Working Women, Husband's Home Time, and Lowest-Low Fertility in Europe[1]

Joost de Laat* Almudena Sevilla-Sanz*

Department of Economics, Brown University
March 2004

Abstract

Traditional economic models predict a negative correlation between female labor force participation and fertility that is driven by variation in the female wage. Although this simple prediction has repeatedly been supported at both the micro and macro levels, rapid fertility declines in Southern Europe have led to a reversal of this relationship at the aggregate level: for the past decade OECD countries with relatively low female labor force participation have also had relatively low fertility. In this paper, we reconcile these results by developing a simple model to explain inter- and intra-country differences in labor force participation and fertility. We look at heterogeneity in attitudes towards women's home time and introduce a social externality that influences husbands' willingness to participate in home production. Implications of the model are tested using the ISSP 94, a multi-country household survey containing detailed information on attitudes toward gender roles, as well as data on childbearing and division of housework. We find that, within a given country, households with less egalitarian views toward gender roles have higher levels of fertility, lower husband's home time, and lower female labor force participation than those with more egalitarian views. More surprisingly, but consistent with the predictions of the model, we find that countries with less egalitarian views on gender roles have lower average fertility. This relationship arises due to lower average levels of husbands' home time. Our model also suggests that the intertemporal reversal in the relationship between fertility and labor force participation may be attributed to a secular increase in female schooling over this period.

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

Email: Joost_DeLaat@brown.edu, Almudena_Sevilla-Sanz@brown.edu; *We thank Brown University, the Social Science Research Council Program in Applied Economics, and the Population Council for financial support. We are grateful to Andrew Foster, David Weil, Rachel Friedberg, Mark Pitt, and others at the Department of Economics and The Population and Training Center at Brown University for their many insights. An earlier version of this paper was presented at the 8th Spring Meeting of Young Economists in Leuven 2003, and the Population Association of America annual meeting in Minneapolis, 2003. All errors are ours.

I Introduction

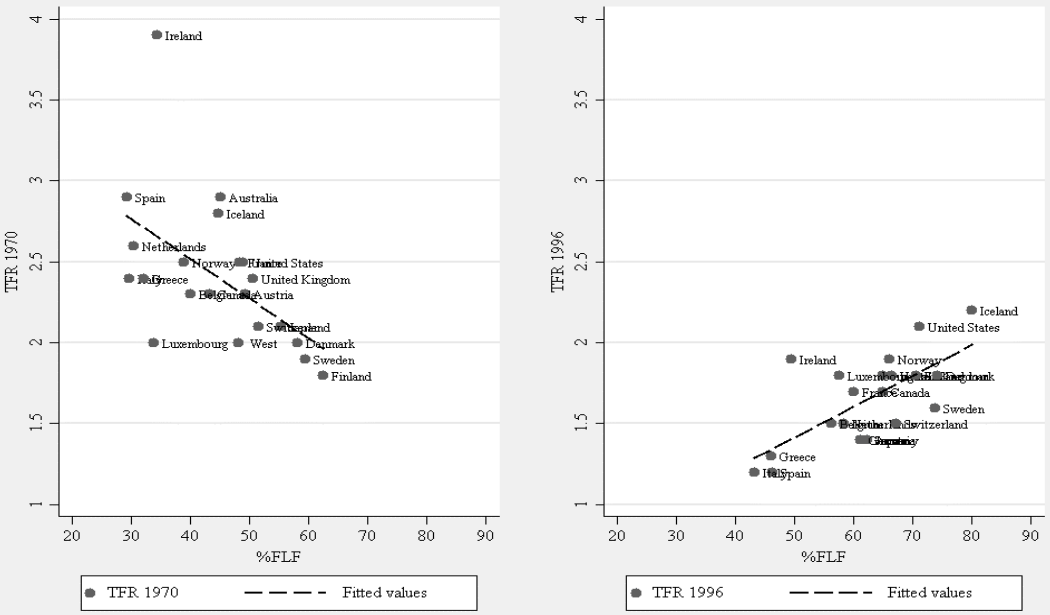
Ever since Mincer's classic article (Mincer, 1985), most economists take it for granted that there is an inverse relationship between fertility and female labor-force participation at the aggregate level. Mincer's findings using cross country data corroborated previous household level evidence documenting this inverse relationship. These household studies in turn were based on theoretical models (e.g. Becker, 1965 and Willis, 1973) that predicted a negative correlation between female labor force participation and fertility, driven by variation in the female wage. Using data from the 1990s, however, several authors in a variety of disciplines have recently noted an aggregate reversal in sign toward the current positive association between these two variables among OECD countries. Our main research goal is to develop and empirically test a model that can explain this positive correlation at the cross country level while maintaining the traditional negative correlation sign at the household level.

Several countries within this the OECD, most notably Japan and several southern European countries such as Italy and Spain, stand out as having fertility levels well below replacement while female labor force participation remains low. In contrast, women in Northern European countries, have not only much higher participation rates but also considerably higher fertility levels. Figure 1 below depicts the correlation in 1970 and 1996 between these two variables.[2]

While the correlation was -.517 in 1970 it became positive in the mid eighties and was .714 in 1996. Notice, however, that the relative positions of most countries have changed little between 1970 and 1996. Sweden, Finland, Denmark, and the United States, for example, are clustered at the right-hand side of both panels, while Italy, Spain, and Greece are grouped at the left-hand side (Rindfuss and Brewster, 2000). Fertility in the first group decreased only slightly over this time period, even though the proportion of women in the labor force increased by an average of 15%. In contrast, smaller rises in already-lower participation rates in the Southern European countries were accompanied by a fertility decline of more than 1 child per woman.

[2] Table 1 in appendix 1 shows the fertility (as measured by the TFR) and female labor force participation rates respectively.

Fig 1. Correlation between female labor force participation and total fertility rates: 1970, 1996

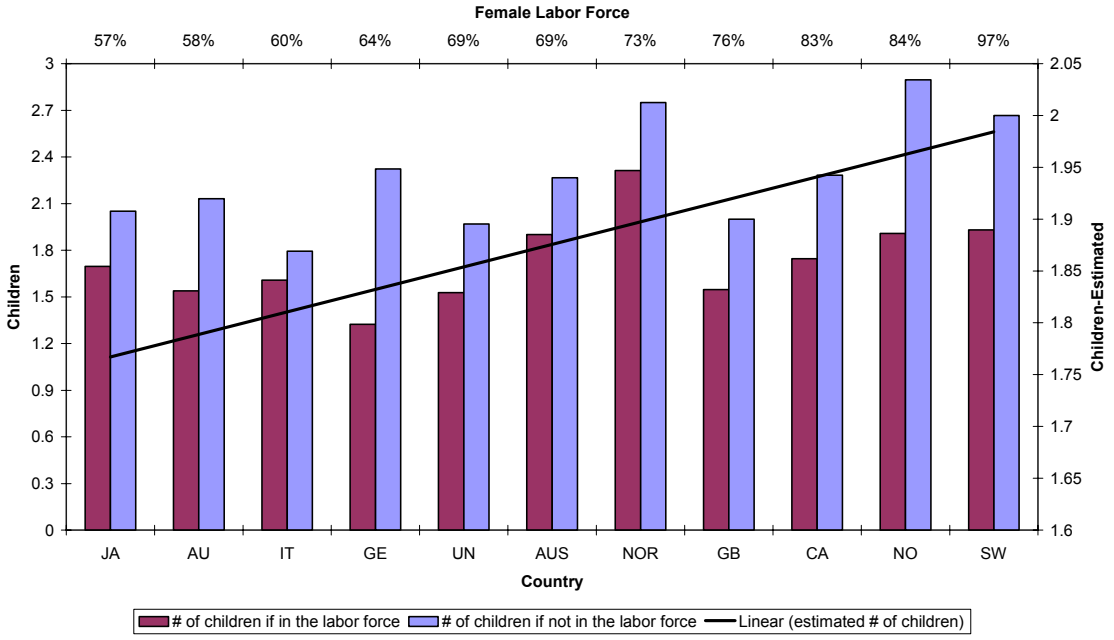


Data source: Rindfuss and Brewster (1996). See Tables 1a and b in appendix.

