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## Working women, men's home time and lowest-low fertility

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# **WORKING WOMEN, MEN'S HOME TIME AND LOWEST-LOW FERTILITY**

**Joost de Laat and Almudena Sevilla Sanz**

**ISER Working Paper  
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## **ABSTRACT**

Southern Europe's rapid fertility decline has resulted in a positive cross-country correlation between female labor force participation and fertility. We develop a model with heterogeneity in attitudes towards women's home time and a social externality associated to men's home production to explain (1) this positive correlation and (2) its intertemporal reversal. Implications of the theory are tested using the multi-country ISSP94 household survey. We find that, within countries, households with less egalitarian attitudes have more children but lower female labor force participation. However, consistent with the presence of social externalities, countries with less egalitarian views have lower average fertility.

JEL Classification: D13, J0, J1, J2, Z13

Keywords: Household Time Allocation, Fertility, Female Labor Force Participation, Social Externalities

## NON-TECHNICAL SUMMARY

The average number of children in Southern Europe went from over 3 children per women in 1970 to lowest world levels of below 1.5 children. While common to most developed countries in the last decades, the decline in fertility in Southern Europe was not accompanied by the corresponding increase in female labour force participation. The percentage of women participating in the labour market (which includes employed and unemployed) did not significantly increased in Southern Europe over this period. Female labour force participation went from about 30% in the 1970's to just about 40%, a fairly low figure when compared to over 70% in Sweden and the US.

This paper explains these cross-country differences appealing to the existence of non-egalitarian attitudes toward gender roles, which constrain the way in which families distribute the allocation of time and, in particular, man's contribution to household chores. 20% of Spaniards between 30 and 40 years of age agreed or totally agreed to the statement "It is a man's job to earn money; a woman's job to look after the home and family", whereas only 7% of Swedish did. Not surprisingly, Spanish men devote only about 8 hours a week to household chores, just half the time devoted by their Swedish counterparts. The argument is that a man's contribution to household activities is not important in a world of low levels of female education, as was in all countries in the 1970's, when it was reasonable that men went out to work as they could make much more than their wives. It however becomes more relevant as female education (and potential wages) increase and women find it profitable to work in the market. Whereas in Northern European countries women's incorporation to the workforce was followed by an increased in men's contribution to household activities, in Southern Europe it did not. This, the authors show, translates into Southern European women searching for ways to alleviate time pressures, which involve a reduction in fertility (either by having fewer children within marriage or not entering a union altogether) or, a reduction in market work, or a combination of both.

This piece of research comes along with important policy implications. Traditional gender roles have penalized those men and fathers who are willing to get more actively involved in family matters. Children, women and men, and the society at large would be better off if social policies were pursued that would not discriminate men's involvement at home. Examples of policies toward this direction would be compulsory paternity leave or a presumption of joint parenting after divorce. In turn, achieving women's equality in the work place, the paper argues, goes by achieving men's equality at home.

# 1 Introduction

Consistent with micro evidence based on models of the household (Becker, 1965), (Willis, 1973), Mincer's seminal article (Mincer, 1985) showed an inverse relationship between fertility and female labor-force participation also at the cross-country level. Although the relationship between fertility and female labor force participation continues to be negative within countries (Engelhardt and Prskawetz, 2004), several authors have noted a reversal in sign of the cross-country correlation among OECD countries since the 1990s. In particular, countries such as Spain, Italy and Japan, the now so-called lowest-low fertility countries, have witnessed large reductions in family size, but only modest increases in female labor force participation. Table 1 shows that the cross-country correlation between fertility and female labor force participation increased from -.54 in 1970 to .68 in 1996. Macro and micro evidence run therefore in opposite directions.

Country	1970		1980		1985		1990		1996	
	FLF	TFR	FLF	TFR	FLF	TFR	FLF	TFR	FLF	TFR
Canada	43	2.3	57	1.9	63	1.8	68	1.7	65	1.7
United States	49	2.5	60	1.8	64	1.8	68	2	71	2.1
Australia	45	2.9	53	2.1	54	1.9	62	1.8	65	1.8
Japan	55	2.1	55	1.8	57	1.7	60	1.6	62	1.4
Austria	49	2.3	49	1.6	51	1.7	55	1.4	62	1.4
Belgium	40	2.3	48	1.7	51	1.6	52	1.6	56	1.5
Denmark	58	2	70	1.7	75	1.4	78	1.8	74	1.8
Finland	63	1.8	70	1.7	74	1.6	73	1.6	71	1.8
France	48	2.5	54	1.9	55	1.9	57	1.8	60	1.7
Germany								1.3	61	1.4
East	—	2.2	—	1.8	—	1.7	—	1.7	—	—
West	48	2	50	1.4	50	1.3	56	1.4	—	—
Greece	32	2.4	33	2.3	42	2.1	44	1.5	46	1.3
Iceland	45	2.8	—	2.3	—	2.2	—	2.3	80	2.2
Ireland	34	3.9	36	3.4	37	3	39	2.2	49	1.9
Italy	30	2.4	40	1.9	41	1.6	45	1.3	43	1.2
Luxembourg	34	2	40	1.5	43	1.6	47	1.4	58	1.8
Netherlands	30	2.6	35	1.6	41	1.5	53	1.5	58	1.5
Norway	39	2.5	63	1.8	68	1.7	71	1.8	66	1.9
Spain	29	2.9	32	2.6	34	2	41	1.5	46	1.2
Sweden	59	1.9	74	1.7	78	1.6	81	2	74	1.6
Switzerland	51	2.1	54	1.5	53	1.6	59	1.6	67	1.5
United Kingdom	50.5	2.4	58.3	1.7	60.1	1.8	65.1	1.8	66.4	1.8
Cross-Country Correlations	-0.54		-0.45		-0.41		0.39		0.68	

Source: Rindfuss and Brewster (1996)

Figure 1: Cross-country Correlation between Fertility and Female Labor Force Participation

In recent years much progress has been made highlighting how institutions such as the availability of child care and flexible work arrangements allow mothers in some countries to

combine employment with child rearing (DiTomasso, 1999) and (Del Boca, 2002). This paper complements the existing literature by arguing that the gender division of household labor importantly shapes a household's time allocation and fertility. Time-use studies show that a substantial amount of non-market work is devoted to household production and there is growing evidence that fathers are increasingly involved in childcare (Goldscheider and Kaufman, 1996). In fact, a comparison of high-fertility with low-fertility industrialized countries indicates that men's involvement in household tasks is considerably higher in high-fertility countries. For example, weekly hours devoted to housework by men in Japan is 3.5 versus 13.8 hours by men in the United States (Juster and Stafford, 1991). Similarly, more recent time use studies in Europe reveal that Spanish women devote one more hour to domestic work than Swedish women per day and that only 70 percent of Spanish and Italian men versus 92 percent of Swedish engage in household activities (EUROSTAT, 2004).

We develop and empirically test a model that can explain both (1) the micro and macro evidence on labor force participation and fertility and (2) the change of the macro correlation over time. The theory focuses on the heterogeneity in attitudes towards women's home time and an externality associated with a man's willingness to participate in home production. Similar to Akerlof and Kranton's model of *identity* (Akerlof and Kranton, 2000), the externality is motivated by the idea that while husbands may dislike, for example, shopping for groceries, they mind it less if upon going to the store they see other husbands shopping for groceries too. Thus, even though it may make sense for some egalitarian husbands to share household production tasks more equally with their wives, such husbands will be reluctant to do so in countries where household production is traditionally carried out by women.

The theory delivers two main predictions. First, households with less egalitarian attitudes have lower female labor force participation, but spend more time on household production and have more children. This prediction follows since less egalitarian households place less value on a woman's market time, which lowers her opportunity cost of home time and increases her time to household production and children; we denominate this effect the *household attitude* effect. Second, households living in countries where the average household is less egalitarian spend less time on household production and have fewer children. This

prediction follows since the opportunity cost of a man's home time is higher in countries that are on average less egalitarian, which lowers his time allocation to household production and reduces the number of children. We denominate this effect the *social externality* effect. The interaction of *household attitude* and *social externality* effects can, under certain parameter values, give rise to a positive cross-country correlation between fertility and female labor force participation, while maintaining the negative sign at the household level.

The theory is also able to explain the intertemporal reversal in the cross-country correlation. We show that the *social externality* effect is negligible relative to the *household attitude* effect in a regime of low relative female wages and high specialization of women in home production, giving rise to more egalitarian countries having lower fertility and higher female labor force participation (as in the 70's). However, when relative female wages rise, men's contribution to household production becomes higher, allowing the *social externality* effect to dominate. A larger *social externality* effect translates in egalitarian countries having both higher fertility and female labor force participation (as in the present).

The presence of externalities and attitudes associated to demographic processes can be found in Kohler (2000), Munshi (2002), Akerlof and Kranton (2000) and Fernandez et al. (2004) among others. The fact that social externalities are to a large extent enforced through nonmarket interactions makes them difficult to isolate empirically. In this paper the identification strategy of the social externality net of individual preferences (*household attitude* effect) uses the subjective information available in the 1994 International Social Survey Program (ISSP) as proposed in Manski (1993, 2000). The empirical results support the predictions of a model with social externalities associated to the allocation of household time. Whereas *ceteris paribus*, more egalitarian households have fewer children, households living in more egalitarian countries have, everything else equal, higher fertility.

