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CAN YOU DO THE DISHES?
INTRA-HOUSEHOLD TIME USE, LABOR SUPPLY AND FERTILITY

by Andrea Mattia*

Abstract

Women everywhere do more housework (including childcare) than men, which can negatively affect fertility rates and women's careers. We argue that rebalancing the housework load increases female employment and men's opportunity cost of children: only if outsourcing childcare is possible, fertility also increases. Using Italian data, we estimate a life-cycle model of housework, employment and fertility, with a limited availability of nursery schools. To match time-use moments, men's weight in housework production should be 30% of women's, even taking into account labor market gaps, perceived housework skills, and preferences. Housework imbalance has a similar effect on employment to an additional 50% gender wage gap, and accounts for 70% of the child penalty. Removing all constraints, fertility increases to 2.28 (+63%) children per woman and female employment to 0.97 (+40%, mostly driven by housework). The model replicates the negative correlation between fertility and female employment in Southern Italy, the positive correlation in the North, and historical trends.

JEL Classification: J13, J22, D13.

Keywords: fertility, female labor supply, intra-household time use.

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1 Introduction[1]

Across the world, women carry out a larger share of housework, including chores and childcare, compared to men:[2] in Italy, the setting of this paper, the difference amounted to about 30 hours per week in 2013.[3] This can decrease women's labor market participation on both the extensive and intensive margin, access to professions where time flexibility is highly rewarded, and total realized fertility.[4]

The unequal division of housework time has also been claimed to be the reason why in many high-income countries there is now a positive correlation between fertility and female employment.[5] *Figure 1* shows this correlation from 1980 to 2024 in the South and in the Center-North of Italy. In the South the relationship is negative for the entire period. In the Center-North, it flips to positive after 1995. The negative correlation is consistent with a story of increasing opportunity cost of fertility for women, due to an improvement in their labor market prospects. The reasons for the positive correlation are less clear and the role of housework time has received less attention, partly due to lack of detailed data.[6]

In this paper, I argue that a more equal division of housework can lead to this positive correlation, not *per se* but because it increases demand to outsource childcare. When this demand is met, both fertility and female employment increase. In fact, increasing the male share of housework raises men's opportunity cost of fertility. For women, the time cost of fertility decreases but its opportunity cost increases. In

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[2]Throughout the paper, "housework" includes all forms of unpaid work related to household production. I equate stable cohabitation to marriage and separation to divorce. Since I focus on heterosexual couples, in the rest of the paper I refer to partners as husband and wife or men and women.

[3]Source: ISTAT Time Use Survey 2013.

[4]For reviews see, for instance, Goldin (2014), Doepke, Hannusch, Kindermann, and Tertilt (2023), and Carta, De Philippis, Rizzica, and Viviano (2023), who also show that Italy has the widest gender disparity in housework across EU countries.

[5]See Feyrer, Sacerdote, and Stern (2008) and Goldin (2025).

[6]Notable exceptions are Goussé, Jacquemet, and Robin (2017), Cubas, Juhn, and Silos (2022), Erosa, Fuster, Kambourov, and Rogerson (2022), and Calvo, Lindenlaub, and Reynoso (2024).

Figure 1: *Correlation between female employment and fertility in the Center-North and in the South regions of Italy between 1980 and 2024. Own elaboration on ISTAT data.*

principle, since both partners have to agree on having a baby[7] and since men on average have better labor market prospects, the opportunity cost channel would prevail, fertility would decrease and female employment would increase. However, for the same reason, this pushes demand for services like nursery schools, especially by men. Hence, the positive correlation appears in areas where these services are also supplied, which results in both higher fertility and higher female employment. The same logic applies in general to factors which push to outsource housework.

To make this argument, I propose a dynamic life-cycle collective household model of time use with joint endogenous fertility and employment and limited nursery school access. The model parameters, estimated to match current time use moments, can be used to microfound the correlation between female employment and fertility and explain their historical trends. I use a restricted-access time-use survey by ISTAT, the Italian statistical bureau, which provides a detailed diary of activities in 10-minute intervals for a nationally representative sample of households in 2002, 2008, and 2013. The survey directly asks respondents about their opinions on gender norms, beliefs about male housework productivity, and taste for tidiness: all these usually unobservable factors could affect the division of housework.

I start by presenting stylized facts about housework specialization. First, marriage

[7]This reflects a point made by Doepke and Kindermann (2019).

is associated with much lower employment rates for women, whereas there is no difference between men and women when they are single, and little difference when divorced.[8] Second, among couples, women always do more housework regardless of their employment status.[9] Third, in the presence of children, the degree of specialization within the household increases further.[10] Fourth, the main factor that correlates with gender difference in housework is the employment status of both spouses, but traditional gender values and taste for tidiness have moderate relevance as well.

Then, I introduce the model, which builds on the principle of household specialization as in Becker (1981). The main intuition is that household members pick their level of specialization depending on their comparative advantages and on the home production technology. Even when spouses have the same formal work productivity, if they believe housework requires more of the wife's time or she is assumed to be more home-productive, she specializes relatively more in home production (formally, her housework time input has a higher weight). Individuals receive utility from leisure and consumption, produced through housework and formal work earnings. The home production function allows flexibility and potentially complementarity between husband and wife's housework time.[11] People with a taste for tidiness are assumed to receive relatively more utility from home production.

The optimal allocation is affected by life-cycle, external and heterogeneity factors. A higher earnings trajectory is sustainable only by consistently working over time, while unemployment incurs a permanent penalty.[12] Limited commitment and unilateral divorce limit the incentive for women to specialize away from the labor market and for men to do too little housework in order to prevent the marriage from breaking. The gender wage gap and the presence of traditional gender values increase women's incentive to specialize in household production. Spouses have to agree on fertility

[8] In the preferred data sample, about 98% and 84% of single and divorced women, respectively, are employed. The rate falls below 56% for married women. Men's employment rate, instead, is about 98% when single, 97% when married and 95% when divorced.

[9] Wives who work do about 34 housework hours per week compared to 61 hours when they do not. Husbands do less than 15 hours in both cases. When the wife works, she has about 8 fewer leisure hours than her husband.

[10] The wife's housework load increases by over 14 hours per week and the husband's by just 2.

[11] There is limited variation in leisure time across individuals and less than 6% of households formally outsource housework and childcare. Hence, flexibility in unpaid work between spouses appears to be the main channel.

[12] This reflects evidence about the scarring effects of unemployment starting with Jacobson, LaLonde, and Sullivan (1993) and it can help reproduce the "child penalty" first found in Kleven, Landais, and Søgaard (2019).

decisions, and the availability of nursery schools offers parents the option to pay for childcare services that they would otherwise have to do at home by subtracting time from other activities. Connecting all these heterogeneity dimensions, often not observed in the data, and placing them into a dynamic life-cycle framework, is another important and novel contribution of the paper.

The model is estimated using the method of simulated moments. Three facts help identification: (i) Italian work contracts allow little variation in total hours;[13] (ii) parents have to use the nursery school provided by their town and have limited ability to settle where one is available; (iii) they are price-takers for the tuition fee.[14]

To rationalize gender differences, the estimated parameters imply that men's home production weight is about 30% that of women's, even after accounting for the gender wage gap, traditional gender values, taste for tidiness and perceived home production skills.[15] Spouses' home production hours are substitutes.[16] Gender differences in housework weights account for about 70% of the "child penalty" in women's earnings. Holding housework weights fixed, female employment would reach the men's level only if women's wage were 50% higher than men's. In an unconstrained scenario with no gender gaps and full nursery school coverage, fertility would increase to 2.28 children per woman (+63%, in line with a 2.3 ideal fertility reported by Italians a 2016 ISTAT survey) and female employment to 0.97 (+40%).[17] In a more realistic scenario with constraints relaxed by half, figures increase to 1.55 and 0.82 respectively. The housework channel drives two thirds of the employment effect, so ignoring it would stifle the effectiveness of policies aimed at increasing both fertility and female employment.

The model can endogenously generate a positive correlation between fertility and female employment without targeting it. Rebalancing housework weights increases female employment and decreases fertility, because it raises the husband's opportunity cost of having children. Similar effects arise from erasing the gender wage gap or

[13] Weekly hours are tightly distributed around 20-25 for part-time and 36-40 for full-time contracts, regardless of gender. Over-time, even if usually not contractualized, concentrates at 48-50 hours.

[14] In Italy in the period considered, about 22% of children aged 0-3 have a nursery school spot. Tuition fees for the average household are about 300 euros per month, or 10% of their net income.

[15] The data and model imply a limited role of disparity in housework skills but only allow speculating about other explanations like habit, learning by doing or effort, as I discuss later. However, the magnitude of the effects signals a large payoff of understanding the root causes of such difference.

[16] This differs from the complementarity result in Calvo, Lindenlaub, and Reynoso (2024) for Germany, but it is in line with their historical perspective that the gender convergence can be partly due to the increase in complementarity between men and women's home production time. If there were more complementarity my model would also predict gender convergence in employment.

[17] The employment rate would be the same as the current male one in the baseline sample.

changing the consumption technology to require less own housework time input. All these factors increase the demand to outsource childcare to nursery schools. When this demand is met, fertility increases together with female employment. This positive correlation appears in the Center-North of Italy, where nursery school supply covers a higher share of demand. Conversely, fertility and female employment are negatively correlated in the South, where nursery school demand is low and supply even lower.

Finally, I re-estimate the parameters separately for South and Center-North and replicate the historical trends in fertility and employment in both areas from 1980 to 2024. Through the lens of the model, the initial drop in fertility after 1980 is mostly due to an increase in the cost of children, especially in the South. The subsequent variations in fertility and employment are instead mostly due to changes in the gender wage gap, home production technology, husband's housework weight and nursery school coverage. The cost of children seems to be somewhat increasing again in recent years.

The paper's first contribution is to microfound, using housework, the correlation between fertility and employment, in a way that is consistent with known historical trends.[18] In Feyrer, Sacerdote, and Stern (2008) a more equal division of housework generates the positive correlation. I show that it only does when it is possible to outsource childcare. This is consistent with Goldin (2025) where, in countries which had a more gradual economic development, society evolved in a way that achieved both high fertility and female employment.[19]

Second, it adds a quantitatively precise channel of housework time choice as one of the determinants of long-term fertility to the literature on collective models of the household. Other papers have focused on labor supply specialization (Browning, Bourguignon, Chiappori, and Lechene (1994), Browning and Chiappori (1998), Attanasio, Low, and Sánchez-Marcos (2008)), consumption and expenditure (Lise and Seitz (2011), Dunbar, Lewbel, and Pendakur (2013), Lise and Yamada (2018), Lechene, Pendakur, and Wolf (2022)), asset accumulation and unilateral divorce (Voena (2015), Lafortune and Low (2023)), gender-based taxation (Alesina, Ichino, and Karabarbounis (2011)), college choice and family-friendly jobs (Bronson (2019)).[20] The results connected to

[18]Seminal papers in this literature are Becker (1960), Becker and Lewis (1973), up to more recent contributions by Goussé, Jacquemet, and Robin (2017), Cubas, Juhn, and Silos (2022), Erosa, Fuster, Kambourov, and Rogerson (2022), and Calvo, Lindenlaub, and Reynoso (2024).

[19]Future iterations can use the model to produce comparable results across European countries using the Harmonised European Time Use Surveys, at a time when fertility rates are historically low.

[20]Other structural papers with endogenous fertility in isolation or from other angles are Ward and Butz (1980), Hotz and Miller (1988), Fernández, Fogli, and Olivetti (2004), Angelov, Johansson, and Lindahl (2016), Adda, Dustmann, and Stevens (2017), Doepke and Kindermann (2019), Zhang (2021),

nursery schools and division of labor are also consistent with reduced-form evidence by Baker, Gruber, and Milligan (2008), Havnes and Mogstad (2011), Carta and Rizzica (2018), Ciasullo and Uccioli (2025).[21]

The rest of the paper is organized as follows. Section 2 presents the data and the stylized facts. Section 3 presents the model and the estimation results. Section 4 presents the counterfactuals and policy remarks. Section 5 concludes.

2 Data and descriptive analysis

2.1 Dataset and sample restrictions

I use a restricted-access version of the Italian time-use survey by ISTAT, the National Statistical Agency, as part of the Harmonised European Time Use Survey (HETUS). It is a repeated cross-section of a nationally-representative sample of households in years 2002, 2008 and 2013. A key advantage is that it provides information about perceived housework skills, taste for tidiness and attitudes towards gender roles within the household.

In the survey, every individual aged 3 and above fills in a diary of their activities over an entire day in 10-minute intervals.[22] I divide activities into 4 categories: (i) formal work, including time actively spent on the job, physically and remotely, and commuting; (ii) housework, including chores, grocery trips, childcare, care for pets, and gardening and reparation works.[23], (iii) leisure, including hobbies and entertainment, breaks taken on the job, social and religious activities, volunteering; (iv) personal care and sleep.[24]

Every individual aged 15 and above also provides details about demographics, employment, work time and flexibility arrangements, and parents' employment status while growing up. Moreover, starting from the 2013 wave, respondents state how much they agree with a number of statements about gender-specific issues. Traditional gen-

Guner, Kaygusuz, and Ventura (2020), Cumming and Dettling (2023).