Despite the change in the sign of the cross-country correlation, fertility and female labor force participation at the individual level continues to be negatively correlated at the household as we observe in Figure 2[3] , although the correlation seems to be weaker over time (Engelhardt and Prskawetz, 2002). We observe that within countries, the mean number of children is always lower for those women who are working than for those who are not, which is consistent with traditional micro economic theories of the family. Yet, a cross country level, we see that there is a positive relationship between the country mean number of children and female labor force participation. Macro and micro evidence run, therefore in opposite directions. In particular, it is the cross country variation which seems opposite to the predictions of economic theory.

[3] Women 35 to 45 , see Section IV for a detailed description of the variables.

Fig 2. Correlation between female labor force participation and total fertility rates [4]



The positive correlation between female labor force participation and fertility has been explained in both, economics and sociology literatures, by cross-country variation in the (in-)ability of mothers to combine employment with child rearing. In particular, much of the research has focused on exploring how the organization of labor markets and childcare centers affects fertility and work choices through, for example, the costs associated with intermittent labor force participation and access to childcare alternatives. While this approach has clearly been informative in thinking about fertility and labor force participation, most studies indicate that work incompatibility forces individual women to make either-work-or-children choices. This binary choice is less informative in explaining the occurrence of lower-order births and low participation that has taken place in lowest-low fertility countries (Bettio and Villa 1998) and has played a major role in the positive cross-country correlation between these two variables.

Several authors have recently suggested that important differences between southern and northern Europe in norms regarding family structure and the role of the family in economic life might provide a missing link in explaining the low fertility – low participation puzzle. They point, for example, to the stark differences in perceived gender roles, with women in low fertility OECD

[4] Countries in this figure are ordered from those with the highest female labor force participation (Sweden) to the lowest (Japan). A regression of the mean number of children on female labor force participation indicates that those countries with a higher predicted mean number of children are also the countries with the highest female labor force participation.

countries contributing a much greater share of the housework than those in higher fertility countries.

Acknowledging that cross-country variations in attitudes toward gender roles affect the individual decisions on fertility and labor force participation is at the heart of our theory. We develop a theoretical model within the standard household economics framework that embeds cross-country differences in attitudes toward the gender division of housework and draws from the recent literature on social networks that incorporate various ways in which individual behavior can be socially regulated. The theory developed in this paper delivers two main predictions: First, the model shows that households with more egalitarian attitudes toward gender roles have fewer children, higher female labor force participation, and a more equal division of housework between the spouses. This is the *household specific* effect of having more egalitarian attitudes. Second, while egalitarian attitudes lead a household to choose lower fertility levels and a more equal division of housework consistent with economic theory, the latter choice induces a *social externality* on other households. In particular, by raising the country average share of housework performed by men, a household with egalitarian attitudes lowers the disutility that men in other households experience when doing housework, thereby causing them to increase their housework contribution, and increase fertility and female labor force participation. Thus the interaction of individual and social externality effects can, under certain parameter values, give rise to a positive cross-country correlation between fertility and female labor force participation. Further, the model formalizes how individual and social externalities interact with traditional predictors of fertility, such as female wages, to offer a potential explanation for the intertemporal changes in fertility and female labor force participation, shedding some light on the change in the sign of the correlation between these two variables from being negative in the 1970s to positive by the 1990s.

In section II we provide a brief overview of previous research on the positive correlation with special attention to the low fertility - low female participation puzzle. We provide additional macroeconomic evidence further supporting the notion that ideational factors are important to fertility and work decisions; in particular, we focus on cross-country differences in attitudes towards the gender division of housework. In section III we develop a model in which attitudes toward the gender division of housework mediate the degree of (in-)compatibility between fertility and work decisions. In section IV we describe the ISSP 94 data, which we will use in our empirical analysis. We contrast the macro evidence with some preliminary micro regression in

the first part of section V and present the main regression results in the second part of the section. We find that, within a country, households with less egalitarian views toward gender roles have higher levels of fertility, lower husband's home time, and lower female labor force participation than those with more egalitarian views. More surprisingly, but consistent with the predictions of the model, we find that countries with less egalitarian views on gender roles have not only lower average fertility but also lower female labor force participation. This evidence supports the model's social externality predictions. In section VI we discuss how the model helps to explain fertility dynamics since 1970s and provide additional regression support. In section VII we conclude.

II. Existing Literature

While several (mostly empirical) papers have explored the correlation between fertility and female labor force participation, some authors initially argued that extremely low fertility levels (the primary cause of the positive correlation) were simply manifestations of a tempo effect induced by the postponement of marriage and first births common to most OECD countries. Because it is a composite of age-specific fertility rates at a point in time, the drop in the total fertility rate (TFR) could merely reflect a postponement of fertility to later ages by younger cohorts, and not a permanent decline in the true measure of interest (Bongaarts and Feeny, 1998). However, declines in fertility in Southern Europe and Japan in particular have been continuing for more than twenty years now, causing significant declines in completed cohort fertility rates too. Bettio and Villa (1998), Kohler (2000) and Koegler (2001) among others point to the fact that completed cohort fertility rates have fallen dramatically from around 2.8 children to about 1.5 for cohorts born between 1910 and 1960 in Mediterranean countries, the principal cause being a decrease in second and higher order births within marriage. Yet, in Sweden and Norway, for example, the completed fertility rate for the 1960 cohort exceeds 2 children per woman.

Moving beyond the debate over whether the drop in fertility is real, Rindfuss and Brewster (1996) provide a useful classification of studies that focus on the compatibility of work and children. They distinguish between studies focusing on (1) social-structural factors and, (2) ideational factors.

Social-Structural Factors There are two broad categories within these factors that affect the compatibility between family and work: (1) labor market rigidities; and, (2) constraints facing households with regards to the organization of child care arrangements. Both sets of constraints

affect the opportunity costs of working in terms of being able to afford and provide for children. It is widely believed, for example, that the availability and acceptance of part-time employment and more flexible work hours in Scandinavian countries compared to Mediterranean countries have facilitated women's abilities to work while at the same time have children, giving rise to these countries' relatively high fertility-high female labor force participation rates (Rubery et al., 1994; Meulders et al., 1994). Scholars have also pointed to high unemployment being a potential source of low fertility in southern Europe. However, the effects on fertility of unemployment are not unambiguous. On the one hand, high male unemployment lowers expected lifetime earnings and might thus reduce fertility through an income effect. Likewise for women, unemployment might reduce fertility through a negative income effect but can increase fertility through a positive substitution effect induced by lower expected wages (Bettio and Villa, 1998). Household constraints constitute the limited availability of different childcare arrangements. All countries, for example, with low female participation and low fertility are countries with low levels of public childcare, especially for children under 3 (Di Tomasso, 1999, Del Boca, 2002). Some argue that this absence of (affordable) public childcare centers makes it difficult for women to combine work and family. A weakness in this argument stems from the observation that countries with relatively high fertility and female labor force participation levels such as USA and Sweden have very different child care markets, the former being private in nature and the latter being highly public. Also, taking the argument to its extreme, one would also expect that people's preferences over childcare, fertility, and labor force participation are taken into account when designing the public provision of care. For instance, an analysis of the provision and use of small children's nursery facilities in Bilbao (Spain) in 1994 shows that although only 14 percent of the children between 0 and 4 years had access to subsidized nurseries, 18 percent of the places in private nurseries remained vacant (Carrasco and Rodriguez, 2000).

