dependent variable is Housework, Z is the instrument Equality opinion and η is the error term. With a valid instrument, one can obtain $\widehat{H}$ from equation (5) by OLS and use this estimate in equation (4) and thus only use the part of housework which is exogenous.

$$W = \beta' H + \varepsilon \tag{4}$$

$$H = \gamma' Z + \eta \tag{5}$$

When we only have one instrument and one endogenous explanatory variable of interest, the IV estimate can be written as $\widehat{\beta}_{IV} = (Z'H)^{-1}Z'W$ or $\widehat{\beta}_{IV} = \beta + \frac{Z'\varepsilon}{Z'H}$. Taking the probability limit of $\widehat{\beta}_{IV}$ yields equation (6) which shows that the IV estimate is only unbiased if Z is uncorrelated with ε.

$$\operatorname{plim} \widehat{\beta}_{IV} = \beta + \frac{\sigma_{Z,\varepsilon}}{\sigma_{Z,H}} \tag{6}$$

The bias term in equation (6) captures the impact of both the exclusion restriction $\sigma_{Z,\varepsilon} = 0$ and the existence of a first stage $\sigma_{Z,H} \neq 0$. We can use this expression to form expectations about a potential bias of the IV estimate. As previously mentioned, one of the greatest disadvantage with Equality opinion is that people might answer the question in a certain way in order to justify their own housework behaviour, thus housework affects equality opinion rather than the other way around. If wage determines housework, then it will determine equality opinion as well which will cause correlation between the instrument and the error term. To investigate what may happen in this situation, we assume that women who do much housework have some characteristic which we call low ability[14] that causes low wages and these women justify their housework by having a negative equality opinion.

Similarly, men who do much housework have low ability that causes low wages and these men justify their housework by having a positive equality opinion. According to these assumptions, for women, the negative effect of housework on wages is really due to that negative equality opinion is associated with low ability. Similarly for men, the negative effect of housework on wages may in fact be due to that positive equality opinion is associated with low ability. These situations will lead to a downward bias since for women the instrument is positively correlated with ε and $\sigma_{Z,H}$ is negative while it is reversed for men, $\sigma_{Z,\varepsilon}$ is negative and $\sigma_{Z,H}$ is positive.[15] The magnitude of the bias is enhanced if the denominator in the bias term of equation (6) is close to zero, i.e. if the correlation between the instrument and explanatory variable of interest is weak.

In summary, the main problems with using Equality opinion as an instrument for housework is that neither can we guarantee that persons with a positive equality opinion is completely similar to persons with a negative equality opinion other than when it comes to housework, nor that persons answer the question independently of how much housework they actually do. An ideal instrument would be something that completely randomly affected time spent on housework. The ideal situation would be an experiment where a randomly selected fraction would receive a household appliance which greatly reduced

[14] Ability is just a phrase used to describe unknown characteristics and preferences which affects wages positively and housework negatively.

[15] See Table 5 for first stage equations.

time spent on housework. To find such situations, where people do not make an active choice but rather are forced or offered an advantageous opportunity for treatment, is very difficult. In this thesis we have decided to use Equality opinion as an instrument for housework despite the risk of biased estimates. The nature of the instrument will thus not allow for casual interpretation but, at the very least, it will highlight the issues involved in accounting for the endogeneity of housework in the housework-wage equation.

Propensity score matching

The above empirical OLS specification is extended with the addition of housework as a dummy variable in order to shed light on potential threshold effects of housework as examined in previous literature (Hersch and Stratton 1997; Hersch 2009). That is, the significant negative effect of housework on wages may start after a certain amount of time spent on housework, as mentioned we use the threshold level 18 hours or more of housework. In order to deal with endogeneity in this framework, propensity score matching is applied. Matching is a technique used to estimate the effect of a treatment by accounting for the covariates that predict treatment. That is, what matching tries to do is to mimic randomisation by creating a sample of individuals that received treatment that is comparable on all covariates to those individuals that did not receive treatment (Caliendo and Kopeinig 2008).

The matching is done using the propensity to be treated, i.e. the probability of conducting more than the threshold hours of housework per week (the treatment) should be more or less equal for controls and treated. The propensity scores are calculated using a probit model where the covariates are the standard control variables from the baseline regression. The procedure that follows is that the sample is divided into blocks so that the mean propensity scores for treated and untreated are similar within every block. The blocks enable analysis of the balancing property, i.e. t-tests are performed for the covariates within each block to ensure that the treatment and control group are similar in terms of covariates.

Once the treatment and control group are established, each treated individual is matched with a very similar untreated individual and the average treatment effect of the treated (ATT) is obtained by taking the average of the difference in the logarithm of wage between treated and controls as follows:

$$ATT = \frac{1}{m}\sum_{i=1}^{m}(W_i^{treated} - W_i^{control}) \tag{7}$$

The matching of individuals can be performed in various ways, in this study we apply nearest-neighbour matching, radius matching and Kernel matching. The nearest-neighbour approach matches each treated individual with the control which has the closest propensity score. This method is intuitively straight forward but it can lead to 'bad' matches since the nearest-neighbour for some treated individuals may not be very 'near'. Using radius matching, one can define what is sufficiently near in terms of propensity score. In this study, the radius sizes tested are 0.1, 0.01 and 0.001. The Kernel approach matches each treated individual with a weighted average of all controls, where near controls are given larger weights. All matching methods are applied *with* replacement, i.e. the same control can be matched with several treated observations, to avoid bad matches and sample shrinkage. Furthermore, the standard errors of the ATT estimates are estimated using bootstrap with 200 replications.