[21]For reviews, also see Olivetti and Petrongolo (2017) and Cortés and Pan (2023).

[22]Parents fill in the diary for small children. In flagged cases (less than 10% of the preferred sample), an adult can fill in for their partner in case they are absent at the time of the interview.

[23]This notion minimizes gender differences because men tend to do a larger share of gardening and reparation.

[24]Personal care is fairly stable at about 8 hours per day regardless of gender, employment and parenthood status. For this reason, formal work, housework and leisure are normalized to sum to 110 hours per week.

der values emerge from: "Is it better when the man works and the woman takes care of the house?"; "When both partners work full-time, the man needs to do the same amount of housework as the woman" and "Working parents need to take turns caring for their sick child". Beliefs about men's housework skills are gauged by: "Men can do housework just as well as women" and "Men can take care of children just as well as women". Finally, preferences about tidiness emerge from "Is it important that the house always be clean and tidy?".

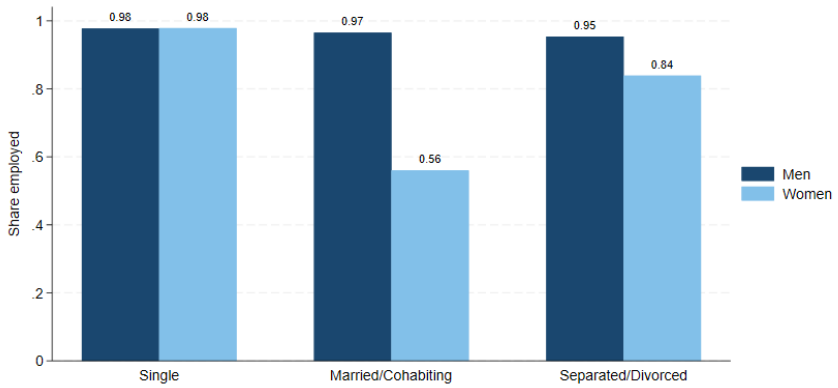
I apply the following sample restrictions, in order to focus on individuals who are credibly making employment, marriage, housework, fertility (if young enough) and divorce decisions, and who are describing a plausibly normal day in their diary. First, I keep nuclear households, i.e. composed by the head, their cohabiting partner and their offspring if they have any. Second, I focus on households where the head is 25-63 years old, able-bodied, not in school, not on military service duty, not widowed, not retired and not on vacation.[25] Third, I exclude individuals (and the household they belong to) with characteristics which, for simplicity, are not allowed in the model: retired before age 63, never-married singles with kids or living mainly off monetary help from their family, people living only off own wealth, people working less than 12 or more than 60 weekly hours on their main job. Instead, I include men who work part-time, even if they are less than 3% of working men, since the model should be able to reproduce the rarity of this choice even when it is available.[26] From the initial sample of active individuals aged 25-63 in nuclear households, the restrictions introduced for modeling purposes exclude less than 20% of observations, with about 10% due only to early retirement. More details are in *Table A.1* in the Appendix.

The final sample is made up of 44,262 individuals, of which 9.5% are single, 81.6% are cohabiting or married and 8.9% are separated or divorced. Regarding fertility, 25.1% of the people who are not single and are at least 45 years old do not have children, 30.2% have one child, 35.8% have two children and 8.90% have at least 3 children. There are no significant gender differences in educational attainment: about 17% of individuals are college educated, 42% have a high school diploma and 41% do not. Less-educated individuals are less likely to be employed, and the gradient is steeper for women than for men. Finally, about 38% of both men and women agree that men are somewhat or

[25]Some never-married individuals are still in school, with the share decreasing from about 25% at age 25 to 6% at age 30. For simplicity, school choice is not allowed in the model.

[26]It is also important to account for potential counterfactual changes in the share of men who work part-time.

Figure 2: *Employment rates by gender and marital status. Data: ISTAT time use survey.*



completely able to do chores and care for children just as well as women.

2.2 Descriptive analysis

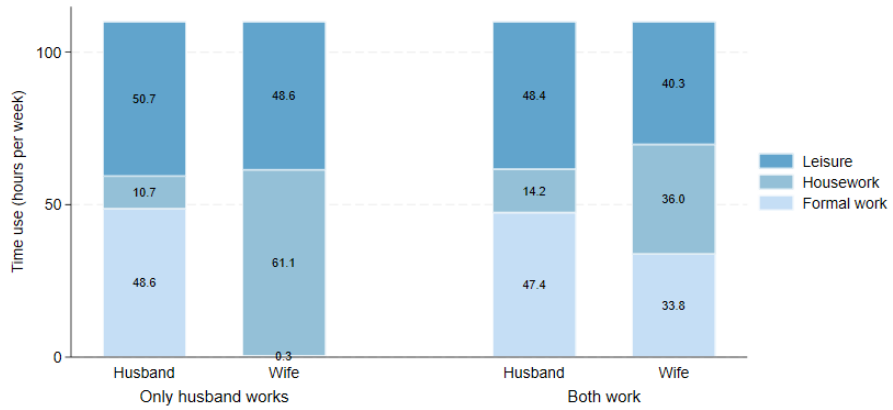
I now show three stylized facts that the structural model has to match and explain.

The first stylized fact is that marriage is associated with a much lower employment rate for women but not for men, and most of this difference disappears upon divorce. *Figure 2* shows that there is no difference in employment rates between single men and women, which are 0.98 for both. The share of employed men stays roughly constant when married or divorced. For women, the employment rate is 0.56 when married and 0.83 when divorced. Conditional on being employed, the share of women working part-time is about 14% when single, 27% when married and 18% when divorced.

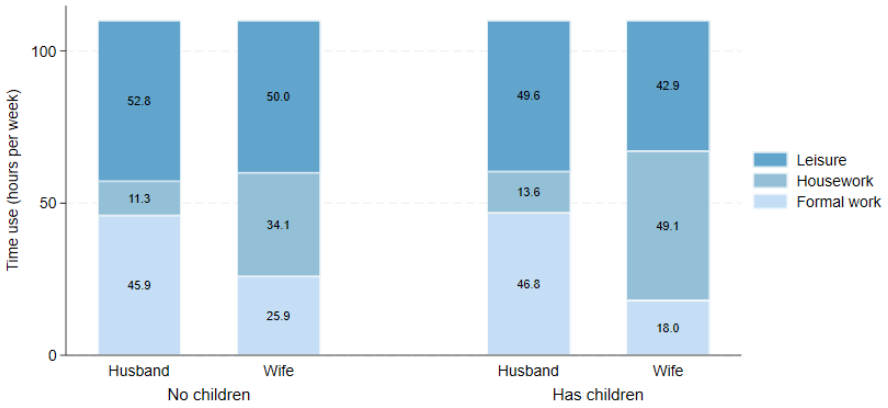
The second stylized fact is that, among couples, women always do more housework regardless of their employment status.[27] The average difference in housework time between spouses is about 33 hours per week. Panel (a) in *Figure 3* shows that when the wife is unemployed, she performs 61 weekly hours of housework, as opposed to 36 when she works. The husband's contribution, instead, increases only by 3.5 hours when the wife is employed compared to when she is not. For the wife, employment corresponds to a 10-hour reduction in her own leisure time, on average. Conversely, the wife's employment is associated with little change in the husband's leisure time. The sum of paid and unpaid work time is, on average, higher for women by over 7 hours

[27] In less than 5% of households the husband is unemployed but in over 86% of those he is looking for a job. Hence, the time use of these households is not considered representative of a long-term situation and is not shown. However, even when only the wife works, her housework time is still roughly the same as her husband.

Figure 3: *Time use of partners by gender and other characteristics. Data: ISTAT time use survey.*



(a) Time use of partners by gender and woman's occupational status



(b) Time use of partners by gender and parenthood status

per week.

The third stylized fact is that having children is associated with further specialization among spouses, even if childless couples are already quite specialized. Panel (b) in *Figure 3* shows that, without children, the wife works 18 hours less than the husband and does 23 more hours of housework. With children, housework time is higher for both spouses, but relatively more for women, while the husband's work time remains roughly unchanged. Having children decreases the wife's leisure time significantly more than the husband's.

Finally, the factors that correlate with the gender difference in housework time and their relative importance are summarized in *Table 1*. The coefficients result from

Table 1: *Contribution of each factor to the difference in housework time between husband and wife, measured in hours per week. A positive coefficient means that the factor contributes to increasing the difference. The first specification uses only year 2013; the second specification uses the full sample (2002, 2008 and 2013) but does not include controls that were not available in all years; the third specification uses only year 2013 and the same set of controls as the second. Robust standard error are in parentheses. Data: ISTAT time use survey.*

	Dep: Housework time difference (hours per week)					
	Only 2013		Full sample		2013 (FS spec.)	
	Coeff	Std err	Coeff	Std err	Coeff	Std err
Employment:						
Husband part-time	4.67	(3.70)	8.74***	(2.64)	5.16	(3.71)
Husband full-time	15.57***	(2.75)	15.39***	(1.91)	15.80***	(2.79)
Husband over-time	21.93***	(2.97)	20.77***	(1.96)	22.25***	(3.00)
Wife part-time	-19.76***	(1.54)	-20.89***	(0.89)	-20.15***	(1.54)
Wife full-time	-27.64***	(1.38)	-28.35***	(0.68)	-28.54***	(1.39)
Wife over-time	-35.95***	(2.53)	-35.07***	(1.29)	-36.68***	(2.48)
Children:						
1 child	3.12**	(1.43)	5.10***	(0.79)	3.61**	(1.45)
2 children	4.84***	(1.46)	7.61***	(0.81)	4.85***	(1.46)
3 or more children	7.00***	(2.31)	9.83***	(1.14)	6.96***	(2.32)
Any child below age 3: no nursery	2.18	(2.52)	3.48***	(1.16)	2.56	(2.67)
Any child below age 3: goes to nursery	-1.26	(2.56)	2.15	(1.38)	-1.55	(2.58)
Education:						
Husband: high school	-3.02*	(1.83)	-2.08**	(1.02)	-2.82	(1.85)
Husband: less than high school	0.40	(1.95)	1.21	(1.09)	1.15	(1.98)
Wife: high school	1.69	(1.80)	1.36	(1.05)	2.04	(1.81)
Wife: less than high school	3.49*	(2.04)	2.17*	(1.18)	4.31**	(2.06)
Has formal domestic help	-4.90**	(2.25)	-4.02***	(1.13)	-5.23**	(2.19)
Has traditional gender values:						
Husband	4.51***	(1.35)				
Wife	1.91	(1.38)				
Cares about tidy house:						
Husband	0.55	(1.96)				
Wife	5.80**	(2.56)				
Thinks men home-productive as women:						
Husband	-2.27*	(1.28)				
Wife	0.36	(1.29)				
Baseline dependent variable:	30.90		34.32		30.90	
Husband + wife housework hours:	59.53		60.24		59.53	
Observations	3,808		13,488		3,808	
Adjusted R^2	0.3846		0.3843		0.3730	
Year FE	No		Yes		No	
Geographic region FE	Yes		Yes		Yes	
Household head's age	Yes		Yes		Yes	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

a regression of absolute difference of housework weekly hours between woman and men on a number of covariates, controlling for age of the household head, survey year and geographical location (each of the 20 regions of Italy). The first column shows coefficients using only year 2013, when it is possible to add covariates about values and attitudes; the second column uses the full sample of years 2002, 2008 and 2013; the third column, as a robustness check, uses the same sample as the first and the same

specification as the second.

The most relevant determinant of the gender difference is the employment status of both partners, followed by the number of kids. A smaller share of the difference is due to: (i) whether the wife cares about the house being tidy, (ii) whether the husband has traditional gender role values, and (iii) whether the husband thinks men are as home-productive as women. Having no access to nursery schools plays on average a minor role.

Overall, the stylized facts point to stark gender differences in employment and housework time, which are associated with marriage, children, and individual heterogeneity. The model should replicate these facts, within the Italian economic environment, while allowing individuals to optimally choose marriage, employment, housework time and fertility.

3 The model

3.1 General framework and intuition

The model moves from the principle of household specialization by Becker (1981). Utility comes from leisure and consumption, which is produced by both the the household sector and the formal work sector. Spouses coordinate to allocate time optimally to each sector, under the assumption that total time is fixed and limited, and residual time is leisure. Household members specialize depending on comparative advantages and on the housework technology. Even if spouses have the same formal-work productivity, if the wife is more productive in the household sector, or if spouses place a higher weight on housework by the wife, she will specialize relatively more in household production. Housework time is chosen conditional on employment and fertility, so the final level of specialization depends on a number of factors that derive from the dynamic, life-cycle nature of the model.

In terms of labor market prospects, devoting too little time to formal work might cause individuals to permanently lose future earnings potential. This is because unemployment places individual on a lower life earnings trajectory,[28] and a high-paying

[28]This feature incorporates evidence from the literature that unemployment has long-term earnings consequences. See, for example, Jacobson, LaLonde, and Sullivan (1993), Couch and Placzek (2010), Lachowska, Mas, and Woodbury (2020), Jarosch (2023), and Schmieder, Wachter, and Heining (2023).

career can only be sustained by working consistently over time.[29] Additionally, women incur an exogenous wage gap that captures a mixture of penalizing factors.[30] On the other hand, cohabitation comes with economies of scale and the possibility to specialize while sharing the output between spouses. Moreover, divorce is unilateral and spouses have limited commitment.[31] For these reasons, single individuals have an incentive to spend less time doing housework compared to married ones. Similarly, women have an incentive to retain their earnings potential in case the marriage breaks. Men, conversely, enjoy a higher level of household production during marriage than they would be able to sustain by themselves, so they have an incentive to take up some of the housework burden in order to prevent divorce.