The paper is organized as follows. Section 2 presents a model of household production and attitudes toward the gender division of household labor. Section 3 describes the 1994 ISSP data. Section 4 presents the main empirical results. Section 5 solves for the steady state equilibrium specification of the model presented in Section 2 and sheds light on the reversal in the cross-country correlation. Section 6 concludes.



## 2 A Theory of Fertility, Home Production and Social Externalities

We adopt a collective approach in that households are assumed to be a pair of individuals with distinct utility functions arriving at Pareto-efficient allocations as in Chiappori (1992).<sup>1</sup> A departure from previous literature is that efficiency is secured due to spousal transfers of time, rather than private consumption. This specification allows for a broader household production function because it does not require the assumption of perfect substitutability between household production and market goods, an assumption that does not seem to be validated by data on outsourcing of housework activities (Folbre and Bittman, 2004).<sup>2</sup>

### 2.1 Fertility and Preferences

**Fertility** Children are assumed to be a public good. Both spouses derive utility from children  $U(n)$ , with  $U'(n) > 0$  and  $U''(n) < 0$ . We define  $t_m, t_w$  as the amount of time a husband and a wife devote to the production of household services. We normalize total time spent in household activities and market work to 1 so that  $t_i \in [0, 1]$ , for  $i = m, w$ . The number of children  $n$  is assumed to be an increasing function of the sum of time devoted to household services:  $n = \alpha(t_w + t_m)$ , where  $\alpha$  is the parameter that translates *time units* into *children units*. Without loss of generality, we normalize  $\alpha = 1$ . For simplicity we ignore direct costs of clothing, feeding, etc. The main results are not affected by this assumption. Utility from children is traded off (on the relevant margin) by the disutility from performing household production tasks. An alternative interpretation of the latter is that each spouse derives utility from leisure.

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<sup>1</sup>The efficient framework is preferable to a private provision of public goods game where both spouses contribute inefficiently low levels of housework (causing fertility to decline) and inefficiently high levels of labor force participation, since the latter is not true empirically.

<sup>2</sup>See Apps and Rees (1997) for a detailed discussion on the theoretical results and empirical biases when the assumption of separability between consumption and household production is relaxed.

**Husband's utility** We assume that a husband's utility depends positively on the number of children ( $n$ ) and a private consumption good ( $x_m$ ), and negatively on time spent on household production activities  $V(t_m)$ , which is an increasing convex cost function such that  $\partial V/\partial t_m > 0$ ,  $\partial^2 V/\partial t_m^2 > 0$ . Time not devoted to household services is devoted to work. We assume a husband's utility to have a quasilinear and additive form such that:

$$U_m(n, t_m, x_m) = U(n) - f(\bar{s}_\gamma, L_m)V_m(t_m) + x_m$$

where  $f'_s < 0$  and  $f'_{L_m} < 0$ .

$L_m$  represents the *household attitude* effect and captures variation across husbands in attitudes toward the gender allocation of household tasks. Higher values of  $L_m$  imply more egalitarian attitudes and a lower disutility from a given amount of time devoted to household production ( $t_m$ ). The *social externality* effect is captured through  $\bar{s}_\gamma$ , where  $\bar{s}_\gamma = \bar{t}_{m,\gamma}/(\bar{t}_{m,\gamma} + \bar{t}_{w,\gamma})$  is the average share of household production by men in country  $\gamma$  and  $\bar{t}_{i,\gamma}$   $i = m, w$  is the average amount of household production performed by husbands and wives respectively, defined as  $\bar{t}_{i,\gamma} = \sum_i t_{i,\gamma}/N_\gamma$  for  $N_\gamma$  the number of people in country  $\gamma$ . An increase in  $\bar{s}_\gamma$  means that men in country  $\gamma$  devote on average a greater proportion of time to housework. This reduces a given man's disutility from doing household labor and induces him to work more at home, allowing fertility to increase.

**Wife's utility** We define a wife's utility in a symmetrical way:

$$U_w(n, t_w, x_w) = U(n) - g(\bar{s}_\gamma, L_w)V_w(t_w) + x_w$$

where  $g'_s > 0$  and  $g'_{L_w} > 0$ .

As with husbands, the *household attitude* effect is represented by  $L_w$ . Thus a wife's disutility from a given amount of time devoted to household production ( $t_w$ ) is higher the more egalitarian her attitudes. Similarly, the *social externality* effect is captured through  $\bar{s}_\gamma$ , or its counterpart  $(1-\bar{s}_\gamma)$ , the average share of household production by women in country  $\gamma$ . Higher values of  $\bar{s}_\gamma$  result in a greater disutility from doing household labor for a given

woman because it means that fewer women are doing housework in country  $\gamma$ .

For the rest of the analysis we equalize husband's and wife's attitudes toward gender roles so that  $L = L_m = L_w$ . This is in part motivated by the data since we only have information on the wife's attitudes toward the allocation of housework, although under assortative mating we should expect these attitudes to be strongly correlated among spouses.<sup>3</sup> We further assume that the functions  $f$  and  $g$  are separable in  $L$  and  $\bar{s}$  (i.e.  $f_{\bar{s}\gamma L} = g_{\bar{s}\gamma L} = 0$ ), and that on their relevant domains  $g_{\bar{s}\gamma} = f_L = 0$ . These simplifications are made for expositional purposes only and are much stronger than what is needed for our main results to follow. In particular, Appendix E shows that the results follow under the weaker assumption of decreasing marginal returns in  $f$  and  $g$ . That is, on the relevant domain where women in all countries continue to do most of the housework and general beliefs favor an unequal division of housework (i.e. low values of  $L$ ), it holds that (1) a marginal increase (decrease) in men's (women's) average share of housework will increase women's disutility from doing housework less than it will decrease men's disutility; and (2) a marginal increase in egalitarian attitudes will decrease a husband's disutility from housework less than it will increase his wife's.

Under the simplifying assumptions the spouses' utility functions become

$$\begin{aligned} U_m(n, t_m, x_m) &= U(n) - f(\bar{s}_\gamma)V_m(t_m) + x_m \\ U_w(n, t_w, x_w) &= U(n) - g(L)V_w(t_w) + x_w \end{aligned}$$

## 2.2 Household Resource Allocation

We adopt a transferable utility set up where the bargaining process over private consumption becomes irrelevant for the efficient provision of the public good (in our case, children). Although under transferable utility the marginal rate of transformation between money and the number of children is the same for both spouses, the marginal rate of transformation

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<sup>3</sup>Indeed, in the empirical analysis we observe that the correlation between the average of the male and female responses for the 11 countries used in the analysis is 0.89.

between the time devoted to household production and the number of children is different for each spouse. Thus, we are capturing the relevant trade off between spouses' home time and fertility. We assume efficiency in the household optimization problem, where a husband (wife) maximizes his utility subject to his wife's (husband's) reservation utility, technology and budget constraints. The assumption of transferable utility makes it also unnecessary to take a stand on which spouse is the maximizer (Bergstrom, 1989). Thus, the household maximization problem becomes:

$$\begin{aligned}
& \max_{t_m, t_w, x_m, x_w, \tau} U(n) - f(\bar{s}_\gamma)V(t_m) + x_m \\
& s.t : \\
& n = t_m + t_w \\
& x_m = (1 - t_m)w_m - \tau \\
& x_w = (1 - t_w)w_w + \tau \\
& U(n) - g(L)V(t_w) + x_w \geq \bar{U}_w
\end{aligned}$$

where  $\tau$  denotes the private consumption transfers that a husband gives to a wife if  $\tau > 0$  (or vice versa) and  $w_m, w_w$  denote husband's and wife's wages. In sum, a husband maximizes his utility with respect to  $t_m, t_w, x_m, x_w, \tau$  subject to the children's time constraint, his budget constraint, his wife's budget constraint and his wife's reservation utility. He takes individual wages  $(w_m, w_w)$ , household attitudes toward gender roles  $(L)$  and the average share of household production performed by husbands in his country  $(\bar{s}_\gamma)$  as given.

It is a well known result that under transferable utility the above problem simplifies to maximizing the joint marital surplus.<sup>4</sup> Substituting all the constraints into the objective function, the household maximization problem collapses to:

$$\max_{t_m, t_w} 2U(t_m, t_w) - f(\bar{s}_\gamma)V(t_m) - g(L)V(t_w) + (1 - t_m)w_m + (1 - t_w)w_w$$

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The quasilinear nature of the utility function allows us to focus on substitution effects

<sup>4</sup>Formal proof in Appendix D.

between husband's and wife's time allocations rather than income effects.<sup>5</sup> At the optimum, both spouses equalize the marginal utility of time spent on the provision of the public good (children) to the combined marginal cost of time in both household production and the labor market :

$$\begin{aligned}(t_m) : \quad 2 \frac{\partial U}{\partial n} &= f(\bar{s}_\gamma) \frac{\partial V_m(t_m)}{\partial t_m} + w_m \\ (t_f) : \quad 2 \frac{\partial U}{\partial n} &= g(L) \frac{\partial V_w(t_w)}{\partial t_w} + w_w\end{aligned}$$

## 2.3 Comparative Statics

This section focuses on some of the comparative statics for household  $i$  in country  $\gamma$ .<sup>6</sup> We denote the solution to the maximization problem as  $t_{m,i}^* = t_{m,i}(\bar{s}_\gamma, L, w_m, w_w)$ ,  $t_{w,i}^* = t_{w,i}(\bar{s}_\gamma, L, w_m, w_w)$ , and  $n_i^* = n_i(\bar{s}_\gamma, L, w_m, w_w)$ .

