Household Time Allocation Decisions: Evidence from Germany's Introduction of a Minimum Wage

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Abstract

This paper examines how income, preferences, and productivity influence household time allocation decisions, with a focus on the effects of Germany's 2015 minimum wage introduction. Using data from the German Socio-Economic Panel (SOEP), we perform a difference-in-differences analysis followed by an event study to assess the reform's impact on time spent on childcare, housework, and paid labor. We find that the minimum wage reduced household time spent on home production between 30-60 minutes per day, primarily by decreasing the time women allocate to childcare. This shift is sustained over time, suggesting a re-optimization of household time allocation. We then propose a structural model where spouses receive wage offers and jointly allocate time to supplying labor market hours and to producing a public good. We estimate the model and find that men have a higher preference for leisure and women are more productive in providing the public good. Differences in wage offers largely explain disparities in paid working hours, while preferences and productivity account for most variation in home production hours. Finally, our estimated model suggests that a minimum wage of €10 would have increased women's labor participation by 14%, which is 4 percentage points higher than observed with the actual minimum wage. These results suggest that, in the absence of other frictions, minimum wage policies can help reduce the gender wage gap.

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I Introduction

The amount of time household members spend on housework can account for up to half of the time spent in the labor market in industrialized countries. For most households, the majority of this time is spent by women (Stratton 2020). This has been attributed to various factors, with the gender wage gap being a prominent explanation. Other contributing factors include gender norms, differences in productivity and preferences, as well as tax distortions. While gender differences in housework time that arise from differences in opportunity costs or productivity are efficient, gender differences caused by social norms or tax distortions may lead to inefficiencies, further reinforcing the gender wage gap. If low female labor force participation is driven by inefficient intra-household bargaining dynamics, addressing these inefficiencies could help reduce the wage gap. This paper examines how households make time allocation decisions and the main factors that influence them.

According to the literature, three main factors shape how time is allocated within the household. The first is income, both in absolute and relative terms (Gupta 2007, Stratton 2012 and Browning and Chiappori 1998). Second, there are differences in preferences and gender roles (Bittman and Craig 2008, Akerlof and Kranton 2000). Finally, the last factor is differences in productivity (Becker 1965, Gimenez-Nadal and Alberto 2022). Since there is evidence for each of these factors, it is likely that all three interact in shaping the joint decision on time allocation. This paper aims to shed light on the weight of each factor in household time allocation, using Germany as a case study. In particular, by examining the change in household time allocation following the introduction of the minimum wage in Germany, we aim to determine how relevant each channel was and whether the policy contributes to a more equal division of chores and reallocates time toward a more efficient distribution.

Germany presents a particularly compelling case for studying household time allocation decisions, as it exhibits all the key factors previously discussed. First, Germany has a high proportion of dual-earner households, driven by a notably high female labor force participation rate—approximately 75%, compared to 64% in other OECD countries. Additionally, while only about 5% of working men are employed part-time, this figure rises to 51% for women, offering a wide range of spousal income combinations for analysis. Second, Germany's traditional male breadwinner model, in which most mothers are solely responsible for childcare, creates a unique setting to explore gender roles and how minimum wage policies impact women's labor market decisions. Finally, having the second largest gender wage gap in the EU, with a gap of 22% in 2014 (Caliendo and Wittbrodt 2022), Germany has implemented several family-related policies to remedy it, with substantial costs amounting to approximately 1.7% of GDP, highlighting its relevance. However, these efforts could be better directed if household behavior is better

understood. A policy like the minimum wage could either help reduce or exacerbate the gap, depending on which factors are at play and who benefits from the policy. Thus, this paper contributes to both the household and minimum wage literature.

In January 2015, Germany introduced a minimum wage of €8.50 per hour. At the time of its introduction, Germany's minimum wage ranked among the highest in Europe when adjusted for purchasing power, impacting approximately 11-15% of the working population who previously earned below this threshold. Germany's introduction of a relatively high minimum wage, despite lacking previous experience with a national wage floor, provides a unique and valuable case study. While decades of research on minimum wage exist, its effects remain controversial and poorly understood. The main point of debate has been on the direction and magnitude of employment effects (e.g., Stigler 1946; Neumark and Wascher 2001; Card and Krueger 1995; Dube, Lester, and Reich 2010). However, its impact on other areas, such as time allocation, remains understudied. This paper fills this gap in two ways: first, by providing evidence on the minimum wage's effect on time allocation, and second, by analyzing its impact at the household level, rather than the individual level. Existing studies overlook household-level substitutions and complementarities, which we address in this paper.

In the first part of this paper, we examine the effects of the minimum wage on household time allocation to childcare, housework, and paid labor using data from the German Socioeconomic Panel (GSOEP). We begin with a difference-in-differences analysis, followed by an event study to visually assess the reform's impact and explore the dynamics of the outcomes of interest. Our findings indicate that the minimum wage led to a decrease in home production time—ranging from thirty minutes to one hour per day. This reduction is driven primarily by a decrease in women's childcare time. We observe no significant change in men's time allocation. Furthermore, the event study shows that the post-policy response was not a temporary shift but a sustained change. This suggests that households reoptimized their time allocation in response to the new wage structure and have maintained this new equilibrium.

In order to identify the factors influencing this re-optimization, following Flinn, Todd, and Zhang 2018 we present a cooperative model that rationalizes the household time allocation decision. In particular, the model disentangles preferences from productivity, allowing us to test for the relevance of both separately. Our analysis focuses on the same sample used for the reduced-form analysis: households with spouses aged 20 to 40, in which at least one spouse works and earns below a specified hourly-wage threshold. In the model, each spouse has an independent preference for leisure and for a public good (which the spouses share) and a (potentially) different productivity in the production of this public good. Households in the model choose jointly how many hours to allocate to leisure, paid labor and the production of the public good. The model is static and returns individuals' preferences over leisure and home production productivity, conditional on the

household Pareto weight. These parameters are estimated using maximum likelihood and we use the estimated model to analyze the determinants of time allocation differentials.

This paper presents several key findings. First, we estimate the effect of the minimum wage on household-level time allocation—specifically paid work versus home production—and find that it mainly reduced women's childcare time. Second, our structural model indicates that men have a higher preference for leisure than women do, while women are more than twice as productive as men in home production. Third, we show that policies such as the minimum wage—which disproportionately raise wages for women—tend to promote a more equal distribution of home production time. We also find that differences in wage offers primarily explain disparities in paid work hours, whereas differences in preferences and production technology account for most of the variation in home production time. Finally, a counterfactual analysis indicates that raising the minimum wage to €10 (instead of €8.50) would have increased women's labor-market entry from 9% in the observed data to 14%. These findings support the view that, absent other frictions, minimum wage policies can help reduce the gender wage gap.

The paper proceeds as follows. The next section describes the policy background. Section III presents the data and discusses sample choices. Section IV outlines the empirical methodology used and results. Section V introduces the model, along with the econometric specification and estimation procedure. Sections VI and VII present the estimation results and counterfactual experiments. Finally, Section VIII discusses the findings and their implications for policymaking.

II Institutional Context and Data

This section describes Germany's minimum wage policy and the conditions at the time the minimum wage was implemented. It then presents the relevant literature on the minimum wage, in particular for the German case. The section concludes with a review of the most relevant time allocation theories found in the literature.

II.A Minimum Wage Implementation: Context

The Minimum Wage Law was passed by the German Parliament on July 3, 2014, with the minimum wage coming into effect on January 1, 2015. It has since been raised at regular intervals on the recommendation of the Minimum Wage Commission. The minimum wage was set to €8.84 in October 2017 and €9.19 in January 2019. At €12.82, it is currently around 50% above the hourly rate of €8.50 that applied when the law was introduced. At the time of its implementation, it was binding for more than 10% of workers, meaning that around 4 million jobs were directly affected. On average, affected employees before the minimum wage was introduced had hourly wages of €6.12. Thus, on average, the

hourly wage of an affected employee would have increased by 39% (Bossler and Schank 2023), underlining the relevance of the policy.

Although the minimum wage was nationally implemented, it didn't include everyone. Pre-policy some unions were already negotiating wages at the sectoral level, acting in practice as wage floors. The share of workers covered by union agreements went from about 80% in 1995 to 55% in 2015 (Kügler, Schönberg, and Schreiner 2018). After the policy, some of these sectors were allowed to keep their union-agreed wage until December 31, 2016. However, this is not too concerning for our research since these industries make up only a relatively small fraction of total employment (5%). The remaining few exceptions—workers younger than 18, apprentices, interns, voluntary workers, and the long-term unemployed—were exempt from the minimum wage.

It is worth emphasizing that the policy was implemented during a period of robust economic growth for Germany. Between 2011 and 2016, nominal GDP grew by 15%, while unemployment fell from 7.1% in 2011 to 6.1% in 2016 (Dustmann et al. 2022). At the time that the policy was being considered, the party advocating for the minimum wage stressed positive distributive effects, fairness aspects, and a reduced dependence of workers on social transfers (e.g. Kalina and Weinkopf 2014). This was in line with international empirical evidence (Addison and Ozturk 2012; Autor et al., 2016; DiNardo et al., 1996; Lee, 1999; Teulings, 2003). On the other hand, the opposition predicted a decrease in employment by 500,000 to over a million jobs in the long run (Bachmann, Bauer, and Frings 2014; Müller and Steiner 2013).

While the literature on the federal minimum wage introduction in Germany largely finds no or few anticipation effects of the reform (Caliendo, Fedorets, et al. 2018, Bossler and Gerner 2020), helping our analysis, we cannot say the same about compliance. Setting the minimum wage at an hourly rate instead of a minimum salary per month made it harder to enforce. We observe in the data hourly wages below €8.50 for the years after 2015, showing that the actual wage increases were not large enough for some employees. This presents a challenge for evaluating the effects, as the potential impacts of the wage floor could be underestimated.

II.B Effects of Minimum Wage

This subsection summarizes the most relevant findings about the implementation of the minimum wage in Germany.

As to potential employment effects, the literature has reached a consensus that these were non-existent or very small (e.g. Caliendo, Fedorets, et al. 2018, Dustmann et al. 2022, Bossler and Schank 2023). Minimum wage theory predicts this effects to be greater, however there are two key factors that might be attenuating it. First, the elevated number of instances of non-compliance and second, and probably most relevant, the policy was

implemented at a time of high economic growth. Dustmann et al. 2022 shows that one to two years after the introduction of the minimum wage, hourly wages at the lower end of the distribution saw a significant increase. Descriptive literature also finds positive effects of the minimum wage reform on gross hourly wages, particularly in the low wage segment. This effect is greater for women, low-skilled and East-German workers (e.g. Burauel et al. 2017). There is evidence for spillover effects which shows that wages increased for workers earning up to €12-€15 per hour.

Despite hourly wages increasing, there is evidence that total income did not significantly changed. Caliendo, Fedorets, et al. 2023 suggests that employers decreased working time of affected workers rather than increasing their earnings to comply with the minimum wage. As a consequence, the reform led to a significant reduction in working hours, causing monthly earnings for low-wage workers to nearly stagnate. However, for the households we study, we do not observe this reduction in hours; if anything, we see a slight increase. This discrepancy may be due to our analysis being conducted at the household level rather than the individual level, a distinction we discuss further in Section IV.

II.C Theories on Household Time Allocation

Under the assumption that households behave cooperatively, there are three main theories in the literature on how spouses decide to distribute their time in the production of the "public good", which involves mainly housework and childcare. The minimum wage could impact any of them, thus to determine which one is the predominant one for Germany's case a more detailed analysis is necessary.

I. Income

Two key frameworks explain how income affects household time allocation. In both, the relevant measure of income may refer to actual or perceived earnings, or to opportunity cost—i.e., the wage an individual would earn if employed.

Relative income (Browning and Chiappori 1998): The partner with higher relative income enjoys stronger bargaining power and consequently spends less time on domestic chores. A partner who earns a larger share of household income is viewed as having greater power, making it easier to negotiate their way out of unpaid domestic work. Increases in a woman's share of household income—interpreted as a proxy for her bargaining power—reduce her total housework time while increasing his housework time.

Absolute Income (Gupta 2007; Stratton 2012): The absolute income of a partner (i.e., their opportunity cost) is the main determinant of time allocated to housework. Lietzmann and Frodermann 2023 find that when spouses work part-time or have more flexible schedules, they take on more domestic work. The minimum wage, in this case, will reduce housework hours for the spouse with the highest opportunity cost.