In terms of fertility, each additional kid increases utility but requires higher expenditure. The balance between the two forces determines the choice of having a(nother) child depending on the couple's total productive potential. Spouses have to agree on having a child. Their decision can be influenced by access to nursery schools, which offer the option to pay to outsource childcare instead of subtracting time from utility-producing activities. Household efficiency might require the spouse who has a higher home production weight to specialize in housework as the number of children increases. Thus, husband and wife might wish to make different optimal fertility and nursery school choices.[32]

Finally, the level of intra-household specialization is affected by individual heterogeneity. First, a higher level of human capital corresponds to a higher earnings potential.[33] Second, for single women and couples, holding traditional gender values generates a utility penalty when the woman works full-time. Third, men can have different house-

[29]For over-time wage convexity, see, for instance, Gicheva (2013) and Goldin (2014).

[30]Some examples of these factors are that women tend to be placed in less promotable tasks (Babcock, Recalde, Vesterlund, and Weingart (2017)), to be in majors linked to lower-paying jobs (Wiswall and Zafar (2021)), or to be more risk averse and less confident than men during the job acceptance process (CPPR+ (2023)).

[31]That is, they cannot credibly commit to future actions if, when the time to take those actions arrives, they have an alternative that provides more utility. See, for instance, Mazzocco (2007).

[32]This incorporates a result by Doepke and Kindermann (2019). Household bargaining might imply greater career discontinuity for mothers, as in ABFV+ (2026). I abstract from the female-specific unanticipated effects of motherhood found in Kuziemko, Pan, Shen, and Washington (2018) and, because of context, from strategic interactions in intra-household fertility decisions (Ashraf, Field, and Lee (2014) and Rossi (2018)), and from information frictions about childbearing costs (ABFV+ (2026)).

[33]The models abstracts from intensive parenting (Doepke, Sorrenti, and Zilibotti (2019), and Kearney, Levine, and Pardue (2022)), and from status externalities in offspring's education (Kim, Tertilt, and Yum (2024)) since the Italian data do not seem to support this as a main channel.

work skill levels, which affects their home production weight. Fourth, individuals with a taste for tidiness derive relatively more utility from the household public good.

Connecting all these factors, which are often not measured or not observed in the data, into a dynamic life-cycle framework, is an important contribution of the model.

3.2 Model timeline

There are 13 periods and each corresponds to a time span of 3 years. Individuals start out aged 25, single, childless and with completed education. Current shocks and draws are known at the beginning of each period and happen before any choice is made. From the first period, individuals draw potential mates and decide whether to marry. If they are married, they coordinate with their spouse to make employment, housework and fertility decisions.[34] Only married people can have children, up to a maximum of 3. People can marry and have children up to the 7th period, i.e. up to ages 43-45.[35] Single and divorced individuals only make a time allocation choice between employment and housework. At the beginning of each period, married individuals decide whether to unilaterally divorce or stay in the marriage. Divorced people pay a proportionally equal share of their income in child expenses, cannot have more children and cannot remarry.[36] Finally, individuals end their career in the 13th period at age 61-63 and there is no retirement.[37]

3.3 Model equations and value functions

3.3.1 Period utility function

Each individual $j = H, W$, for man and woman respectively, conditional on employment status, has their own period utility u_j of the following general Cobb-Douglas form:

$$u_j = S_1 \cdot C_j^{\gamma_1} L_j^{1-\gamma_1} \qquad j = H, W$$

[34]Since each period corresponds to 3 years, I assume all three decisions happen within the same period.

[35]Fewer than 1% of individuals in the data have more than 3 children. There are very few first marriages and virtually no births in the data beyond this age range.

[36]In the data, just above 2% of marriages include divorced people.

[37]In the period 2013-2018, the average age at retirement in Italy was 63.3 for men and 61.5 for women.

where C_j is consumption, L_j is leisure, γ_1 governs the share of resources that go to consumption, and S_1 is a scaling factor.

In a cohabiting/married couple, the household period utility is a weighted sum:

$$U = \theta u_H + (1-\theta) u_W$$

with husband's weight equal to θ. The household follows a collective model, and spouses can renegotiate their weight in each period if their outside option of divorcing makes their participation constraint binding.[38]

Household consumption C and individual consumption C_j take the form:

$$C = S_2 \cdot \Omega^{\gamma_2} Y^{1-\gamma_2}, \qquad C_j = \eta_j \cdot C$$

where Ω and Y are the household's home production and total earnings from formal work, respectively. The exponent γ_2 governs the allocation of time resources to each consumption-producing activity, and it is diminished by a factor π^O if nobody in the household has a taste for tidiness ($O_j = 0, \forall j$). Each spouse receives a share η_j of the household consumption, while for single and divorced individuals $\eta_j = 1$.

The scaling factors S_1 and S_2 depend on employment, marital status and fertility:

$$S_1 = (1 + s_{K_1} \cdot K)(1 + s_L)(1 - s_G \cdot \Phi_W \cdot G_j)$$
$$S_2 = (1 + s_M)(1 - s_{K_2} \cdot K)$$

where $s_{K_1} > 0$ is a utility premium for each kid K and $s_{K_2} > 0$ is a household expenditure increase for each kid K.[39] The balance between s_{K_1} and s_{K_2}, together with concavity of the utility function, generates the distribution of realized fertility. For single individuals, $s_{K_1} = s_{K_2} = 0$, since they cannot have children in the model, but the parameters appear in the divorced individuals' utility function if they had children during marriage. Both s_L and s_M are different from 0 only for married individuals and govern how desirable marriage is compared to being single or divorced. The love shock s_L follows a random walk process with $s_L = s_{L,previous} + \varepsilon_L$. The initial shock is drawn at the time of marriage as $s_{L,0} \sim \mathcal{N}(0, \sigma_{L,0})$. s_M captures economies of scale of

[38] This follows the standard literature on collective household models. See, for instance, Chiappori (1992), Browning, Bourguignon, Chiappori, and Lechene (1994), Chiappori (1997) and Browning and Chiappori (1998).

[39] Alternatively, s_{K_2} can be interpreted as a decrease in the share of household consumption that produces utility for the parents, under the assumption that the parents receive utility only from own consumption.

cohabitation. The penalty s_G captures traditional gender values when women work at least full-time ($\Phi_W = 1$). The penalty applies when women (or men if married) hold traditional gender values ($G_j = 1$).

3.3.2 Production functions

Individuals allocate their time to the competing sectors of formal work and home production, and take residual time as leisure. The production function of leisure is a one-to-one transformation of time units into leisure units, which provide decreasing marginal utility.

With formal work time, each individual earns Y_j consumption-generating units:[40]

$$Y_j = f(h_j^{\mathcal{W}}) = w_j(e_j, a_j, \mu_j, N, j) \cdot h_j^{\mathcal{W}}$$

where $h_j^{\mathcal{W}}$ is the amount of weekly hours of work $\mathcal{W} \in \{U, PT, FT, OT\}$, which is 0 for the unemployed U, 24 for part-time contracts PT, 40 for full-time contracts FT and 50 when choosing over-time OT.[41] The pay is linear in hours worked,[42] with wage convexity only for over-time workers. The net wage rate function w_j is:

$$w_j = (1 + \pi^e e_j)(1 + \pi^a a_j)(1 - \pi^U \mathbb{1}[\mu_j = -1] + \pi^{OT} \mathbb{1}[\mu_j = 1, \mathcal{W} = OT])(1 - \pi^N \Phi^N)(1 - \pi^G \mathbb{1}[j = W]) \cdot w_{base}$$

where π^e is the premium for permanent income level e_j; π^a is the premium for each age level a_j; π^U is a penalty for the low-paying career ($\mu_j = -1$); $\pi^{\mu_{OT}}$ is the hourly premium for over-time ($\mathcal{W} = OT$) in a high-paying career ($\mu_j = 1$); π^N is the wage share necessary to pay for nursery school fees (if any, $\Phi^N = 1$); π^g is the gender pay gap if and only if the individual is a woman ($j = W$); w_{base} normalized to 1 without loss of generality.[43] Unemployed individuals receive an amount of income equal to $I_{base} \cdot w_{base}$ regardless of their education and age. Permanent income e_j is a state variable whose initial level corresponds to the individual's education. In each subsequent period, it is subject to a shock with standard deviation σ_e. There are 3 education levels (college,

[40] These earnings have to be intended as a mixture of actual consumption and savings potential, so they represent the entire utility-generating potential of net take-home earnings from formal work.

[41] These are obtained by rounding the average weekly worked hours found in the data for each category, which are similar across genders and equal to 23.1 for part-time, 39.2 for full-time and 51.7 for over-time.

[42] This reflects the structure of salaries in the Italian economy, where there is limited flexibility in pay schedules.

[43] In principle, individuals could value hours devoted to formal work, home production and leisure differently solely on the grounds of the type of activity. Since this aspect is not observed and amounts to pure preference, the model captures it agnostically through the utility parameters γ_1 and γ_2.

high school, less than high school) that are drawn in the first period to match the education levels in the data sample.

For single and divorced people, their household total earnings correspond to Y_j. For a couple, total earnings are equal to $Y = Y_H + Y_W$. There is perfect substitutability between the money earned (i.e. the utility-generating units produced) by each spouse, but the share appropriated by each of them could differ depending on their endogenous Pareto weight.

The other input to the consumption production technology is home production. For a single or divorced person, the input $\Omega_j = \pi_j^{\mathcal{H}} \cdot h_j^{\mathcal{H}}$ is plugged into $C_j = S_2 \cdot \Omega_j^{\gamma_2} Y_j^{1-\gamma_2}$, with $h_j^{\mathcal{H}}$ hours devoted to the home sector $\mathcal{H}$, and $\pi_j^{\mathcal{H}}$ gender-specific home sector productivity weight. In a couple, the home production input Ω follows the CES function:

$$\Omega = \left[\frac{\pi_H^{\mathcal{H}}}{\pi_H^{\mathcal{H}} + \pi_W^{\mathcal{H}}} (h_H^{\mathcal{H}})^{1-\gamma_3} + \frac{\pi_W^{\mathcal{H}}}{\pi_H^{\mathcal{H}} + \pi_W^{\mathcal{H}}} (h_W^{\mathcal{H}})^{1-\gamma_3} \right]^{\frac{1}{1-\gamma_3}}$$

where spouses' hours contribution are weighted by their relative home productivity weights and the parameter γ_3 governs the substitution or complementarity pattern. Without loss of generality, women's weight is fixed at 1. Men can have two productivity weight levels: a high one $\pi_{H,high}^{\mathcal{H}} \leq \pi_W^{\mathcal{H}}$ which could be as high as the woman's, and a low one $\pi_{H,low}^{\mathcal{H}} < \pi_{H,high}^{\mathcal{H}}$. Even if men and women have the same housework skill level, men can have a lower weight if individuals for any reason believe that men should not be performing housework. In that case, $\pi_{H,high}^{\mathcal{H}} < 1$, and the home production technology places more weight on the wife's time input regardless of the husband's skill level.

The combination of Cobb-Douglas utility and CES production forms can provide a good approximation of the data. *Figure A.1* in the Appendix shows that the kernel density distributions of the wife's housework time differ across her employment status, whereas the distributions of leisure time are roughly similar.

Finally, conditional on the employment choice, individual leisure time is:

$$L_j = H^{max} - h_j^{\mathcal{W}} - h_j^{\mathcal{H}} - H_j^N (1 - \Phi^N)$$

where H^{max} is the total available time, excluding personal care time such as sleeping, fixed at 110 hours per week. and H_j^N is the number of hours that individual j, if married and with a newborn that does not go to nursery school ($\Phi^N = 0$), has to devote to childcare, subtracting time from other utility-generating activities.[44] The

[44] According to the data, 3-year-old children spend on average 6 weekly hours in the care of their

nursery school fee can only be paid with the result of formal work and it does not affect home productivity. Hence, if there were no fees, using a nursery school would be a dominating choice for everyone.[45] With fees, nursery schools are relatively more valuable for couples who are more productive in the formal sector or where neither spouse is already specializing in home production.

3.3.3 Closed-form solutions conditional on employment

Using the functional forms, we can solve for the individual and the couple's the optimal home production hours conditional on the employment choices. In both cases, they will be a function of parameters and of the available amount of hours after formal work $H_j = H^{max} - h_j^{\mathcal{W}}$. This means that, in the dynamic problem, individuals choose how many hours to work in the formal sector in each period knowing that the choice is, in turn, tied to an optimal amount of home production time $h_j^{\mathcal{H}*}$ and, residually, leisure L_j^*.