The advantage of using propensity score matching is that it balances treatment and control group, on a large group of covariates, without losing a large number of observations. By comparing two very similar groups, it is possible to obtain a less biased treatment effect than in the case of OLS. One disadvantage of propensity score matching is that it only accounts for observed (and observable) covariates. Unobserved factors that could affect who is and who is not treated, and thereby could affect the outcome, cannot be accounted for in the matching procedure. As the procedure only controls for observed variables, any hidden bias due to latent variables may remain after matching. One other problem is that propensity score matching requires large samples, with substantial overlap between treatment and control groups. To our knowledge the use of matching has not been employed in previous studies of the housework-wage relation.

Results

OLS results

In this section the results from the ordinary least squares (OLS) regressions are presented. The baseline results are reported in Table 2. First the simplest regression possible is presented, where Wage is regressed on Housework (see column 1 and 3 of Table 2), and the results shows that Housework has the expected negative association with wages for both men and women, however only statistically significant for women. Next in the baseline regression which includes standard controls (see column 2 and 4 in Table 2), the housework coefficient remains negative and only significant for women, where housework reduce women's wages with 0.22 %.[16] Turning the attention to the control variables, the variables Education, Experience and its square, City, Full time, Public sector and Qualified work are all significant and have their expected sign. It is worth noting that Cohabiting has a positive and significant effect on men's and women's wages, thus it seems that a marriage/cohabitation premium is present. The marriage premium is a debatable wage effect, where previous studies have found mixed results, as an example consider Lincoln (2008) who finds no support for the marriage premium. The same line of reasoning can be applied to the positive and significant effect of Children found in Table 2 (see for example Bryan and Sevilla-Sanz 2011).

[16] The difference in the housework effect on wages between women and men is however not statistically significant according to the baseline regression for the full sample (both women and men) with an interaction term between Gender and Housework (specific results not provided in this thesis).

Table 2: Baseline results

	(1)	(2)	(3)	(4)
VARIABLES	Females		Males	
Housework	-0.0027**	-0.0022**	-0.0021	-0.0013
	(0.0012)	(0.0010)	(0.0021)	(0.0016)
Cohabiting		0.0331**		0.0429**
		(0.0148)		(0.0195)
Education		0.0227***		0.0272***
		(0.0031)		(0.0036)
Experience		0.0142***		0.0161***
		(0.0021)		(0.0024)
Experience^2		-0.000183***		-0.000196***
		(0.00005)		(0.00005)
City		0.0903***		0.0829***
		(0.0139)		(0.0176)
Full time		0.0750**		0.0992*
		(0.0301)		(0.0511)
Public sector		-0.0786***		-0.1450***
		(0.0137)		(0.0184)
Children		0.0328**		0.0366*
		(0.0157)		(0.0195)
Qualified work		0.1780***		0.2600***
		(0.0152)		(0.0188)
Constant	5.0320***	4.3280***	5.1530***	4.3040***
	(0.0186)	(0.0510)	(0.0188)	(0.0694)
Observations	1100	1100	1180	1180
R-squared	0.0040	0.3930	0.0010	0.4290

Dependent variable in all regressions is the logarithm of before-tax hourly wage. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Next the analysis is extended by considering the working conditions channel, results reported in Table 3, where the baseline regression results are also included for comparison. What the working condition channels are supposed to test is the hypothesis that men and women who do much housework will choose jobs that are easier to combine with housework and that these jobs carry a wage penalty (the selection hypothesis). Thus the expected effect, is that the inclusion of working conditions reduces the negative wage effect of housework in the baseline regression. This channel is investigated in three ways; first a control for jobs with a higher degree of flexible hours is included (columns 2 and 6), second controls for specific working conditions are included (columns 3 and 7), and finally a profession effect is controlled for (columns 4 and 8).

Starting with the High flexibility variable, it seems that jobs with a high degree of flexible hours have positive and significant effect on both women's and men's wages, contrary to the expected effect. The inclusion of High flexibility also further enhances the wage penalty of housework for women but reduces it for men. Indicating that the housework wage penalty for women is not explained by the selection into jobs that are more compatible with housework, while a part of the housework wage penalty for men can be explained by selection into flexible jobs, however the estimates for men are not statistically significant. Furthermore, these results should be interpreted with some caution, since the number of observations is greatly reduced and there could possibly be some kind of selection bias from who answered the question.

The second control is specific working conditions, such as stress at work and heavy lifting. The inclusion of these working condition variables does have the expected effect on housework for women, where the wage reduction of housework is now 0.16 %, giving some support to the idea that women choose jobs with compensating wage differentials in response to greater housework responsibilities, but the reduction is not enough to conclude that the selection hypothesis holds. The results for men are reversed, the housework wage penalty is enhanced when controlling for specific working conditions, however the estimates are not statistically significant.