**Proposition 1** *The optimal number of children is a decreasing function of the woman's wage such that*

$$\frac{\partial n_i}{\partial w_{w,i}} < 0$$

The model has the standard prediction that following an increase in the female wage a wife's contribution to household production, and thus the number of children, declines.

**Proposition 2** *The optimal number of children is a decreasing function of the household's egalitarian index  $L$  such that*

$$\frac{\partial n_i}{\partial L_i} < 0$$

Egalitarian attitudes toward the gender division of labor raise the shadow price of female household production, thereby reducing the wife's household labor  $t_w$  and the number of children.

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<sup>5</sup>See (Ahn and Mira, 2002) for an interesting discussion on how changes in the importance of income versus substitution effects driven by high male unemployment rates in Southern Europe may have contributed to the drop in fertility.

<sup>6</sup>Comparative statics for this simplified version of the model are derived in appendix A. Appendix E derives comparative statics for the extended version of the model.

**Proposition 3** *The optimal number of children in any given household  $i$  in country  $\gamma$  is an increasing function of the average share of household production performed by men in country  $\gamma$  such that*

$$\frac{\partial n_{i,\gamma}}{\partial \bar{s}_\gamma} > 0$$

Hence a husband living in a more egalitarian country where these externalities are greatest faces a lower opportunity cost of providing home time and henceforth increases his household production contribution, thus contributing to higher fertility levels.

**Proposition 4** *The optimal man's share of household production in a given household  $s_{m,i} = t_{m,i}/(t_{w,i} + t_{m,i})$  is an increasing function of the household egalitarian index such that*

$$\frac{\partial s_{m,i}}{\partial L_i} > 0$$

This follows from the fact that egalitarian attitudes toward the gender division of labor lower the shadow price of female market work. Given that husbands and wives are substitutes in the production of household services, this decreases the wife's household production contribution and increases her husband's.

From Proposition 2 and Proposition 3 we see that average fertility could be either higher or lower in egalitarian countries. On the one hand, because of the *household attitude* effect, an egalitarian household derives greater disutility from any given time the woman spends in household production, lowering overall household production and thus fertility. On the other hand, because of the *social externality* effect, a man living in an egalitarian country faces a lower disutility from doing household production, thus increasing household production and fertility.

### 3 The Data: 1994 International Social Survey Program

The data used for the empirical analysis come from the International Social Survey Program (ISSP), which is an annual program of cross-national collaboration on surveys dating to 1983. Each year a common set of questions is asked on a particular topic making these particularly useful for cross-country analyses. Our analysis is based on the ISSP94 *Family and Changing Gender Roles* survey. An example of the use of the ISSP94 is Albrech et al. (2000). The ISSP94 covered 33,590 households from 23 countries. In each of these countries, a male or female adult older than 16 or 18 years (depending on the country) from the selected household was administered (almost) the same questionnaire. This survey is particularly useful for our purposes because it contains information on employment and wages as well as attitudes toward the gender division of household labor, actual household division of labor, and household composition.

We consider only those households with a married or living as married couple in which both husband and wife are capable of working in the labor market (i.e. students and disabled are excluded) and limit the sample to respondents between 25 and 45 years. We restrict our sample to those where the woman is the respondent, which is approximately 56% of households. Although neither the partner's education nor partner's earnings are asked, using the female sample makes it possible to account for both the wife and husband's opportunity cost of time. We use years of education of the wife as a proxy for her opportunity cost of housework rather than her reported earnings since many women either do not work full time or do not participate in the labor force. We construct the husband's opportunity cost of time by inferring his net earnings as the difference between net household income and his wife's net earnings (being the respondent, her earnings are reported but not his)<sup>7</sup>.

We use a principal component factor analysis to construct a standardized household

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<sup>7</sup>Earnings (from all sources) reported in Germany, Austria, and Italy are after taxes. Net earnings are constructed for these countries using personal income tax information published by the World Bank. Using the Penn World Tables 6.1, all earnings are transformed to a common scale by calculating Purchasing Power Parity (ppp) estimates using the formula:  $\frac{w_{currency}}{w_{\$}} PPP$ .

egalitarian index based on the wife's response to ten statements that capture attitudes towards the gender division of household labor.<sup>8</sup> We focus on the wife's attitudes because there is no information on the husband's. However, the correlation between the average of the male and female responses for the 11 countries is 0.89. The responses are coded on a 1 to 5 scale, from *strongly agree* to *strongly disagree*.

Countries in Table 3 are ordered by their attitudes toward the gender division of household production, with low fertility countries such as Japan and Italy being less egalitarian. The positive correlation between egalitarian attitudes and fertility might seem at odds with traditional economic theories of the household since we would expect that less egalitarian households place less value on women's market work and thus would have more children as women remain at home. Yet, less egalitarian countries have smaller family sizes on average, pointing at prima facie evidence for the existence of an externality associated to the household production process.

Our fertility variable becomes noisy for respondents older than 45 because there is not direct information about the number of children. Using instead the survey information on the total number of people living in the household, the number of adults living in the household (available for about 1/3 of the respondents), whether the respondent was living with a spouse, and whether the respondent's mother is living in the household, we infer how many children were living in the household and used this measure as a best approximation for fertility. The bias introduced by this method is two-fold. First, since extended families are common in lowest-low fertility countries such as Italy, this may overestimate fertility in these countries. Second, since in higher fertility countries such as Sweden children leave

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<sup>8</sup>"A working mother can establish just as warm and secure a relationship with her children as a mother who does not work."

"A pre-school child is likely to suffer if his or her mother works."

"All in all, family life suffers when the woman has a full-time job."

"A job is alright, but what most women really want is a home and children."

"Being a housewife is just as fulfilling as working for pay."

"Having a job is the best way for a woman to be an independent person."

"Both the man and woman should contribute to the household income."

"A man's job is to earn money; a woman's job is to look after the home and family."

"It is not good if the man stays at home and the woman goes to work"

"A family suffers because men work too much"



the household at younger ages, this may underestimate fertility in these countries. Both biases reduce cross-country differences in fertility, which strengthen the estimation results presented in the next sections.

A comparison of our constructed fertility variable with actual completed cohort fertility data compiled by the *Council of Europe* for the cohort born in 1955 shows the former is a close approximation of the latter.<sup>9</sup> The correlation between the two measures is 0.96 for the seven countries for which both measures are available. Despite the close approximation, the comparison suggests that we might be slightly underestimating fertility in the United Kingdom and the United States, but are clearly overestimating it in Ireland. Consequently, Ireland is left out of our sample.

Country	Attitudes Index		Housework Index		Number of Children		Female Years of Education		Female Labor Force		Husband's Wage	
Austria	-0.16	(1.96)	-0.38	(1.32)	1.92	(1.40)	11.45	(2.40)	0.60	(0.49)	9,392	(4,674)
Italy	-0.02	(1.95)	-0.52	(1.40)	1.50	(0.92)	11.03	(4.30)	0.58	(0.50)	11,045	(3,932)
Japan	0.07	(1.54)	-1.21	(1.30)	1.83	(1.12)	12.64	(1.89)	0.51	(0.50)	9,807	(6,863)
West Germany	0.29	(1.80)	0.13	(1.14)	1.63	(1.12)	--		0.58	(0.50)	9,536	(5,528)
Australia	0.48	(1.98)	-0.45	(1.35)	1.78	(1.12)	11.78	(3.12)	0.67	(0.47)	9,933	(6,675)
Nothorn Ireland	0.78	(1.74)	-0.34	(1.33)	2.13	(1.34)	11.65	(1.23)	0.69	(0.46)	9,233	(4,869)
Great Britain	0.88	(2.00)	0.04	(1.31)	1.59	(1.08)	11.71	(1.37)	0.71	(0.45)	14,153	(9,107)
USA	1.07	(1.87)	0.33	(1.36)	1.57	(1.12)	13.65	(2.42)	0.69	(0.46)	16,803	(11,767)
Norway	1.25	(1.74)	0.50	(1.12)	2.04	(0.98)	13.00	(2.66)	0.82	(0.39)	13,033	(6,129)
Sweden	1.57	(1.66)	0.48	(1.13)	1.83	(1.03)	12.08	(3.00)	0.96	(0.19)	13,056	(4,518)
Canada	1.58	(1.87)	0.54	(1.35)	1.67	(1.10)	--		0.85	(0.35)	19,645	(10,579)
Mean	0.71		-0.08		1.77		12.11		0.70		12,331	

Standard Deviations in Parenthesis

Table 3: Summary Statistics

Table 3 shows a positive correlation between more egalitarian countries and a higher participation of men in household activities. The actual reported division of household labor is used to construct a principal component index. Household production activities include who does the laundry, who shops for groceries, who prepares meals, and who cares for the sick. Answers to the question "who does what" are tabulated in 6 different categories: The first two is *always* and *usually* the woman, the third is *both* and the fourth and fifth are *usually* and *always* the man. A sixth category is *a third person*. These observations are

<sup>9</sup>The constructed fertility and real completed cohort fertility values for the European countries in our sample are respectively: 1.74 and 1.76 for Austria, 1.65 and 1.67 for Germany, 3.13 and 2.67 for Ireland, 1.68 and 1.80 for Italy, 2.04 and 2.05 for Norway, 2.00 and 2.03 for Sweden and 1.76 and 2.02 for the UK.

dropped from the analysis since less than 2% of the respondents outsource any household service.