For a single or divorced person, their optimal home production hours are:

$$h_j^{\mathcal{H}*} = \frac{\gamma_1\gamma_2}{1-\gamma_1(1-\gamma_2)} \cdot H_j$$

For a couple, the optimal solutions are found within the couple's cooperative problem. Using the fact that the Pareto weights change at the beginning of the period but do not change within the household problem, the first-order conditions impose:

$$h_H^{\mathcal{H}*} = D \cdot h_W^{\mathcal{H}*} \qquad \text{with } D \equiv \left(\frac{1-\theta}{\theta}\right)^{\frac{1}{\gamma_3(1-\gamma_1)}} \left(\frac{\pi_H}{\pi_W}\right)^{\frac{1}{\gamma_3}}$$

$$\eta^* = \frac{\Theta \cdot L_H^*}{\Theta \cdot L_H^* + L_W^*} \qquad \text{with} \quad \Theta \equiv \frac{\theta}{1-\theta}^{\frac{1}{1-\gamma_1}} \qquad \text{and} \quad L_j^* = H_j - h_j^{\mathcal{H}*}$$

which are all pinned down by:

$$h_W^{\mathcal{H}*} = \frac{1}{1+D} \cdot \frac{\gamma_1\gamma_2}{1-\gamma_1(1-\gamma_2)} \cdot \Big[\Theta \cdot H_H + H_W\Big]$$

Intuitively, when the husband's Pareto weight θ increases or when his home productivity π_H is lower, *ceteris paribus* he performs fewer hours of housework compared to the wife. When the husband's weight is exactly equal to 0.5, the ratio between the two

grandparents, with little variation depending on whether the household uses a nursery school or not.

[45] In the model parents do not prefer or have better ability to care for the child themselves instead of using a nursery school, and there is no crowding out of informal arrangements (Baker, Gruber, and Milligan (2008)).

spouses' housework time is only determined by their relative productivity and the degree of complementarity. A higher γ_3, denoting more complementarity, decreases gender differences in housework time. Even if there were no gender gap in the labor market, women would still do more home production if they had a higher home productivity than their husband.

3.3.4 Value functions and endogenous choices

For ease of notation, I do not indicate that value functions depend on time, on C_j, L_j, and on individual heterogeneity $\mathcal{I}_j = \{G_j, \pi_j, O_j\}$ which includes traditional gender values G_j, home productivity π_j and taste for tidiness O_j. Value functions also depend on the career state μ_j (high, medium or low). Working full-time in the high state and part-time in the medium one entail a chance β_u of moving to a lower state in the next period, which is irreversible. Unemployment brings directly to the low career state, which is thus absorbing.

I follow the backward recursive solution of the model. I start from the problem of divorced people, who are only making an employment choice every period:

$$V_j^{div}(e_j, \mu_j) = \max_{h_j^{\mathcal{W}}} \tilde{V}_j^{div}(e_j, \mu_j, h_j^{\mathcal{W}})$$

where education level e_j proxies for permanent income level state. The number of kids K_j is formally part of the divorced state space but is not included here to avoid notation clutter since divorced people in the model cannot have (more) children so their K_j remains fixed.

The result of the *max* operator with respect to work hours $h_j^{\mathcal{W}}$ determines the employment choice. Each $h_j^{\mathcal{W}} \in (OT, FT, PT, U)$ affects period utility through disposable income, and the continuation value through the next-period career state μ_j':

$$\tilde{V}_j^{div}(e_j, \mu_j, h_j^{\mathcal{W}}) = u_j(e_j, h_j^{\mathcal{W}}) + \beta \mathbb{E} V_j^{div'}(e_j', \mu_j' | h_j^{\mathcal{W}})$$

where the prime superscript indicates the following period value function and the expectation is taken with respect to the permanent income shock which affects e_j' given e_j.

Married people choose, in each period, whether unilaterally divorce:

$$V_j^{mar}(\Xi_j, K_j) = \max\{\tilde{V}_j^{mar}(\Xi_j, K_j), \quad V_j^{div}(e_j, \mu_j, K_j)\}$$

Denoting the other spouse by j', the married state space is $\Xi_j = \{e_j, e_{j'}, \mu_j, \mu_{j'}, s_L, \theta_j, N\}$, which includes both spouses' permanent income levels $e_j, e_{j'}$, their career levels $\mu_j, \mu_{j'}$, the love shock s_L, the Pareto weight θ_j, and a dummy for the availability of nursery schools N, equal across spouses.[46] This problem nests the value of staying married $\tilde{V}_j^{mar}(\Xi_j, K_j)$:

$$\begin{aligned}
\tilde{V}_j^{mar}(\Xi_j, K_j) &= (1 - \alpha_j \alpha_{j'}) \cdot \tilde{V}_j^{mar,NF}(\Xi_j, K_j) + \alpha_j \alpha_{j'} \cdot \tilde{V}_j^{mar,F}(\Xi_j, K_j) \\
\alpha_j &= \mathbb{1}[\tilde{V}_j^{mar,F}(\Xi_j, K_j) > \tilde{V}_j^{mar,NF}(\Xi_j, K_j)] \\
\alpha_{j'} &= \mathbb{1}[\tilde{V}_{j'}^{mar,F}(\Xi_{j'}, K_{j'}) > \tilde{V}_{j'}^{mar,NF}(\Xi_{j'}, K_{j'})]
\end{aligned}$$

where NF and F stand for no fertility and fertility respectively, so that this step determines the decision of having a child. Following Doepke and Kindermann (2019), having a child only happens if both spouses agree, which the model expresses through the indicators α_j and $\alpha_{j'}$, known to both spouses at the time of the fertility choice. The NF problem is:

$$\begin{aligned}
\tilde{V}_j^{mar,NF}(\Xi_j, K_j) &= u_j(\Xi_j(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}_j), K_j) + \beta \mathbb{E} V_j^{mar}(\Xi_j'(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}), K_j)\} \\
(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}_j) &= \underset{h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}, \theta_j}{\operatorname{argmax}} \{\sum_j \theta_j [u_j(\Xi_j(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}), K_j) + \beta \mathbb{E} \tilde{V}_j^{mar}(\Xi_j'(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}), K_j)]\} \\
&\text{s.t. } u_j(\Xi_j(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}), K_j) + \beta \mathbb{E} \tilde{V}_j^{mar}(\Xi_j'(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}), K_j) \geq V_j^{div}(e_j, \mu_j, K_j)
\end{aligned}$$

where $(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta})$ are the optimal solutions to the cooperative married household problem. The expectation is taken with respect to own- and cross- permanent income shock and to the spouse's future career state. The Pareto weight θ_j remains unchanged unless the participation constraint of one of the spouses binds, in which case, if a solution exists, the weight adjusts until both spouses prefer staying in the marriage. The share $\eta_j(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}_j)$ of total production output efficiently assigned to each spouse maximizes the surplus generated by marriage.[47] Notice that the individual continuation value $V_j^{mar}(\Xi_j'(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}), K_j)$ takes into account that each person always has the option to unilaterally divorce, whereas the household's continuation value $\tilde{V}_j^{mar}(\Xi_j'(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}), K_j)$ assumes the couple stays married.

[46] K_j is included separately from Ξ_j to underline the effect of fertility choices on K_j in the married problem.

[47] Differently from Mattia and Voena (2026), here divorce is the only outside option if cooperation breaks, so a regime of property separation of assets between spouses would always be weakly preferred to splitting assets equally. Consistently, even if this model has no assets, consumption can be thought of as also stemming from savings and is split between spouses according to the $\eta_j(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}_j)$ rule, not necessarily in equal shares.

When fertility is not possible, the F problem collapses to the NF one; otherwise:

$$\tilde{V}_j^{mar,F}(\Xi_j, K_j) = u_j(\Xi_j(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}_j, \hat{\Phi^N}), K_j + 1) + \beta \mathbb{E} V_j^{mar}(\Xi'_j(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}, \hat{\Phi^N}), K_j + 1)\}$$

$$(\hat{h}_j^{\mathcal{W}}, \hat{h}_{j'}^{\mathcal{W}}, \hat{\theta}_j, \hat{\Phi^N}) = \underset{h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}, \theta_j, \Phi^N}{\operatorname{argmax}} \{\sum_j \theta_j [u_j(\Xi_j(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}, \Phi^N), K_j + 1) + \beta \mathbb{E} \tilde{V}_j^{mar}(\Xi'_j(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}, \Phi^N), K_j + 1)]\}$$

$$\text{s.t. } u_j(\Xi_j(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}, \Phi^N), K_j + 1) + \beta \mathbb{E} \tilde{V}_j^{mar}(\Xi'_j(h_j^{\mathcal{W}}, h_{j'}^{\mathcal{W}}, \Phi^N), K_j + 1) \geq V_j^{div}(e_j, \mu_j, K_j + 1)$$

$$\text{s.t. } H_j + H_{j'} = 2 \cdot H^{max} - H^N(1 - \Phi^N)$$

where the kids state variable K_j increases by 1. The final constraint implies that when a nursery school is unavailable or the newborn's parents do not use it ($\Phi^N = 0$), spouses have to devote H^N hours to childcare, thus decreasing the total amount of time resources available for utility-producing activities. When $\Phi^N = 0$, the parent with the lowest wage or the highest home productivity is more likely to take time off work to care for the newborn. That spouse is also more likely to block the fertility decision, since their future participation constraints might become binding and since fertility has to be optimal for both spouses.

Finally, the problem of a single person in periods when they can marry is:

$$V_j^{sin}(\Xi_j) = \max\{\tilde{V}_j^{sin}(e_j, \mu_j), \quad \tilde{V}_j^{mar}(\Xi_j(\hat{\theta}_{j,0}), K_j = 0)\}$$

where the result of the *max* operator determines the marriage choice and the value depends on the heterogeneity dimensions of the potential spouse, the availability of nursery schools N, and the initial love shock $s_{L,0}$, all drawn at the beginning of the period. Thus, when couples are already married, nursery schools are either available to them or not. This reflects the limited geographical mobility of Italian couples and the fact that, anticipating having kids, they would have previously tried to settle where nursery schools are available. Single people, by assumption, enter the marriage problem with 0 kids, but they can have children in the first period they are married. When marriage is not possible anymore, this problem collapses to just $\tilde{V}_j^{sin}(e_j, \mu_j)$. The initial Pareto weight $\hat{\theta}_{j,0}$ maximizes marriage surplus Σ:

$$\hat{\theta}_{j,0} = \underset{\theta}{\operatorname{argmax}}\, \Sigma(\theta)$$

$$\Sigma(\theta) = (\tilde{V}_H^{mar}(\Xi_H(\theta), 0) - \tilde{V}_H^{sin}(e_H, \mu_H))^{\lambda} \cdot (\tilde{V}_W^{mar}(\Xi_W(1 - \theta), 0) - \tilde{V}_W^{sin}(e_W, \mu_W))^{1-\lambda}$$

where λ is the husband's Nash bargaining weight. Marriage happens if and only if, given the characteristics of spouses, there exists an endogenous value of the initial Pareto weight such that both spouses receive a positive surplus from the marriage.

Table 2: *List of main calibrated parameters.*

Description	**Source**	**Value**
Average nursery school fee as family income share (π^N)	National average	0.1
Nursery school availability chance ($N = 1$)	National average	0.22
Full-time contract hours (h_j^{FT})	National average	40
Part-time contract hours (h_j^{PT})	National average	24
Over-time hours (h_j^{OT})	Time use data	50
Total available weekly hours (H^{max})	Time use data	110
Average childcare hours covered by nursery school (H^N)	Time use data	33
Share women with taste for tidiness ($O_W = 1$)	Time use data	0.94
Share women who start in high-paying career ($\mu_W = \text{high}$)	Time use data	0.25
Share women with college education or higher ($e_W = \text{high}$)	Time use data	0.16
of whom, share with traditional gender values ($G_W = 1$)	Time use data	0.12
Share women with less than high school education ($e_W = \text{low}$)	Time use data	0.45
of whom, share with traditional gender values ($G_W = 1$)	Time use data	0.25
Time discount rate (β)	Standard literature	0.97

The nested single problem has the form:

$$\tilde{V}_j^{sin}(e_j, \mu_j) = \max_{h_j^{\mathcal{W}}} \left(u(e_j, \mu_j, h_j^{\mathcal{W}}) + \beta \mathbb{E} V_j^{sin}(\Xi_j(h_j^{\mathcal{W}})) \right)$$

The expectation is taken with respect to all dimensions of the potential future spouse drawn, the availability of nursery schools, the initial love shock and own permanent income and career shocks. The probabilities of such draws start with a guess in the backward iteration and the singles problem is then solved forward and backwards until the realized and expected draw probabilities in each period coincide. Future draws are unknown but current ones become known at the beginning of each period, before making the marriage choice. The singles' employment decision also affects their own attractiveness on the marriage market, providing an additional incentive to sustain higher paying careers.

3.4 Identification of the model

A number of parameters are calibrated to match the Italian economic environment, either as national averages or from the literature. Other parameters are calibrated from the data, to match the initial unobserved heterogeneity among women in terms of traditional gender values, taste for tidiness, career type, and education level. The list is in *Table 2*.