Table 3: Selection hypothesis results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Females				Males			
VARIABLES	Baseline				Baseline			
Housework	-0.0022**	-0.0035**	-0.0016*	-0.0020**	-0.0013	-0.0009	-0.0016	-0.0014
	(0.0010)	(0.0015)	(0.0010)	(0.00010)	(0.0016)	(0.0022)	(0.0016)	(0.0016)
High flexibility		0.0898***				0.0750***		
		(0.0202)				(0.0204)		
Heavy lifts			0.0481**				-0.0416**	
			(0.0237)				(0.0178)	
Physically demanding			-0.0712***				-0.0543***	
			(0.0130)				(0.0166)	
Mentally demanding			0.0220				0.0515***	
			(0.0141)				(0.0156)	
Stressful work			-0.0070				0.0333**	
			(0.0151)				(0.0163)	
Monotonous work			-0.0679***				-0.0541***	
			(0.0153)				(0.0170)	
Mental work			0.0257*				0.0458**	
			(0.0141)				(0.0189)	
Emotionally demanding			-0.0589***				-0.1700***	
			(0.0154)				(0.0287)	
Constant	4.3280***	4.2320***	4.3830***	4.4100***	4.3040***	4.1950***	4.3580***	4.5170***
	(0.0510)	(0.0772)	(0.0540)	(0.0537)	(0.0694)	(0.0992)	(0.0749)	(0.0886)
Profession effect	NO	NO	NO	YES	NO	NO	NO	YES
Observations	1100	664	1100	1100	1180	774	1180	1180
R-squared	0.3930	0.4460	0.4300	0.5190	0.429	0.4230	0.4660	0.5360

Dependent variable in all regressions is the logarithm of before-tax hourly wage. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard control variables (Education, Experience and its square, City, Full time, Public sector, Children and Qualified work) are included in all regressions but suppressed from table.

Finally, working conditions are controlled for through a Profession effect, where profession is controlled for with two digits precision.[17] When including the Profession effect, Housework remains significant for women and its effect becomes somewhat less negative. Thus, it seems that some of the negative effect of housework on women's wages found in the baseline regressions is explained by a pure profession effect, however a large part of the negative association on women's wages remains. For men, there is essentially no difference between the estimate from the baseline regression and the regression including the Profession effect and yet again the housework wage penalty is not statistically significant. These are similar to the results presented in Bryan and Sevilla-Sanz (2011) who do not find that controlling for occupation reduces the negative effect of housework.

The second hypothesis on how housework can affect wages is through reduced effort, which here is assumed to manifests itself as a worsening of individual health in effort related variables, e.g. feelings of fatigue (i.e. the health channel). Thus, what is expected is that when health variables are included, they should have a negative effect on wages and they should reduce the negative effect of housework on women's wages. The results are presented in Table 4, in which one can see that the only health variable that is statistically significant is Fatigue. The inclusion of health variables does not appear to change the effect of housework, since its coefficient remains more or less unchanged in magnitude for both men and women. Thus, for our sample the health channel does not seem to account for the effect of housework on wages. However, the lack of support for the effort hypothesis can be a result of that the variables included here do a less than perfect job of accounting for reduced effort. For example, consider the Fatigue variable, a general sense of fatigue could of course be a result of housework as well as the result of one's work, therefore we cannot be certain in which way the included health variables are affected, i.e. if they are an outcome from one's workload or from one's housework responsibilities.

[17] The two digit profession categories are in accordance with the Nordic occupation classification system (NYK85) which in turn is based on the International Standard Classification of Occupations (ISCO).

Table 4: Effort hypothesis results

	(1)	(2)	(3)	(4)
	Females		Males	
VARIABLES	Baseline		Baseline	
Housework	-0.0022**	-0.0022**	-0.0013	-0.0013
	(0.0010)	(0.0010)	(0.0016)	(0.0016)
Fatigue		-0.0278*		-0.0358*
		(0.0149)		(0.0203)
Stomach		-0.0068		-0.0227
		(0.0146)		(0.0251)
Headache		-0.0090		-0.0224
		(0.0138)		(0.0157)
Sleep		0.0046		-0.0106
		(0.0178)		(0.0235)
Overwork		0.0151		0.0167
		(0.0268)		(0.0340)
Constant	4.3280***	4.3440***	4.3040***	4.3280***
	(0.0510)	(0.0522)	(0.0694)	(0.0686)
Observations	1100	1100	1180	1180
R-squared	0.3930	0.3950	0.4290	0.4340

Dependent variable in all regressions is the logarithm of before-tax hourly wage. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard control variables (Education, Experience and its square, City, Full time, Public sector, Children and Qualified work) are included in all regressions but suppressed from table.

IV results

In this section the results from the instrumental variable (IV) regressions are presented. As mentioned earlier, the application of IV is conducted in this study in attempt to reduce the endogeneity of housework.

The chosen instrument in this study is the opinion that time spent on housework should be equally distributed within couples. As previously described, we argue that ones opinion about the distribution of housework should affect the time spent on housework but not necessarily affect ones wage directly or indirectly (through any other covariate than housework). It should however be clarified that there is a risk of individuals stating their housework equality opinion with their own time spent on housework in mind, thus the unrevealed preferences and the endogeneity of housework prevails. This will most likely cause downward biased estimates as described in the methodology section.

Table 5 shows the first stage regressions where Housework is regressed on Equality opinion. The F-values for females and males are around the rule-of-thumb value 10, thus the instrument is on the verge of suffering from weak instrument issues.