II. Preferences and Gender Roles

This theory suggests that gender roles are a key factor in time allocation decisions within households. According to this perspective, women may disproportionately contribute to housework as a way of affirming traditional gender roles (Bittman and Craig 2008; Akerlof and Kranton 2000). Bertrand, Kamenica, and Pan 2015 shows that the distribution of the share of income earned by the wife exhibits a sharp drop to the right of 0.5, where the wife's income exceeds the husband's. This pattern is best explained by gender identity norms, which create an aversion to a situation where the wife earns more than her husband. In couples where the wife earns more, she tends to spend more time on household chores. An alternative explanation is that preferences over leisure and the public good (home production) differ within the household. This hypothesis suggests that certain activities are valued differently, and individuals allocate their time in a way that favors their preferred activities. More so, there is a rising literature that links personality traits to preferences for consumed commodities (Heckman, Jagelka, and Kautz 2019, Flinn, Todd, and Zhang 2018 and Fernández 2025).

III. Productivity

Following the classic framework of Becker 1965, this strand of the literature suggests that when spouses differ in their productivity, they tend to specialize according to comparative advantage in household production. Gimenez-Nadal and Alberto 2022 further shows that differences in productivity—both in terms of physical output and cognitive labor—shape how household members allocate their time and resources. These insights highlight how household dynamics are influenced by the relative contributions of each spouse.

III Data and Descriptive Statistics

Socio Economic Panel

The Socio-Economic Panel (SOEP) is one of the largest and longest-running multidisciplinary household surveys worldwide. It is a large-scale representative longitudinal household survey. Every year, there are nearly 11,000 households surveyed and more than 20,000 persons sampled from the German residential population. The years covered for the Federal Republic of Germany go from 1984 to 2022 and for the eastern German länder from 1990 to 2021. An important advantage of the GSOEP for this project is that it collects information from everyone in the household, contains monthly earnings, hours worked in addition to detailed socio-demographic information.

Our paper makes use of the following variables: hourly wages, which are obtained by self-reported gross monthly earnings and weekly working hours. Gross monthly earnings refer to wages from the principal occupation including overtime remuneration but not

including bonuses. Weekly working hours measure a worker's actual working hours in an average week. Technically the policy aims to regulate any number of working hours (which includes overtime), making actual working hours the main object of interest. However, contractual hours have the advantage of being most visible and easy to regulate and they are arguably less affected by measurement errors. For this reason, we pay attention to both variables. The other relevant variables for our research are hours devoted to childcare and hours devoted to household tasks. The latter includes washing, cooking, and cleaning activities. All these variables are obtained from the same question that states: "What does your normal everyday life look like? How many hours do you spend on the following activities on an average working day?"

Sample Choices

We study the period from 2012 to 2018 from which we have annual level data. We consider only heterosexual couples who live together and are either household heads or married to the household head. The other criteria to be in the sample is to be born between 1970 to 1995 and to earn less than €20.[1]

A household is considered treated if any spouse earns below minimum wage. When we perform the analysis for the full sample (considering households with both spouses working and only one working), for the cases where one spouse is not working in order to determine if the household is treated or control is not straightforward. We will consider the household treated if one spouse is not working and the partner earns less than €10, assuming that the spouse with the highest wage is the one who enters the labor market first. Table 1 presents the sample means and standard deviations of the respondents' characteristics by treatment group for the pre minimum wage year 2014 for all households with at least one spouse working and earning below €20. Table 2 repeats the analysis for households with both partners active in the labor market.

IV Method

This section introduces the empirical strategy we use to identify the effects of the minimum wage introduction on the distribution of time within the household. We present results from a difference-in-differences and from an event study analysis. The empirical strategy and the assumptions necessary to identify the causal effects of the minimum wage introduction are discussed.

[1] We change the cutoff to be €14 and €24 and we find no major changes in our analysis. The choice of €20 is to be consistent with the rest of the literature.

Table 1: Descriptive Statistics for Treated and Control Groups 2014

	Treated		**Control**	
	Mean	Std. Dev.	Mean	Std. Dev.
Age Women	33.20	4.64	34.23	4.42
Age Men	35.66	4.69	36.58	4.39
Children	2.15	1.15	2.22	1.14
Years Education W	11.17	2.00	11.82	2.39
Years Education M	11.23	2.29	11.36	2.07
Childcare W	4.74	2.88	4.86	2.93
Childcare M	1.77	1.63	1.74	1.56
Housework	3.35	1.58	3.35	1.66
Home (Total Time)	9.86	4.59	9.95	4.69
Work W	5.37	2.69	5.66	2.51
Work M	8.59	2.52	8.63	1.58
Wage W	5.25	3.97	7.35	6.90
Wage M	11.40	4.21	14.71	2.88
Number of Obs	**278**		**697**	

Note: Table 1 displays averages and standard deviations for various characteristics of the control and treated groups. The treated group consists of all households where at least one spouse earns below the minimum wage (€8.50) in 2014, while the control group includes those earning between €8.50 and €20. In the sample are all households with at least 1 person working.

Table 2: Descriptive Statistics for Treated and Control Groups: Both working 2014

	Treated		**Control**	
	Mean	Std. Dev.	Mean	Std. Dev.
Age Women	33.55	4.57	35.15	4.10
Age Men	35.93	4.61	37.26	4.19
Number of Kids	1.99	1.08	1.95	0.96
Years Education W	11.28	1.95	12.14	2.21
Years Education M	11.54	2.22	11.48	2.00
Childcare W	4.26	2.81	3.95	2.75
Childcare M	1.83	1.69	1.77	1.65
Housework	3.06	1.35	2.86	1.27
Home (Total Time)	9.15	4.50	8.58	4.32
Work W	5.39	2.69	5.67	2.51
Work M	8.77	2.22	8.59	1.62
Wage W	6.98	2.97	13.07	3.15
Wage M	12.55	4.21	14.63	2.94
Number of Obs	**209**		**392**	

Note: Table 2 displays averages and standard deviations for various characteristics of the control and treated groups for the sample of households where both spouses work. The treated group consists of all households where at least one spouse earns below the minimum wage (€8.50) in 2014, while the control group includes those with both spouses earning between €8.50 and €20.

IV.A DID

As a first step, we study the effects of the policy by comparing households who had a member earning below minimum wage (treated group) with those earning above (control group). To determine treated households we considered all households with at least one of the spouses earning less than €8.5 in 2014[2]. Control households are those earning above the minimum wage and below a threshold, which we established at €14 per hour[3], since households with higher wages might have different ways of allocating time or have access to substitutes that the treated group does not (for example nannies).

We estimate a difference-in-differences regressions of the following form:

$$Y_{it} = \alpha_t + \delta i + \gamma Post_t T_i + \beta \mathbf{X}_{it} + \epsilon_{it} \tag{1}$$

The left-hand side variable is the outcome of interest: Time spent on work, childcare and housework on an average weekday for household i on year t and for each spouse of household i on year t. The right-hand side includes household fixed effects, year fixed effects, control variables and an error term. *Post* is a dummy that takes the value 1 after the minimum wage policy becomes binding and T_i is a dummy for treated, this is, every household earning below minimum wage in 2014. The model includes a set of explanatory variables, $\mathbf{X}_{it}$, which include the number of children, a dummy for children aged below 10 and a dummy that takes the value 1 if someone in the household took the Abitur exam, which is performed after high school. The central coefficient of interest is γ. This parameter captures the effect of the minimum wage at the household-level on the outcomes of interest during the period after minimum wage introduction. The causal interpretation of the estimates relies on the assumption that had the policy not been implemented, the outcomes we study would have kept their pre-policy trend.

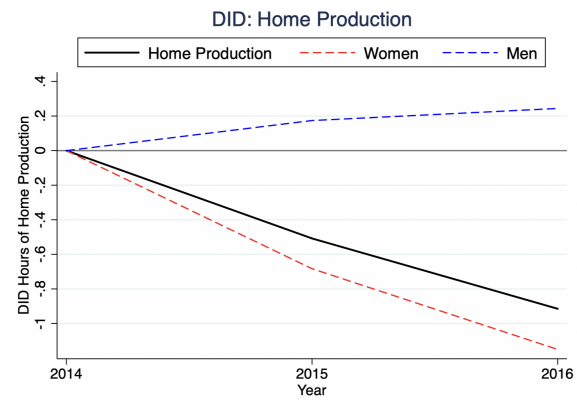
Below we display the results for the γ coefficients at the household level in Table 3 and Figure 1 and by spouse on Table 4 and Figure 2.

The coefficients obtained show that at the household level total hours in home production decreased between 30 minutes and one hour. The decrease is mainly due to a reduction in women's time in childcare. The husband's hours allocation does not show a significant change after the policy. This decrease implies that at a weekly level women are now spending around 2.5-4.5 hours less in childcare. We do observe an increase in working hours for women that were already working. The analysis suggests that women re-allocated one hour of childcare to an extra hour in the labor market, without thus changing leisure.

[2]When we restrict the sample to households where both partners work, in addition to requiring treated households to have someone earning less than €8.5 we require that they earn above €3 to discard marginal workers.

[3]We repeat the analysis for different thresholds: €16, 20, 24, 35.

Figure 1: DID Home Production



Note: Figure 1 displays the DID results for year 2015 and 2016 for change in hours of home production, which is the sum of childcare and housework hours (domestic chores).

Figure 2: DID by Activity



Note: Figure 2 shows the resulting DID using 2014 as the pre-period and 2015 and 2016 as the post-period. It displays the DID results in terms of hours spent on childcare and housework (domestic chores) for each spouse.

Table 3: DID Estimates - Household Level

	Home	**Childcare**	**Housework**	**Work**
DID 2015	-0.508	-0.226	-0.298	0.528
	(0.482)	(0.388)	(0.202)	(0.839)
DID 2016	-0.915	-0.618	-0.290	0.986
	(0.522)	(0.416)	(0.220)	(0.907)
Households	862	862	862	862

Note: Table 3 shows the resulting DID using 2014 as the pre-period and 2015 and 2016 as the post-period. It displays the DID results in terms of hours spent on childcare, housework (domestic chores), the sum of both (home) and time allocated to paid labor at the household level for households with both spouses working. Robust standard errors in parentheses

Table 4: DID Estimates - By Spouse

	Childcare		**Housework**		**Home Hrs**		**Work Hrs**	
	Women	Men	Women	Men	Women	Men	Women	Men
DID 2015	-0.499	0.274	-0.201	-0.099	-0.68	0.174	1.109	0.384
	(0.286)	(0.227)	(0.176)	(0.099)	(0.369)	(0.283)	(0.714)	(0.417)
DID 2016	-0.853	0.235	-0.300	0.009	-1.15	0.244	1.12	0.63
	(0.309)	(0.245)	(0.189)	(0.109)	(0.399)	(0.31)	(0.731)	(0.461)
DID 2016*	-0.894	0.267	-0.344	0.111	-1.04	0.375	0.215	0.225
	(0.420)	(0.256)	(0.192)	(0.111)	(0.432)	(0.327)	(0.645)	(0.308)
Households	862	862	862	862	862	862	862	862

*Note: Table 4 shows the resulting DID using 2014 as the pre-period and 2015 and 2016 as the post-period. It displays the DID results in terms of hours spent on childcare, housework (domestic chores), the sum of both (home), and time allocated to paid labor, at the spouse level for households with both spouses working. * The 2016 DID for the full sample (902 households) is included in the last row. Robust standard errors in parentheses.*

IV.B DID: Propensity Score Matching

In this subsection, we repeat the DID analysis using Propensity Score Matching (PSM) to assign households to treatment or control in order to increase the sample size. The rationale behind this approach is that in households where one spouse does not work, we cannot observe their salary and, therefore, cannot immediately classify the household as treated or control. As mentioned in the previous sections, most men in our sample are employed, but this is not always the case for women. In this subsection, we explore different strategies to address these households.

For households where the husband earns less than the minimum wage, we assign them to the treatment group, regardless of the wife's potential income. For households where the husband earns just above the minimum wage, the situation becomes more complicated. Economic theory predicts, and evidence shows, that the person with the higher wage offer is typically the one who enters the labor market first. Therefore, it is not a big leap to assume that the wife's potential wage offer in these cases would not exceed the control threshold. For the other cases (the man earns above minimum wage but the woman doesn't work), the strategy we use involves calculating the probability of a household being treated based on observable characteristics. To do so we perform propensity score matching.

First, we run a logit regression for households where both spouses are working. This regression models the probability of being treated based on the observed characteristics of the households. The dependent variable is a binary indicator for treatment (1 = treated, 0 = control), while the right-hand side variables are the age, education, and experience of both spouses. These variables are used to predict the likelihood that a household

is assigned to the treatment group, with the assumption that individuals with certain characteristics (e.g., younger age, lower education, or less experience) are more likely to be treated. Once we have estimated the propensity scores (the predicted probabilities of treatment based on the logit regression), the next step is to use these scores to assign individuals to the treated or control group based on their observables, for those whose wage we do not observe. However, since observables are imperfect predictors of treatment, using the entire sample (by classifying individuals with propensity scores above or below 0.5 as treated or control) could be problematic. Therefore, we gradually expand the sample, starting with those individuals who are most likely to be accurately classified based on their observables, and eventually include the full sample. Table 17 presents the DID results for four different (nested) samples.