Such cross-country analyses of labor markets and family policies provide important arguments as to why fertility barely dropped in northern Europe despite substantial increases in female labor force participation, in other words, why women there have been able to make "*both* work-and-children" choices. These same studies also provide important arguments as to why women in southern Europe may be faced with "either-work-or-children" choices causing female labor force participation to remain low. However, they fail to explain a central piece of the puzzle: why are such low rates of female labor force participation *accompanied* by extremely low fertility rates? In other words, what causes women in some countries to make "*neither*-work-*nor*-children" choices?

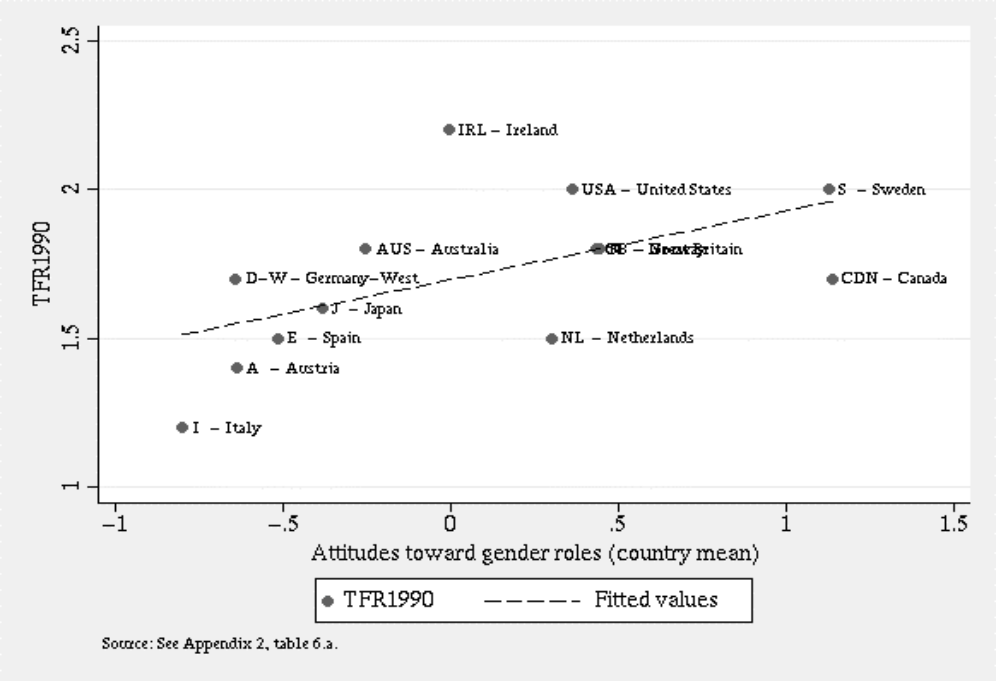
Ideational Factors Several authors highlight the central role of the Mediterranean family as the key to understanding the low-fertility - low-participation puzzle (Bentolila and Ichino, 2000; Bettio and Villa, 1998; Delgado-Perez and Livi-Bacci, 1992; Di Tommaso, 1999). Very cohesive family structures foster the persistence of traditional ideas about women's roles as well as the unequal sharing of domestic labor with women still doing the great majority of the work. Di Tomasso (1999) and Del Boca (2002), for example, note that norms regarding the division of time within the household might be reinforcing social structural factors that limit Italian women to combine work with children. A recent study by Koegel (2001) using cross-country data finds that once country fixed effects (which would include nationwide attitudes) are controlled for, the within-country relationship between participation and fertility remains negative.

Furthermore, while the growing study of "fatherhood" is rarely connected with demographic processes (except for divorce), there is growing evidence that fathers are increasingly involved in childcare (Goldscheider and Kaufman, 1996). In the United States, for example, O'Connell (1993) reports that the proportion of young children cared for by their fathers while their mothers worked had increased by 20 percent in 1991, after hovering around 15 to 16 percent for a decade and a half. And, in married-couple families, fathers are now the most important source of relative-provided care for the pre-school children of working mothers. In fact, a comparison of high-fertility with low-fertility industrialized countries indicates that involvement of men in household tasks in the high-fertility countries is considerably higher than in the low-fertility ones. According to the UN Human Development Report 1995, the male share of domestic labor in Italy was the lowest among industrialized countries. For all northern European countries mentioned in this report, women contributed between 64 and 67 percent of all domestic work, which is considerably lower than in low fertility southern European countries. For example, for couples with and without children, an average Italian working woman still spends 7.15 hours a day on domestic work, or 88 percent of all domestic work (Di Tommaso, 1999). A 1991 survey of Spanish men and women over age 18 shows that women, on average, spent 7.46 hours a day on domestic work, or 83% of all domestic work (Carrasco and Rodriguez, 2000).

This relationship between man's housework, fertility and female labor force participation is also reflected in cross-country variation in attitudes toward the gender division of housework. Figure 3 shows regression results from 12 OECD countries indicating that countries in which married men

and women between the ages of 25 and 40 in 1990 were more favorable towards men taking responsibility of housework also had higher fertility rates[5].

Fig 3. Correlation between TFR in 1990 and general country attitudes toward gender roles



Finally, while little research has formally explored how cross-country variation in such ideational factors may help to explain the positive correlation in fertility and female labor force participation, recent work by Akerlof and Kranton (2000), Kohler (2000), Munshi and Myaux (2002), and others has argued that individual behavior can be socially regulated through, for example, identity- and social network formation, which can provide important insights into the demographic processes.

In sum, the literature and empirical evidence suggests that relatively high fertility and high female labor force participation countries are characterized by families favoring a more balanced division of housework in which women take on a smaller share of housework. Below we will use this fact to motivate a modeling approach that focuses on the interaction of gender attitudes toward housework with fertility and spousal labor force participation decisions.

[5] Section III contains a description of the data source and the attitudinal index.

III A Theory of Fertility, Gender Attitudes, and Social Externalities in the Division of Housework

The model presented in this section attempts to rationalize the stylized fact in Fig. 3: Countries with more egalitarian views on gender roles are not only those with the highest female labor force participation but also those with the highest fertility. This observation might seem counter-intuitive at first, not only based on conventional wisdom but also based on economic theory. If countries with less egalitarian gender roles are also the ones with stronger family values, then it would only be natural that they have more and not fewer children (Bettio and Villa, 1998). We reconcile these facts in the model presented below by introducing a social externality that affects the husband's provision of housework and gives riseto the cross country observation that more egalitarian countries have not only higher female labor force participation but might also have higher fertility.

Why Egalitarian Families Tend To Be Smaller In our model we assume there to be a monotonically increasing relationship between the number of children and the amount of housework needed to be performed by the parents. Thus in choosing a certain family size, we assume that parents are aware that having many children requires more time spent on child care and housework than having few children. Upon choosing family size, couples then have to decide on how to divide these tasks between them. Further, while we assume each spouse gets utility from the number of children, this is traded off (on the relevant margin) by the disutility they derive from performing these housework tasks. An alternative interpretation of the latter is that each spouse derives utility from leisure. Finally, egalitarian couples in our model distinguish themselves from couples with less egalitarian views with respect to the gender division of labor by deriving greater disutility by the wife for a given time allocation on housework tasks. As we will show below, this not only induces a more equitable distribution of housework tasks, but the overall level of housework will also be lower in egalitarian families. Given that children are a positive function of the overall level of housework, family size goes down.