Table 5: First stage regressions

VARIABLES	(1) Females	(2) Males
Equality opinion	-1.1900***	1.0270***
	(0.3960)	(0.2790)
Constant	13.4800***	7.6340***
	(0.2970)	(0.1890)
Observations	1100	1180
R-squared	0.0080	0.0110
F-value	9.0300	13.5900

Dependent variable is Housework. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Knowing that women on average spend more time on housework than men, the coefficients of the first stage regressions have the expected signs. More specifically, women who endorse equality do approximately 1.2 hours less housework on average and men who endorse equality do approximately 1 more hour of housework on average.

Table 6 shows the results from the IV regressions in comparison to the OLS baselines. For females, the magnitude of the coefficient for housework in the IV specification is more than 10 times larger than in the OLS specification. Under the assumption of a valid instrument, this indicates that there is a negative (although not statistically significant) causal effect of time spent on housework on wages for women, an effect that is much larger than shown in the OLS regression. The conclusion regarding the IV estimate of housework is evidently limited by the fact that the coefficient is not statistically significant. Nevertheless, it is perhaps even more limited by the fact that the validity of the instrument can be questioned. It may be that the IV estimates are downward biased as described in the methodology section, and since the estimated wage penalties in the IV regressions are substantially larger than the OLS estimates, one may suspect that the weak correlation between the instrument and housework (see F-values in Table 5) have enhanced the bias.

If we for a moment assume that the instrument in fact is valid, it is worth to comment on the large difference in magnitude of the effect between OLS and IV. What in this case drives the difference is difficult to pinpoint. Although, it seems so that the anticipated downward bias from simultaneous causality (high wage leads to less housework) in the OLS specification is not true, instead it may be that a high wage leads to more housework and thus causes an upward bias of the OLS estimate. Omitted variable bias may also be the reason for the difference between the OLS and IV estimate, it is possible that unobserved 'ability' is positively correlated with both time spent on housework and wages and thus omitting this covariate in the OLS regression causes an upward bias of the housework effect. However, again, because of the large difference between OLS and IV the most likely situation is that the instrument fails to account for the endogeneity of housework.

Table 6: IV results

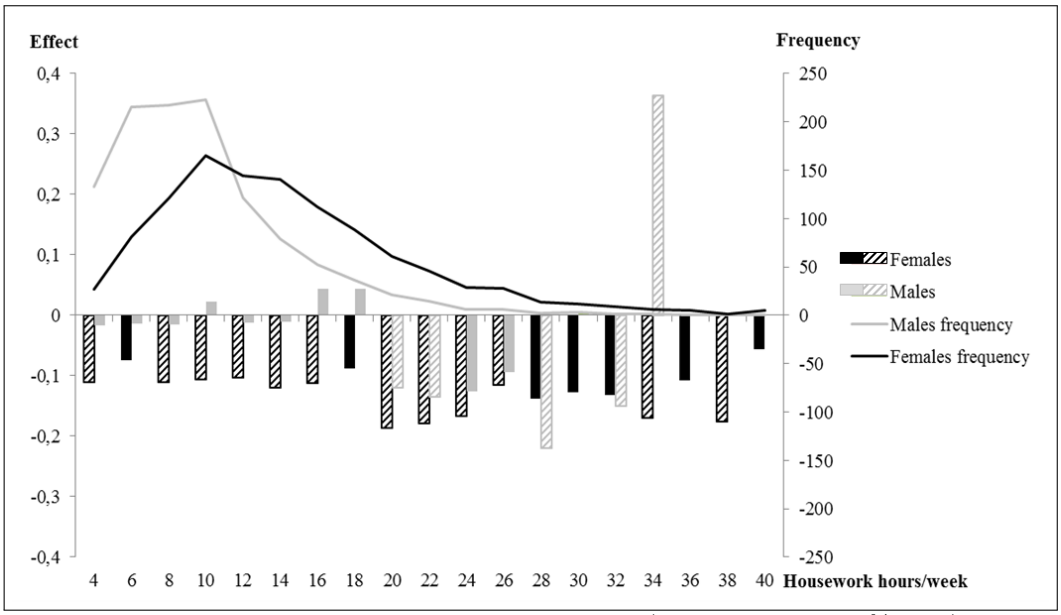
	(1)	(2)	(3)	(4)
	Females		Males	
VARIABLES	OLS	IV	OLS	IV
Housework	-0.0022**	-0.0276	-0.0013	-0.0199
	(0.0010)	(0.0263)	(0.0016)	(0.0223)
Cohabiting	0.0331**	0.0159	0.0429**	-0.0167
	(0.0148)	(0.0256)	(0.0195)	(0.0738)
Education	0.0227***	0.0203***	0.0272***	0.0293***
	(0.0031)	(0.0043)	(0.0036)	(0.0045)
Experience	0.0142***	0.0176***	0.0161***	0.0177***
	(0.0021)	(0.0045)	(0.0024)	(0.0033)
Experience^2	-0.000183***	-0.000210***	-0.000196***	-0.000229***
	(0.00005)	(0.00007)	(0.00005)	(0.00007)
City	0.0903***	0.0613*	0.0829***	0.0960***
	(0.0139)	(0.0339)	(0.0176)	(0.0237)
Full time	0.0750**	0.0587	0.0992*	0.1030**
	(0.0301)	(0.0381)	(0.0511)	(0.0499)
Public sector	-0.0786***	-0.0718***	-0.1450***	-0.1320***
	(0.0137)	(0.0183)	(0.0184)	(0.0246)
Children	0.0328**	0.1560	0.0366*	0.0729
	(0.0157)	(0.1300)	(0.0195)	(0.0463)
Qualified work	0.1780***	0.1430***	0.2600***	0.2480***
	(0.0152)	(0.0404)	(0.0188)	(0.0246)
Constant	4.3280***	4.6200***	4.3040***	4.4310***
	(0.0510)	(0.3090)	(0.0694)	(0.1700)
Observations	1100	1100	1180	1180
R-squared	0.3930	0.0740	0.4290	0.3670