Since the model is solved from the point of view of women, the marriage market

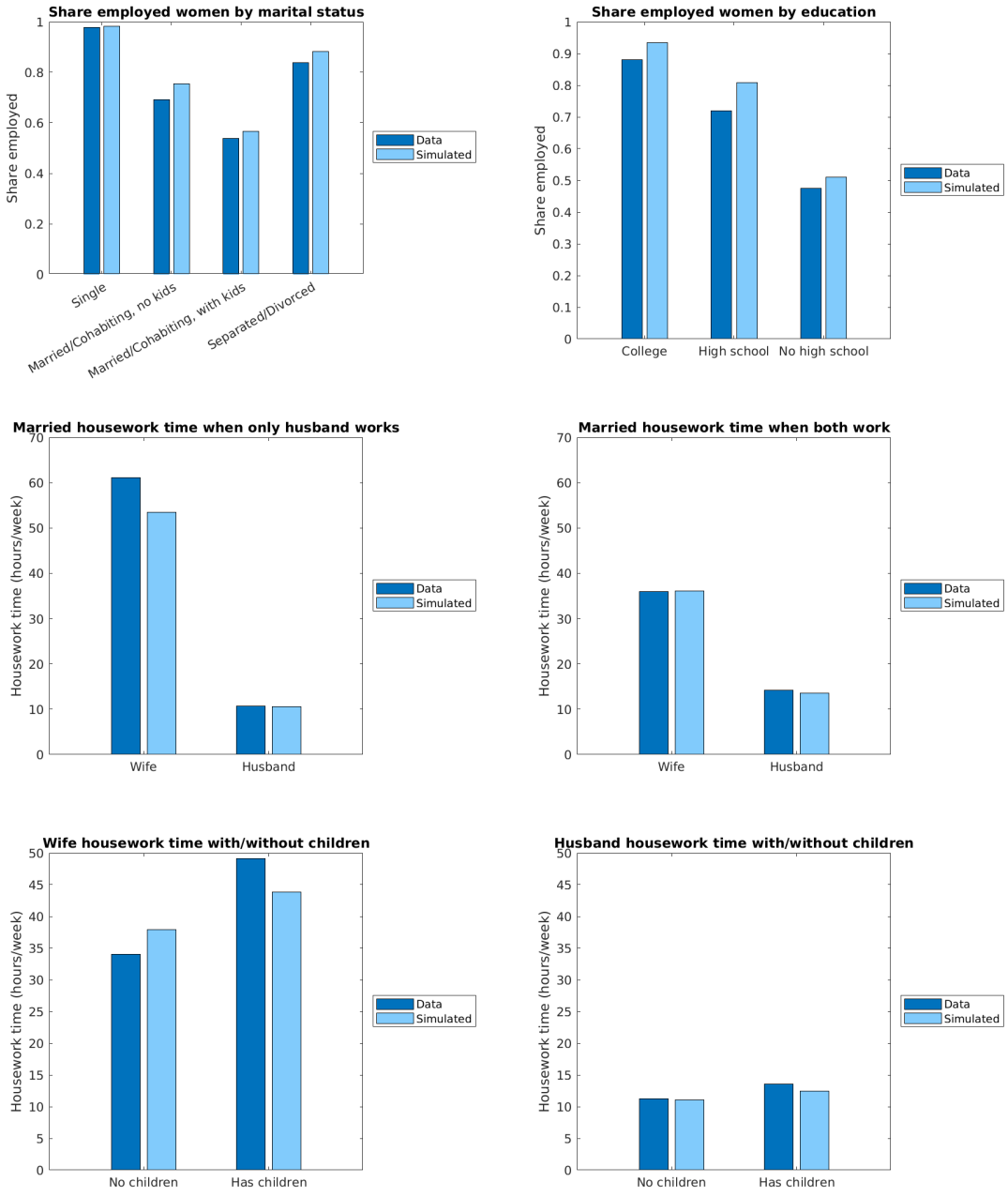
requires drawing potential husbands. They are first drawn from uncorrelated distributions of education, tidiness and career type. More educated mates are less likely to have traditional gender values and more likely to be perceived as home-productive; holding education fixed, non-traditional men are more likely to be perceived as home-productive. These distributions are calibrated from the data, with details in Appendix *Tables A.2* and *A.3*.[48] This is not a full marriage market equilibrium but a random matching with two-sided acceptance, so the model solution and counterfactuals have to be intended as conditional on the fixed point of the distribution of potential mates.

Identification of the remaining parameters is helped by features of the economic environment that are exogenous to individuals and plausibly taken as given by them when making decisions. The fixed amount of hours in each work contract exogenously changes the time budget constraint that individuals face when making the time allocation choice. The cost of nursery school fees exogenously shifts the cost of having a child, which has to be traded off against the parents' cost of providing childcare themselves. Finally, the characteristics of potential mates are taken as given by singles on the marriage market, since no individual can alone modify the market conditions.

The model is estimated using the method of simulated moments. There are 21 remaining parameters to be estimated. I target 31 moments on fertility, and on employment and housework time, slicing the population into subsamples by education, traditional values, perceived home productivity, taste for tidiness, and marriage and parenthood status.

In terms of identification, it is helpful that the data ask questions that allow separating between relevant but otherwise unobservable factors like taste for tidiness, traditional values and home productivity. Even if these values are self-reported, they are informative about people's own perceptions and stated preferences, which is what likely guides their choices. Moreover, knowing individuals' actual use of time allows linking stated to revealed preferences. This is an important advantage of this model also compared to previous literature.

Figure 4: *Summary of fit of targeted moments that show how the model reproduces the stylized facts. The class of moments represented in each plot is described in the header. More details are in the Appendix.*



3.5 Estimation results

The simulated moments resulting from the estimated parameters fit the data very well. The full list of simulated moments is in *Table A.5*. The plots in *Figure 4* illustrate

[48] *Table A.4* further suggests that having traditional gender values is negatively correlated with

Table 3: *List of estimated parameters. To compute the standard errors in parenthesis, the moments gradient has been approximated by perturbating the parameters by 0.01% symmetrically on each side. Further details and metrics computed following Honoré, Jørgensen, and Paula (2020) are available upon request.*

Parameter description	**Value**	**Standard error**
Gender wage gap (π^g)	0.0549	(0.0016)
Wage penalty in low-paying career (π^μ)	0.2488	(0.0044)
Over-time wage premium in high-paying career (π^{OT})	0.2615	(0.0029)
Education wage premium (π^e)	0.3663	(0.0032)
Age wage premium (π^a)	0.0331	(0.0011)
Standard deviation of permanent wage shocks (σ_e)	0.1277	(0.0003)
Risk of shifting to lower career type (β_u)	0.9630	(0.0028)
Income floor when unemployed (I_{base})	0.3261	(0.0025)
Economies of scale of marriage (s_M)	0.2425	(0.0026)
Utility factor increase for each child (s_{K_1})	0.0997	(0.0012)
Household budget expansion for each child (s_{K_2})	0.0766	(0.0008)
Standard deviation of initial love shock ($\sigma_{L,0}$)	0.4157	(0.0025)
Standard deviation of permanent love shocks (σ_L)	0.2881	(0.0022)
Man's Nash bargaining power in splitting marriage surplus (λ)	0.6259	(0.0126)
Traditional gender values penalty (s_G)	0.0694	(0.0005)
Utility exponent of consumption (γ_1)	0.6899	(0.0007)
Exponent of home production (γ_2)	0.2662	(0.0010)
Substitutability between spouses' housework time (γ_3)	0.4960	(0.0040)
Men high home production weight ($\pi_{H,high}$)	0.3376	(0.0010)
Men low home production weight ($\pi_{H,low}$)	0.2585	(0.0014)
Housework utility malus for untidiness (π_O)	0.0541	(0.0134)

the main moments, which show that the model reproduces the desired stylized facts very well.

Starting from the top left graph, the model correctly predicts the large drop in female labor force participation associated with marriage, as well as the rebound upon divorce. In the top right plot, the simulated moments accurately portray the negative employment gradient linked to decreasing education levels. In terms of housework hours, the two center plots show that the model correctly predicts the amount of housework hours for both spouses regardless of their employment status, even if slightly lower hours for the wife when she is unemployed. Finally, the bottom two graphs capture the fact that marrying and having children corresponds to an increase in the wife's housework hours contribution (albeit slightly under-predicted), whereas the husband's increases only very modestly.

perceived male housework productivity even after conditioning on education level, and the correlation pattern does not change significantly across age groups.

The full list of estimated parameters to match the targeted moments is in *Table 3*. The main result is that, to rationalize gender differences in housework, men's weight should be about 30% that of women, even after accounting for gender wage gap, traditional gender values and taste for tidiness. The small difference between the high weight (0.34) and the low one (0.26) points to a limited role of perceived husband's housework skills. Just over a quarter of consumption comes from housework, the rest from the labor market. Finally, spouses' housework time inputs tend to be substitutes, with γ_3 close to 0.5.

Some estimates can be suggestively validated using external sources. Education and age levels increase the wage by 37% and 3.3% respectively: for comparable prime-age men from the Bank of Italy SHIW dataset, the numbers would be about 35% and 4% respectively. Children require 7.7% higher expenses, which projects to 3 times the average lifetime household income. Recent estimates place that figure for Italy at about 4 times.[49]

The data allows for some speculation about the reasons for such a large residual gender difference in housework weights, taking for granted that the set of housework skills is not biological. A potential explanation involves habit formation. In fact, starting from a young age, girls devote more time to housework and studying and less to leisure, compared to boys, and the difference increases with age.[50] Another speculative explanation could be that men do not put effort into housework because they do not think it is their social or gender role. Such views might be underestimated in the data, or they could produce effects even when held unconsciously.[51] In any case, given the magnitude of the gender difference in housework, there would be a large payoff to understanding its root causes more in depth.

[49]Source: Bank of Italy in 2021, more recent than this paper's time frame (2002-2013) and with slightly different definitions. There are no historical estimates for Italy but US Department of Agriculture data suggests that the cost of raising kids has grown from about 3 times the median household income in 1983 to over 4 times in 2024.

[50]Teenage girls spend about 2-4 weekly hours more than boys doing chores. The difference starts being statistically significant around age 9 and grows over time up to age 17, as shown in panel (a) of *Figure A.2*. However, this is only partly compatible with learning by doing: husband and wife both spend only a third of their housework time on tasks such as cooking, small constructions, and childcare, which might require learning. The majority of time is instead spent on repetitive tasks with limited scope for learning, such as cleaning, laundry, and groceries.

[51]In Goldin (2025), in the countries with the lowest fertility rates, social norms evolved more slowly than economic progress, creating frictions between spouses' fertility desires and intra-household division of tasks. Similarly, in Hancock, Lafortune, and Low (2025) there is a gendered wedge in willingness to perform housework. In Coran, Laczek, and Miserocchi (2023), childhood environment can affect motherhood penalties decades later.

4 Discussion, counterfactuals and implications

In this section, I show the model mechanisms by changing the model parameters in isolation and showing how they affect fertility and female employment. Then, I repeat the estimation for the Center-North and the South of Italy, and replicate the historical trends in fertility and female employment in the two areas from 1980 to 2024. Finally, I use the model to microfound the correlation between fertility and female employment, presenting conditions under which there is negative or positive correlation.

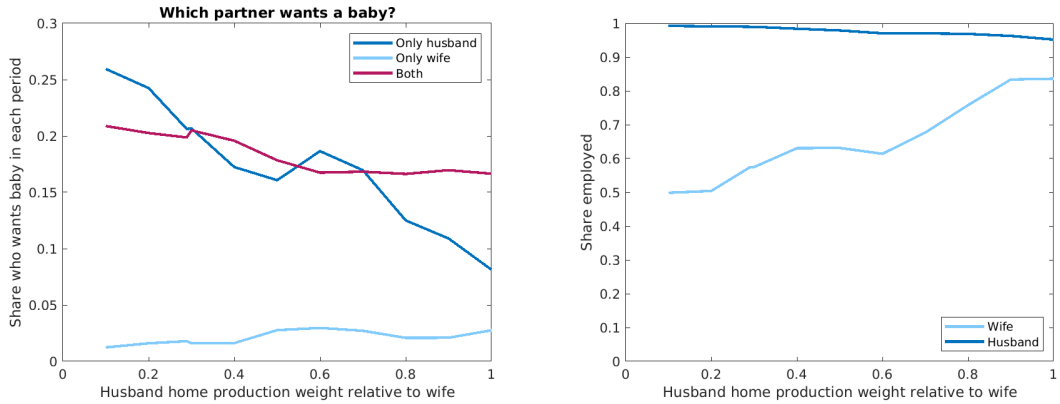
4.1 Mechanisms and effects of parameter changes

The first parameter I change is the husband's home production weight, so that it spans from 0.1 to 1 relative to the wife's, as shown on the x-axis in both panels of *Figure 5*. In the left panel I compute both partners' fertility desires, obtained as the share of husbands and wives whose individual value function would be higher if they had a baby in each of the 7 fertile periods in the model. Increasing the husband's home production weight decreases the share of husbands who want a baby in each period from about 0.3 to just over 0.1. This happens because household efficiency would require them to perform much more housework, which increases their opportunity cost of having children. Hence, even if women's desires remain stable, the overall effect is that erasing gender differences in housework would decrease fertility by about 0.03 children per woman per period, bringing total realized fertility down to 1.17. On the other hand, the right panel shows that increasing the husband's home production weight would have a strong effect on the wife's employment, which increases to over 0.8, with little changes to the husband's employment level.