Why Egalitarian Countries Tend To Have Bigger Families The fact that egalitarian countries have higher fertility levels despite the fact that egalitarian families tend to be smaller provides prima facie evidence for the existence of an externality or social effects. The existence of externalities in the domain of housework tasks can be motivated by appealing to 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 husbands who are either egalitarian or have wives with better labor market opportunities to share housework tasks more equally with their wives, they will be reluctant to do so particularly in countries where housework has been a task carried out by women only. But, as some of these men (the "innovators") begin to take up some of the housework tasks, they reduce the social stigma surrounding men's contributions at home, and make it easier for other men (the "followers") to engage in housework tasks as well. Consequently, for two otherwise identical families living in different countries, the cost of doing housework is less for the husband living in the more egalitarian country where husbands are taking on a greater share of housework. In the model, we capture this externality by assuming that a husbands' disutility of doing housework tasks is a decreasing function of the average share of housework done by men in the country as a whole. In less egalitarian countries this externality is therefore small, and the opportunity cost of raising children high, thus putting downward pressure on family size. At the same time, women in less egalitarian countries perform more housework and have lower labor force participation.

These two approaches (being egalitarian at the household level coupled with the housework externality) can give rise to the current empirical observation that within a country the families with less egalitarian views about the division of housework are bigger, yet on average fertility and female labor force participation will be higher in countries which tend to be egalitarian. As will be shown below, these two observations can be consistent with each other if a husband's share of housework (and thus fertility) is sufficiently sensitive to changes in the country's average share of housework by husbands, which for given wage levels is always higher in egalitarian countries.

III.1 Spouses' preferences and Household Public Good

Fertility We assume that children are the only household public good and both spouses derive utility from children $U(n)$, which is an increasing and concave utility function such that $U'(n) > 0$ and $U''(n) < 0$. Husband and wife are assumed to be perfect substitutes in the production child services, which include time doing housework and time at child care. We define t_m, t_w as the amount of time the husband (man) and the wife (woman) devote to the production of household services. We normalize time spent in household activities to 1 and thus $t_i \in [0,1]$, for $i=m,w$ and specify the number of children n as an increasing function of the sum of time devoted to household services: $n = \alpha(t_w + t_m)$, where α is the parameter that translates time "units" into children "units". Without loss of generality, we normalize α =1. For simplicity we

ignore direct costs of clothing, feeding, etc. that come with raising children. The main results are not affected by this assumption.

Husband's utility We assume that the husband's utility depends on the number of children (n) as well as a private consumption good x_m. He also gets disutility from the time he spends providing housework, as well as from the time his wife spends doing housework. We assume that the disutility of doing housework $V(t_i)$, for $i = m, w$ has the same functional form for both spouses and is an increasing convex cost function in housework such that $\partial V / \partial t_i > 0$, $\partial^2 V / \partial t_i^{\,2} > 0$. We disregard leisure in our model, so that the amount of time not devoted to household services is devoted to work.

We assume that the husband's disutility of his own housework depends negatively on $\bar{s}_\gamma$, where $\bar{s}_\gamma = \bar{t}_{m,\gamma} / (\bar{t}_{m,\gamma} + \bar{t}_{w,\gamma})$ is the average share of housework by husbands in country γ, that is taken as given in the household optimization problem and $\bar{t}_{i,\gamma}$ i=m,w, is the average amount of housework performed by husbands and wives respectively in country γ defined as $\bar{t}_{i,\gamma} = \sum_i t_{i,\gamma} / N_\gamma$, where N_γ is the number of people in country γ. Therefore, an increase in $\bar{s}_\gamma$, i.e. an increase in the average share of housework that husbands do in country γ, lowers the disutility that an individual husband has from performing housework tasks $V(t_m)$ and has a positive externality on the amount of housework time that individual husbands provide.

We also assume that the husband's utility decreases with the amount of housework his wife does by $L_m V(t_w)$, where L_m (egalitarian) is the husband's specific parameter that reflects his personal attitudes toward gender roles and in particular the degree to which he cares about his wife's disutility from performing housework. Thus, an increase in L_m, i.e. as the husband becomes more egalitarian with respect to gender roles, the disutility he gets from a given t_w increases and the household would allocate less housework to the wife.

We assume the husband's utility to have the quasilinear and additive form such that:

$$U_m(n, t_m, t_w, x_m) = U(n) - (1 - \bar{s}_\gamma)V_m(t_m) - L_m V_w(t_w) + x_m$$

Wife's utility The wife's utility depends on the number of children (n), as well as a private consumption good x_w. She also gets disutility from time that she spends providing housework denoted by $L_w V_w(t_w)$. Therefore, the wife's disutility of housework depends solely on her attitudes toward gender roles, where L_w (egalitarian) is the wife's specific parameter that denotes her views on gender roles. Thus, as L_w increases, i.e. as the wife becomes more egalitarian with respect to gender roles, the disutility from her housework increases. The wife is thus not affected by aggregate share of housework performed by men/women in her country. Unlike her husband, we assume that the amount of housework her husband does affects the wife's utility solely through the number of children. The wife's utility is quasilinear with respect to private consumption such that:

$$U_w(n, t_m, t_w, x_w) = U(n) - L_w V_w(t_w) + x_w$$

III.2 Household Surplus and Spouses' Allocation of Time

Our focus is on the household allocation of "time" between spouses rather than the allocation of private consumption. This justifies the adoption of a transferable utility set up (Bergstrom, 1997) where the bargaining process over private consumption becomes irrelevant for the efficient provision of the public good (unlike, for example, McElroy and Horney, 1981; Lundberg and Pollak, 2001). It nonetheless captures the key elements of the decisions about time allocation between spouses[6]. We also maintain the assumption that the household reaches efficient outcomes with respect to the provision of public goods.[7] Under this assumption, the household

[6] Under transferable utility, the marginal rate of transformation of money for the number of children (the public good) is the same for both spouses, even though the marginal rate of transformation of time doing housework for the number of children differs between spouses.

[7] While an initially intuitive set-up might be to follow a growing literature that relaxes the efficiency assumption on the household provision of public goods, and adopt the well-known "private provision of public goods" game in which spouses make voluntary contributions to housework (the public good), this is unattractive here. In particular, while adoption of a voluntary provision public goods game in our model would have the empirically attractive feature that both spouses contribute inefficiently low levels of housework and thus leading to low fertility levels, time spent not doing housework in our model is time spent in the labor market, suggesting that low fertility countries should also have high female labor force participation. The latter is not true empirically.

optimization problem can be understood as a principal-agent problem where the husband maximizes his utility subject to his wife's reservation utility[8]:

$$\max_{t_m, t_w, x_m, x_w, \tau} U(n) - (1 - \bar{s}_\gamma)V(t_m) - L_m V(t_w) + x_m$$
$$s.t:$$
$$n = t_m + t_w$$
$$x_m = (1 - t_m)w_m - \tau$$
$$x_w = (1 - t_w)w_w + \tau$$
$$U(n) - L_w V(t_w) + x_w \geq \bar{U}_w$$

where τ denotes the private consumption transfers that husbands give to wife if $\tau > 0$ (or vice versa) and w_m, w_w denote husband's and wife's wages. In sum, the husband maximizes his utility with respect to t_m, t_w, x_m, x_w, τ subject to the children production function, his budget constraint, his wife's budget constraint and his wife's reservation utility constraint. He takes individual wages (w_m, w_w), individual attitudes (L_w, L_m) and the average share of housework performed by husbands in his country ($\bar{s}_\gamma$) as given.[9]

The quasilinear nature of the utility function allows us to focus on substitution effects between husband's and wife's time allocations rather than income effects[10]. Given that the household maximization problem exhibits transferable utility, the above problem simplifies to maximizing the joint marriage surplus[11]:

---

[8] The assumption of transferable utility makes it unnecessary to take a stand on which spouse is the maximizer. See appendix 3.