Dependent variable in all regressions is the logarithm of before-tax hourly wage. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Threshold analysis and matching

So far, time spent on housework have been considered to be a continuous variable and thus the effect of housework has been assumed to be linear in the previous analysis. Since some amount of housework is a necessary part of essentially all people's life, which is recognised by both employers and employees, it may be that the significant negative impact of housework on wages starts at some threshold above the 'normal' time people spend on housework (Hersch and Stratton 1997; Hersch 2009). To gain a better understanding of the effect of housework on wages for different levels of time spent on housework, the baseline OLS regression is conducted with dummy variables for each 2 hour interval in the span [0,40], using the interval 0-2 hours as reference level. The resulting effects of housework at different levels, compared to the level of 0-2 hours, are graphically illustrated in Figure 1 together with the frequency distributions across the housework hours range. It is clear that the distribution for men is more skewed towards few housework hours, however the distribution for both women and men peaks at the 8-10 hour category.

Figure 1: Threshold effects



Note: Patterned bars indicate significant effects (on at least the 10 % level)

There is a persistent negative association between housework and wages across all intervals for women while the housework effect for men is more irregular. Nevertheless, it seems like the negative impact of housework on wages begins after 18 hours for men. Similarly for women, after the 18 hours threshold, the negative impact is notably increased. [18]

Based on these results, the OLS regressions are re-specified to include a dummy variable of housework which takes the value 1 if housework hours are larger than or equal to 18 hours and 0 otherwise. The results are shown in Table 7 from which it is clear that spending more than 18 hours of housework a week is associated with a large wage penalty for both women and men. However, the negative effect is approximately twice as large for men compared to women. The difference in the housework effect between women and men is statistically significant at the 10 % level as shown in Table 8 where the full sample is used to run the baseline regression including an interaction term between the housework dummy and gender. These results provide an important illustration of the gender difference in the housework wage penalty which may partly explain why women still perform more housework than men (since women suffer less of a wage penalty than men do).

The results presented in this section so far may be biased due to endogeneity of housework in the same way as previous OLS regressions. The IV strategy applied above cannot be used when housework is defined as a threshold because the first stage regressions are close to non-existent.[19]

[18] Note that in Figure 1 the large positive (and significant) effect for men in the category with an upper limit of 34 hours is based on a single observation.

[19] In the first stage regressions the F-value for females is 1.56 and the F-value for males is 0.21.

Table 7: Housework as a dummy

VARIABLES	(1) Females	(2) Males
Housework dummy	-0.0540***	-0.1110***
	(0.0152)	(0.0365)
Cohabiting	0.0313**	0.0359*
	(0.0150)	(0.0192)
Education	0.0228***	0.0271***
	(0.0031)	(0.0036)
Experience	0.0141***	0.0162***
	(0.0021)	(0.0024)
Experience^2	-0.000182***	-0.000196***
	(0.00005)	(0.00005)
City	0.0904***	0.0823***
	(0.0138)	(0.0174)
Full time	0.0709**	0.0994**
	(0.0289)	(0.0500)
Public sector	-0.0784***	-0.1460***
	(0.0137)	(0.0181)
Children	0.0337**	0.0373*
	(0.0155)	(0.0192)
Qualified work	0.1770***	0.2590***
	(0.0151)	(0.0186)
Constant	4.3160***	4.3030***
	(0.0508)	(0.0684)
Observations	1100	1180
R-squared	0.3960	0.4340

Dependent variable in all regressions is the logarithm of before-tax hourly wage. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 8: Difference in housework effect between females and males

VARIABLES	(1)
Housework dummy	-0.1140***
	(0.0357)
Housework dummy*Female	0.0647*
	(0.0389)
Constant	4.3750***
	(0.0449)
Observations	2280
R-squared	0.4400

Dependent variable is the logarithm of before-tax hourly wage. Robust standard errors in parentheses. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$. Standard control variables (Education, Experience and its square, City, Full time, Public sector, Children and Qualified work) are included in the regression but suppressed from table.

In order to reduce the potential endogeneity of the housework dummy, propensity score matching is applied as described in the methodology section. In the process of defining control and treatment group based on propensity score, 5 blocks are identified within the range of propensity score common support for females [0.0490, 0.5733] (see Appendix C Figure 2). For males, 3 blocks are identified within the range of propensity score common support [0.0095, 0.2118] (see Appendix C Figure 3). In these blocks, the balancing property is satisfied for both females and males.