Female labor force participation tends to be low in countries experiencing low fertility, a more unequal division of household labor and less egalitarian attitudes, such as Austria, Italy, and Japan. Female labor force participation refers to whether or not the wife is working full-time, part-time, less than part-time, or unemployed. If none of the above, she responded being a housewife or working for a household member.

## 4 Reconciling the (Negative) Micro and (Positive) Macro Correlation

The first part of this section provides evidence of the *household attitude* effect by showing the importance of attitudes as a determinant of household time allocation and fertility decisions. We find that within a country households with more egalitarian views toward the gender division of household labor have lower levels of fertility, higher husband's home time, and higher female labor force participation. The second part of this section provides an identification strategy for the *social externality* effect and finds that it is positive and dominates the negative *household attitude* effect, which explains the higher fertility (and female labor force participation) observed in more egalitarian countries.

### 4.1 Household Attitude Effect

We specify the following econometric model:

$$y_{i,\gamma} = \alpha_0 + \beta_1 L_{i,\gamma} + \beta_2 FemEd_{i,\gamma} + \beta_3 \ln(MaleE_{i,\gamma}) + \delta_\gamma + \eta_{cohort} + \varepsilon_{i,\gamma}$$

where  $y_{i,\gamma}$  is either the number of children, the division of household production, or whether or not a wife participates in the labor force for household  $i$  in country  $\gamma$ . Female education  $FemEd_{i,\gamma}$  (measured in years of schooling) and the log of male earnings  $\ln(MaleE_{i,\gamma})$  are

included as independent variables. We use female education as a proxy for potential female wages. Country fixed effects  $\delta_\gamma$  and 5-year cohort dummies  $\eta_{cohort}$  are included to take into account country and cohort specific heterogeneity. Household attitudes toward the gender division of household labor are controlled for by the household's *Egalitarian Index* ( $L_{i,\gamma}$ ) constructed in Section 3.<sup>10</sup> The error term captures unobserved heterogeneity and is assumed to follow a normal distribution and to be independently distributed across countries but correlated within households in the same country, with variance  $\sigma_\gamma$  the same for all women in country  $\gamma$ . Results are presented in Table 4.1.

	Number of Children (1)			Wife's Labor Force Participation (2)			Husband's Share of Housework (3)		
Wife's Egalitarian Index	-.083*** (-4.96)	-.074*** (-4.56)	-.053*** (-4.19)	.284*** (17.60)	.283*** (19.63)	.275*** (17.95)	.142*** (7.44)	.121*** (5.24)	.118*** (5.29)
Wife's Years of Education		-.033** (-2.99)	-.042*** (-4.00)		0.023 (1.19)	0.027 (1.29)		.074*** (3.57)	.076*** (3.73)
Log of Husband's Wage		.154** (2.35)	.154** (2.60)		-.381*** (-3.60)	-.384*** (-3.63)		-.220** (-3.11)	-.220*** (-3.16)
Desired Fertility			.435*** (10.74)			-.198*** (-3.69)			-.078** (-3.02)
Country Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Cohort Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1763	1763	1763	1763	1763	1763	1763	1763	1763
R-squared	0.0864	0.0958	0.1651	0.1804	0.1979	0.2051	0.2005	0.2201	0.2215

Robust standard errors clustered on a country indicator variable in parenthesis

Significance levels: \* 10% ; \*\* 5% ; \*\*\*1%

(1) Ordinary least square estimation

(2) and (3) Probit estimation

Table 4.1: Household Attitude Effect

**Fertility** The first set of regressions reported in Column (1) of Table 4.1 shows the fertility results. While the cross-country correlation suggests that more egalitarian attitudes should increase family size, the negative coefficient sign on the *household egalitarian index* is consistent with economic theory and clearly indicates the opposite. This result is robust to including measures of full-time income. A coefficient of -.074 for the variable *Egalitarian* means that the most egalitarian household, with an egalitarian index of 5.41 has 0.87 fewer children than the least egalitarian one, with an index value of -6.23. The effect of female education is somewhat small, with each extra year lowering household size by 0.033 children. Similarly, a raise in husband's earnings from, for example, US\$ 15,000 to US\$ 25,000 increases

<sup>10</sup>Note that the household egalitarian index is constructed using only the wife's attitudes.

household size by 0.43. Finally, the negative and significant coefficient on female education and the positive and significant coefficient on male earnings suggest that, while the income effect on male wages dominates, the substitution effect dominates on female wages.

One source of identification difficulty arises if the attitudinal index is correlated with unobserved preferences toward the number of children. However, while one might argue that answers to these attitudinal questions may not be fully independent of some household choices, particularly the actual division of housework or female labor force participation, it is not clear what the endogeneity nature would be with respect to household fertility choices. Unfortunately, the survey questionnaire does not contain obvious instruments that would allow us to assess this. An alternative way is explored in the third column of each set of regressions, which includes the desired number of children as reported in the survey. While including this variable is problematic since it is likely endogenous to the dependent variables (and we consequently did not use this regression in the welfare analysis), its inclusion had little to no effect on the size or significance of the rest of the coefficients, thus suggesting that the *Egalitarian* variable is *not* merely picking up differences in other unobserved preferences.

**Female Labor Force Participation** Column (2) in Table 4.1 shows the results for female labor force participation. Female labor force participation is estimated as the probability of being in the labor force (which includes working part-time and being unemployed). The highly significant and positive coefficient sign on egalitarian attitudes toward the division of household production further indicates that fertility, female labor force participation, and household production are not only intricately linked but that attitudes toward the division of housework, along with wages, are an important component of the opportunity cost of spousal time allocations. In particular a unit change in *Egalitarian* raises the probability that a wife participates in the labor force by 8.9 %. Results from the female labor force and housework regressions suggest that a greater participation in the labor force is made possible due to the fact that women in more egalitarian households take on a smaller share of household production.

**Household Division of Labor** Column (3) in Table 4.1 shows how egalitarian attitudes affect the allocation of time to home labor. We observe that husbands in more egalitarian households tend to do a greater share of household production, while an increase in their own wages lowers it. Similarly, an increase in the shadow price of female time (captured by the female education variable) raises the share performed by husbands. The coefficient sign on wages is consistent with standard household labor force participation models. Interpretation of the *Egalitarian* coefficient is not straightforward since the dependent variable is also a principal component index. For example, a one unit (standard deviation) increase in *Egalitarian* from the mean at 0.81 to 1.81, which is equivalent to an increase from the 48<sup>th</sup> percentile to the 68<sup>th</sup> percentile, raises the principal component index of a husband's share of household production by 0.121. This is equivalent to a husband formerly at the mean of a husband's *Share of household production* jumping up four percentiles from the 49<sup>th</sup> to the 53<sup>rd</sup>.

## 4.2 Social Externality Effect

The model presented in Section 2 predicts that by altering the opportunity cost of a husband's housework, the average share of housework done by men in a given country affects household decisions on fertility, female labor force participation and the division of housework. Thus, the econometric model is

$$y_{i,\gamma} = \alpha_0 + \beta_1 L_{i,\gamma} + \beta_2 FemEd_{i,\gamma} + \beta_3 \ln(MaleE_{i,\gamma}) + \beta_4 \bar{s}_\gamma + \eta_{cohort} + \varepsilon_{i,\gamma} \quad (1)$$

where notation is the same as before except for country dummies, which are replaced by the average share of household production done by men in country  $\gamma$ .

We first test this hypothesis by estimating the following reduced form equations<sup>11</sup>

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<sup>11</sup>We can approximate the average share of household production ( $\bar{s}_\gamma$ ) in country  $\gamma$  as follows

$$\bar{s}_\gamma = \frac{1}{N} \sum_{i \in \gamma} \frac{t_{m,i}}{t_{m,i} + t_{w,i}} \simeq s(\bar{L}_\gamma, \bar{w}_{m,\gamma}, \bar{w}_{w,\gamma})$$

for  $\bar{L}, \bar{w}_m, \bar{w}_w$  the average level of egalitarianism, male and female wages in country  $\gamma$ .

$$y_{i,\gamma} = \alpha_0 + \beta_1 L_{i,\gamma} + \beta_2 FemEd_{i,\gamma} + \beta_3 \ln(MaleE_{i,\gamma}) + \\ + \delta_1 \overline{L}_\gamma + \delta_2 \overline{FemEd}_\gamma + \delta_3 \overline{\ln(MaleE_\gamma)} + \eta_{cohort} + \varepsilon_{i,\gamma}$$

where  $\overline{L}_\gamma$  is the country mean values of attitudes toward the gender division of labor,  $\overline{FemEd}_\gamma$  is the country mean female education and,  $\overline{\ln(MaleE_\gamma)}$  is the country mean men's earnings. Aggregate education is measured in levels rather than years. This allows Canada and Germany to be included in the analysis, which have information on education levels but not years of education. Age cohort dummies, represented by  $\eta_{cohort}$ , are included to account for cohort unobserved heterogeneity. The sample is identical to that in the regressions presented in Section 4.1.