[9] Appendix 5 contains a more general utility specification where the household's attitudes towards gender roles (L) and the country average housework share by men (s_m) each affect both the husband and the wife's disutility from performing housework tasks:

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

The signs of the comparative statics in this more general model mirror those derived below, as long as changes in gender attitudes increase the disutility from the wife's housework sufficiently more than that it decreases disutility from the husband's housework, and similarly that the husband's housework contribution is more sensitive than the wife's housework contribution to changes in the country average share of housework by men.

[10] It has been shown in the empirical literature on fertility and female labor force participation that the female wage (substitution effect) dominates the family income effect. We impose this empirical observation onto our model by obviating the income effect on fertility and labor force participation altogether. Furthermore, as discussed in the empirical section, the income effect is not able to address the puzzle.

[11] See proof in Appendix 3

$$\max_{t_m, t_w, x_m, x_w, \tau} 2U(n) - (1-\bar{s}_\gamma)V(t_m) - (L_m + L_w)V(t_w) + x_m + x_w$$

$$s.t:$$

$$n = t_m + t_w$$

$$x_m = (1-t_m)w_m - \tau$$

$$x_w = (1-t_w)w_w + \tau$$

Substituting all the constraints into the objective function, the household maximization problem collapses to:

$$\max_{t_m, t_w} U(t_m, t_w) - (1-\bar{s}_\gamma)V(t_m) - (L_m + L_w)V(t_w) + (1-t_m)w_m + (1-t_w)w_w$$

That is, the household's disutility from the time the individual husband devotes to housework $(1-\bar{s}_\gamma)V(t_m)$ decreases with the share of housework done by husbands in that particular country $\bar{s}_\gamma$. The household's disutility from the time the wife devotes to housework $(L_m + L_w)V(t_w)$ is higher for households with more egalitarian views on gender roles. Thus, we assume that only husband's housework time is affected by the social externality, whereas the wife's housework time is solely affected by the household's attitudes toward gender roles. For the rest of the analysis we denote by *L* the household's egalitarian index defined as $L = (L_m + L_w)/2$ [12]

It follows from the household optimization problem that the marginal cost of time spent in housework is equal to the marginal utility of the public good (in our case children) produced with housework time. For both man's and woman's housework time the following holds:

$$(t_m): \quad \frac{\partial U}{\partial t_m} = (1-\bar{s}_\gamma)\frac{\partial V_m(t_m)}{\partial t_m} + w_m$$

$$(t_f): \quad \frac{\partial U}{\partial t_f} = L\frac{\partial V_w(t_w)}{\partial t_w} + w_w$$

[12] This normalization is supported by the assumption that there exists positive assortative mating with respect to attitudes in the marriage market. In the data only the attitudes of one spouse are reported. However, the fact that the correlation between men's and women's attitudes in one country are close to unity further validates the assumption.

Notice that $n = t_m + t_w$ implies $\frac{\partial U}{\partial t_i} = \frac{\partial U}{\partial n}$. At the optimum, the marginal utility of children has to be equal to the marginal cost (or shadow price) of children, which is the RHS in the equations above, such that:

$$MC(n) = (1 - \bar{s}_\gamma)\frac{\partial V_m(t_m)}{\partial t_m} + w_m = L\frac{\partial V_w(t_w)}{\partial t_w} + w_w$$

III.3 Comparative Statics

This section focuses on the comparative statics for household *i* in country γ. The solution to the maximization problem is given by $t_i^* = t_i(\bar{s}_\gamma, L_m, L_w, w_m, w_w)$ for $i=m,w$ and $n_i^* = n_i(\bar{s}_\gamma, L_m, L_w, w_m, w_w)$.

Proposition 1[13]***:*** *The number of children is a decreasing function of the household's egalitarian index L such that*

$$\frac{dn_i}{dL} < 0$$

Recall that egalitarian attitudes toward the gender division of labor raise the shadow price of female housework, thereby reducing the wife's housework contribution t_w. Given that wife's time in household activities translates into children, and holding the husband's contribution constant, an increase in the shadow price of wife's time at home decreases the household amount of output produced, i.e. children.

Proposition 2: *The number of children in any given household* i *in country* γ *is an increasing function of the average share of housework performed by men in country* γ *such that*

$$\frac{dn_i}{d\bar{s}_\gamma} > 0$$

Hence, the model predicts that households in more egalitarian countries have, ceteris paribus, bigger families. Husbands living in countries where these externalities are greatest will henceforth increase their housework contribution. Reducing the overall opportunity cost of providing housework tasks increases the total amount of household services, thus supporting higher fertility levels.

[13] Comparative static results are derived in Appendix 4

Proposition 3: *The man's share of housework in a given household* $s_m = t_m/(t_w + t_m)$ *is an increasing function of the household egalitarian index such that*

$$\frac{ds_{im}}{dL} > 0$$

Proposition 3 implies that men in egalitarian households take on a greater share of the housework. This follows from the fact that egalitarian attitudes toward the gender division of labor raise the shadow price of female housework. Given that husbands and wives are perfect substitutes, this decreases the wife's housework contribution and increases the husband's.

Proposition 4: *The number of children is a decreasing function of the woman's wage such that*

$$\frac{dn_i}{dw_w} < 0$$

Finally, the model has the standard prediction that the wife's contribution to housework declines and the husband's increases following an increase in the female wage, causing family size to decline.

IV The ISSP 94 Data

IV.1 General Description

The data used in the empirical analysis come from the International Social Survey Programme (ISSP), which is an annual cross-national survey undertaken by several social science institutes and dates back to 1983. Over two-dozen countries have been participating in several survey efforts covering topics such as social inequality, social networks and support systems, and the role of government. Our analysis is based on the 1994 survey, "Family and Changing Gender Roles," which covered 33,590 households from Australia, Austria, Bulgaria, Canada, the Czech Republic, Germany (East and West), Great Britain and Northern Ireland, Hungary, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, Philippines, Poland, Russia, Slovenia, Spain, Sweden, and the United States. 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 across all countries. This survey is particularly useful for our purposes

because it collected information on employment and wages, attitudes toward gender roles as well as the realized division of labor within the household, and household composition.

IV.2 Sample and Variables

In the empirical analysis we limited the sample to female respondents who were married or living as married. The male sample is excluded as wife's wages cannot be estimated due to lack of information on spouse's characteristics. We exclude women from Eastern Europe, whose fertility and female patterns exhibit different dynamics. We further consider only those households where both the husband and the wife are capable of working in the labor market (i.e. students and people incapable of working are excluded) and where respondents are between 25 and 45 years old. This age restriction follows since our fertility estimates are inferred from the household composition and become noisy for respondents older than 45.

Table 4.1 presents summary information collected from these data on the key variables used in the analysis: attitudes toward the gender division of housework, fertility, the division of housework, female labor force participation, female education and spousal earnings.