The results from the different matching procedures described in the methodology section are reported in Table 9 (Panel A for females and Panel B for males). Looking at the nearest-neighbour estimates for the average treatment effect on the treated for women, it differs quite a bit from the other methods. This could be a result of the nearest neighbour not being very

near and thus leading to bad matches. The nearest-neighbour estimate for women is also the only estimate which is not statistically significant and the number of controls used are very few compared to the other methods. The wage penalty for women who do 18 hours or more is statistically significant and of the same magnitude for both radius and Kernel matching. What the results indicate is that women who do 18 hours or more of housework have 6.2-7.6 % lower wages, hence the estimated negative effect of housework is larger using matching compared to the OLS estimate of approximately 5.4 %.[20] For men the effects from all three matching methods are statistically significant, and indicate that men who do 18 hours or more of housework have 13.5-20.4 % lower wages, which once again is larger in magnitude than the 11.1 % estimated by OLS.[21]

The different matching methods yield more varying estimates for men than for women. This may be due to that men have worse common support properties (see Appendix C) with fewer treated observations than untreated observations, especially in the upper part of the propensity score scale. This could actually affect the estimates from all matching method. Thus, there is an increased risk of bad matches. Nevertheless, all estimates from the matching procedure points in the same direction (except the nearest-neighbour estimate for women), namely a larger wage penalty than observed using OLS. However, it should be re-stated that all matching strategies are essentially a form of control strategy, and thus any hidden bias caused by latent variables may still persist after matching. For example, if persons who do 18 hours or more housework per week have some unobserved common characteristic which affects wage negatively, the matching estimates will be downward biased.

The choice to employ the matching strategy was an attempt to reduce the endogeneity of housework, which was also the aim of the IV strategy previously used. It is noteworthy that the results from both of these two methods suggests that the estimated wage penalty from housework is greater than the estimates provided by OLS. This can either be due to that the bias of these methods works in the same direction, or that the OLS estimates are upward biased.

[20] OLS estimates from Table 7
[21] Once again compare with OLS estimates from Table 7

Table 9: Matching results

Panel A: Females				
Matching Method	**No. treated**	**No. untreated**	**ATT**	**t-stat**
Nearest-neighbour	216	177	-0.0070	-0.2460
			(0.0280)	
Radius (0.1)	216	822	-0.0760	-4.2730
			(0.0180)	
Radius (0.01)	213	822	-0.0700	-4.0660
			(0.0170)	
Radius (0.001)	190	510	-0.0630	-2.5300
			(0.0250)	
Kernel	216	822	-0.0620	-3.4070
			(0.0180)	
Panel B: Males				
Nearest-neighbour	55	53	-0.1860	-2.5840
			(0.0720)	
Radius (0.1)	55	1056	-0.1410	-3.4940
			(0.0400)	
Radius (0.01)	55	1054	-0.1950	-5.5320
			(0.0350)	
Radius (0.001)	49	730	-0.2040	-4.4040
			(0.0460)	
Kernel	55	1056	-0.1350	-3.3580
			(0.0400)	

Dependent variable is the logarithm of before-tax hourly wage. Treatment is doing 18 hours or more of housework. Bootstrapped standard errors in parentheses. *Note:* The number of treated and untreated refer to actual matches within each method.

Summary and concluding remarks

The purpose of this thesis is to examine the effect of time spent on housework on wages for women and men in Sweden. In the OLS regressions, where housework is treated as a continuous variable, we find that time spent on housework has a negative association with wages for both women and men. For women, spending one more hour of housework per week is associated with approximately 0.2 % decrease in hourly wage, an effect which is statistically significant on the 5 % level. For men, the wage penalty from housework is somewhat smaller and not statistically significant. These results are in line with results from previous studies (e.g. Hersch 1991a, 1991b; Hersch and Stratton 1997) which have found a significant negative effect of housework on wages for women, while the results for men have been mixed.

In order to evaluate the selection and effort hypotheses originating from Becker (1985), variables which are assumed to be channels for the housework effect are added to the OLS regressions, i.e. working conditions and health variables, respectively. We find little support for either of the hypotheses, i.e. neither is the housework wage penalty explained by that some individuals select low wage jobs which are more compatible with housework, nor is the housework wage penalty explained by reduced effort in terms of stress related health symptoms. These results are in line with previous research (Hersch 2009; Stratton 2001; Bryan and Sevilla-Sanz 2011) which finds weak support for the selection and effort hypotheses. More specifically, our results show that a statistically significant negative impact of housework on wages prevail for women even though potential channels are accounted for, while the housework effect for men is inconclusive due to lack of statistical significance. The results indicate that there is an autonomous negative effect of housework on wages which is unrelated to occupational compensating differentials or reduced effort. Since women still perform more housework than men on average, the allocation of housework within households may partly explain the persistence of the gender wage gap. Nevertheless, it is not certain that the channel variables used in this thesis perfectly capture the essence of the hypotheses. For example, it is difficult to isolate potential reduced effort stemming from performing housework. The health measurements used in this study may capture reduced effort stemming from other parts of life or from unobservable characteristics.