The relevant coefficients for our analysis are  $\beta_1$  and  $\delta_1$ , which respectively measure the effect of the *household attitude* effect and the *social externality* effect. Notice that by construction average attitudes toward the gender division of household labor in a country are correlated with individual attitudes. Thus, any heterogeneity in individual attitudes toward the gender division of household labor that induces variation in the dependent variables would result in a bias of the  $\delta_1$  coefficient if omitted. Controlling for individual reported attitudes toward the gender division of household labor identifies the effect of average attitudes in a country net of individual attitudes.<sup>12</sup>

The key results are shown in Table 4.2.A. While the coefficient on the country mean value of attitudes toward the gender division of labor is positive, the coefficient on individual attitudes has the opposite sign. Thus, while a household with more egalitarian attitudes tends to have lower fertility, a household living in a country with higher average egalitarian attitudes has higher fertility, supporting the notion of externality effects. For example, the coefficient on the country average attitudinal index suggests that a county such as Norway whose average value on this index is 1.265 points higher than that of Italy, enjoys an externality effect that raises household size by 0.45 children. A simple comparison of these two

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<sup>12</sup>See Manski (1993, 2000) for the use of subjective data in the identification of social effects.

coefficients indicates that the size of the *social externality* effect, whose coefficient is 0.358, dominates that of the coefficient of the *household attitude* effect, -0.075.

	Number of Children (1)			Wife's Labor Force Participation (2)			Husband's Share of Housework (3)		
Wife's Egalitarian Index	-.076*** (-4.73)	-.076*** (-4.74)	-.075*** (-4.74)	.281*** (18.01)	.282*** (18.58)	.281*** (18.69)	.121*** (5.27)	.123*** (5.3)	.124*** (5.48)
Wife's Years of Education	-.030** (-2.56)	-.028** (-2.52)	-.032** (-3.12)	.017 (0.9)	.019 (1.08)	.02 (1.12)	.078*** (3.23)	.086*** (3.41)	.079*** (3.42)
Log of Husband's Wage	.160** (2.61)	.166** (2.58)	.150** (2.24)	-.397*** (-3.71)	-.385*** (-3.61)	-.382*** (-3.61)	-.228*** (-3.30)	-.193** (-2.76)	-.22** (-3.13)
Country Mean Egalitarian Index	.169** (2.54)	.219* (2.2)	.358*** (3.19)	.427*** (5.23)	.505*** (4.49)	.482*** (5.27)	.503** (2.96)	.758*** (3.83)	.986*** (5.27)
Country Mean Level of Female Education		-0.074 (-0.90)	-.206** (-2.70)		-.113 (-1.26)	-.091 (-1.09)		-.382** (-2.26)	-.597*** (-3.99)
Country Mean Level of Male (log) Wages			.629* (1.99)			-.11 (-.42)			1.025* (1.95)
No. of Countries	Reduced Form Regressions 11 11 11			Reduced Form Regressions 11 11 11			Reduced Form Regressions 11 11 11		
Cohort Dummies	Yes Yes Yes			Yes Yes Yes			Yes Yes Yes		
N	1763	1763	1763	1763	1763	1763	1763	1763	1763
R-squared	0.0777	0.0786	0.0817	0.1884	0.1894	0.1894	0.1779	0.1932	0.1985

Robust standard errors clustered on a country indicator variable in parenthesis

Significance levels: \* 10% ; \*\* 5% ; \*\*\*1%

(1) Ordinary least square estimation

(2) and (3) Probit estimation

Table 4.2.A: Household Attitude Effect vs. Social Externality Effect

The model in Section 2 argues that it is not the average attitudes as such which creates the social externality that matters for household fertility decisions, but their effect on the average share of household production by men in a given country. Since the average share of household production is likely to be correlated with the error term, we instrument it with the average level of female education, male wages, and attitudes in a country, which follows from our theoretical specification.<sup>13</sup> The results of this alternative specification are presented in Table 4.2.B. The similarly significant and positive coefficient sign on the average share of household production by men further supports the notion of a social externality associated

<sup>13</sup>To see this we can linearize a man's share of household production in household  $i$  and write it as:

$$s_{m,i} = \alpha \bar{s}_\gamma + \beta w_{f,i} + \gamma w_{m,i} + \delta L_i + \varepsilon_i$$

Solving for the average share:

$$\bar{s}_\gamma = \frac{1}{1 - \alpha} [\beta \bar{w}_f + \gamma \bar{w}_m + \delta \bar{L} + \bar{\varepsilon}]$$

Then

to household production activities.<sup>14</sup> For example, the difference between Norway and Italy in the index of the mean share of men's household production is 1.016, which corresponds to an increase in fertility of 0.271 due to the *social externality* effect.

	Number of Children (1)			Wife's Labor Force Participation (2)			Husband's Share of Housework (3)		
Wife's Egalitarian Index	-.076*** (-4.77)	-.075*** (-4.62)	-.076*** (-4.75)	.080*** (15.36)	.081*** (15.01)	.081*** (15.54)	.121*** (5.23)	.119*** (5.09)	.118*** (5.1)
Wife's Years of Education	-.032** (-2.48)	-.031** (-2.41)	-.032** (-2.42)	.001 (0.29)	.001 (0.35)	.072 (0.37)	.073*** (3.8)	.072*** (3.83)	.072*** (3.83)
Log of Husband's Wage	.164** (2.55)	.163** (2.55)	.164** (2.57)	-.095*** (-3.64)	-.096*** (-3.78)	-.097*** (-3.80)	-.215** (-3.08)	-.212** (-2.98)	-.221** (-2.94)
Country Mean 'Share' of Housework by Husbands	.261* (2.02)	.247* (1.81)		.182*** (3.61)	.163*** (3.64)	.158*** (3.9)	.774*** (14.12)	.808*** (15.57)	.825*** (18.35)
Country Mean Egalitarian Index	IV	IV	IV	IV	IV	IV	IV	IV	IV
Country Mean Level of Female Education		IV	IV		IV	IV		IV	IV
Country Mean Level of Male (log) Income			IV			IV			IV
	Instrumented Regressions			Instrumented Regressions			Instrumented Regressions		
No. of Countries	11	11	11	11	11	11	11	11	11
Cohort Dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	1763	1763	1763	1763	1763	1763	1763	1763	1763
R-squared	0.0713	0.0718	0.0711	0.1923	0.1943	0.1949	0.2173	0.2176	0.2176

Robust standard errors clustered on a country indicator variable in parenthesis

Significance levels: \* 10% ; \*\* 5% ; \*\*\*1%

(1) Ordinary least square estimation

(2) and (3) Probit estimation

Table 4.2.B (IV Estimation): Household Attitude vs. Social Externality Effect

The results for female labor force participation are in line with our theoretical model. Women in households with more egalitarian attitudes toward the gender division of household

$$\begin{aligned}
E[\bar{s}] &= \frac{1}{1-\alpha} E[(\beta \bar{w}_f + \gamma \bar{w}_m + \delta \bar{L} + \bar{\varepsilon})' \varepsilon_i] = \\
&= \frac{1}{1-\alpha} E[0 + \bar{\varepsilon}' \varepsilon_i] = \\
&= \frac{1}{1-\alpha} \frac{1}{N} \sum_K E[\varepsilon_K \varepsilon_i] \neq 0 \quad \text{for } k = i.
\end{aligned}$$

In fact, an endogeneity Hausman test cannot reject the hypothesis that  $\bar{s}$  is exogenous.

<sup>14</sup>The first-stage results are presented in Table B in Appendix B, with the coefficients on each of the instruments highly significant. We run a heteroskedasticity robust version of an overid test (see Wooldridge (2002) for details) with two overidentifying restrictions for (1) country average female education and (2) country average male earnings for the instrumented fertility regression. A test statistic of 3.04 with a p-value of .219 means that we cannot reject the overidentifying restrictions at any reasonable level.



labor have a higher probability of participating in the labor force. By the same token, women living in countries where men do a lot of household production have a higher probability of participation. The *social externality* effect contributes to a difference of 16.1 percentage points in female labor force participation between Norway and Italy. Finally, the husband's share of housework similarly increases with country average share of housework. Evaluated at the mean, the externality effect contributes to an increase from the 50<sup>th</sup> to the 69<sup>th</sup> percentile in the overall distribution of the man's share of housework between Norway and Italy.

## 5 Intertemporal Change in the Sign of the Correlation

This section shows that the steady state equilibrium of the model presented in Section 2 is consistent with the intertemporal change in the correlation between fertility and female labor force participation. Given the *initial* cross-country differences in attitudes toward the division of housework, an exogenous increase in female relative wages in all countries differentially affects the magnitude of the *household attitude* and *social externality* effects. Thus, the interaction between *household attitude* and *social externality* effects may give rise to the observed change in the correlation.

The intuition is simple. In our model the opportunity cost of children depends on woman's and man's cost of home time. For sufficiently low female wages as in the 1970s, cross-country differences in  $\bar{s}_\gamma$  (the *social externality* effect) are negligible since few men perform housework tasks even in egalitarian countries. In this case, the *household attitude* effect may dominate the *social externality* effect. As female wages increase over time household specialization decreases, and cross-country differences in  $\bar{s}_\gamma$  increase as men take on more housework tasks. The *social externality* effect may now dominate.<sup>15</sup>

Figure 1 shows the case of Spain and Norway based on Table 1. According to the opportunity cost theory the sharp decline in fertility in Spain relative to Norway would have required a bigger increase in relative female wages in Spain. However, a bigger increase in

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<sup>15</sup>Appendix C formally derives the results presented in this section.