The gender difference in housework production weights also accounts for about 70% of the child penalty in women's earnings after the birth of their first child. As *Figure 6* shows in panel (a), in the baseline women's earnings are 50% lower than men's 4 periods after having their first child, with the gap widening over time.[52] In panel (b), if men's housework production weight were the same as women's, the penalty in period 4 would be equal to only 29% of what it was in the baseline. In both cases the lack of nursery schools forces parents to reduce their paid work time in the year when the child

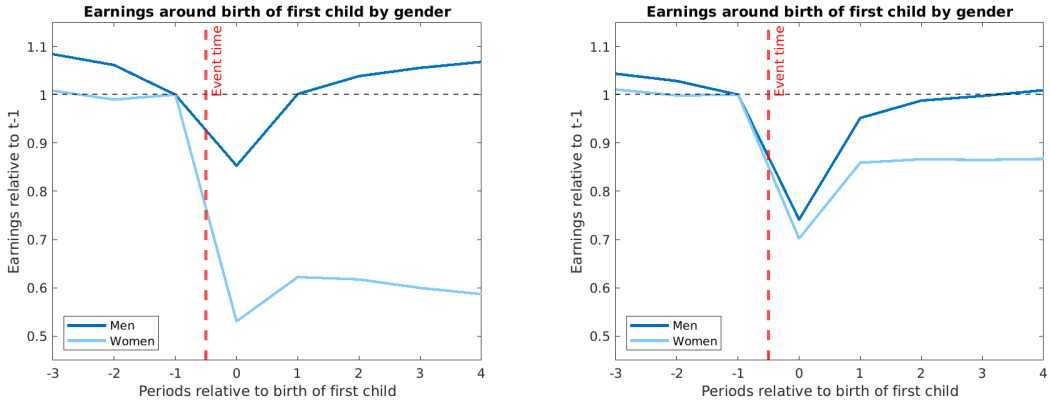
[52]Notably, the model has no parameter for child penalty, which emerges endogenously. Nonetheless, the magnitude of the penalty is similar to Casarico and Lattanzio (2023) and Kleven, Landais, and Leite-Mariante (2024).

Figure 5: *Spouses' fertility desires and employment rate if the husband's home production weight increased up to the wife's level. In both graphs, the x-axis represents the husband's weight relative to the woman's, and the plotted lines show the estimated counterfactual magnitudes as the man's home productivity changes.*



(a) Fertility desires (b) Husband's and wife's employment

Figure 6: *Earnings of men and women around the birth of their first child, represented as relative to their earnings in the period before the birth. Every model period on the x-axis corresponds to 3 calendar years.*



(a) Baseline (b) Men same housework weight as women

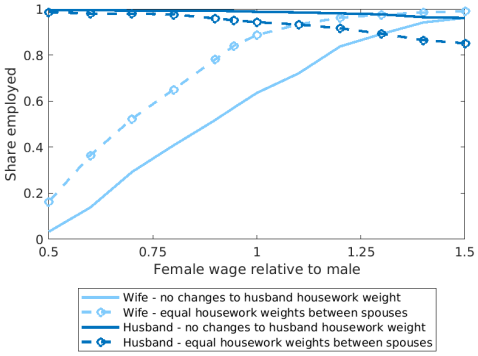
is born, but this reduction is much more equal when spouses have the same housework production weights.[53]

Figure 7 shows the fertility and employment effects of changing the gender wage gap (panels a and b), the time intensity of housework (panels c and d), or the availability

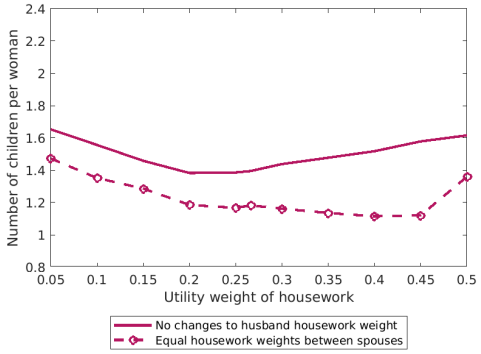
[53]Mandatory paternity leave might have a similar effect if it forces the husband to permanently increase his home production weight.

Figure 7: *Realized fertility and spouses' employment rate when the level of potential female wage from 50% to 150% that of men (panels a and b); when the exponent γ_2 of home production time input spans from 0.05 to 0.5 (panels c and d); when the nursery school coverage rate spans from 0 to 1 (panels e and f). In all plots, the dashed lines show what the results would be if the husband's home production weight were set equal to the wife's.*

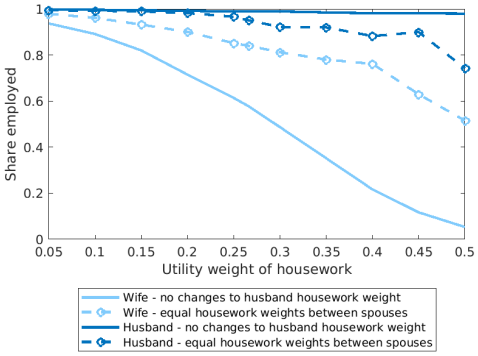
(a) Fertility



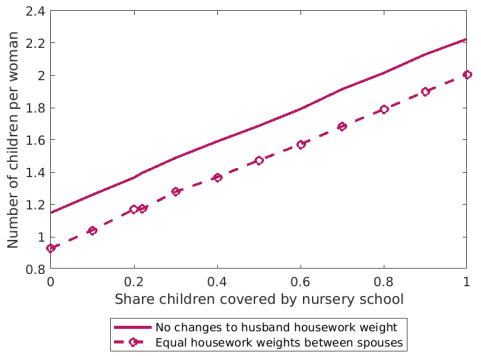
(b) Husband's and wife's employment



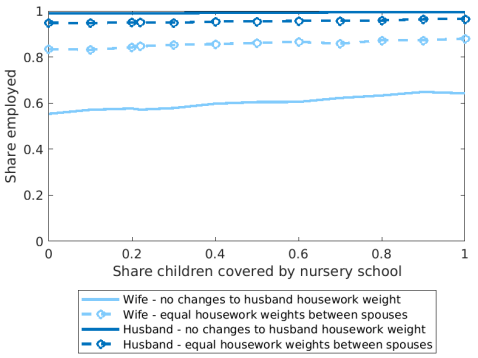
(c) Fertility



(d) Husband's and wife's employment



(e) Fertility



(f) Husband's and wife's employment

of nursery schools (panels e and f). In all cases I consider how results would change if the husband's home production weight were set equal to the wife's.

In the gender wage gap case, I let the female potential wage span from 50% to 150% of the male wage (the estimated baseline is 94.5%). Panel (a) shows that fertility tends to decrease, because the opportunity cost of having children increases. The wife's employment increases as her potential wage increases, and would reach the husband's level only when the female wage is 1.5 times the male, which means the disparity in housework has an employment effect comparable to an additional 50% gender wage gap. However, since the baseline gender wage gap here is small, the light-blue dashed line in (b) highlights that larger gains in the wife's employment could come from rebalancing housework.

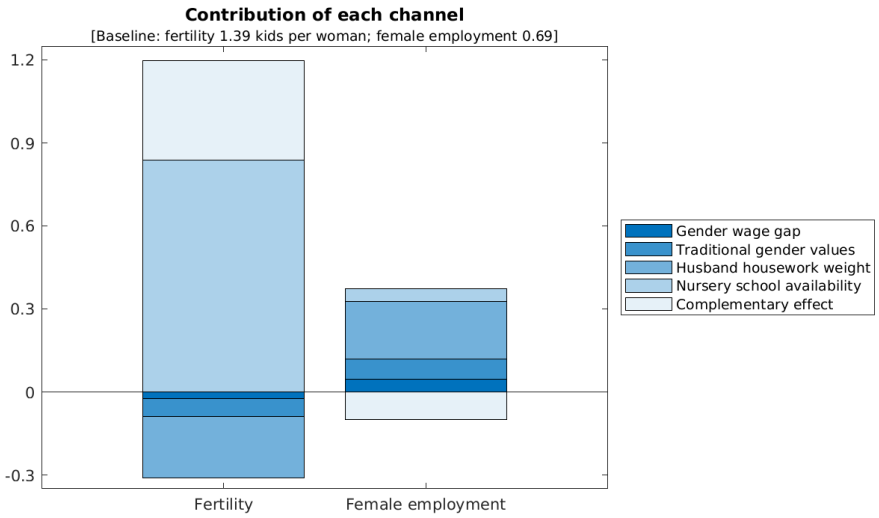
Then, I let the exponent γ_2, which governs the weight of the home production time input in the consumption technology, span from 0.05 to 0.5 (the baseline is 0.28).[54] Panel (c) shows that fertility would be higher at the extremes: with a low γ_2 housework time intensity would be low enough to allow both work and children; with a high γ_2 the wife would already be specializing in home production. In panel (d) the wife's employment increases as γ_2 decreases, since her time becomes increasingly free from housework and childcare. Again, if realistic future changes of γ_2 do not decrease too much from the baseline,[55] larger female employment gains might come from rebalancing housework.

Finally, the bottom panels of *Figure 7* show the effect of changing nursery school availability, which was an externally calibrated parameter, from 0 to 1 (the baseline is 0.22). In this case fertility increases the most, to 2.2 in case of full coverage. However, in panel (f) the employment effect would be modest, and there would be much higher female employment gains from rebalancing housework. This happens because, even if women are already specializing in housework, outsourcing childcare increases fertility desires but it does not free up enough time to increase employment significantly.

[54] In principle, the amount of time-saving technology that a household purchases could also be a choice variable, since individuals with a higher opportunity cost of not working might want to purchase more. For simplicity, the model considers only an average level of γ_2, but I allow it to change in the historical analysis that follows.

[55] A factor preventing γ_2 from decreasing too much is that the childcare time (here included in housework) is harder to reduce and recent trends show that it is increasing, especially among high-educated households. Outsourcing housework to domestic workers is not allowed in this model because the data shows that it is not common for Italian households, but similarly Cortés and Pan (2013) and Cortés and Pan (2019) show it increases labor supply of mothers of young children and female relative earnings in occupations that reward over-time work.

Figure 8: *Contribution to counterfactual level changes in fertility and female employment, relative to their baseline, of closing all gender gaps and setting nursery school availability to 1. Fertility is measured in children per woman and female employment as the rate of employed women aged 25-63.*



In all counterfactuals, if the husband's home production weight were the same as the wife's, fertility would be lower and female employment much higher. This underscores the importance of taking the balance of housework time between spouses into account when designing policies aimed at boosting both fertility and female employment.

To summarize the takeaways from these parameter changes, I estimate the combined effect of an unconstrained scenario of setting (i) the gender wage gap to 0, (ii) the penalty for working against traditional gender values to 0, (iii) the husband's home production weight equal to the wife's, (iv) the availability rate of nursery schools to 1. Fertility would increase to 2.28 children per woman from a baseline of 1.39, and the rate of employed women aged 25-63 to 0.97 from 0.69. Notably, the 2016 FSS survey places ideal number of children in Italy at around 2.3 per family.[56] *Figure 8* shows the relative contribution of each factor and the complementary effect of all four changes together. Nursery schools account for most of the positive effect on fertility, but the housework channel accounts for about two thirds of the employment effect, again underscoring its

[56]The survey is *Famiglie, soggetti sociali e ciclo di vita* by ISTAT (elaborations available upon request). A less extreme counterfactual, with gender wage gap and utility penalty for working cut in half, husband's housework weight 0.5 and nursery school availability 0.5, would increase fertility to 1.55 and female employment to 0.82.

policy relevance.[57]

4.2 Historical trends in Center-North and South of Italy

I re-estimate the model to get one set of parameters for the Center-North of Italy and one for the South, using the same 2002-2013 data as the main estimation for the whole country. I also adjust the externally calibrated parameters to each area. For instance, the Center-North has higher supply of nursery schools at 0.28 (compared to 0.1 in the South), and generally a more educated population. Consequently, using the distributions of women and potential husbands conditional on education, in the Center-North the population will be less conservative and potential husbands tend to have a higher home production weight.

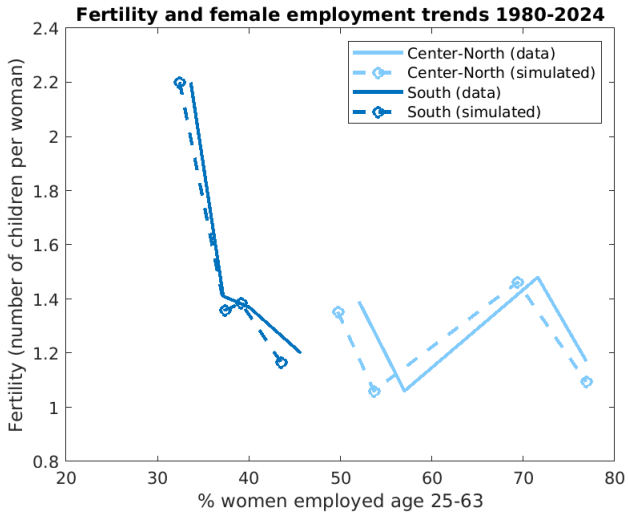
The main implied differences are that the Center-North has a lower gender wage gap π^g, a lower exponent of housework time input γ_2, a higher average husband's home production weight, and slightly higher cost of children s_{K_2} and slightly lower utility taste for kids s_{K_1}. The model correctly predicts the higher female employment and lower fertility in the Center-North compared to the South. Estimated parameters are available upon request.