TABLE 4.1 SUMMARY STATISTICS

Country	Attitudes Index	Housework Index	Number of Children	Female Years 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)
Nothern 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

Countries in the table above are ordered by their attitudes toward the gender division of housework, with those at the bottom being more egalitarian. These attitudes are measured by constructing a principal component index from a series of fifteen responses to statements[14]

[14] The variables included in the egalitarian index are the answers to the following questions: 1- Working mom: warm relationship with child ok; 2- Working mom: pre school child suffers; 3- Working woman: family life suffers; 4- What women really want is home & kids; 5- Household satisfies as much as paid job; 6- Work is best for woman's independence; 7- Women must work to support family; 8- Both should contribute to household-income; 9- Household is wife's job; 10- Not good if man at home and woman at work; 11- Family suffers because men work too much; 12- Should women work :after marriage, before kid; 13- Should women work: with preschool child; 14- Should women work: after youngest kid at school; 15- Should women work: kids left home

designed to capture attitudes towards the gender division of housework such as "How much should women work with preschool children?" and "A man's job is to earn money and a woman's job is to look after the home and family". The responses were coded on a 1 to 5 scale, from "strongly agree" to "strongly disagree". Our composite index indicates that attitudes toward the gender division of housework are less egalitarian in countries such as Austria, Italy, Japan, and Spain than in countries such as Norway, Sweden, and Canada.

The realized gender division of housework is also a principal component index, constructed from information reported on the gender division of the following activities: laundry, small repairs, sick care, grocery shopping, and dinner decisions. Answers are ranked from 1 to 5, 1 being the woman "always does it" and 5 being the man "always does it".

The table also shows our fertility estimates. Unfortunately, the survey did not directly asked respondents 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 only 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 inferred how many children were living in the household and used this measure as a best approximation for fertility. This measure will be biased upward whenever extended families members or others are members of the household are counted as children (which is more likely the case in *low* fertility countries in Southern Europe), and biased downward whenever children have already left the household (which is less likely in low fertility countries in Southern Europe).

Figure 2 in appendix 2 compares our fertility estimates, this time restricted to age 35-45, with completed cohort fertility estimates compiled by the *Council of Europe*. Overall, our fertility measure is a close approximation to actual fertility levels. In fact, the correlation with the 1955 completed cohort fertility is 0.96 for the seven countries for which this latter measure is available, and is 0.65 when considering a measure of TFR in 1990 for eleven countries. Despite the close approximation, comparing the estimated fertility levels with the cohort fertility and TFR 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 or our sample.

Female labor force participation refers to whether or not the wife is working full-time, part-time, less than part-time, or unemployed at the time of the survey. If none of the above, she responded

being a housewife or working for a family member. Notice that female labor force participation tends to be low in countries experiencing low fertility such as Italy, Japan, and Spain and high in such higher fertility countries as the United States and Norway.

Male earnings and female years of education are included to capture the opportunity cost of time, which couples use in determining fertility, the division of housework, and labor force participation. Male earnings reported in Germany, Austria, and Italy were after taxes. Reported earnings for all other countries were pre-tax. Net earnings were estimated for these countries using personal income tax information published by the World Bank. Finally, using the Penn World Tables 6.1, all earnings were transformed to a common scale by calculating Purchasing Power Parity (ppp) estimates[15]. Male wages were imputed from deducting from reported total household earnings the reported female earnings, provided the husband was working. Information on the average years of education for women in our sample is also presented.

V Empirical Analysis

Do These Attitudes Really Matter? We explore this question by regressing fertility on household attitudes toward the gender division of housework using the household level data described above, and investigate whether the positive cross-country correlation between these two variables also holds when looking at different households within countries. We also run the same regressions on the other two endogenous variables observed in our data: the men's actual share of housework task and the wife's labor force participation. While one might argue that answers to these housework attitudinal questions may not be fully independent of household choices, particularly the actual division of housework, the survey questionnaire does not contain obvious instruments that would allow us to assess this. The regression equation is:

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

where $y_{i,\gamma}$ is either the number of children, the division of housework, or whether or not the wife participates in the labor force for household *i* in country γ. Country fixed effects, δ_γ, and age

[15] Using the formula: $\frac{w_{currency}}{w_{\$}} PPP$

cohort dummies, represented by η_{cohort}, are also included. The regression results are presented in tables 5.1-5.3[16]:

Fertility Regressions[17][18] While the cross-country evidence suggests that an *increase* in the extent to which spouses exhibit a willingness to share in housework tasks should *increase* family size, the negative coefficient sign on the "egalitarian" variable in regression 1 of the fertility regressions clearly indicates the opposite. This result is robust to including measures of full-time income in regression 2. A coefficient of -.074 in regression 2 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.

TABLE 5.1 FERTILITY

Variables	**1**	**2**	**3**
	Number of Children		
Egalitarian	-.083***	-.074***	-.053***
	(-4.96)	(-4.56)	(-4.19)
Female Years of Education	-	-.033**	-.042***
		(-2.99)	(-4.00)
Log of Male Wage	-	.154**	.154**
		(2.35)	(2.60)
Desired Fertility	-	-	.435***
			(10.74)
Countries Dummies	Yes	Yes	Yes
Cohort Dummies	Yes	Yes	Yes
N	1763	1763	1763
R-squared	0.0864	0.0958	0.1651

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

Although including the desired number of children can be problematic since it is likely endogenous to actual family size, we included it in regression 3 to see if the "egalitarian" variable is merely picking up differences in the desired number of children. This is clearly not the case. Note that in regressions 2 and 3 we included the wife's years of education rather than her reported earnings. The reason for this is that economic models of fertility suggest that fertility (and housework) levels are a function of potential wages, not necessarily realized earnings. The effect of female education is somewhat small, with each extra year lowering family size by 0.033 children. Similarly, a raise in husband's earnings from, for example, US$ 15,000 to US$ 25,000

[16] For all regressions robust standard errors (clustered by country) are considered.
[17] Years of education were missing for Canada and Germany. We put in a dummy for the missing years of education to allow us to keep these 2 countries in the analysis, and still get unbiased parameter estimates on this variable.
[18] Female cohorts are grouped in 5-year cohorts

increases family 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 as the theory predicts.

Division of Housework Regressions We next explore how egalitarian attitudes toward the division of housework affect the actual share of housework done by men. The table below shows that husbands in more egalitarian households tend to perform a greater share of the housework tasks, while an increase in their own wages lowers it. Similarly, an increase in the shadow price of female time (captured by her education levels) raises the share performed by husbands. The coefficient signs on the 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 increase in *Egalitarian* from the mean at 0.81 to 1.81, which is equivalent to an increase from the 48th percentile to the 68th percentile, raises the principal component index of the husband's share of housework by 0.121. This is equivalent to a husband formerly at the mean of the *Husband's Share of Housework* jumping up four percentiles from the 49th to the 53rd.

TABLE 5.2 DIVISION OF HOUSEWORK

Variables	**1**	**2**	**3**
	Husband's Share of Housework		
Egalitarian	.142***	.121***	.118***
	(7.44)	(5.24)	(5.29)
Female Years of Education	-	.074***	.076***
		(3.57)	(3.73)
Log of Male Wage	-	-.220**	-.220***
		(-3.11)	(-3.16)
Desired Fertility	-	-	-.078**
			(-3.02)
Country Dummies	Yes	Yes	Yes
Cohort Dummies	Yes	Yes	Yes
N	1763	1763	1763
R-squared	0.2005	0.2201	0.2215

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

Female Labor Force Participation Regressions Finally, in the female labor force participation regression below , the highly significant and positive coefficient sign on egalitarian

attitudes toward the division of housework further indicates that fertility, housework, and female labor force participation are not only intricately linked, but that attitudes, along with wages, are an important component of the opportunity costs of spousal time allocations. It indicates that women in more egalitarian families are more likely to participate in the labor market. In fact, evaluated at the mean of the variables, a unit change[19] in *Egalitarian* raises the probability that a wife participates in the labor force by 8.9 %. The previous housework division regression indicates that this greater participation is made possible by the fact that women in more egalitarian families will take on a smaller share of housework. Interestingly, the increase in female labor force participation corresponding to higher female years of education is not very significant. Given the variable's statistical significance in the housework regression, this suggests certain barriers preventing women from participating in the labor market.