The results from the OLS regressions do not provide a casual interpretation of the impact of housework on wages, mainly due to potential simultaneous causality and omitted variable bias. The main concern is that the OLS estimates suffer from downward bias and thus indicate a much more severe wage penalty from housework than is actually the case. The application of IV regressions in this study are meant to reduce this potential bias. The IV estimates contradicts the initial suspicion of downward biased OLS estimates. Under the assumption of a valid instrument, the housework wage penalty for women is 2.8 % and 2.0 % for men, which is more than 10 times more negative than the OLS estimates. However, the instrument is not good enough to ensure that endogeneity have been mitigated. In fact, the large deviation between the IV and OLS estimates indicate that the potential bias of the IV estimate is enhanced by weakness of the instrument. Even though we cannot stipulate the direction of the bias induced by endogeneity in the OLS estimate, we are convinced that potential endogeneity is blurring the picture when it comes to the wage penalty from housework. It is in fact a major issue which has not been dealt with properly in previous literature. More specifically, we have a hard time accepting previous conclusions about housework being exogenous (Hersch and Stratton 1997; Bryan and Sevilla-Sanz 2011).

In order to improve the analysis of the housework effect on wages, we relax the assumption of linearity in housework and turn to potential threshold effects where the threshold for housework is defined as 18 hours per week for both men and women. The OLS estimates of the housework threshold effect shows that doing more than 18 hours of housework per week is associated with statistically significant wage penalties of 5.4 % for women and 11.1 % for men. Thus, men who spend a large part of their time doing housework receive a more than twice as large wage penalty than women. The difference in the housework threshold effect between men and women is also statistically significant at the 10 % level. The underlying reasons for the difference may be similar to those often referred to in studies regarding the wage penalty from parental leave (see for example Albrecht et al 1999) which has to do with signaling. Men who take on a large part of the family and household responsibility may signal to their employers that they are less committed to their careers than men who act more according to gender norms. While women who take on the same degree of responsibility do not signal less career commitment since it is an expected female behaviour. Nevertheless, household

work is a much more 'hidden' activity than parental leave so the presumed signal may be significantly weaker. Whatever the underlying reason is, the results may provide an explanation for why fewer men than women take on the majority of the household responsibility. However, the fraction of men who engage in 18 hours or more housework is small which makes it difficult to draw conclusions about the mechanism which determines the gender division of housework in general.

In order to verify and reduce endogeneity bias of the OLS estimates of housework threshold effects, propensity score matching is applied. The results from various matching techniques implies that the wage penalty from spending more than 18 hours per week on housework (the average treatment effect for the treated) is larger than the OLS estimates for both women and men. Thus, the results from the matching strategy indicate that the OLS estimates in fact are upward biased, although we cannot know for sure that this is the case because of limitations to matching method.

Further research which effectively deals with the endogeneity of housework is needed in order to determine its true effect on wages. The true underlying reasons for the persistent observed negative effect of housework on wages (especially for women) also needs further clarification. This kind of investigation requires more sophisticated measurements of housework effort and jobs which are compatible with housework.

This thesis sheds light on the relationship between housework and wages in Sweden using specifications of methods, which attempts to account for endogeneity of housework, which has not been applied in any other study of our knowledge before. However, the complexion of the relationship prevails since the applied methods cannot fully replicate total randomisation of time spent on housework (treatment). Nevertheless, our results indicate that there is a persistent negative effect of housework on wages for women. From a society point of view, one may draw the conclusion that policies designed to ease women's housework load are needed in order to enable women to unfold their full earnings potential. Such policies are already well-established in Sweden, such as public childcare and the more recent introduction of tax reductions for housework purchases. Perhaps, the only way of dealing with the negative impact of housework on wages is for couples to equally bear the burden within households. However, this is a normative challenge yet to be

resolved.

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Appendix

A. Difference in means

Table 10: t-tests for difference in means

VARIABLES	Females		Males		Difference
Dependent variable	Mean	Std.Dev.	Mean	Std.Dev.	
Wage	153.9493	50.0836	180.9051	73.4482	26.9558***
Standard wage determinants					
Cohabiting	0.7309	0.4437	0.7085	0.4547	-0.0224
City	0.3636	0.4813	0.3203	0.4668	-0.0433**
Children	0.5236	0.4997	0.4703	0.4993	-0.0533**
Education	14.0227	3.1340	13.5898	2.9410	-0.4329***
Experience	21.0364	12.3416	21.3576	13.1788	0.3212
Full time	0.9782	0.1462	0.9703	0.1697	-0.0079*
Public sector	0.5573	0.4969	0.2534	0.4351	-0.3039***
Qualified work	0.4809	0.4999	0.4559	0.4983	-0.0250
Explanatory variable of interest					
Housework	12.8109	6.5419	8.1072	4.7970	-4.7037***
Housework dummy	0.1964	0.3974	0.0466	0.2109	-0.1498***
Health channel - effort hypothesis					
Fatigue	0.2718	0.4451	0.1602	0.3669	-0.1116***
Stomach	0.2073	0.4055	0.1288	0.3351	-0.0785***
Headache	0.5182	0.4999	0.3805	0.4857	-0.1377***
Sleep	0.2191	0.4138	0.1305	0.3370	-0.0886***
Overwork	0.0718	0.2583	0.0407	0.1976	-0.0311***
Working conditions channel - selection hypothesis					
High flexibility*	0.3178	0.466	0.4483	0.4976	0.1305***
Heavy lift	0.0791	0.2700	0.1915	0.3937	0.1124***
Physically demanding	0.4427	0.4969	0.4051	0.4911	-0.0376*
Mentally demanding	0.6364	0.4813	0.5711	0.4951	-0.0653***
Stressful work	0.7673	0.4228	0.7322	0.4430	-0.0351*
Monotonic work	0.1746	0.3798	0,1966	0,3976	0.0220
Mental work	0.3036	0.4600	0.2271	0.4192	-0.0765***
Emotionally demanding	0.2273	0.4193	0.0525	0.2232	-0.1748***
Instrument					
Equality opinion	0.5609	0.4965	0.4610	0.4987	-0.0999***
Sample size	1100		1180		