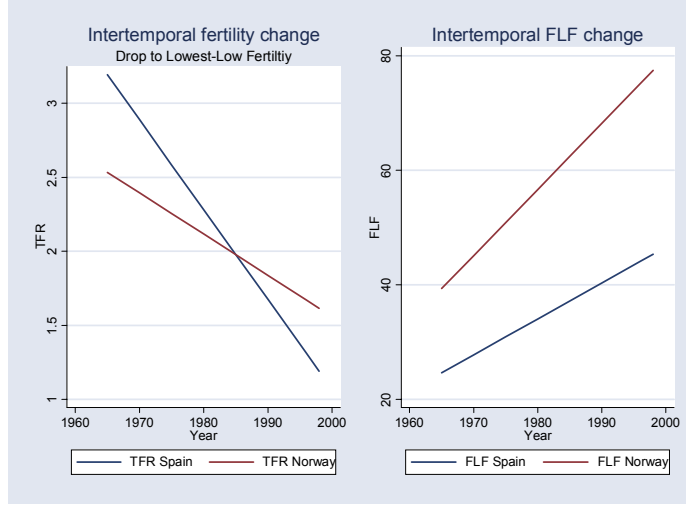


Figure 1: Intertemporal Change in TFR and FLF- Norway and Spain (1960-2000)

relative female wages in Spain would have implied at least a convergence in female labor force participation rates between the two countries. However, as Figure 1 clearly shows female labor force participation rates between the two countries have diverged rather than converged. Moreover data on wages seems to go in opposite direction. Whereas female wages were about 67% of those of males in 1970 and rose to just over 75% in 1995 in low female labor force participation countries, they rose slightly faster from 68% to almost 80% in high female labor force participation countries (Engelhardt and Prskawetz, 2004). Thus traditional theories of the household based on the opportunity cost of women's time do not offer a complete story of the cross-country intertemporal variation in the correlation between fertility and female labor force participation.<sup>16</sup>

The steady state equilibrium of the model presented in Section 2 is characterized by the fact that the country's average share of housework done by men  $\bar{s}_\gamma$  is equal to the man's share of housework of the representative household  $\bar{s}$ .<sup>17</sup> We can write  $\bar{s} = \frac{t_m}{t_m + t_w} = \bar{s}(L, w_w, w_m)$ , and thus in equilibrium the following equality holds for any country  $\gamma$ :  $\bar{s} =$

<sup>16</sup>Note that we assume that the substitution effect dominates the income effect. See Ahn and Mira (Ahn and Mira, 2002) for a discussion on income effects.

<sup>17</sup>Alternatively, we could assume that a household's attitudes toward gender roles depends on the

$h(L, w_w, w_m, \bar{s}(L, w_w, w_m))$ . Let  $f(\bar{s}_\gamma) = \theta(L, w_w, w_m)$ , so that in equilibrium the household maximization problem becomes:

$$\max_{t_m, t_w} U(n) - \theta(L, w_w, w_m)V_m(t_m) - g(L)V_w(t_w) + (1 - t_m)w_m + (1 - t_w)w_w$$

where  $\partial\theta/\partial L < 0$  and  $\partial\theta/\partial w_w < 0$ .<sup>18</sup>

Solving for the comparative statics in equilibrium we can show that an increase in a country's average egalitarian attitudes has an ambiguous effect on fertility and that the sign of the inequality in (2) depends on the female wage and the resulting level of household specialization as depicted in inequality (3). That is, in a low relative female wage regime with high levels of specialization (and low  $\bar{s}_\gamma$ ), more egalitarian countries have lower fertility  $\frac{dn}{dL} < 0$ . However, in a high relative female wage regime (and thus high  $\bar{s}_\gamma$ ) we have that  $\frac{dn}{dL} > 0$ , and thus more egalitarian countries have higher fertility. Thus

$$\frac{dn}{dL} \gtrless 0 \tag{2}$$

and

$$\frac{d^2n}{dw_w dL} > 0 \tag{3}$$

and

Finally, in equilibrium female labor force participation is always lower for a household

country mean and some deviation. Fertility for household  $i$  in country  $\gamma$  can be expressed then as  $n_{i,\gamma} = n(w_m, w_w, L_\gamma + \varepsilon_i\sigma)$ , where  $L_{i\gamma} = L_\gamma + \varepsilon_i\sigma$ , for  $\varepsilon_i \sim iidN(0, 1)$ . A Taylor expansion around  $\sigma = 0$ , yields that  $n_{i,\gamma} = n(w_m, w_w, L_\gamma) + \partial n/\partial L_\gamma \varepsilon_i\sigma + O^2(\sigma)$ . Aggregating over  $i$ , this yields that  $n_\gamma = n(w_m, w_w, L_\gamma)$ , given that  $\sum_i \varepsilon_i = 0$ .

<sup>18</sup>The derivative of  $\bar{s}_\gamma = h(L, w_w, w_m, \bar{s}_\gamma(L, w_w, w_m))$  with respect to an increase in egalitarian attitudes in the representative household is given by

$$\frac{\partial \bar{s}_\gamma}{\partial L} = \frac{\partial h/\partial L}{1 - \partial h/\partial \bar{s}_\gamma}$$

This derivative is positive since  $\partial h/\partial L$  (the direct effect) was previously shown to be greater than 0. We also know that  $\partial h/\partial \bar{s}_\gamma$  is less than 1 for an equilibrium value of  $\bar{s}_\gamma$  to exist. Further, since  $f_{\bar{s}_\gamma} < 0$ , we know that  $\partial\theta/\partial L < 0$ . A similar exercise can be done to show that  $\partial\theta/\partial w_w < 0$ .

living in a less egalitarian country. This is true because at any given wage both *household* and *social externality* effects run in the same direction.

$$\frac{dt_w}{dL} < 0, \forall w_w \quad (4)$$

Expressions 2, 3 and 4 can therefore explain the empirical observation that fertility was higher in non-egalitarian countries in the 1970's, but dropped at a faster rate and became lower than fertility in egalitarian countries in the 1990's till the present. The model is also consistent with the empirical observation that female labor force participation, while increasing in both sets of countries, remained lower in non-egalitarian countries during this period.

## 6 Conclusion

Overcoming below replacement fertility is an important concern for industrialized countries. Research has shown that institutional arrangements which allow mothers to combine employment with child rearing can prevent significant reductions in family size when female labor force participation increases. Somewhat surprisingly, however, the risk of persistent below replacement fertility is the greatest for countries with historically low female labor force participation. This paper complements the existing literature by highlighting the importance of attitudes toward the division of household labor in shaping labor force participation and fertility outcomes, and by suggesting an avenue by which social externalities can help explain the complex cross-and-within country variation in these variables.

In particular, the model shows that households with less egalitarian attitudes place less value on women's market time, thus increasing women's contribution to housework at the expense of their labor force participation, and increasing fertility. The empirical results indicate that heterogeneity in egalitarian attitudes across all households can explain fertility differences of up to 0.87 children. The model appeals to a social externality effect to explain the positive cross-country correlation. The opportunity cost for market time is higher for husbands living in less egalitarian countries where the average share of housework performed

by men is low. Husbands consequently reduce their housework contribution, causing women to take on a greater share at the expense of their labor force participation, but the net effect on total housework and fertility is negative. The empirical results show that for example in Norway, a higher mean share of household production by men is associated to a fertility increase of 0.271 children and a rise in female labor force participation of 16.1 percentage points over Italy.

The results presented here are relevant for the policy debate about recent demographic developments in the industrialized world. Below replacement fertility together with the slow increase in female labor force participation jeopardizes the pay as you go pension system and has important implications for welfare (Bound et al., 2004). The importance of man's home labor for fertility outcomes and the presence of social externalities associated to household production suggests that work-family policies should also encourage men's participation in household work. Further research that analyzes the elasticity of fertility with respect to men and women's home time would aid in the design of such policies. Novel time-use surveys based on diary information recently released in most developed countries provide a unique opportunity to understand the division of household labor and how it affects these socioeconomic outputs.

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## A Comparative Statics

Let  $t_m$ ,  $t_w$ ,  $x_m$ ,  $x_w$ ,  $n$ ,  $w_m$ , and  $w_w$  be defined as before. Let  $L$  be a household specific parameter that denotes the degree to which a husband (or household) cares about a wife's disutility from performing household production. Thus a higher  $L$  suggests that the household has a more equitable attitude toward the distribution of household production tasks. Further, let  $\bar{s}_\gamma = \sum_{i=1}^{N_\gamma} \bar{s}_{i,\gamma}$  be the average share of household production by men in country  $\gamma$ , where  $\bar{s}_{i,\gamma}$  represents average share of household production for household  $i$  in country  $\gamma$ .

As shown in the text, given transferable utility the problem simplifies to:

$$\max_{t_m, t_w} U(t_m + t_w) - f(\bar{s}_\gamma)V_m(t_m) - g(L)V_w(t_w) + (1 - t_m)w_m + (1 - t_w)w_w$$

**Comparative Statics** We use Crammer's rule to solve for the comparative statics. The denominator of the comparative statics is given by the determinant of the Hessian:

$$|H| = -\frac{\partial^2 U(n)}{\partial n^2} \left[ f(\bar{s}_\gamma) \frac{\partial^2 V_m(t_m)}{\partial t_m^2} + g(L) \frac{\partial^2 V_w(t_w)}{\partial t_w^2} \right] + f(\bar{s}_\gamma) \frac{\partial^2 V_m(t_m)}{\partial t_m^2} \frac{\partial^2 V_w(t_w)}{\partial t_w^2} g(L) > 0$$

which is positive by the concavity of  $U(n)$  and the convexity of  $V_{m,w}$ .

The numerators of the comparative statics are presented below, such that the sign of the expressions equals the sign of the overall effects.