Table 5: DID Estimates using PSM - By Spouse

	Childcare		**Home Hrs**	
	Women	**Men**	**Women**	**Men**
PSM: 0.2-0.8				
DID	-0.7274	0.2200	-0.9652	0.2211
	(0.292)	(0.226)	(0.391)	(0.283)
Households	1,039	1,039	1,039	1,039
PSM: 0.3-0.7				
DID	-0.6438	0.134	-0.8095	0.0989
	(0.283)	(0.218)	(0.377)	(0.271)
Households	1,170	1,170	1,170	1,170
PSM: 0.4-0.6				
DID	-0.5295	0.2176	-0.6778	0.2137
	(0.278)	(0.214)	(0.371)	(0.266)
Households	1,261	1,261	1,261	1,261
PSM: 0.5-0.5				
DID	-0.5326	0.1830	-0.6319	0.1681
	(0.273)	(0.209)	(0.366)	(0.259)
Households	1,326	1,326	1,326	1,326
Households before: 862				

Note: Table 5 shows DID results when households are included and classified by their wage offers (for households with non working spouses we impute their wage offer based on observables). It provides results for different propensity score cut-offs. Robust standard errors in parentheses.

We find that as the sample is augmented, the effect is attenuated in magnitude but remains statistically significant. This reduction may be attributed to misclassifications of treatment. Nevertheless, women still significantly reduce their time in home production, while men experience a smaller, statistically insignificant increase. This provides compelling evidence that the restriction of our sample does not lead to a substantial loss of information. Alternatively, we consider the case where treatment is determined solely by the wife's salary. In this case, we can include the husband's hourly wage as an ad-

ditional explanatory variable to estimate the probability of a household being treated. These propensity scores are better predictors of being treated than those used before and we can see in Table 15 that the estimates closely follow the ones found on the restricted sample.

Table 6: DID using PSM -with men wage (0.3-0.7)

	Childcare		**Home Hrs**	
	Women	**Men**	**Women**	**Men**
DID	-0.6805	0.0226	-0.8974	0.1201
	(0.349)	(0.287)	(0.465)	(0.356)
Households	742	742	742	742

Note: Table 6 shows DID results when households are included and classify by their wage offers using husband's wage to estimate the wage offer. Households before: 588. Robust standard errors in parentheses.

IV.C Event Study

As mentioned in the previous section, the identification strategy for the Difference-in-Differences analysis relies on the crucial assumption of parallel trends—that is, in the absence of the reform, the treated and control groups would have followed similar trajectories over time. In order to assess the validity of this assumption more rigorously and to explore the dynamic effects of the minimum wage reform over an extended period, we employ an event study framework. This approach allows us not only to visually inspect pre-trends behavior but also to evaluate how the outcomes of interest evolve before and after the introduction of the policy. The corresponding estimates are obtained from regressions of the following form:

$$Y_{it} = \alpha_t + \beta_i + \sum_{s \in \{-m,\ldots 0,\ldots n\}} \gamma_s \mathbf{1}(t = t_0 + s) T_i + \epsilon_{it}$$

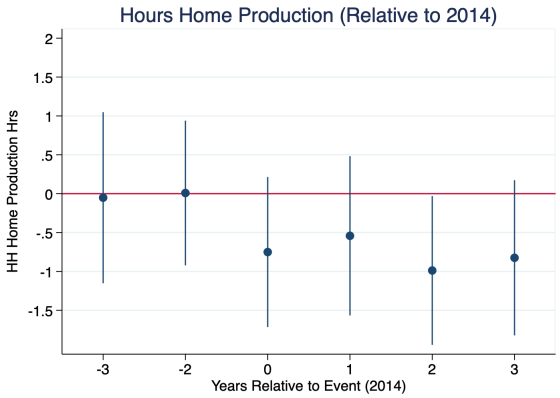
In this approach a separate term is included for each event time. As explained in Miller 2023, the key features of this specification are the terms $\gamma_s \times \mathbf{1}(t = t_0 + s) \times T_i$. The coefficients after the event has occurred (γ_s for $s \geq 0$) capture the dynamic effects of the treatment as these effects manifest over time since the event. The terms γ_s for before the event has occurred (for $s < 0$) provide a placebo or falsification test. In the absence of anticipation effects, model misspecification, or omitted confounding variables, these pre event terms should not have a trend in s. The index t represents the calendar time in which we observe the outcomes. The index s represents time since event, or "event time." α_t and β_i are fixed effects for time and households, T_i is a dummy for treated and $\mathbf{1}(t = t_0 + s)$ works as the post dummy variable of the DID.

The time period we study is from 2012 to 2018 with yearly observations. This means that we observe 3 periods before the policy, the year of the policy, and three periods after that. The year 2014 (the last year without minimum wage) is omitted and serves as a baseline. We plot the resulting coefficients below. Figures 3-4 are for hours in home production at the aggregate level and by spouse. Figure 5 shows hours of work by spouse.

The households considered for the event study are those with heterosexual couples with partners born between 1970 and 1995 (thus, by the year of the policy, they were between 20-45 years old). We keep households where both partners earn less than €20 and have at least one spouse working in 2014. The reason for studying three periods around the event and no more is because we are keeping a balanced panel and expanding the number of periods makes us lose too many observations, requiring people to be coupled too young.

IV.D Results

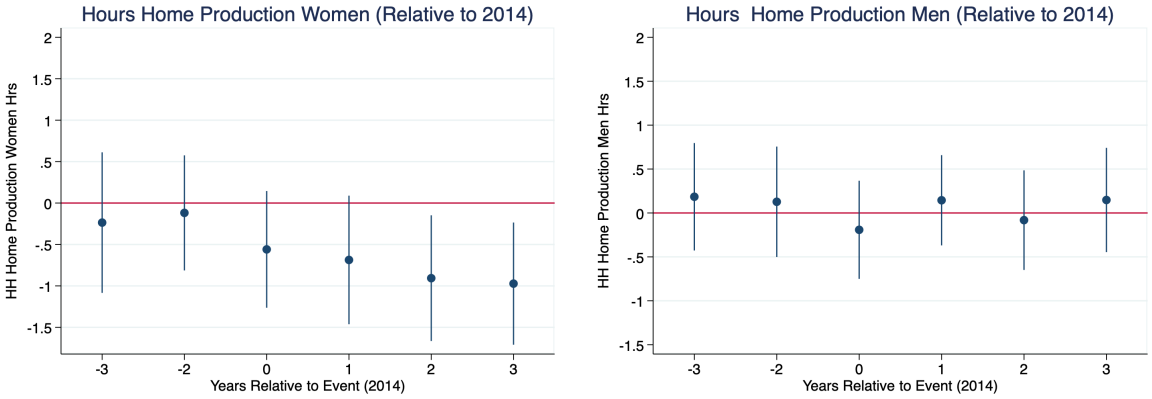
Figure 3: Event Study: Home Production



Note: Figure 3 shows the event study for home production hours at the household level for households with both spouses working. Treated are those households with at least one spouse below €8.5 and controls are those with both spouses above €8.5 but below €20. It spans from year 2012 to 2018 with year 2014 as the omitted baseline.

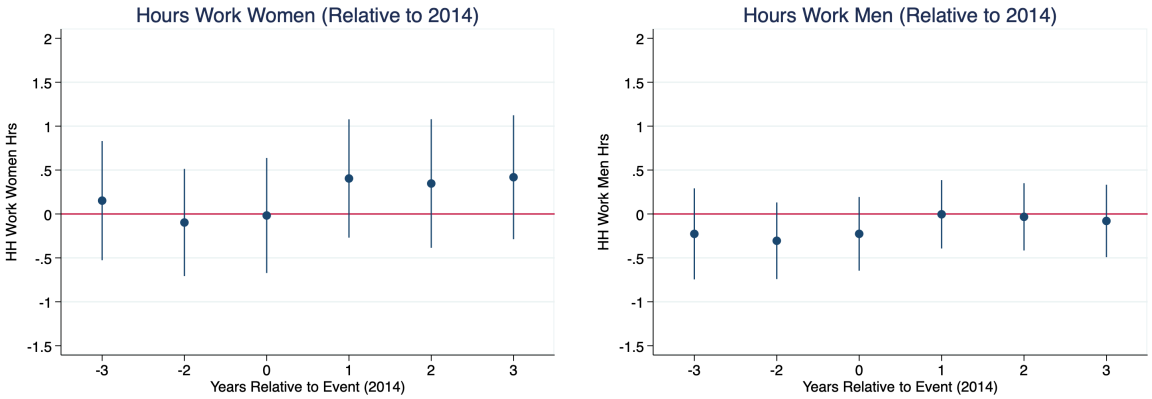
The event study results yield two key insights. First, the pre-policy trends in household time allocation appear stable. We do not observe significant deviations from the 2014 baseline in the years preceding the minimum wage reform, providing support for the parallel trends assumption underlying our Difference-in-Differences identification strategy. This consistency reinforces the credibility of our DID estimates. Second, the post-policy response is not a temporary shift followed by a return to previous behavior. Rather, the effects are sustained over time, suggesting that households re-optimized their time allocation in response to the new wage structure and maintained this new equilibrium. The most pronounced adjustments continue to come from women, who significantly reduced the time spent on childcare. However, the increase in women's labor market hours is not as large as the decrease in home production, implying that a small portion of the

Figure 4: Event Study: Home Production by Spouse



Note: Figure 4 shows the event study for home production hours at the spouses level (left panel for wives and right panel for husbands). It spans from year 2012 to 2018 with year as the omitted baseline 2014.

Figure 5: Event Study: Work by Spouse



Note: Figure 5 shows the event study for paid labor hours at the spouses level (left panel for wives and right panel for husbands). It spans from year 2012 to 2018 with year as the omitted baseline 2014.

time previously devoted to childcare may have been reallocated to leisure. In contrast, men's time allocation remains largely unchanged—both in terms of paid work and home production—resulting in no observable change in their leisure hours.

V Model

V.A Model Specification

This section presents the model, which follows closely Flinn, Todd, and Zhang 2018. A household is composed by a husband and a wife, respectively denoted by the subscripts m and f. Each spouse values leisure and a public good, with a utility function given by

$$U_m = \lambda_m \ln (T - l_m - h_m) + (1 - \lambda_m) \ln K$$
$$U_f = \lambda_f \ln (T - l_f - h_f) + (1 - \lambda_f) \ln K$$

where T represents the available hours in a day. The hours allocated to the labor market and housework are l_j and h_j respectively, such that $T - l_j - h_j$ is the leisure of spouse j $(j = m, f)$. λ_m, $\lambda_f \in (0, 1)$ is their taste for leisure and K is the quantity produced of the public good. The household production technology is given by:

$$K = h_m^{\delta_m} h_f^{\delta_f} M^{1-\delta_m-\delta_f}$$

The time spouse j allocates to housework is denoted by h_j, δ_j is a Cobb–Douglas productivity parameter, and M is the total income of the household given by

$$M = w_m h_m + w_f h_f + y_m + y_f$$

Given this setting, each individual faces the following time constraint

$$T = h_j + h_j + l_j, \quad j = m, f$$

A few remarks regarding the specification of this model. First, it does not explicitly model a consumption choice. This is standard since most data sets contain detailed labor market information but lack precise consumption data. Second, our model is static, we do not model continuation value or allow for divorce. Third, we assume households behave cooperatively, that is, they maximize a joint weighted utility function. Finally, by assuming a Cobb-Douglas production function for the public good we might be imposing too much structure. However, by allowing spouses within the household to have different preferences for leisure (λ_j) and different productivity in the production of the public good (δ_j) we are able to get a good fit despite the Cobb-Douglas assumption.

Since we want to study the time allocation decision, which includes the labor market participation decision, we must estimate wage equations for each spouse in order to deal with the unobserved wages. For this, let x_j denote observable characteristics and θ_j the personality characteristics. A household is characterized by the state vector

$$S_{m,f} = (\lambda_m, \delta_m, w_m, y_m, \theta_m, x_m) \cup (\lambda_f, \delta_f, w_f, y_f, \theta_f, x_f)$$

The welfare function for the household for a given Pareto weight $\alpha(S_{m,f})$ is given by

$$W(h_m, h_f, l_m, l_f; S_{m,f}) = \alpha(S_{m,f}) U_m(h_m, h_f, l_m, l_f; S_{m,f}) + \\ (1 - \alpha(S_{m,f}))\, U_f(h_m, h_f, l_m, l_f; S_{m,f})$$

The Pareto weight $\alpha(S_{m,f}) \in (0, 1)$ is a function of the elements in $S_{m,f}$. The Household will chose the time allocations $\{h_j, l_j\}$ that maximizes W, this is

$$(h_m, h_f, l_m, l_f)(S_{m,f}) = \arg \max_{\substack{h_j, l_j \\ j=m,f}} W(h_m, h_f, l_m, l_f; S_{m,f})$$

Given that this is a maximization of two concave utility functions that are being weighted, the solution to the problem is unique and yields the following utility levels for each spouse, where $\alpha(S_{m,f})$ is denoted by PW:

$$V_j(PW) = \lambda_j \log(T - h_j(PW) - l_j(PW)) + (1 - \lambda_j) \log K(PW)$$

with

$$K(PW) = h_m(PW)^{\delta_m} h_f(PW)^{\delta_f} \left(w_m l_m(PW) + w_f l_f(PW) + y_m + y_f\right)^{1-\delta_m-\delta_f}$$

V.B Econometric Implementation

Set of unobserved household characteristics: $S^u_{m,f} = \{\lambda_m, \delta_m, \lambda_f, \delta_f\}$, set of observed characteristics: $S^o_{m,f} = \{w_m, y_m, \theta_m, x_m, w_f, y_f, \theta_f, x_f\}$ and a log-wage equation given by:

$$\ln\, w_{ij} = \gamma_{0j} + \gamma_{1j} edu_{ij} + \gamma_{2j} exp_{ij} + \gamma_{3j} \frac{exp^2_{ij}}{100} + \epsilon_{ij} \quad j = \{m, f\}$$

This specification is the standard Mincer equation where $exp = (FTexp + PTexp)$. $FTexp$ and $PTexp$ are experience variables that reflects the total length of part-time and full time employment in the respondent's career up to the point of the interview in a given year. The school years and the additional vocational training are added together for the education variable.[4]

[4] See Table 13.