TABLE 5.3 FEMALE LABOR FORCE PARTIC

Variables	**1**	**2**	**3**
	Wife's Labor Force Participation		
Egalitarian	.284***	.283***	.275***
	(17.6)	(19.63)	(17.95)
Female Years of Education	-	0.023	0.027
		(1.19)	(1.29)
Log of Male Wage	-	-.381***	-.384***
		(-3.60)	(-3.63)
Desired Fertility	-	-	-.198***
			(-3.69)
Country Dummies	Yes	Yes	Yes
Cohort Dummies	Yes	Yes	Yes
N	1763	1763	1763
Pseudo R-squared	0.1804	0.1979	0.2051

Probit estimations; Significance levels: * 10% ; ** 5% ; ***1%

Thus, consistent with the model, we find that within a country households with more egalitarian views toward gender roles have lower levels of fertility, higher husband's home time, and higher female labor force participation than those with less egalitarian views. In section VII, we further explore the existence of a social externality, which can reconcile this negative micro relation between egalitarian housework attitudes and fertility with the positive cross-country relation between these variables.

[19] The mean value of *egalitarian* is 0.81, which corresponds to the 48th percentile. A one unit change 0.81+1=1.81 corresponds to the 68th percentile.

V.II Empirical Analysis (II): Social externalities and the cross-country positive correlation between fertility and female labor force participation

The existence of a social externality allows us to explain the opposite sign of the correlation observed at the micro and macro level between fertility and female labor force participation. We replace the country dummies in the above micro analysis with country aggregate mean values of attitudes toward the gender division of labor, female education,[20] and men's earnings, thus effectively parceling out the composition of the country fixed effects. The reduced form equations are thus

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

where $y_{i,\gamma}$ is either the number of children, the division of housework, or whether or not the wife participates in the labor force for household *i* in country γ. Age cohort dummies, represented by η_{cohort}, are also included. The sample is identical to the previous regressions. We also run a second set of regressions, which includes the same micro variables but instruments the country average share of housework performed by men with the country mean values of the micro variables. Instrumenting is necessary since the country average share of housework is correlated with the error term in light of our model[21].

The key result, shown in Tables 5.4 and 5.5 below, follows from the fertility and female labor force participation regressions. Table 5.4 shows that while the positive coefficient on the aggregate effect of our attitudinal measure is positive, the coefficient on the individual attitudes has the opposite sign. Thus, while individual egalitarian attitudes tend to lower fertility, countries with egalitarian attitudes toward the gender division of housework labor tend to have higher fertility, which supports the notion of externality effects. In particular, the coefficient of 0.358 on the country average gender attitudinal index suggests, for example, that a county such as Norway

[20] Recall that we included a dummy variable to keep Canada and Germany in the earlier regressions because individual educational attainment was not available for those countries. Since adding a second dummy to get an unbiased estimate also for *average* years of education that includes Canada and Germany will be perfectly collinear with the first dummy, we calculated average *levels* of education instead, which were available for Canada and Germany.

[21] To see this, note that we can linearize the men's share of housework in household *i* and write it as:

$s_{m,i} = \alpha \bar{s}_m + \beta w_{f,i} + \gamma w_{m,i} + \delta L_i + \varepsilon_i$ Solving for the average share:

$$\bar{s}_{m,\gamma} = \frac{1}{1-\alpha}\left[\beta \bar{w}_f + \gamma \bar{w}_m + \delta \bar{L} + \bar{\varepsilon}\right] \text{ Then } E[\bar{s}_m' \varepsilon_i] = \frac{1}{1-\alpha} E\left[(\beta \bar{w}_f + \gamma \bar{w}_m + \delta \bar{L} + \bar{\varepsilon})' \varepsilon_i\right]$$

$$= \frac{1}{1-\alpha} E[0 + \bar{\varepsilon}' \varepsilon_i] = \frac{1}{1-\alpha} \frac{1}{N} \sum_K E[\varepsilon_K \varepsilon_i] \neq 0 \text{ for k=i}$$

whose average value on this index is 1.265 points higher than that of Italy, enjoys a externality effect that raises family size by 0.45 children compared to Italy. A simple comparison of these two coefficients indicates that the size of the externality effect, whose coefficient is 0.358, dominates that of the coefficient of the individual effect, -0.075.

We argue that it is not the average attitudes as such, but their effect on the average share of housework by men, which creates the social externality that matters for household fertility decisions. This notion is supported by the similarly significant and positive coefficient sign on the countries' average share of housework by men in the second set of regressions in the same table. As the average share of housework by husbands rises in a country, something that can be triggered by, for example, a shift toward more egalitarian attitudes or a general rise in female education, then fertility will rise. For example, the difference between Norway and Italy in the index of *Country Mean Share of Housework by Husbands* is 1.016, which corresponds to a externality increase in fertility of 0.271.

TABLE 5.4 FERTILITY (INDIVIDUAL AND SOCIAL EFFECTS)

Variables	**4a**	**4b**	**4c**	**5a**	**5b**	**5c**
	Number of Children					
Egalitarian	-.076***	-.076***	-.075***	-.076***	-.075***	-.076***
	(-4.73)	(-4.74)	(-4.74)	(-4.77)	(-4.62)	(-4.75)
Female Years of Education	-.030**	-.028**	-.032**	-.032**	-.031**	-.032**
	(-2.56)	(-2.52)	(-3.12)	(-2.48)	(-2.41)	(-2.42)
Log of Male Wage	.160**	.166**	.150**	.164**	.163**	.164**
	(2.61)	(2.58)	(2.24)	(2.55)	(2.55)	(2.57)
Country Mean 'Share' of House- Work by Husbands*				.261*	.247*	.266*
				(2.02)	(1.81)	(1.90)
Country Mean Egalitarian	.169**	.219*	.358***			
	(2.54)	(2.2)	(3.19)	IV	IV	IV
Country Mean Level of Female Education		-0.074	-.206**			
		(-0.90)	(-2.70)		IV	IV
Country Mean Level of Male (log) Income			.629*			
			(1.99)			IV
	Reduced Form Regressions			Instrumented Regressions		
No. of Countries	11	11	11	11	11	11
Cohort Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1763	1763	1763	1763	1763	1763
R-squared	0.0777	0.0786	0.0817	0.0713	0.0718	0.0711

Robust standard errors clustered on a country indicator variable;

T-statistics in parentheses; Significance levels: * 10% ; ** 5% ; ***1%.

The regression results for the husband's share of housework are presented in the appendix[22]. Table 5.5 shows the results for female labor force participation. In line with our theoretical model, individual and country attitudes have a positive effect on the probability of participation in the labor market, meaning that women in households with more egalitarian attitudes toward gender roles have a higher probability of participating in the labor force. By the same token, women living in countries where men do a lot of housework have a higher probability of participation. Again, the externality effect contributes to a difference of 16.1 percentage points in female labor force participation between Norway and Italy.