### The Effect of A Change in the Household Egalitarian Index $L$

*The number of children is decreasing in the household egalitarian index  $L$*

$$\frac{\partial n}{\partial L} = -\frac{\partial V_w(t_w)}{\partial t_w} f(\bar{s}_\gamma) \frac{\partial V_m^2(t_m)}{\partial t_m^2} < 0$$

*A husband's household production share is increasing in the household egalitarian index  $L$*

$$\frac{\partial t_m}{\partial L} = -\frac{\partial V_w(t_w)}{\partial t_w} \frac{\partial^2 U}{\partial n^2} > 0$$

*A wife's household production share is increasing in the household egalitarian index  $L$*

$$\frac{\partial t_w}{\partial L} = \left[ \frac{\partial^2 U}{\partial n^2} - \frac{\partial^2 V_m(t_m)}{\partial t_m^2} f(\bar{s}_\gamma) \right] \frac{\partial V_w}{\partial t_w} > 0$$

**The Effect of A Change in A Country's Average Share of household production by Men  $\bar{s}_\gamma$**

*The number of children is increasing in a country's average share of household production by men  $\bar{s}_\gamma$*

$$\frac{\partial n}{\partial \bar{s}_\gamma} = \left[ \frac{\partial^2 V_w(t_w)}{\partial t_w^2} g(L) \right] \frac{\partial V_m(t_m)}{\partial t_m} > 0$$

*A husband's household production share is increasing in a country's average share of household production by men  $\bar{s}_\gamma$*

$$\frac{\partial t_m}{\partial \bar{s}_\gamma} = -\frac{\partial^2 U(n)}{\partial n^2} \left[ \frac{\partial^2 V_w(t_w)}{\partial t_w^2} g(L) \right] \frac{\partial V_m(t_m)}{\partial t_m} > 0$$

*A wife's household production share is increasing in a country's average share of household production by men  $\bar{s}_\gamma$*

$$\frac{\partial t_w}{\partial \bar{s}_\gamma} = \frac{\partial^2 U(n)}{\partial n^2} \frac{\partial V_m(t_m)}{\partial t_m} > 0$$

**The Effect of an Increase in the Female Wage  $w_w$**

*The number of children is decreasing in the wife's wage*

$$\frac{\partial n}{\partial w_w} = -f_m(\bar{s}_\gamma) \frac{\partial^2 V_m(t_m)}{\partial t_m^2} < 0$$

*A husband's household production share is increasing in the wife's wage*

$$\frac{\partial t_m}{\partial w_w} = -\frac{\partial^2 U(n)}{\partial n^2} > 0$$

*A wife's household production share is decreasing in the wife's wage*

$$\frac{\partial t_w}{\partial w_w} = \frac{\partial^2 U(n)}{\partial n^2} - f_m(\bar{s}_\gamma) \frac{\partial^2 V_m(t_m)}{\partial t_m^2} < 0$$

## B First Stage Coefficients

	Country Average Share of Household Production by Men
Egalitarian	.003 (.79)
Female Years of Education	.010*** (3.89)
Log of Male Wage	-.002 (-.16)
Country Mean Egalitarian	1.088*** (60.31)
Country Mean Level of Female Education	-.560*** (-32.24)
Country Mean Level of Male (log) Income	.784*** (13.77)
No. of Countries	11
Cohort Dummies	Yes
N	1763
R-squared	0.8098
Robust standard errors clustered on a country indicator variable	
Significance levels: * 10% ; ** 5% ; ***1%	
(1) Ordinary least square estimation	
(2) Probit estimation	

Table B: First Stage Coefficients (Fertility)

## C Intertemporal Change in the Sign of the Correlation

Recall that in the general set up, after substituting in for the budget constraints, the household maximization problem reduces to:

$$\max_{t_m, t_w} U(n) - f(\bar{s}_\gamma) V_m(t_m) - g(L) V_w(t_w) + (1 - t_m) w_m + (1 - t_w) w_w$$

where in equilibrium

$$f(\bar{s}_\gamma) = f(h(L, w_w, w_m, \bar{s}_\gamma(L, w_w, w_m))) = \theta(L, w_w, w_m)$$

We showed that  $\partial\theta/\partial L < 0$  and  $\partial\theta/\partial w_w < 0$ . Substituting the equilibrium value  $f(\bar{s}_\gamma) = \theta(L, w_w, w_m)$  in the FOC corresponding to the maximization problem, we are able to obtain the equilibrium comparative statics.

**Comparative Statics in Equilibrium:**<sup>19</sup> The determinant of the Hessian is given by

$$|H| = [g(L) + f(\bar{s}_\gamma)] k \frac{\partial^2 U}{\partial n^2} - g(L) f(\bar{s}_\gamma) k^2 < 0$$

### The Effect of A Change in the Household Egalitarian Index L on Fertility in Equilibrium

In equilibrium, an increase in the household egalitarian attitudes on fertility  $dn/dL$  can be positive or negative. The numerator of this comparative static is:

$$num \left( \frac{dn}{dL} \right) = \overbrace{\left( kg(L) \frac{\partial V_m}{\partial t_m} \right)}^{(+)} \overbrace{\frac{\partial \theta}{\partial L}}^{(-)} + \overbrace{\left( kf(\bar{s}_\gamma) \frac{\partial V_w}{\partial t_w} \right)}^{(+)} \overbrace{\frac{\partial g}{\partial L}}^{(+)} > < 0$$

This implies that  $\frac{dn}{dL} < 0$  if

$$f(\bar{s}_\gamma) > \frac{g(L) \frac{\partial V_m}{\partial t_m} abs \left| \frac{\partial \theta}{\partial w_w} \right|}{\frac{\partial V_w}{\partial t_w} \frac{\partial g}{\partial L}}$$

Since  $f_{\bar{s}_\gamma} < 0$  an increase in the (country average) egalitarian attitudes is more likely to reduce fertility if  $\bar{s}_\gamma$  is small. Given that  $\partial\theta/\partial w_w < 0$ , this is more likely to be true in a low relative female wage scenario such as the one in the 1970s. Low female wages are associated to small values of  $\bar{s}_\gamma$ , and more egalitarian countries experience lower fertility levels. A

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<sup>19</sup>In this section we assume  $V'''(t_i) = 0$ , which implies that  $V''(t_i) = k$  (constant).

formal derivation of  $d^2n/dw_w dL$  (this cross-partial derivative ) is presented below.<sup>20</sup>

The denominator is given by:

$$den \frac{\partial^2 n}{\partial w_w \partial L} = \left( -k \left( \frac{\partial^2 U}{\partial n^2} (f(\bar{s}_\gamma) + g(L)) - kg(L)f(\bar{s}_\gamma) \right) \right)^2 > 0$$

The numerator is given by:

$$\begin{aligned} num \frac{\partial^2 n}{\partial w_w \partial L} &= k^2 \overbrace{(2f_w g^2 f_L V_{t_m}^m k)}^{(+)} + \overbrace{(U_{nn} f_L g)}^{(+)} + \overbrace{(U_{nn} f_w g_L V_{t_w}^w g)}^{(+)} + \\ &+ k^2 \left( \overbrace{(-2f_w g f_L V_{t_m}^m U_{nn})}^{(+)} + \overbrace{(-U_{nn} g_L f)}^{(+)} + \overbrace{(U_{nn} g_w f_w V_{t_w}^m f)}^{(+)} \right) + k^2 \overbrace{(k g_L f^2)}^{(+)} > 0 \end{aligned}$$

Thus,  $\frac{\partial^2 n}{\partial w_w \partial L} > 0$ . Intuition for this result is provided in Section 5.

### **The Effect of A Change in the Household Egalitarian Index L on Female Labor Force Participation in Equilibrium**

In equilibrium female labor force participation is always increasing in egalitarian attitudes. This can be seen in the numerator of  $dt_w/dL$ . Therefore, as a wife's wage increases, her share of household production decreases and her market work increases.

$$num \left( \frac{dt_w}{dL} \right) = \overbrace{f_L \frac{\partial V_m}{\partial t_m} U_{nn}}^{(+)} - \overbrace{g_L \frac{\partial V_w}{\partial t_w} U_{nn}}^{(-)} + \overbrace{f \frac{\partial^2 V_m}{\partial t_m^2} g_L \frac{\partial V_w}{\partial t_w}}^{(+)} > 0$$

## **D Transferable Utility (Not for Publication)**

This section shows that the household optimization problem exhibits transferable utility by proving that under our utility specification, the efficient amount of public good produced within the household (n) does not depend on the allocation of private consumption  $x_m$  and

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<sup>20</sup>We further assume that  $U''' = 0$ .

$x_w$  between spouses. In other words, the principal agent problem is the same as the unitary problem where the household surplus is jointly maximized.