$(\epsilon_{im}, \epsilon_{if})$ are assumed to follow a joint normal distribution:

$$\begin{bmatrix} \epsilon_{im} \\ \epsilon_{if} \end{bmatrix} \sim N\left(\begin{bmatrix} 0 \\ 0 \end{bmatrix}, \begin{bmatrix} \sigma^2_{\epsilon m} & \rho\sigma_{\epsilon m}\sigma_{\epsilon f} \\ \rho\sigma_{\epsilon m}\sigma_{\epsilon f} & \sigma^2_{\epsilon f} \end{bmatrix} \right)$$

The standard deviation for the man's wage is denoted by $\sigma_{\epsilon m}$, $\sigma_{\epsilon f}$ denotes the standard deviation of the wife's wage and ρ is the correlation of the wage disturbances.

The heterogeneity among households in the model comes by allowing different households to have different preferences (λ) and productivity (δ). In addition spouses differ in these parameters as well, giving us heterogeneity within the household. For this, we assume the parameters $(\lambda_m, \lambda_f, \delta_m, \delta_f)$ are drawn from a joint distribution $G_u(S^u_{m,f})$. Although G_u is a parametric distribution, it is characterized by a high-dimensional parameter vector, which makes it "flexible".

The distribution is created by mapping a four-dimensional normal distribution into the appropriate parameter space using known functions[5]. Define the random vector $z_{4\times 1} \sim N(\mu_z, \Sigma_z)$, where μ_z is 4×1 and Σ_z is a 4×4 symmetric, positive-definite covariance matrix. The random variables $(\lambda_m, \lambda_f, \delta_m, \delta_f)$ are then defined using the link functions:

$$\lambda_m = \frac{\exp(z_1)}{1 + \exp(z_1)}$$

$$\lambda_f = \frac{\exp(z_2)}{1 + \exp(z_2)}$$

$$\delta_m = \frac{\exp(z_3)}{1 + \exp(z_3) + \exp(z_4)}$$

$$\delta_f = \frac{\exp(z_4)}{1 + \exp(z_3) + \exp(z_4)}$$

Thus:

$$\begin{pmatrix} z_1 \\ z_2 \\ z_3 \\ z_4 \end{pmatrix} \sim \mathrm{N}(\mu_z, \Sigma_z) \quad \text{and} \quad \begin{pmatrix} \frac{e^{z_1}}{1+e^{z_1}} \\ \frac{e^{z_2}}{1+e^{z_2}} \\ \frac{e^{z_3}}{1+e^{z_3}+e^{z_4}} \\ \frac{e^{z_4}}{1+e^{z_3}+e^{z_4}} \end{pmatrix} = \begin{pmatrix} \lambda_m \\ \lambda_f \\ \delta_m \\ \delta_f \end{pmatrix} \sim G(\cdot)$$

The means of z_3 and z_4 are allowed to depend on weather the household has a kid below 5 years old. This improves the model fit since it is expected that spouses with young children spend more time at home. Specifically, let BF be a dummy that equals 1 if there is in the household a child below the age of 5, the mean of z_3 is

$$\overline{z}_3 = \mu_3 + \mu_3^{\mathrm{BF}} \cdot \mathrm{BF}$$

[5]To assure $\lambda_j \in \{0, 1\}$ and $\delta_m + \delta_f < 1$.

and similarly the mean of z_4 is

$$\overline{z}_4 = \mu_4 + \mu_4^{\text{BF}} \cdot \text{BF}$$

where μ_i^{BF} for $i = 3, 4$ is the mean differences relative to households with older kids.

V.C Pareto Weights

Pareto weights α_i are modeled as a function of observables. To estimate the household's relative weight—interpreted as the weight placed on the husband's utility ($\alpha_i = 1$ indicates that only the husband's utility matters)—we use the variable "Last word on financial decisions. This variable records responses to the question: "Who has the last word in your relationship/marriage when making important financial decisions?" The question is asked to both partners, and the possible responses are: "me, my partner, or both equally". With these answers, we create a dummy variable called LW that equals 1 if the man in the household has the last word in financial decisions.

Differences in age and education between spouses can influence the Pareto weight. The following two equations describe this relationship:

$$\tilde{\alpha}_i = \beta_0 + \beta_1 \text{LW} + \beta_2(\text{age}_m - \text{age}_f) + \beta_3(\text{edu}_m - \text{edu}_f)$$

$$\alpha_i = \frac{1}{3} + \frac{1}{3} \times \frac{e^{\tilde{\alpha}_i}}{1 + e^{\tilde{\alpha}_i}}$$

Once we obtain the index $\tilde{\alpha}_i$ for each household, we then apply a transformation to ensure that $\alpha \in (\frac{1}{3}, \frac{2}{3})$. A Pareto weight $\alpha = 1/3$ implies that the husband's utility is twice as important as the wife's utility for the household, which is an extreme case.

V.D Identification

For households where both members work, we can compute the implied leisure and productivity parameters as a function of observables. These are informative about which variation in the data the model uses to identify the parameters. See Appendix (IX.C) for details on how we obtain these.

$$\lambda_j = \frac{w_j(T - l_j - h_j)}{\alpha_i(w_j + w_{-j})T} \quad \text{and} \quad \delta_j = \frac{w_j h_j}{M + w_j h_j + w_{-j} h_{-j}} \quad \text{with} \quad j \in \{M, F\}$$

The opportunity cost of leisure $w_j(T - l_j - h_j)$ relative to the potential earnings of the household $(w_i + w_j)T$ informs the leisure parameter λ_j. How each household member splits the time between leisure and working (either at home or in the labor market) is closely related to the relative weight leisure receives in the utility function. Similarly, the amount

of money foregone due to housework hours ($w_j h_j$) relative to the potential income of the household (net of leisure), informs the productivity parameter δ_j. Household members allocating long hours to housework are giving up a sizable share of potential income. Intuitively the model maps these members to a higher productivity parameter.

Three sources of variation help us identify the mean, variance, and covariances of the leisure/productivity distribution. First, the variation in observed hours across households identifies both the mean and covariance of preferences and productivity across the population. When similar households chose different allocations of time, the model infers different combination of parameters and these differences help uncover interactions and correlations. Second, the variation in time allocation within gender identifies the heterogeneity in preferences and productivity between men and women. We can infer different means and variances for men and women based on the observed differences in hours. Finally, the variation in wages across households helps with overall identification. Different wages imply different opportunity costs, and how households with different wages divide the time between work, housework, and leisure reveals information about their preferences and productivity.

Besides hours allocated to work, housework, and leisure, we rely on other observables at the individual level. Education, experience, and their interaction with observed wages are the main variation source in our wage equations. Differences in education and age within the household are the main variation source for identifying the Pareto weights. After estimating the model we verify the first order conditions are linearly independent, which ensures that the likelihood has a unique local maximum and that the parameters are locally identified.

V.E Estimation

We estimate the model using maximum likelihood. Let $g(\lambda_m, \lambda_f, \delta_m, \delta_f)$ denote the joint density of preference and technology parameters, and let $f(w_m, w_f|X)$ represent the joint density of wages from the log-Normal distribution, conditional on education and experience levels of both spouses.[6] To obtain the likelihood we follow these steps. First, given the observed choices—namely, hours of work and hours allocated to childcare and housework by each partner—we back out the implied preference and technology parameters, denoted $(\lambda_m^*, \lambda_f^*, \delta_m^*, \delta_f^*)$.

Next, we compute the density of the observed allocation of time, conditional on wages and income, using the change of variables formula:

$$f(l_m, h_m, l_f, h_f|w_m, w_f) = |J|^{-1} \cdot g(\lambda_m^*, \lambda_f^*, \delta_m^*, \delta_f^*),$$

[6]We are assuming there's no non-labor income. Including it modifies this joint density to $f(w_m, w_f, y|X)$.

where $|J|$ is the determinant of the Jacobian associated with the transformation from the parameter space to the space of observed choices.

Let $\theta = (\mu_z, \Sigma_z, \gamma, \Sigma_w, \beta)'$. The likelihood to maximize is[7]

$$L(\theta) = \prod_{i=1}^{n} f_{\text{INT}}(l_m^i, h_m^i, l_f^i, h_f^i, w_m^i, w_f^i)^{\mathbf{1}\{l_f^i>0\}} \cdot f_{\text{COR}}(l_m^i, h_m^i, h_f^i, w_m^i)^{\mathbf{1}\{l_f^i=0\}}$$

$$f_{\text{INT}}(\cdot) = f(l_m^i, h_m^i, l_f^i, h_f^i | w_m^i, w_f^i) \cdot f(w_m^i, w_f^i | X)$$
$$f_{\text{COR}}(\cdot) = \int f(l_m^i, h_m^i, u, h_f^i | w_m^i) \cdot \mathbf{P}[w_f < \bar{w}_f(w_m^i) | w_m^i, X] \cdot f(w_m^i | X) du$$

This likelihood is then maximized with respect to the parameters governing the distribution of heterogeneity in preferences and technologies, wage offers, and Pareto weights.

Selection of sample characteristics

For the estimation of the model we use only data from year 2014. We keep all married couples between the age of 20-45. We also require that the man of the household works, that both spouses earn less than €25 and to have at least one child. After applying this criteria we get a sample of 1112 households with which we estimate our model.

VI Estimation Results

Table 7 presents the point estimates, and Figure 6 displays the estimated distribution of the spousal preference and production parameters $\{\lambda_m, \lambda_f, \delta_m, \delta_f\}$. We find that the distributions of leisure preferences for men and women share a similar shape but differ in mean—men exhibit a higher preference for leisure. In contrast, the productivity parameter, which likely captures efficiency or skill in home production or labor market work, differs not only in average level but also in the overall shape of its distribution between genders. This suggests greater heterogeneity in productivity between men and women. Together, these differences imply that gender plays a key role in shaping household time allocation, both through preferences and constraints. Men and women might respond differently to policy or wage changes due to these underlying structural differences.