Starting from these two sets of parameters, I then replicate the historical trends in fertility and employment in the two areas, focusing on 4 years in particular: 1980, 1995, 2010, 2024. The fertility data is the actual fertility rate measured in children per woman aged 15-49 by ISTAT in those years. I compute female employment as the share of employed women aged 25-63 in the Survey of Household Income and Wealth (SHIW) by the Bank of Italy in those years. To better resemble the model restrictions, I exclude people who are students, retired, not able-bodied or living off personal wealth from the survey sample. To match the historical environment in each year, I calibrate the nursery school coverage rate using data from ISTAT and the distribution of education using SHIW data. To focus on the most relevant dimensions for female employment and fertility, I keep all model parameters fixed at the baseline level except for the following, which are allowed to vary year by year: (i) the gender wage gap π^g, (ii) the exponent of the housework time input γ_2, (iii) the husband's home production weights collapsed to just one average weight, (iv) the utility taste for kids s_{K_1} and (v) the cost of children s_{K_2}.[58]

The comparison between the data and the model simulation is in *Figure 9*, where

[57] All counterfactuals abstract from general equilibrium effects on wages and on the market for

Figure 9: *Data and simulated historical trends in fertility and female employment by area. In each line, the four dots represent years 1980, 1995, 2010 and 2024 respectively and in chronological order.*



the simulation is in the dashed lines and each line has four dots representing years 1980, 1995, 2010 and 2024 respectively and in chronological order. The model accurately reproduces the downward trend in fertility with only moderate increase in female employment in the South, as well as the larger increase in female employment in the Center-North paired with the corresponding increase and recent decrease in fertility.

The model explanation for these trends can be found by looking at the externally and internally calibrated parameters in *Table 4*. In the Center-North, the increase in employment is due to the parameters π^g, γ_2 and π_H creating more favorable conditions for women to enter the labor market. As a consequence, fertility decreased from 1980 to 1995, then increased mostly due to a sizable increase in nursery school supply, then decreased again in 2024, due to the cost of children outweighing nursery school supply. In the South, the small changes in π^g, γ_2 and π_H over time are consistent with the modest historical increase in female employment. The coverage of nursery school does not grow enough to prevent fertility from decreasing over time, especially in the face of increasing cost of children, which are mostly responsible for the large fertility drop from 1980 to 1995.[59]

childcare, such as crowding in of private supply or decreasing marginal quality of public supply.

[58]I also match the historical trends for Italy as a whole, using a linear combination of the parameters of Center-North and South weighted by their population, so that they weigh about two thirds and one third respectively.

[59]This might still reflect a transition from quantity to quality of children as in Becker and Lewis

Table 4: *Externally and internally calibrated parameters to match the historical trends in fertility and female employment in the Center-North and in the South of Italy in 1980-2024.*

Description	**1980**	**1995**	**2010**	**2024**
Center-North				
Nursery school coverage	0.05	0.09	0.30	0.36
Share men with college education or more	0.11	0.12	0.16	0.27
Share men with less than high school education	0.64	0.54	0.49	0.31
Share women with college education or more	0.11	0.11	0.23	0.23
Share women with less than high school education	0.60	0.58	0.40	0.27
Gender wage gap π^g	0.0783	0.0653	0.0503	0.0402
Exponent of home production γ_2	0.2975	0.2926	0.2741	0.2768
Men home production weight π_H	0.2310	0.2511	0.2816	0.3412
Utility factor increase for each child s_{K_1}	0.0951	0.0961	0.0978	0.0976
Household budget expansion for each child s_{K_2}	0.0712	0.0763	0.0748	0.0805
South				
Nursery school coverage	0.01	0.03	0.09	0.20
Share men with college education or more	0.10	0.10	0.14	0.15
Share men with less than high school education	0.71	0.59	0.56	0.43
Share women with college education or more	0.10	0.10	0.15	0.21
Share women with less than high school education	0.55	0.59	0.52	0.34
Gender wage gap π^g	0.1513	0.1506	0.1406	0.1386
Exponent of home production γ_2	0.3181	0.2998	0.3164	0.3301
Men home production weight π_H	0.1986	0.2080	0.2250	0.2260
Utility factor increase for each child s_{K_1}	0.1038	0.0999	0.0998	0.1011
Household budget expansion for each child s_{K_2}	0.0654	0.0770	0.0771	0.0824

Some parameter values can be suggestively validated by external sources.[60] *Figure A.3*, panel (a) shows a negative correlation between γ_2, which measures the time-intensity of housework, and the share of households who own a dishwasher. Regarding the utility taste for children s_{K_1}, the aforementioned 2016 ISTAT FSS survey suggests that respondents in the South have 5-10% higher ideal number of children per family (panel (b)). Finally, albeit not regarding Italy, data from the US Department of Agriculture suggests that the cost of raising kids has grown significantly between 1983 and 2024.

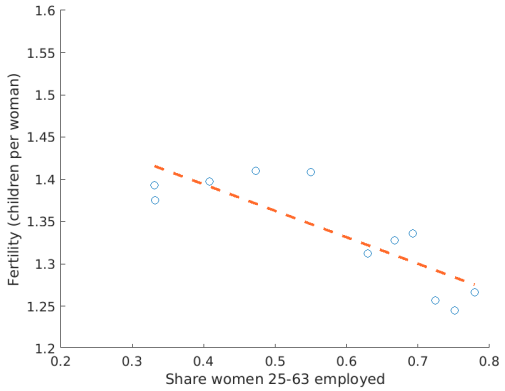
4.3 Correlation between fertility and female employment

The previous counterfactuals highlight the mechanism through which housework (and the gender wage gap and home technology) operate: they increase the opportunity

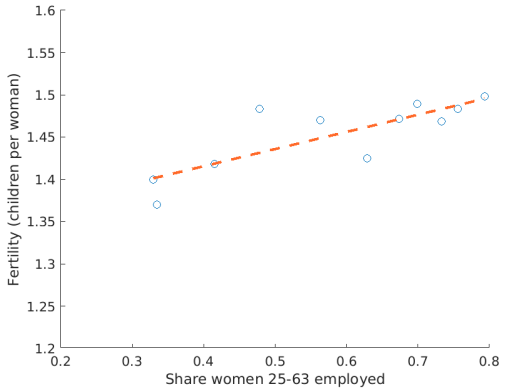
(1973).

[60] Technically, this exercise estimates 40 parameters by matching only 24 moments, and is thus not identified.

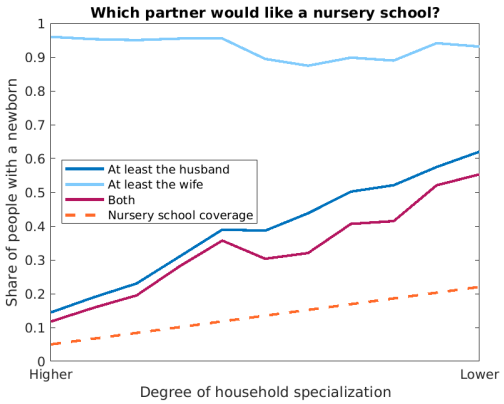
Figure 10: *Examples of negative correlation (left two panels) and positive correlation (right two panels) between fertility and female employment. In all panels, the dots are generated by estimating the model repeatedly, each time moving the parameters towards a lower degree of household specialization.*



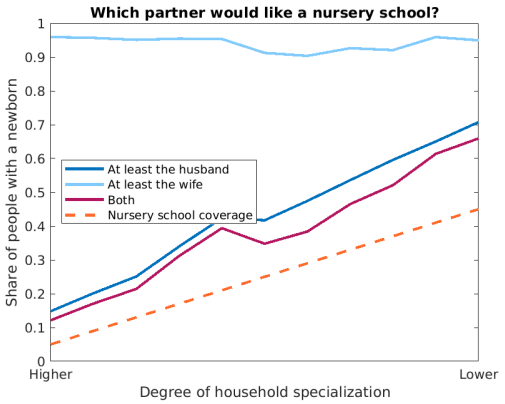
(a) Correlation



(b) Correlation



(c) Nursery demand



(d) Nursery demand

cost of having children especially for men which, all else equal, would increase female employment and reduce fertility. However, the demand to outsource childcare would increase, especially for men. When this demand is met, fertility and female employment would both increase at the same time. The model can endogenously generates this correlation even if the parameters were estimated without targeting it explicitly.

To represent demand for nursery schools by each spouse in the model, I consider the share of husbands and wives whose value function would be higher if a nursery school were available in the period when they had a newborn baby.[61] I then also compute the

[61]In an alternative definition, I also consider individuals who want a baby instead of only those who

share of couples where both spouses would like to have a nursery school available.[62] Fertility is measured as the number of children per woman after age 45 and female employment is measured as the share of employed women aged 25-63.

I re-estimate the model 11 times, gradually changing the gender wage gap π^g from 0.2 to 0.05, the exponent of home production γ_2 from 0.35 to 0.25 and the husband's average home productivity weight (both $\pi_{H,high}$ and $\pi_{H,low}$) from 0.2 to 0.5. This represents a change in the economic environment, which increases women's incentive to enter the labor force and creates demand to outsource childcare, resembling the historical trend from higher to lower household specialization.

Within this changing economic environment, I study two cases. In the first, depicted in the left two panels of *Figure 10*, nursery school availability grows slowly up to the national baseline of 0.22. Here, nursery school demand increases faster than supply, which raises female employment and lowers fertility, generating a negative correlation between the two. In the other case, shown in the right two panels, nursery school availability grows up to 0.45, which is in principle the EU target for 2030. Here nursery school supply tracks demand, which instead generates a positive correlation pattern, with female employment levels similar to before but ultimately higher fertility.

Referring to the historical trends in the previous section, the negative correlation represents the South of Italy over the entire period 1980-2024, and the Center-North up to 1995. After that, the rapid increase in nursery schools in the Center-North reverted the correlation to positive.[63] According to the baseline estimated parameters for 2002-2013, the model implies that the supply of nursery schools lags behind demand in both areas, but it covers about half of demand in the Center-North and less than a third in the South. From the policy point of view, since fertility is a long-term decision, the presence of nursery schools by itself creates some demand just by interacting with the life-cycle aspect of the problem.[64]

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have a newborn in that period. The results are similar, as shown in *Figure A.4*.

[62] In the model, the couple sends their child to a nursery school if it is optimal to do so according to the joint value function, not to the individual value functions. However, it is important to consider the case when both agree because a couple who agrees could constitute a stronger demand, especially in a country like Italy where nursery school are mostly provided by the local government.

[63] Similar patterns for fertility and female employment across Italian regions are documented by Barbiellini Amidei, Di Addario, Gomellini, and Piselli (2023).

[64] The plots of demand for nursery schools as their coverage increases are shown in *Figure A.5*.

5 Concluding remarks

This paper proposes a novel structural, life-cycle model of employment, fertility, marriage and divorce where individuals and couples choose to devote their time to competing uses between formal work, housework and leisure. Men and women have different comparative advantages in each sector. The model is estimated using a restricted-access version of the Italian time use data for years 2002-2008-2013, which allows for disentangling the effect of traditional values about gender roles and perceived male housework productivity.

The model is estimated with the simulated method of moments and, to rationalize gender differences, implies that men's weight in home production is about 30% that of women. The data and the model allow for speculating that such a large residual difference might be due to habit formation and only partly to learning by doing and skills. There might also be a lack of effort by men due to adherence or internalization of gendered norms and household roles. In general, the model and the policy simulations point to a prominent and sizable role of the gender difference in housework productivity in determining female employment outcomes and the success of government policies aiming to raise fertility at the same time. Indeed, in counterfactual analysis I show that closing gender gaps in all dimensions would raise fertility to 2.28 children per woman and female employment to 0.97. Hence, there is a large payoff for future work to understand the root causes of this phenomenon more deeply.

The model can also microfound and explain the positive correlation between fertility and female employment, recently emerged in high-income countries. I argue that a more equal division of housework (and improving home technology and women's career prospects) can lead to this positive correlation, because it increases demand to outsource childcare. When this demand is met, both fertility and female employment increase. I replicate the historical trends in the Center-North and in the South of Italy and show that indeed this has been the case in the Center-North, which has both higher demand and supply of nursery schools. Importantly for policy, the presence of nursery schools interacts with the life-cycle nature of fertility and even just in itself contributes to creating demand. However, it would be important to better understand demand for and perceived cost of outsourcing childcare, which in this model is limited to its monetary cost and fixed even when supply expands.

Future iterations of this research will extend the model to other European countries,

using the Harmonised European Time Use Survey, which the Italian data is a part of. Integrating this with data on cultural attitudes, such as the World Value Survey, could highlight differences across EU countries. While the structure of job contracts might be similar across Europe, individual countries might differ in their public nursery school systems, private provision of such services or people's attitudes towards outsourcing childcare.