Note: *number of observations: 664 for women and 774 for men. The difference is calculated as mean males - mean females. Significance levels: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

B. Variable description

Table 11: List of variables

VARIABLES	Description
Wage	Hourly before-tax wage in SEK.
Log wage	Logarithm of hourly before-tax wage in SEK.
City	Dummy variable taking value 1 if the individual lives in a metropolitan area according to classification in LNU 2010 (Stockholm, Gothenburg, Malmoe/Lund/Trelleborg).
Education	Total years of education (from 1st grade).
Experience	Total years of paid employment.
Full time	Dummy variable taking value 1 if the individual were employed full time in 2009.
Public sector	Dummy variable taking the value 1 if the individual currently works in the public sector.
Qualified work	Dummy variable taking the value 1 if the individual's occupation is qualified work.
Cohabiting	Dummy variable taking the value 1 if the individual is married or cohabitant.
Children	Dummy variable taking the value 1 if the individual has children living at home.
Housework	Hours spent on housework per week, is a composite variable based on the number of hours the individual spends on cleaning, doing laundry and cooking/doing the dishes/food shopping, authors' calculation.
Fatigue	Dummy variable taking the value 1 if the individual answered yes to the question "*During the last 12 months have you experienced a feeling of general fatigue?*".
Stomach	Dummy variable taking the value 1 if the individual answered yes to the question "*During the last 12 months have you experienced stomach pain?*".
Headache	Dummy variable taking the value 1 if the individual answered yes to the question "*During the last 12 months have you experienced headaches or migraine?*".

Sleep	Dummy variable taking the value 1 if the individual answered yes to the question "*During the last 12 months have you had troubles sleeping?*".
Overwork	Dummy variable taking the value 1 if the individual answered yes to the question "*During the last 12 months have you experienced a feeling of overwork?*".
High flexibility	Dummy variable taking the value 1 if the individual has a high degree of flexible working hours, defined as possibility to move working hours several hours or days.
Heavy lift	Dummy variable taking the value 1 if the individual needs to lifts 60 kg or more to do his/her job daily or several times a week.
Physically demanding	Dummy variable taking the value 1 if the individual answered yes to the question "*Is your type of work physically demanding in anyway?*".
Mentally demanding	Dummy variable taking the value 1 if the individual answered yes to the question "*Is your work mentally demanding?*".
Stressful work	Dummy variable taking the value 1 if the individual answered yes to the question "*Is your work stressful?*".
Monotonous work	Dummy variable taking the value 1 if the individual answered yes to the question "*Is your work monotonous?*".
Mental work	Dummy variable taking the value 1 if the individual most of the time or all of the time has to work near the peak of his/her ability, has to use a lot of mental effort.
Emotionally demanding	Dummy variable taking the value 1 if the individual most of the time or all of the time has to work with emotionally demanding tasks.
Profession*	Dummy variable for occupation classes with two digits precision, based on Nordic Classification of Occupation (NYK85).
Equality opinion	Dummy variable taking the value 1 if the individual strongly supports to the statement *"What do you think about the suggestion of committing to a society where men take the same amount of responsibility for children and housework as women?"*.

Source: Swedish level-of-living survey (LNU) 2010 and Nordic Classification of Occupation (NYK85) for variables marked with *.

C. Common support of matching

Figure 2: Common support for females

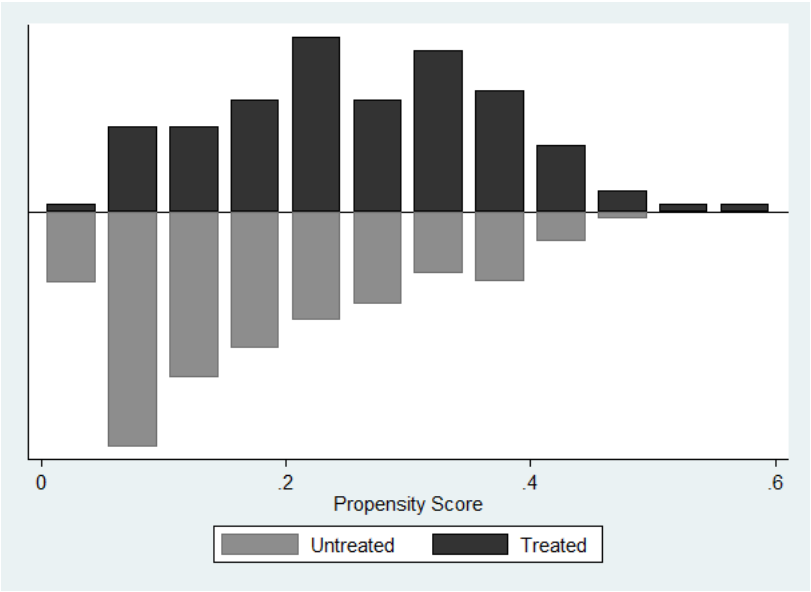

Figure 3: Common support for males