Figure 7 displays the correlation between pairs of leisure and technology parameters. We do not observe a strong degree of assortative matching between leisure preferences or productivity characteristics; if anything, a small negative correlation is evident. There is no clear pattern showing that individuals who value leisure more are either more or less

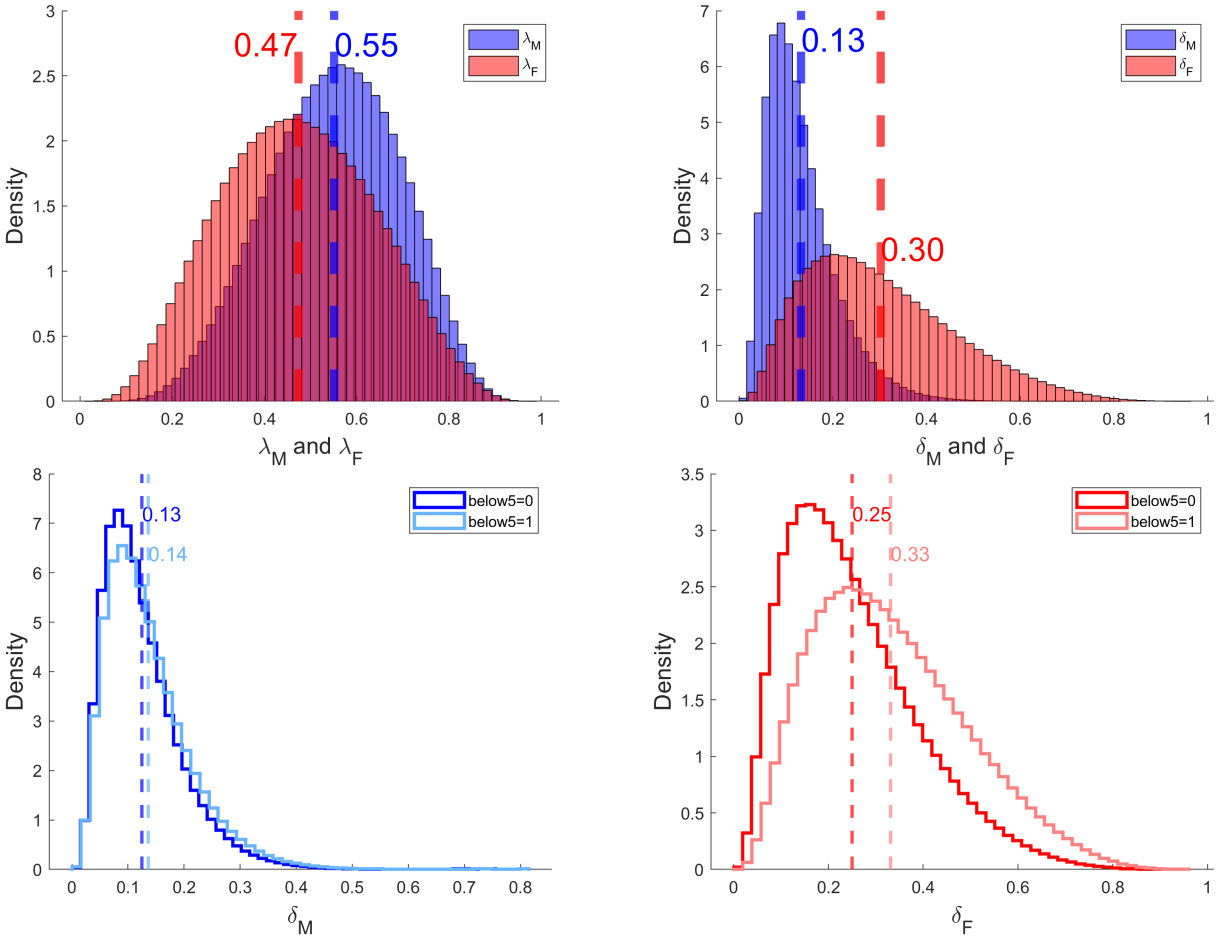
[7] For the corner solution we set $u = \delta_2$, a helper coordinate.

Table 7: Parameter Estimates

	Point Estimate	(Std. Error)			
Preferences and Technology					
μ_1	0.2247	(0.0387)	$\rightarrow$	mean λ_m	0.5513
μ_2	-0.1188	(0.0407)	$\rightarrow$	mean λ_f	0.4736
μ_3	-1.7273	(0.0334)	$\rightarrow$	mean δ_m, if BF=0	0.1251
μ_3^{BF}	0.2607	(0.0410)	$\rightarrow$	mean δ_m, if BF=1	0.1364
μ_4	-1.0510	(0.0428)	$\rightarrow$	mean δ_f, if BF=0	0.2503
μ_4^{BF}	0.4917	(0.0518)	$\rightarrow$	mean δ_f, if BF=1	0.3312
σ_{11}	0.3950	(0.0283)	$\rightarrow$	std λ_m	0.1430
σ_{22}	0.5478	(0.0283)	$\rightarrow$	std λ_f	0.1650
σ_{33}	0.4144	(0.0172)	$\rightarrow$	std δ_m	0.0736
σ_{44}	0.6687	(0.0274)	$\rightarrow$	std δ_f	0.1566
σ_{12}	-0.1839	(0.0268)	$\rightarrow$	corr (λ_m, λ_f)	-0.3933
σ_{13}	-0.0581	(0.0189)	$\rightarrow$	corr (λ_m, δ_m)	0.0048
σ_{14}	-0.1802	(0.0295)	$\rightarrow$	corr (λ_m, δ_f)	-0.3191
σ_{23}	-0.0986	(0.0168)	$\rightarrow$	corr (λ_f, δ_m)	-0.1964
σ_{24}	-0.0006	(0.0186)	$\rightarrow$	corr (λ_f, δ_f)	0.0297
σ_{34}	0.1273	(0.0167)	$\rightarrow$	corr (δ_m, δ_f)	-0.3106
Wage Equations					
γ_{0m}	1.8475	(0.0801)			
γ_{0w}	0.8011	(0.0934)			
γ_{EDU_m}	0.0446	(0.0044)			
γ_{EDU_f}	0.0756	(0.0068)			
γ_{EXP_m}	0.0374	(0.0075)			
γ_{EXP_f}	0.0851	(0.0101)			
$\gamma_{\text{EXP}_m^2}$	-0.0862	(0.0246)			
$\gamma_{\text{EXP}_f^2}$	-0.2209	(0.0436)			
σ_m^2	0.0972	(0.0044)			
σ_f^2	0.1875	(0.0115)			
Pareto Weights					
β_0	0.4071	(0.0788)	$\rightarrow$	mean α	0.5350
β_{LW}	0.0798	(0.1152)	$\rightarrow$	std α	0.0149
$\beta_{\text{AGE-DIFF}}$	0.0001	(0.0120)			
$\beta_{\text{EDU-DIFF}}$	0.0773	(0.0175)			

Note: Standard errors are computed from the inverse Hessian of the log-likelihood. Parameters constrained to be positive are estimated via exponential transformation, and covariance matrices are parameterized through their Cholesky decomposition. Standard errors for the underlying parameters are obtained using the delta method. The last two columns present some moments of the model.

Figure 6: Distribution of Preferences and Technology



Note: The first row shows the distribution of leisure (left panel) and productivity (right panel) parameters. The second row shows the distribution of productivity parameters conditional on having kids below the age of 5 for men (left) and women (right).

productive than those who value leisure less, nor is there evidence that individuals who place a higher value on leisure are matched with more productive partners.

Figure 7: Bivariate relationships between production and preference parameters.

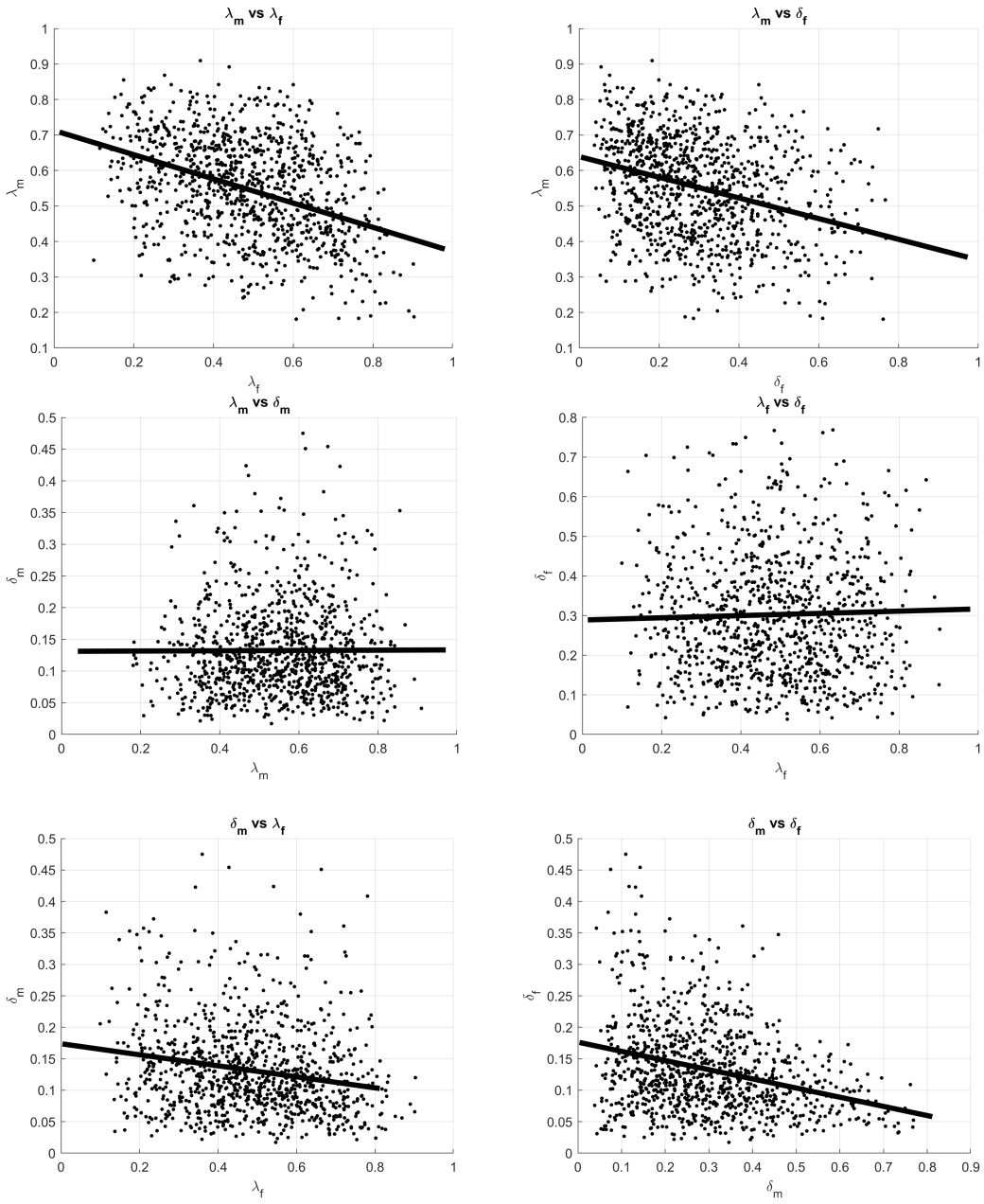
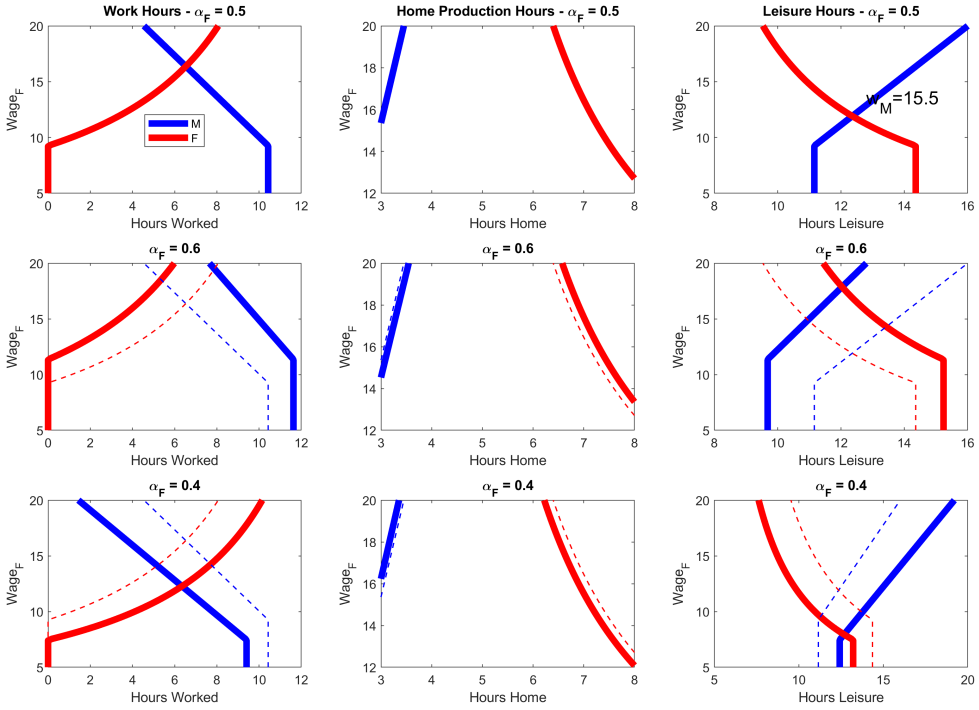


Figure 8 shows the comparative statics for changes in w_f with the recovered parameters, thus it shows the model prediction of the optimal allocation after women increase their wages for the average household. We present the predicted results for different bargaining powers and we expect the true allocation to be somewhere between those two extremes (between $\alpha \in (0.4 - 0.6)$)

Figure 8: Comparative statics for w_f after estimation



Note: Figure 8 shows a comparative statistics analysis for increases in w_f. Each row is for a different Pareto Weight (0.5, 0.6 and 0.4 respectively). From left to right, the columns display the optimal allocation given the estimated parameters for paid labor, home production, and leisure when men's wage is assumed to be the average of $w_h = 15$.

VI.A Validation Exercise

As a validation exercise, we use the model to predict the optimal time allocation following the implementation of the minimum wage. Specifically, we take the 2014 data and our estimated parameters, then assign a wage of €8.5 to every spouse earning below that threshold. Using this adjusted wage structure, we compute the new optimal allocation and measure the change relative to the original allocation. While this is not a true difference-in-differences (DID) design—since the "control" group experiences no change in either wages or parameters—it serves as a useful benchmark to assess whether the model's predicted re-allocations are in line with our empirical DID findings from the previous section. Intuitively, what we are doing in this section is to determine if the model is a good predictor of household behavior by contrasting it with what happened in reality.