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Appendix A. Additional tables and figures

Table A.1: *Sample restrictions. The table shows the number of people who have each characteristic, all of which are excluded from the final sample. Each individual could be part of multiple categories.*

Description	**2002**	**2008**	**2013**	**All years**
Initial sample ages 25-63 in nuclear households	21,249	16,397	16,091	53,737
Missing time use data	851	648	652	2,151
Already retired	2,435	1,806	1,368	5,609
Never married who has children	187	265	498	950
Military service, student, or not able-bodied	183	455	324	962
Lives mainly off own wealth	106	104	116	326
Never married living off money from others	110	153	251	514
Reports working weekly hours < 12 or > 60	985	515	509	2,009
In a couple with someone who was excluded	2,158	1,422	1,297	4,877
Final sample	14,604	11,640	11,559	37,803

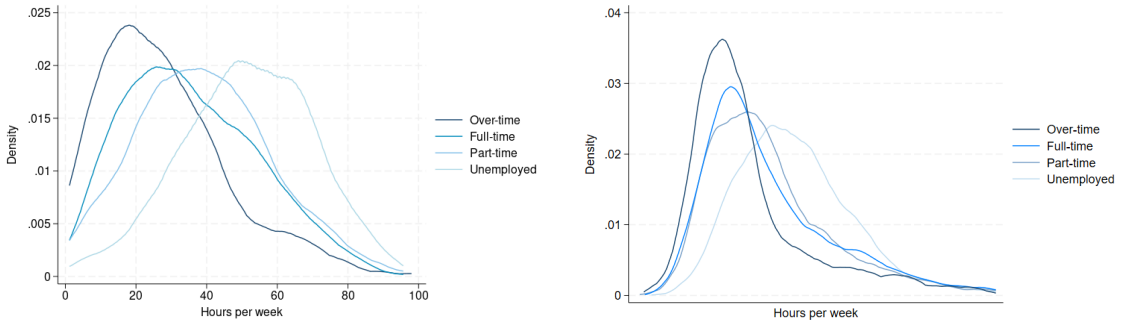
Table A.2: *Joint distribution of traditional gender values and perceived housework productivity of potential husbands on the marriage market conditional on their education level. The shares are age-invariant and sum to 1 inside each 2x2 subtable. The values are raw weighted data frequency tables among single and married men of ages 25 to 45.*

		Housework productivity	
Education level	**Gender values**	Not productive	Productive
Less than high school	Non-traditional	0.36	0.29
(49% of all mates)	Traditional	0.30	0.05
High school	Non-traditional	0.36	0.43
(38% of all mates)	Traditional	0.18	0.03
College or higher	Non-traditional	0.32	0.55
(13% of all mates)	Traditional	0.10	0.03

Table A.3: *Distribution of taste for tidiness and career type of potential husbands. The values for career type are calibrated to match the share of single men working over-time and the share of unemployed single men.*

Description	**Source**	**Value**
Share with taste for tidiness	Time use data	0.91
Share in high-paying career	Time use data	0.25
Share in low-paying career	Time use data	0.05

Figure A.1: *Kernel density distributions of wife's housework time (a) and leisure time (b) in weekly hours depending on wife's employment status as an over-time worker, full-time worker, part-time worker, or unemployed.*



(a) Housework time

(b) Leisure time

Table A.4: *Linear probability regression of having traditional gender values. The sample includes single and married men aged 25 to 45, in the 2013 data wave. The table suggestively corroborates the idea that having traditional gender values is negatively correlated with perceived male housework productivity even conditioning on education level, and the correlation pattern does not change significantly across age groups. The results do not change significantly if controlling for 3 education levels instead of 5 or if controlling for all 20 regions of Italy instead of geographic macro-areas. Robust standard errors are in parentheses.*

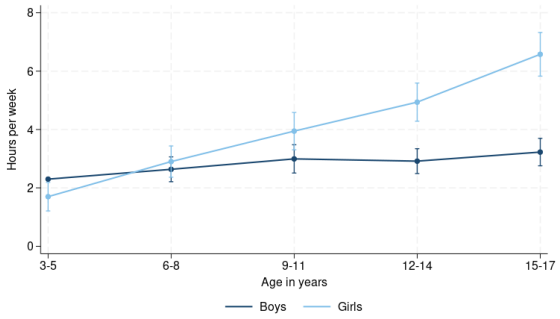
	Dep: traditional gender values dummy	
	Coefficient	Standard error
Thinks men home-productive as women	-0.2517***	(0.0256)
Education (baseline: more than college)		
College	0.1388***	(0.0466)
High school	0.1830***	(0.0444)
Middle school	0.2633***	(0.0453)
Less than middle school	0.4310***	(0.0954)
Age group (baseline: 25-27)		
28-30	0.1358	(0.0944)
31-33	0.0348	(0.0841)
34-36	0.1095	(0.0790)
37-39	0.0452	(0.0787)
40-42	0.0704	(0.0776)
43-45	0.0475	(0.0778)
In an unmarried couple	0.0176	(0.0292)
Geographic area (baseline: North)		
Center	0.0480	(0.0359)
South	0.1140***	(0.0313)
Constant	0.0348	(0.0876)
Observations	2,527	
Adjusted R^2	0.1416	

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

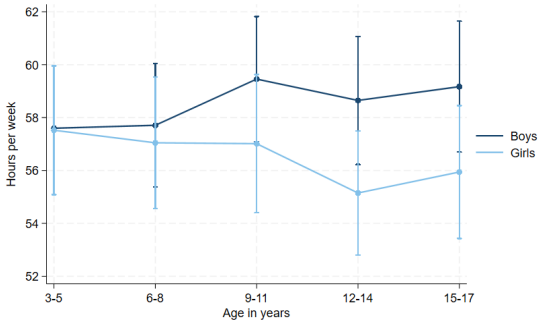
Table A.5: *List of targeted moments. The second and third columns show the data value, and standard deviation computed using 100 bootstrap samples. The fourth column shows the simulated value from the model, obtained by simulating an initial sample of 10,000 women and minimizing the percentage distance from data moments, weighted by the appropriate standard covariance matrix computed using 100 bootstrap samples from the data..*

Moment description	**Data value**	**Data std**	**Simulated**
Average number of kids (after age 45)	1.3699	(0.0163)	1.3950
Share with 3 kids (after age 45)	0.0880	(0.0053)	0.0895
Share divorced women	0.1179	(0.0038)	0.1108
Share employed women when single	0.9787	(0.0058)	0.9833
Share employed women when married without kids	0.6910	(0.0143)	0.7538
Share employed women when married with kids	0.5389	(0.0085)	0.5671
Share employed women when divorced	0.8391	(0.0116)	0.8821
Share employed men when married without kids	0.9639	(0.0063)	0.9942
Share employed men when married with kids	0.9654	(0.0026)	0.9889
Share employed married women working part-time, no kids	0.1442	(0.0142)	0.1123
Share employed married women working part-time, with kids	0.2694	(0.0082)	0.2613
Share employed married men working part-time	0.0286	(0.0022)	0.0433
Share employed married men working over-time	0.2408	(0.0051)	0.2258
Share employed single women working over-time	0.1408	(0.0151)	0.0921
Share employed married women working over-time	0.0754	(0.0040)	0.0822
Share employed women with college education	0.8800	(0.0217)	0.9346
Share employed women with high school education	0.7197	(0.0094)	0.8076
Share employed women with no high school education	0.4759	(0.0080)	0.5100
Ratio employed women when conservative vs not	0.7579	(0.0392)	0.8102
Ratio employed wife when conservative husband vs not	0.7010	(0.0385)	0.7172
Woman housework hours when married without kids	34.0568	(0.7508)	37.9055
Woman housework hours when married with kids	49.1191	(0.3508)	43.8283
Man housework hours when married without kids	11.2520	(0.4715)	11.0536
Man housework hours when married with kids	13.5908	(0.1782)	12.4877
Ratio wife housework hours when home-productive husband vs not	0.9217	(0.0268)	0.9339
Ratio husband housework hours when home-productive vs not	1.2940	(0.0666)	1.3019
Ratio wife housework hours when both spouses like tidiness vs not	1.0536	(0.0800)	1.0145
Husband housework hours when only husband works	10.7453	(0.2013)	10.5580
Wife housework hours when only husband works	61.0933	(0.3614)	53.5339
Husband housework hours when both work	14.2198	(0.2100)	13.5476
Wife housework hours when both work	35.9564	(0.3135)	36.1410

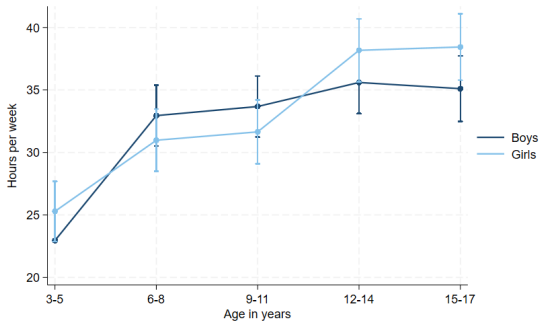
Figure A.2: *Comparison of time use in weekly hours between boys and girls from age 3 to 17, divided into 5 age classes. The plots represent the regression coefficients and 95% confidence intervals after controlling for year and geographical-area-by-gender fixed effects. The baseline coefficient is the time use for boys in age class 3-5. The time use categories are: (a) housework; (b) leisure; (c) school and homework; (d) personal care. The totals might not add to 168 weekly hours due to minor activities, such as volunteering, not falling into any category.*



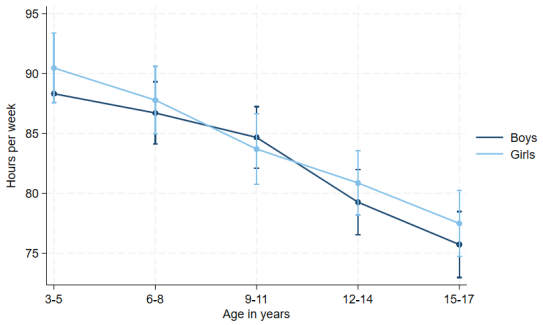
(a) Housework



(b) Leisure

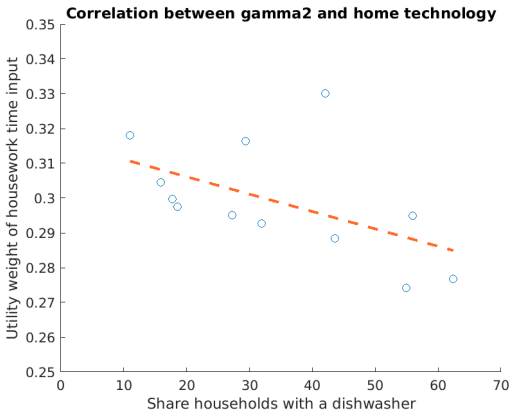


(c) School and homework

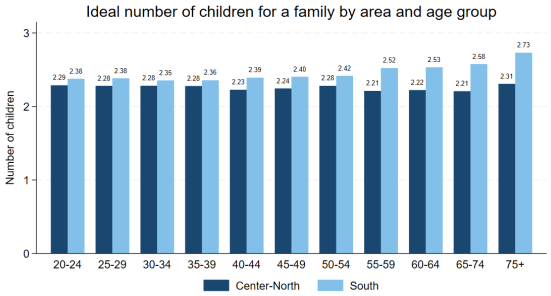


(d) Sleep, meals and personal care

Figure A.3: *Suggestive validation of historical trends. Panel (a): correlation between the estimated γ_2 in 1980-2024, and the share of households who own a dishwasher (resulting from ISTAT data and from Paris (2013)). Panel (b): ideal number of children per family by area and age (2016 FSS survey).*

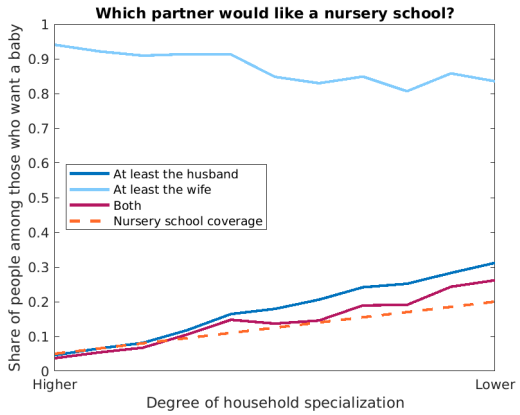


(a) Correlation between γ_2 and dishwashers

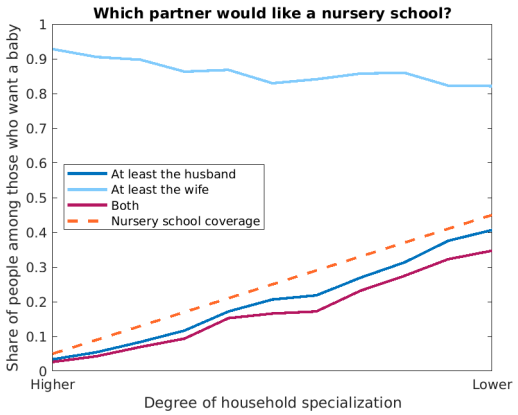


(b) Ideal fertility by area and age

Figure A.4: *Implied demand for nursery schools by each spouse and by both, considering all individuals who theoretically want a baby in each period, regardless of whether the actually do have one. In the negative correlation case on the left, the availability of nursery schools increases from 0.05 to 0.22 (the national average). In the positive correlation case on the right, it increases from 0.05 to 0.45.*



(a) Nursery demand



(b) Nursery demand

Figure A.5: *Demand for nursery schools as their coverage increases, by individuals in the model who would theoretically want a baby (as opposed to individuals who actually have a newborn baby).*