Given the principal agent problem, where a husband is the principal, the maximization problem becomes:

$$\begin{aligned}
& \max_{t_m, t_w, x_m, x_w, \tau} U(n) - f(\bar{s}_\gamma)V_m(t_m) - g_m(L_m)V_w(t_w) + x_m \\
& \text{subject to :} \\
& n = t_m + t_w \\
& x_m = (1 - t_m)w_m - \tau \\
& x_w = (1 - t_w)w_w + \tau \\
& U(n) - g_w(L_w)V_w(t_w) + x_w \geq \bar{U}_w
\end{aligned}$$

the Lagrangian function is given by:

$$\begin{aligned}
L(t_m, t_w, x_m, x_w, \tau) = & \\
= & U(t_m + t_w) - f(\bar{s}_\gamma)V_m(t_m) - g_m(L_m)V_w(t_w) + x_m + \\
& + \mu[\bar{U}_w - U(t_m + t_w) + g_w(L_w)V_w(t_w) - x_w] + \\
& + \lambda_m((T - t_m)w_m - \tau - x_m) + \lambda_w((T - t_w)w_w + \tau - x_w)
\end{aligned}$$

Therefore, the F.O.Cs are given by:

$$\begin{aligned}
t_m : \frac{\partial U}{\partial n}(1 - \mu) &= f(\bar{s}_\gamma)V'_m(t_m) + \lambda_m w_m \\
t_w : \frac{\partial U}{\partial n}(1 - \mu) &= g_m(L_m)V'_w(t_w) - \mu g_w(L_w)V'_w(t_w) + \lambda_w w_w \\
x_m : 1 &= \lambda_m \\
x_w : \mu &= -\lambda_w \\
\tau : \lambda_m &= \lambda_w
\end{aligned}$$

From the last three FOC we get that

$$1 = \lambda_m = \lambda_w; \mu = -1$$

and the FOC system that solves for  $t_m$  and  $t_w$  reduces to

$$\begin{aligned}
t_m : \frac{\partial U}{\partial n} &= f(\bar{s}_\gamma) V'_m(t_m) + w_m \\
t_f : \frac{\partial U}{\partial n} &= [g_m(L_m) + g_w(L_w)] V'_w(t_w) + w_w
\end{aligned}$$

These are the same FOC of that the unitary household would solve to determine the optimal allocation of spousal time  $t_m, t_w$  and therefore the number of children  $n$ .  $< Q.E.D >$

The above also shows that the efficient amount of public good that is produced in the household, in this case children, is independent of the division of private consumption  $x$  between spouses. I.e. Any value of transfers of private consumption  $\tau$  supports the efficient allocation of children  $n^*$ .

## E General Model Specification (Not for publication)

This section generalizes the model presented in Section 2 so that both, a country average share of husband's household production  $\bar{s}_\gamma$ , and a household's egalitarian attitudes toward household production  $L$ , affect the disutility associated with a husband's and a wife's home time.

**Husband Utility** A husband's utility is generalized such that

$$U_m(n, t_m, x_m) = .5[U(n) - f(\bar{s}_\gamma, L) V_m(t_m)] + x_m$$

where as in the previous specification  $f_{\bar{s}} < 0$  (an increase in the average share of household production by men in country  $\gamma$  ( $\bar{s}_\gamma$ ) lowers a husband's disutility of any given unit of his household production  $t_m$ ) and  $f_L < 0$  (i.e. an increase in the household's egalitarian index decreases a husband's disutility of any given unit of his household production  $t_m$ ).

**Wife's utility** A wife's utility is generalized such that

$$U_w(n, t_w, x_w) = .5[U(n) - g(\bar{s}_\gamma, L) V_w(t_w)] + x_w$$

where as in the previous specification  $g_L < 0$  (i.e. an increase in the household's egalitarian index increases a wife's disutility of any given unit of her household production  $t_w$ ) and  $g_{\bar{s}} > 0$  (i.e. an increase in a country's average share of husbands' household production ( $\bar{s}_\gamma$ ) - or a decrease in a country's average share of wives' household production - increases a wife's disutility of any given unit of her household production  $t_w$ ).

Unlike the simplified specification of the model in Section 2, more egalitarian households in this set-up do not necessarily have fewer children. This will only be the case if an increase in the household egalitarian index increases the disutility associated with a wife's household production more than it decreases a husband's disutility from household production. In other words, we have to make the additional assumption that over the relevant range  $\frac{\partial f(\bar{s}_\gamma, L)}{\partial L}$  is small relative to  $\frac{\partial g(\bar{s}_\gamma, L)}{\partial L}$ .

Similarly, an increase in a country's average share of household production by men no longer causes an unambiguous increase in household size. As the second term illustrates, this will only be the case if an increase in a country's average household production share by men (and thus a *decrease* in women's share), leaves a wife's disutility of performing household production tasks relatively unaffected. In other words, we would have to make the additional assumption that over the relevant range  $\frac{\partial f(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma}$  is big relative to  $\frac{\partial g(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma}$ .

**Household's maximization problem** The household's maximization problem becomes thus

$$\max_{t_h, t_w} U(t_m + t_w) - f(\bar{s}_\gamma, L)V_m(t_m) - g(\bar{s}_\gamma, L)V_w(t_w) + (1 - t_m)w_m + (1 - t_w)w_w$$

**Comparative statics** We use Crammer's rule to solve for the comparative statics. The denominator of each of these comparative statics is given by the determinant of the Hessian, which is positive:



$$|H| = - \left[ g(\bar{s}_\gamma, L) \frac{\partial^2 V_w}{\partial t_w^2} + f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} \right] \frac{\partial^2 U}{\partial n^2} + f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} g(\bar{s}_\gamma, L) \frac{\partial^2 V_w}{\partial t_w^2} > 0$$

Hence, the sign of the comparative statics equals the sign of the numerator, which is displayed below.

### **The Effect of A Change in the Household Egalitarian Index L**

*A husband's household production share is increasing in the household egalitarian index L*

$$\begin{aligned} \frac{\partial t_m}{\partial L} &= \\ &= - \left[ \overbrace{\left[ \frac{\partial g(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_w}{\partial t_w} - \frac{\partial f(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_m}{\partial t_m} \right]}^{(-)} \frac{\partial^2 U}{\partial n^2} + \overbrace{g(\bar{s}_\gamma, L) \frac{\partial^2 V_w}{\partial t_w^2} \frac{\partial f(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_m}{\partial t_m}}^{(-)} \right] \\ &> 0 \end{aligned}$$

*A wife's household production share is decreasing in the household egalitarian index L*

$$\begin{aligned} \frac{\partial t_w}{\partial L} &= \\ &= - \left[ - \overbrace{\left[ \frac{\partial g(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_w}{\partial t_w} - \frac{\partial f(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_m}{\partial t_m} \right]}^{(+)} \frac{\partial^2 U}{\partial n^2} + \overbrace{f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} \frac{\partial g(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_w}{\partial t_w}}^{(+)} \right] \\ &< 0 \end{aligned}$$

*The number of children can be increasing or decreasing in the household egalitarian index L*

$$\frac{\partial n}{\partial L} = - \left[ \overbrace{g(\bar{s}_\gamma, L) \frac{\partial^2 V_w}{\partial t_w^2} \frac{\partial f(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_m}{\partial t_m}}^{(-)} + \overbrace{f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} \frac{\partial g(\bar{s}_\gamma, L)}{\partial L} \frac{\partial V_w}{\partial t_w}}^{(+)} \right]$$

$$<> 0$$

**The Effect of A Change in A Country's Average Share of household production by Men  $\bar{s}_\gamma$**

*A husband's share of household production is increasing in a country's average share of household production by men*

$$\frac{\partial t_m}{\partial \bar{s}_\gamma} =$$

$$= - \left[ \overbrace{\left[ \frac{\partial g(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_w}{\partial t_w} - \frac{\partial f(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_m}{\partial t_m} \right] \frac{\partial^2 U}{\partial n^2}}^{(-)} + \overbrace{g(\bar{s}_\gamma, L) \frac{\partial^2 V_w}{\partial t_w^2} \frac{\partial f(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_m}{\partial t_m}}^{(-)} \right]$$

$$> 0$$

*A wife's share of household production is decreasing in a country's average share of household production by men*

$$\frac{\partial t_w}{\partial \bar{s}_\gamma} =$$

$$- \left[ \overbrace{- \left[ \frac{\partial g(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_w}{\partial t_w} - \frac{\partial f(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_m}{\partial t_m} \right] \frac{\partial^2 U}{\partial n^2}}^{(+)} + \overbrace{f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} \frac{\partial g(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_w}{\partial t_w}}^{(+)} \right]$$

$$< 0$$

*The number of children can be increasing or decreasing in a country's average share of household production by men*

$$\begin{aligned} \frac{\partial n}{\partial \bar{s}_\gamma} &= \\ &= - \left[ \overbrace{g(\bar{s}_\gamma, L) \frac{\partial^2 V_w}{\partial t_w^2} \frac{\partial f(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_m}{\partial t_m}}^{(-)} + \overbrace{f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} \frac{\partial g(\bar{s}_\gamma, L)}{\partial \bar{s}_\gamma} \frac{\partial V_w}{\partial t_w}}^{(+)} \right] \\ &< > 0 \end{aligned}$$

### **The Effect of an Increase in the Female Wage $w_w$**

*A Husband's household production time is increasing in the female wage*

$$\frac{\partial t_m}{\partial w_w} = - \overbrace{\left[ \frac{\partial^2 U}{\partial n^2} \right]}^{(-)} > 0$$

*A Wife's household production time is decreasing in the female wage*

$$\frac{\partial t_w}{\partial w_w} = - \overbrace{\left[ -\frac{\partial^2 U}{\partial n^2} + f(s_m, L) \frac{\partial^2 V_m}{\partial t_m^2} \right]}^{(+)} < 0$$

*Fertility is decreasing in the female wage*

$$\frac{\partial n}{\partial w_w} = - \overbrace{\left[ f(\bar{s}_\gamma, L) \frac{\partial^2 V_m}{\partial t_m^2} \right]}^{(+)} < 0$$