We conduct this exercise using two samples. First we consider the full sample, where we impute a wage offer of €8.5 to everyone with a lower wage offer (independently if they were working or not). Then we repeat it for households where originally both spouses were working. For the full sample, our model predicts that men increase their hours in home production by an average of 8 minutes (0.14 hrs), while women decrease theirs by roughly 35 minutes (0.59 hrs) on average. When we restrict the sample to households with both spouses working, the predicted shifts are larger: men increase home production

by an average of 18 minutes (0.3 hours), and women decrease theirs by 1 hour. The magnitude of change in the restricted sample is roughly twice as large as that observed in the full sample, highlighting how labor market attachment conditions the household's response to wage changes.

A few remarks are in order. We do not expect the comparison to be perfect since this static analysis ignores other changes that occurred on year 2015 which the DID is able to capture. We are also ignoring spillover effects, Dustmann et al. 2022 shows that hourly wages up to €12.5 were subjected to increases due to the policy. Finally, the model considers a public good which involves all home production and activities while with the DID differentiates between childcare and housework. However, this analysis provides a straightforward interpretation and the results are considerably close, suggesting that the model accurately captures household behavior. Table 8 contrasts home production and childcare outcomes from the DID with the model predictions for each spouse.

Table 8: Validation Exercise

	Full Sample		Both Working	
	$\triangle h_f$	$\triangle h_m$	$\triangle h_f$	$\triangle h_m$
DID (Home)	-1.04	0.375	-1.15	0.244
DID (Childcare)	-0.894	0.267	-0.853	0.235
Model	-0.59	0.14	-1.00	0.299

Note: The table compares the difference-in-difference results shown in Section IV with the model predictions. The first 2 columns are for all households, while columns 3-4 are for households in which both spouses work. It shows the change in hours for men and women, both in home production and childcare.

These results show that men and women's time allocation is consistent across sample choices. The model does a good job for the case of both spouses working but underestimates the reduction of hours from women when considering the full sample. It also show that the model predictions lie between the two outcomes (home and childcare hours), suggesting that the model is well attuned.

VI.B Hours Decomposition

For Subsections VI.B and VII.A, we use the parameters obtained when wages come from two lognormal distributions: $\ln(w_j) \sim \mathrm{N}(\mu_{wj}, \sigma^2_{wj})$ instead of the Mincer wage offers. The estimated parameters obtained with this method are displayed in Table 19 in the Appendix. These represent the unconditional mean of wages, and since the outcomes we study in the aforementioned sections are for the average household, this method allows for a cleaner interpretation.

Within a household the hours distribution can differ because of wage offers or differences in preferences and technology. We present a simple exercise of decomposition between the two. Let the preference and technology distribution be the following:

$$\begin{pmatrix} Z_1 \\ Z_2 \\ Z_3 \\ Z_4 \end{pmatrix} = \begin{pmatrix} \bar{Z}_{12} + \epsilon_1 \\ \bar{Z}_{12} + \epsilon_2 \\ \bar{Z}_{34} + \epsilon_3 \\ \bar{Z}_{34} + \epsilon_4 \end{pmatrix}$$

Where $\bar{Z}_{12} = \frac{Z_1+Z_2}{2}$ and $\bar{Z}_{34} = \frac{Z_3+Z_4}{2}$ represent the distribution of leisure and productivity of the average person, understood as the average of a man and a woman and ε_i is the deviation from this average. Similarly for the wage distribution we define $\bar{W} = \frac{W_1+W_2}{2}$ to be the average wage offer.

Table (9) presents four simulations. In this simulations we will start with a restricted model where men and women on each household have the exact same preferences and productivity (within the household spouses are identical, however the heterogeneity across households remains). We will then progressively relax the model by introducing heterogeneity in preferences and technology until recovering the original fully flexible model of the previous section. We do this in order to isolate the effects of each component.

Table 9: Mean Hours Decomposition

	Man			**Woman**		
	Work	Prop. Working	Home	Work	Prop. Working	Home
Restricted	6.84	1.00	4.75	6.84	1.00	4.75
Different Wages	8.41	0.95	4.32	3.42	0.58	5.68
Diff. Prefs. & Tech.	6.65	0.95	3.27	6.37	0.88	7.03
Diff. Leisure	5.33	0.94	4.74	8.46	0.99	4.78
Diff. Productivity	8.18	1.00	3.29	4.66	0.89	7.03
Full	8.11	0.93	2.99	3.73	0.54	8.01

Note: First, the restricted model shuts down all sources of heterogeneity. In the second and third rows we allow for wages to be different or preferences and technology parameters to be different respectively. Lastly, the full row allows for heterogeneity in preferences, technology, and wages.

Differences in the wage offer explain most of the differences in working hours, while differences in preferences and technology explain most of the observed differences in home hours. Note that both effects go in the direction of more home hours for the woman and less home hours for the man.

VI.C Goodness of Fit

We present the model's goodness of fit in Table 11, which reports time allocations to paid labor and home production, conditional on education levels. The model replicates the

Table 10: Mean Hours Decomposition - Both Spouses Working

	Men		Women	
	Work	Home	Work	Home
Restricted	6.84	4.75	6.84	4.75
Different Wages	8.41	4.32	3.42	5.68
Diff. Prefs. & Tech.	6.65	3.27	6.37	7.03
Diff. Leisure	5.33	4.74	8.46	4.78
Diff. Productivity	8.18	3.29	4.66	7.03
Full	8.11	2.99	3.73	8.01

Note: Same analysis as in table 9 but for households with both spouses working.

data patterns well, especially for individuals with high education. Mean values are closely matched overall, particularly for home production. However, the simulated standard deviations are systematically higher than those in the data. This may reflect the fact that the model allows individuals to choose any number of hours, while in reality, work hours are subject to institutional and contractual constraints, limiting flexibility and introducing less dispersion around the optimum. The largest discrepancies occur in hours worked by high-education men and in home production for low-education women, though these gaps are not substantial.

VII Counterfactuals

VII.A Same Wage offer

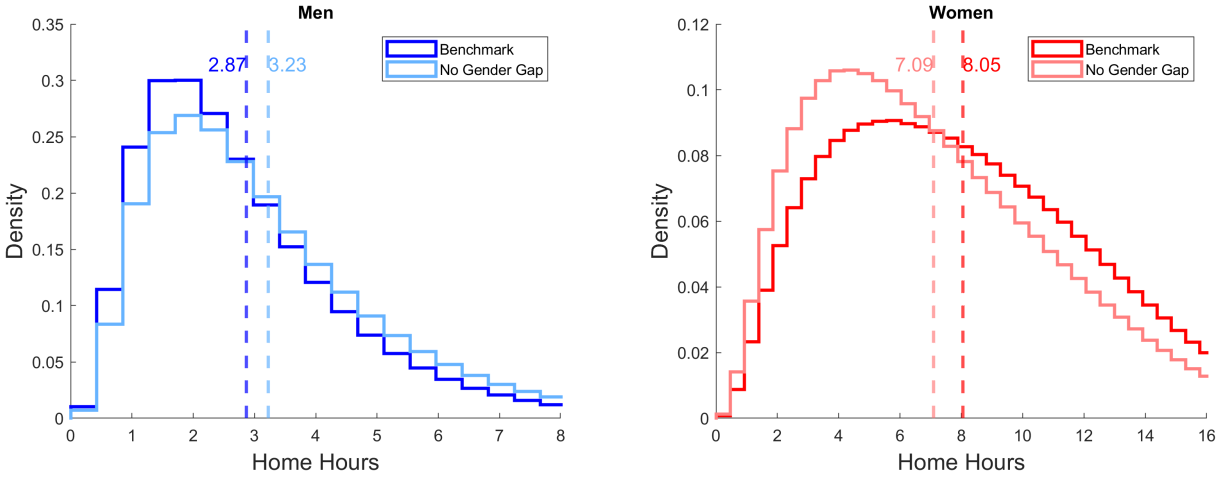
The first counterfactual we perform involves an experiment where, given the leisure preferences and productivity parameters obtained, we re-estimate the optimal time allocations assuming that both spouses receive wage offers from the same distribution. Specifically, we assume the woman receives a wage offer from the wage distribution of the husband. In this exercise with examine how the distribution of time would change if the wage gap were completely closed. The results are displayed in Figure 9. We observe that while the distribution of time allocated to home production does not significantly change in shape, it does shift in terms of the mean. Women's mean time spent on home production decreases from 8.05 hours a day to 7.09 hours, while men slightly increase their time in home production from 2.87 on average to 3.23. These findings suggest that differences persist even when both spouses face the same wage distribution, but the asymmetry in home production tasks would be significantly reduced. Though not exactly the same exercise, these findings are consistent with the mean hours decomposition presented in tables (9) and (10).

Table 11: Goodness of Fit

	Male		**Female**	
	Sim.	Data	Sim.	Data
Panel A: Home Production				
Education				
Low	2.775	2.660	8.170	8.842
	(1.710)	(1.618)	(4.129)	(4.042)
High	2.941	2.909	7.924	7.839
	(1.825)	(1.741)	(4.106)	(3.732)
Panel B: Hours Worked				
Education				
Low	8.574	8.759	3.281	2.631
	(3.473)	(1.392)	(4.462)	(2.895)
High	7.771	8.800	4.197	4.108
	(3.82)	(1.338)	(4.744)	(3.183)
Panel C: Wages				
Education				
Low	14.49	14.81	5.515	6.12
	(5.69)	(4.44)	(6.76)	(6.19)
High	15.90	16.79	8.780	9.994
	(7.13)	(4.66)	(9.10)	(7.70)
Panel D: Below Min Wage				
Workers below min wage				
	0.044	0.0427	0.246	0.239

Note: The table contrasts moments from the simulated with the actual data. Sample is classified as high (low) education if they are above (below) average. It compares by gender the hours in home production, hours of paid labor, wages and fraction of the sample below minimum wage

Figure 9: Wage Offer from the Same Distribution



Note: We plot the distribution of hours allocated in housework for men (left panel) and women (right panel). Darker colors correspond to the benchmark estimation. Relative to the benchmark, we give the woman a wage offer drawn from her partner's wage distribution. Lighter colors show the distribution after this change.

VII.B Different Minimum Wage

In this subsection we present the model predictions for a different minimum wage. We use the current minimum wage of €8.5 per hour as the benchmark, which in our model is associated with an effect of $\triangle h_f = -1.00$ if we consider a woman working and earning below €8.5 before the policy as treated, or $\triangle h_f - 0.59$ if we consider as treated a woman whose wage offer would have been below €8.5, regardless of whether she was working. The corresponding numbers for men's hours are $\triangle h_m = 0.30$ and $\triangle h_m = 0.14$ respectively. Additionally, 10% of women enter the labor market in response to the minimum wage.

Table (12) displays the same outcomes, but for a minimum wage of €10. With the higher minimum wage, the proportion of women entering the labor market increases to 15%. On average, the hours allocated to home production follow the same trend as with the €8.5 minimum wage, but the magnitude is higher. As a result, women (men) decrease (increase) their time in home production even more. For individuals earning above €10 (the control group), none of their relevant variables change after the policy, so the post-policy outcome is the same as the pre-policy outcome, yielding a difference of 0. Consequently, the difference-in-differences calculation reflects only the treatment group's change.

To be considered treated, the woman of the household needs to make less than the minimum wage of €8.5 in the left panel of Table (12) or €10 in the right panel. In the all column we consider treated any woman whose wage offer was below the minimum wage. In the working column we also ask the woman to be working and actively earning a wage before applying the policy. We see that a minimum wage of €10 would imply a reduction of ~ 10 extra minutes on the average time women put on home production.

Table 12: Increasing the Minimum Wage

	$w_f < 8.5$				$w_f < 10$			
	All		**Working**		**All**		**Working**	
	h_f	h_m	h_f	h_m	h_f	h_m	h_f	h_m
Pre	8.96	2.58	6.83	2.85	8.80	2.62	6.76	2.88
Post	8.37	2.73	5.83	3.16	8.02	2.83	5.67	3.25
DID	-0.59	0.14	-1.00	0.30	-0.78	0.21	-1.08	0.37

Note: Table 12 displays DID performed with simulated data for the actual minimum wage of €8.5 and a counterfactual one of €10. The pre row uses data from 2014 and the estimated parameters to compute the optimal allocation, while the post row does the same but assigning minimum wage to all those individuals with wage offers below €8.5 (or €10) and re-computes the new optimal allocation. The DID row shows the resulting difference in optimal home production hours for each spouse.

VII.C Alternative Models: Effect of Restricting Heterogeneity

In this final exercise, we demonstrate the importance of allowing for heterogeneity in the parameters. To do so, we begin by imposing different restrictions on the model, then re-estimate the parameters and compute the new optimal allocations. Using these results, we re-compute the DID and compare it to the outcomes from the fully flexible model. For each new model that we propose, we impose restrictions on either λ, δ, or both, by assuming they come from the same distribution. The goal of this section is to demonstrate how neglecting heterogeneity—whether in preferences or productivity—can bias the estimates and affect predictive power. We find that when we force productivity to be the same across households, the change in preferences is more pronounced than the change in productivity when preferences are forced to be identical. This suggests that models ignoring productivity heterogeneity tend to produce more extreme biases.

Table 13: Different Models

	Benchmark	$\boldsymbol{\lambda, \delta_f, \delta_m}$	$\boldsymbol{\lambda_f, \lambda_m, \delta}$	$\boldsymbol{\lambda, \delta}$	$\boldsymbol{\alpha_f = 0.4}$
meanλ_m	0.582	0.514	0.627	0.519	0.484
meanλ_f	0.448	0.514	0.411	0.519	0.556
meanδ_m	0.129	0.120	0.188	0.193	0.129
meanδ_f	0.309	0.360	0.193	0.218	0.313

Note: Using 1,112 household observations, Table 13 presents the resulting estimated parameters for different model restrictions. The first column displays the parameters with full flexibility, the second assumes a common leisure preference, the third assumes identical productivity, and the fourth assumes both identical productivity and leisure preferences. Finally, the fifth column displays the true model, but with a different (common) Pareto weight

Table 13 shows that when restrictions are imposed, the other parameters absorb some of the ignored heterogeneity to compensate. For example, when we restrict leisure preferences to come from the same distribution, the productivity of each spouse becomes more

Table 14: DID for Different Models

	DID coef. h_f				
	Benchmark	$\lambda_m = \lambda_f$	$\delta_m = \delta_f$	Identical	$\alpha_f = 0.4$
$W_f < 8.5$	-0.49	-0.30	-0.64	-0.36	-0.31
$W_f < 8.5$ and W.	-0.89	-0.77	-0.79	-0.63	-0.84

Note: Table 14 shows for each of the restricted models the resulting DID coefficient. The first row is for the full sample of households while the second considers only household that have both spouses working.

extreme: men are less productive than before ($\triangle\delta_m = -0.009$), while women, who were already significantly more productive, become even more so ($\triangle\delta_f = 0.051$). The last columns is not a restriction but a different choice of Pareto weight. It considers the case where the utility of men is weighted by 0.6 and women by 0.4. We observe that productivity remains the same and that leisure preferences are the ones that adapt to rationalize the time allocations chosen. Table 14 displays the resulting DID for the new models. The first row considers as treated everyone who earns less than €8.5, which includes people who aren't working and the second row restricts it to households where everyone works.

VIII Discussion and Conclusion

In this paper, we study household time allocation decisions and the effect of the minimum wage on optimal allocation. Specifically, we examine the impact of the introduction of the minimum wage in Germany on the time allocation of spouses. In the first part of the paper, we perform a difference-in-differences analysis, where we observe that after the minimum wage was implemented, women spent, on average, between 35-60 minutes less on home production per day and, although not significantly, increased their hours in the labor market. We expand the analysis to an event study to verify that the allocations in the pre-policy period followed parallel trends and to assess the short-term effects. From this, we find that pre-minimum wage time allocations did not move different between the treated and control groups, and that after the policy, households re-optimized and did not revert to the previous allocation. Thus, the observed reduction in home production was sustained.

We then propose a model following Flinn, Todd, and Zhang 2018, where the household maximizes a weighted average of each spouse's utility, which depends on two goods: leisure and a common good, referred to as home production. Households and spouses differ in their valuation of leisure and their productivity in providing the common good. Using maximum likelihood, we estimate these parameters and find that men have a higher preference for leisure, while women have higher productivity in producing the common good. These differences, especially the productivity difference, explain the significant disparity in time allocated to home production among spouses, as observed in the data.

These results align with the theory that spouses specialize according to their comparative advantages. However, as shown in Tables 9 and 10, all factors contribute to the decision, with wages being the primary driver.

With the estimated parameters we perform two counterfactual exercises. First, we calculate the optimal allocation for the case where the wage offers for men and women come from the same distribution. This is a way of approaching the wage gap and what would households do if it was shortened. We show that the spouses' distributions does not change in shape but it does in means. When spouses draw wages from the distribution using the men's data, women significantly reduce their time on home production. The second counterfactual considers a different minimum wage. We assume a minimum wage of €10, which is €1.5 higher than the baseline. Table 12 displays the results. A higher minimum wage would increase women's labor participation by 14%, which is 4 percentage points higher than with the current minimum wage. Since women are more likely to be minimum wage earners, this policy could help reduce the gender wage gap, which is what we observe in this counterfactual.

Our model presents several important features. First, by using maximum likelihood, we avoid the arbitrary selection of moments that SMM requires. We estimate wage equations and Pareto weights based on observables, and we allow for heterogeneity in parameters both across and within households. All of these aforementioned features not only contribute to a good fit but also give us the freedom to explore how changes in any of these affect the optimal allocation and provide the opportunity to run different counterfactuals, enabling a deeper understanding of the model's sensitivity to different assumptions and policy scenarios.

To the best of our knowledge, this is the first paper that links time allocation with minimum wage using a structural approach. The reduced-form approach helps validate our model and contributes to the existing literature on minimum wage. This paper provides suggestive evidence on the most relevant factors for the time allocation decision; however, the framework we provide could be further developed to offer a quantitative estimate of each factor's contribution. This is something we aim to explore in future papers to contribute to the discussion on time allocation theories. Finally, this paper offers valuable insights for policymakers and highlights how various alternatives could be used to reduce the gender wage gap.

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IX Appendix

IX.A DID for different cut-off (16)

Table 15: DID Estimates II (Both Working)

	Childcare		**Home Hrs**	
	Women	Men	women	men
DID	-1.4527	-0.2340	-1.1820	-0.3362
	(0.8584)	(0.4489)	(0.8311)	(0.5118)
Households	728	728	728	728

Robust standard errors in parentheses

Table 16: DID Estimates II (Full Sample)

	Childcare		**Home Hrs**	
	Women	Men	women	men
DID	-0.9948	0.1227	-1.0396	0.1265
	(0.3510)	(0.2023)	(0.3616)	(0.2519)
Households	1190	1190	1190	1190

Robust standard errors in parentheses

IX.B PSM with wage below 16

Table 17: DID Estimates using PSM - By Spouse

	Childcare		Home Hrs	
	Women	**Men**	**Women**	**Men**
PSM: 0.2-0.8				
DID	-1.058	-0.041	-1.317	-0.050
	(0.337)	(0.200)	(0.421)	(0.235)
Households	1,536	1,536	1,536	1,536
PSM: 0.3-0.7				
DID	-0.915	-0.294	-1.156	-0.050
	(0.331)	(0.1946)	(0.413)	(0.228)
Households	1,710	1,710	1,710	1,710
PSM: 0.4-0.6				
DID	-0.837	-0.312	-1.048	-0.067
	(0.326)	(0.190)	(0.408)	(0.222)
Households	1,811	1,811	1,811	1,811
PSM: 0.5-0.5				
DID	-0.782	-0.054	-0.990	-0.064
	(0.319)	(0.1868)	(0.401)	(0.219)
Households	1,880	1,880	1,880	1,880

Robust standard errors in parenthesis
Households before: 1,190

IX.C Algebra of the Model Solution

In this subsection, subindex $i = 1$ refers to the man and $i = 2$ refers to the woman. Given the preference and technology parameters $(\lambda_1, \lambda_2, \delta_1, \delta_2)$, the Pareto weights (α_1, α_2) such that $\alpha_1 + \alpha_2 = 1$, and the wage offers (w_1, w_2) we have four cases: (i) Both work, (ii) men works and woman doesn't, (iii) woman works and men doesn't, and (iv) no one works. Let $\tilde{\alpha} = \alpha_1(1 - \lambda_1) + \alpha_2(1 - \lambda_2) \geq 0$ and similarly $\tilde{\delta} = 1 - \delta_1 - \delta_2 > 0$. We provide a full characterization of the model solution going case by case.

1. Both Work

If spouses receive similar wage offers, they both work. This happens if both w_1 and w_2 are high enough relative to the total potential income the household could make. Specifically:

$$\frac{w_1 T}{\alpha_1\lambda_1 + \tilde{\alpha}\delta_1} \geq (w_1 + w_2)T + y$$
$$\frac{w_2 T}{\alpha_2\lambda_2 + \tilde{\alpha}\delta_2} \geq (w_1 + w_2)T + y$$

The first order conditions are given by the following system of equations:

$$[\alpha_1\lambda_1 + \tilde{\alpha}\delta_1] \cdot h_1 + \tilde{\alpha}\delta_1 \cdot l_1 = \tilde{\alpha}\delta_1 T \tag{2}$$
$$[\alpha_2\lambda_2 + \tilde{\alpha}\delta_2] \cdot h_2 + \tilde{\alpha}\delta_2 \cdot l_3 = \tilde{\alpha}\delta_2 T \tag{3}$$
$$\tilde{\alpha}\tilde{\delta}w_1 \cdot h_m + [\tilde{\alpha}\tilde{\delta}w_1 + \alpha_1\lambda_1 w_1] \cdot l_m + \alpha_1\lambda_1 w_2 \cdot l_f = \tilde{\alpha}\tilde{\delta}w_1 T - \alpha_1\lambda_1 y \tag{4}$$
$$\tilde{\alpha}\tilde{\delta}w_2 \cdot h_f + [\tilde{\alpha}\tilde{\delta}w_2 + \alpha_2\lambda_2 w_2] \cdot l_f + \alpha_2\lambda_2 w_1 \cdot l_m = \tilde{\alpha}\tilde{\delta}w_2 T - \alpha_2\lambda_2 y \tag{5}$$

This a linear system. In matrix form: $(l_m, h_m, l_f, h_f)'$.

$$\begin{pmatrix} \tilde{\alpha}\delta_1 & [\alpha_1\lambda_1 + \tilde{\alpha}\delta_1] & 0 & 0 \\ 0 & 0 & \tilde{\alpha}\delta_2 & [\alpha_2\lambda_2 + \tilde{\alpha}\delta_2] \\ w_1[\tilde{\alpha}\tilde{\delta} + \alpha_1\lambda_1] & \tilde{\alpha}\tilde{\delta}w_1 & \alpha_1\lambda_1 w_2 & 0 \\ \alpha_2\lambda_2 w_1 & 0 & w_2[\tilde{\alpha}\tilde{\delta} + \alpha_2\lambda_2] & \tilde{\alpha}\tilde{\delta}w_2 \end{pmatrix} \cdot \begin{pmatrix} l_m \\ h_m \\ l_f \\ h_f \end{pmatrix} = \begin{pmatrix} \tilde{\alpha}\delta_1 T \\ \tilde{\alpha}\delta_2 T \\ \tilde{\alpha}\tilde{\delta}w_1 T - \alpha_1\lambda_1 y \\ \tilde{\alpha}\tilde{\delta}w_2 T - \alpha_2\lambda_2 y \end{pmatrix}$$

Solving the system yields:

$$l_1 = \frac{w_1 T - (\alpha_1\lambda_1 + \tilde{\alpha}\delta_1)[(w_1 + w_2)T + y]}{w_1}$$
$$h_1 = \frac{\tilde{\alpha}\delta_1[(w_1 + w_2)T + y]}{w_1}$$
$$l_2 = \frac{w_2 T - (\alpha_2\lambda_2 + \tilde{\alpha}\delta_2)[(w_1 + w_2)T + y]}{w_2}$$
$$h_2 = \frac{\tilde{\alpha}\delta_2[(w_1 + w_2)T + y]}{w_2}$$

2. Man Works and Woman doesn't

If the man's wage offer is substantially higher than the woman's wage offer, he'll be the only one working. Formally:

$$\frac{w_1 T}{\alpha_1\lambda_1 + \tilde{\alpha}\delta_1} \geq (w_1 + w_2)T + y > \frac{w_2 T}{\alpha_2\lambda_2 + \tilde{\alpha}\delta_2}$$

For this case the solution is:

$$
\begin{aligned}
l_1 &= \frac{\tilde{\alpha}\tilde{\delta}w_1T - (\alpha_1\lambda_1 + \tilde{\alpha}\delta_1)y}{[\alpha_1\lambda_1 + \tilde{\alpha}(1-\delta_2)]w_1} \\
h_1 &= \frac{\tilde{\alpha}\delta_1(w_1T + y)}{[\alpha_1\lambda_1 + \tilde{\alpha}(1-\delta_2)]w_1} \\
l_2 &= 0 \\
h_2 &= \frac{\tilde{\alpha}\delta_2 T}{\alpha_2\lambda_2 + \tilde{\alpha}\delta_2}
\end{aligned}
$$

3. Woman Works and Men doesn't

If the woman's wage offer is substantially higher than the men's wage offer, she'll be the one working. This happens if:

$$
\frac{w_1T}{\alpha_1\lambda_1 + \tilde{\alpha}\delta_1} < (w_1 + w_2)T + y \leq \frac{w_2T}{\alpha_2\lambda_2 + \tilde{\alpha}\delta_2}
$$

The solution is analogue to case #2.

4. No one Works

If both wage offers are low relative to the non-labor income y, no one will work. Note this never happens for the case $y = 0$.

$$
\begin{aligned}
\frac{w_1T}{\alpha_1\lambda_1 + \tilde{\alpha}\delta_1} &< (w_1 + w_2)T + y \\
\frac{w_2T}{\alpha_2\lambda_2 + \tilde{\alpha}\delta_2} &< (w_1 + w_2)T + y
\end{aligned}
$$

The solution for this case is:

$$
\begin{aligned}
l_1 &= l_2 = 0 \\
h_1 &= \frac{\tilde{\alpha}\delta_1 T}{\alpha_1\lambda_1 + \tilde{\alpha}\delta_1} \\
h_2 &= \frac{\tilde{\alpha}\delta_2 T}{\alpha_2\lambda_2 + \tilde{\alpha}\delta_2}
\end{aligned}
$$

Invert the system

The system (2) can be solved for $(\lambda_1, \lambda_2, \delta_1, \delta_2)$ as a function of observables. This is used for the computation of the likelihood in the interior solution case.

$$\delta_1^* = \frac{w_1 h_1}{M + w_1 h_1 + w_2 h_2}$$
$$\delta_2^* = \frac{w_2 h_2}{M + w_1 h_1 + w_2 h_2}$$
$$\lambda_1^* = \frac{w_1 (T - l_1 - h_1)}{\alpha_1 [(w_1 + w_2)T + y]}$$
$$\lambda_2^* = \frac{w_2 (T - l_2 - h_2)}{\alpha_2 [(w_1 + w_2)T + y]}$$

IX.D Comparative Statics of the Model

Next, we present a series of comparative statics to better understand the model's predictions prior to estimation. This exercise allows us to distinguish which features of the results are driven by the underlying structure of the model versus those emerging from the data.

Figure 10 shows the optimal allocations for different outcomes (hours allocated to the labor market, home production, and leisure) in the case of identical individuals—i.e., both spouses have the same preferences for leisure and home productivity—as a function of the woman's wage (w_f). Figure 11 aggregates the results from 10 at the household level, thus it shows the sum of work, home production and leisure for the household. finally, Figure 12 shows the effects of increasing w_f after a positive productivity shock for women (an increase in δ_f). This final figure suggests that higher productivity could explain the asymmetry in home production distribution observed in the data. It also shows that a higher w_f reduces this gap, making the minimum wage an attractive policy in areas where women are most likely to earn below the minimum wage and have high labor force participation. By contributing to a more even allocation of housework, it increases the hours of paid labor, helping to reduce the wage gap.

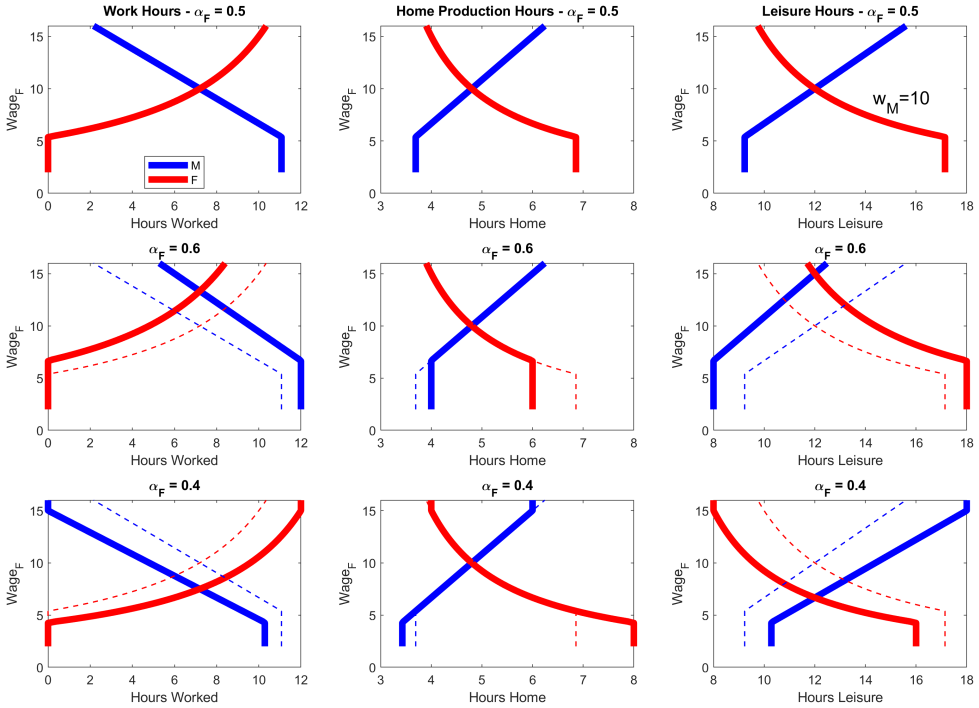


Figure 10: Comparative statics for w_f for identical spouses

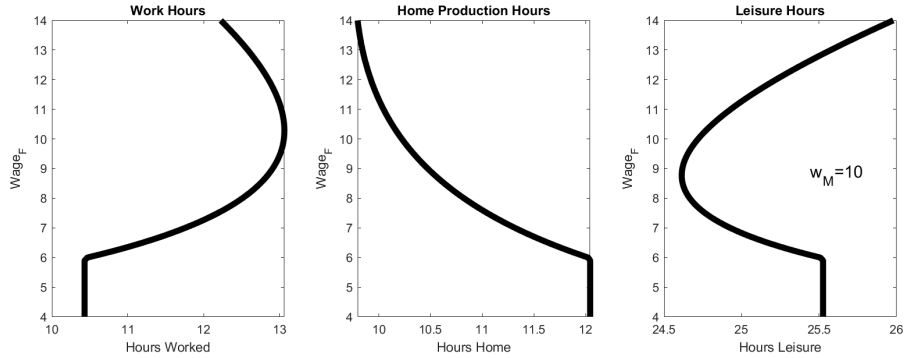


Figure 11: Household level (Aggregate)

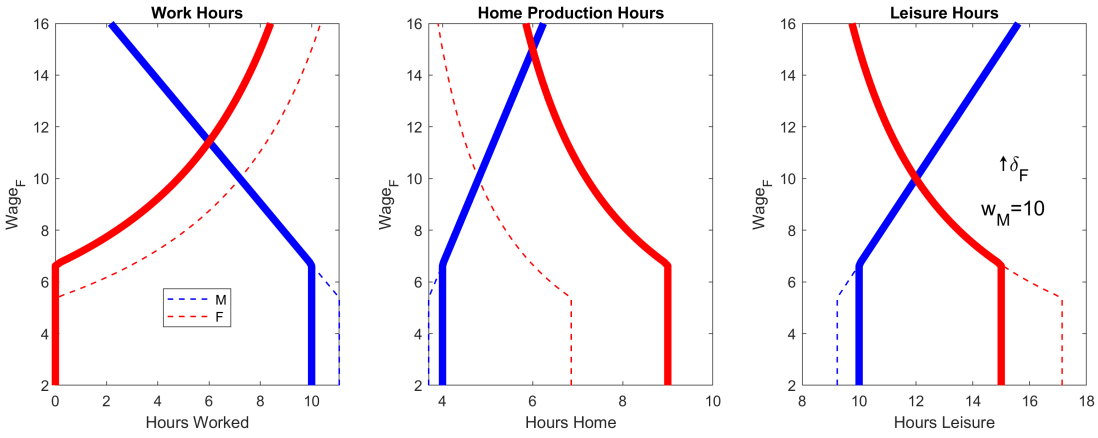


Figure 12: Comparative Statics: Productivity δ_f

IX.E Alternative Estimates

These are the parameters estimates for when we change the sample choices:

	Benchmark	$w_i < 16$	Not Married	No Child	Age < 40
meanλ_m	**0.5822**	0.5452	0.5761	0.5828	0.5816
meanλ_f	**0.4478**	0.4747	0.4551	0.4534	0.4445
meanδ_m	**0.1294**	0.1240	0.1290	0.1252	0.1315
meanδ_f	**0.3097**	0.3372	0.3077	0.2984	0.3234
N	1112	538	1298	1181	731

IX.F Years of Education

For the Mincer equation we use education as a variable. We observe the total number of years according to this table, where the school years and the additional vocational training are added together.

schooling	**years**
no degree	7
lower school degree	9
intermediary school	10
degree for a professional college	12
high school degree	13
other	10
additional occupational training (includes universities)	**years**
apprenticeship	1.5
technical schools (incl. health)	2
civil servants apprenticeship	1.5
higher technical college	3
university degree	5

Figure 13: Total years of education scoring

IX.G Goodness of Fit 2

Sim 2 uses the same simulated data as in Table 18, but restricts the sample to households in which the man works more than 5 hours per day—the same selection criterion applied to the data.

Table 18: Hrs Worked 2

	Male			Female		
	Sim.	Sim. 2	Data	Sim.	Sim. 2	Data
Education						
Low	8.563	9.701	8.759	3.231	2.016	2.631
High	7.804	9.524	8.800	4.241	2.509	4.1078

IX.H Estimation Results without Wage Equation

Table 19: Parameter Estimates

	Point Estimate	(Std. Error)			
μ_1	0.3723	(0.0327)	$\rightarrow$	meanλ_m	**0.5822**
μ_2	-0.2139	(0.0256)	$\rightarrow$	meanλ_f	**0.4478**
μ_3	-1.5741	(0.0198)	$\rightarrow$	meanδ_m	**0.1294**
μ_4	-0.7089	(0.0301)	$\rightarrow$	meanδ_f	**0.3097**
σ_{11}	0.5522	(0.0327)	$\rightarrow$	stdλ_m	0.1622
σ_{22}	0.4744	(0.0191)	$\rightarrow$	stdλ_f	0.1546
σ_{33}	0.4361	(0.0171)	$\rightarrow$	stdδ_m	0.0735
σ_{44}	0.8086	(0.0297)	$\rightarrow$	stdδ_f	0.1658
μ_{w_m}	2.6866	(0.0098)	$\rightarrow$	meanW_m	15.49
μ_f	2.2277	(0.0201)	$\rightarrow$	meanW_{w_f}	10.59
$\sigma^2_{w_m}$	0.1083	(0.0046)	$\rightarrow$	stdW_m	5.24
$\sigma^2_{w_f}$	0.2656	(0.0163)	$\rightarrow$	stdW_f	5.84

Table 20: Covariance matrices

	Z_1	Z_2	Z_3	Z_4		λ_m	λ_f	δ_m	δ_f
Z_1	0.5522				λ_m	0.0263			
	(0.032)								
Z_2	-0.2139	0.4745			λ_f	-0.0104	0.0239		
	(0.025)	(0.019)							
Z_3	-0.0837	-0.0857	0.4361		δ_m	0.0001	-0.0023	0.0054	
	(0.021)	(0.015)	(0.017)						
Z_4	-0.2647	0.0278	0.1673	0.8087	δ_f	-0.0101	0.0019	-0.0040	0.0275
	(0.036)	(0.017)	(0.017)	(0.029)					

IX.I Estimates Results PW

Table 21: Parameter Estimates

	Point Estimate	(Std. Error)		
μ_1	0.423	(0.0278)	$\rightarrow$ meanλ_m	**0.5930**
μ_2	-0.275	(0.0258)	$\rightarrow$ meanλ_f	**0.4380**
μ_3	-1.560	(0.0211)	$\rightarrow$ meanδ_m	**0.1331**
μ_4	-0.754	(0.0297)	$\rightarrow$ meanδ_f	**0.2982**
σ_{11}	0.5573	(0.0322)	$\rightarrow$ stdλ_m	0.1617
σ_{22}	0.4764	(0.0204)	$\rightarrow$ stdλ_f	0.1541
σ_{33}	0.4354	(0.0183)	$\rightarrow$ stdδ_m	0.0741
σ_{44}	0.712	(0.0292)	$\rightarrow$ stdδ_f	0.1545
γ_{0m}	1.8475	(0.0801)		
γ_{0w}	0.7836	(0.0952)		
γ_{1m}	0.044	(0.0044)		
γ_{1f}	0.074	(0.0069)		
γ_{2m}	0.0374	(0.0075)		
γ_{2f}	0.087	(0.0102)		
γ_{3m}	-0.086	(0.0246)		
γ_{3f}	-0.226	(0.0444)		
σ^2_{wm}	0.0972	(0.0044)		
σ^2_{wf}	0.1948	(0.0123)		