TABLE 5.5 LABOR FORCE PARTICIPATION (INDIVIDUAL AND SOCIAL EFFECTS)

Variables	**4a**	**4b**	**4c**	**5a**	**5b**	**5c**
	Wife's Labor Force Participation					
Egalitarian	0.281***	0.282***	0.281***	0.08***	. 081***	0.081***
	(18.01)	(18.58)	(18.69)	(15.36)	(15. 01)	(15.54)
Female Years of Education	0.017	0.019	0.02	0.001	0.001	0.072
	(0.90)	(1.08)	(1.12)	(0.29)	(0.35)	(0.37)
Log of Male Wage	-0.397***	-0.385***	-0.382***	-0.095***	-0.096***	-0.097***
	(-3.71)	(-3.61)	(-3.61)	(-3.64)	(-3.78)	(-3.80)
Country Mean 'Share' of House- Work by Husbands				0.182***	0.163***	0.158***
				(3.61)	(3.64)	(3.90)
Country Mean Egalitarian	. 427***	0.505***	. 482***			
	(5.23)	(4.49)	(5.27)	IV	IV	IV
Country Mean Level of Female Education		-0.113	-0.091			
		(-1.26)	(-1.09)		IV	IV
Country Mean Level of Male (log) Income			-0.11			
			(-0.42)			IV
	Reduced Form Regressions [1]			Instrumented Regressions[2]		
No. of Countries	11	11	11	11	11	11
Cohort Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1763	1763	1763	1763	1763	1763
R-squared	0.1884	0.1894	0.1894	0.1923	0.1943	0.1949

1] Probit estimations; [2] Linear probability

Robust standard errors clustered on a country indicator variable. T-statistics in parentheses

T-statistics in parentheses; Significance levels: * 10% ; ** 5% ; ***1%.

[22] The results are robust to a specification that includes desired fertility.

VI Intertemporal Change in the Sign of the Correlation

We illustrated at the beginning of this paper that Mediterranean countries went from very high levels of fertility in the 1970s to extremely low levels in the 1990s, while in Northern countries fertility levels in the 1970s were lower than in the South but did not decrease nearly as sharply. This sharp decline in fertility in Mediterranean countries was the major factor in the change in sign of the cross-country relationship between fertility and female labor force participation. To explain this phenomenon in the context of our model, we explore the effects below of changes over time in the two reduced form exogenous variables of our model, gender attitudes toward housework and (relative) female wages. We find that while differential change across countries in gender attitudes could have given rise to the change in correlation, there is little empirical evidence to support this. Instead, the reversal was accompanied by a steady decline in the female wage gap across all countries, which as we will show below can have given rise to the reversal in the context of our model.

The first explanation consistent with our model would entail a differential change across countries since the 1970s in household attitudes toward housework. If the group of northern European countries currently experiencing relatively high fertility levels had developed increasingly egalitarian attitudes toward the division of housework, while southern European countries had not, then differences in attitudes across these two groups of countries would have become increasingly important in explaining cross-country variation in fertility levels. In particular, the model predicts that country attitudes toward gender roles affect both man's and woman's housework. On the one hand, households in egalitarian countries derive a greater disutility from any given time the woman spends in housework. This lowers woman's housework (and fertility) in these countries. We denoted this effect as the "household attitude effect". On the other hand, men in egalitarian countries face a lower disutility from doing housework, which increases man's housework (and fertility) in these countries. We denoted this effect the "social externality effect". We concluded that depending on which effect dominates fertility could be higher or lower in egalitarian relative to non-egalitarian countries.

Since the empirical results indicate that the social externality effect dominated the household attitude effect in 1995, such a differential change in attitudes could have boosted fertility in the north relative to the south. However, we do not find evidence that attitudes have differentially changed over time. Using the ISSP survey of 1985, a previous data set that asked some of the same attitudinal questions as in the 1994 ISSP survey to individuals in seven countries, we show

in table 7.1 (in appendix 7) that attitudes toward gender roles have become more egalitarian in all countries, but the ranking of countries has not changed substantially over time.

A second, more plausible explanation that is also consistent with our model points to the steady decline in the female wage gap since the 1970s. Information on the female wage gap comes from Engelhardt and Prskawetz (2002) who draw from an extensive collection of sources to analyze among other things trends in education and wage levels for a group of 21 OECD countries between 1960 and 1999.[23]

Their analysis shows an increasing trend in the average number of years of schooling for females as well as female gross enrollment rates in all three groups of female labor force participation countries (i.e. low, medium, and high FLF) since 1970. The female wage gap follows a similar pattern, with female wages in low FLF countries being about 67 % of those of males in 1970 and rising to just over 75 % in 1995, and rising slightly faster from 68 % to almost 80 % over the same period in high FLF countries. In our model, such an overall rise in female relative wages can have led to a much sharper decline in fertility (while not experiencing a much sharper rise in FLF) in countries with non-egalitarian attitudes.

The argument above can be formalized using our more general model in Section III. For exposition purposes, we assume there to be only one representative household in each country[24], which simply implies that the wages and egalitarian attitudes of this household equal those of the

[23] In each of four 10-year time periods (1960-1969, 1970-1979, 1980-1989, 1990-1999) they classify countries into one of three groups, based on whether a country *in that particular time period* is experiencing relatively low, medium, or high female labor force participation. Thus, with four time periods and three female labor force participation groups, they have a total of twelve "time-FLF" groups and proceed to calculate, for example, the average female years of education for each of these twelve groups. Since the group of countries that constitutes the low FLF group in the 1990s may not be the same as the group of low FLF countries in the 1970s and 1980s, this method obscures inter-temporal movement across FLF groups, and could make it difficult to infer wage trends in low 1990 FLF countries relative to high 1990 FLF countries, which is the goal of our investigation. Fortunately for our purposes, there was little mobility across the three groups. For example, all four Scandinavian countries (Denmark, Finland, Norway, and Spain) experiencing relatively high FLF (and high fertility) in the 1990s were also in the group of high FLF in the 1970s and 1980s. Similarly, Mediterranean countries (Greece, Italy, and Spain) experiencing low FLF (and low fertility) in the 1990s were also in the group of low FLF in the 1970s and 1980s.

[24] Alternatively, we could assume that any household's attitudes toward gender roles depends on the country mean and some deviation; In this way, fertility for household i in country γ can be expressed 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 σ=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 $\sum_i \varepsilon_i = 0$

country as a whole. Further, we assume that the only difference between countries is that the household in the North is more egalitarian than the household in the South, i.e. $L_N > L_S$. Recall that in the general set up, after substituting in for the budget constraints, the household maximization problem reduces to:

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

To see the effect of a change in attitudes or wages, we have to take into account not only their direct effect, which takes $\bar{s}_m$ as given, but also their indirect effect, which recognizes that a change in the household share of the representative household also implies a change in $\bar{s}_m$ and thus induces a further change in the household share and fertility:
$t_m/(t_m + t_w) = \bar{t}_m/(\bar{t}_m + \bar{t}_w) = \bar{s}_m = h(L, w_w, w_m, \bar{s}_m(L, w_w, w_m))$. Thus,

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

The derivative of $\bar{s}_m = h(L, w_w, w_m, \bar{s}_m(L, w_w, w_m)$ with respect to an increase in egalitarian attitudes in the representative household is:

$$\frac{\partial \bar{s}_m}{\partial L} = \frac{\partial h/\partial L}{1 - \partial h/\partial \bar{s}_m} > 0$$

This must be positive since the numerator, the direct effect was previously shown to be greater than 0 and $\partial h/\partial \bar{s}_m < 1$, which must hold for an equilibrium value for $\bar{s}_m$ to exist. Further, since $f_{\bar{s}_m} < 0$, we know that $\partial\theta/\partial L < 0$. A similar exercise can be done to show that $\partial\theta/\partial w_w < 0$.
Substituting $f(\bar{s}_m) = \theta(L, w_w, w_m)$ in the objective function, the maximization problem becomes:

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

Comparative Statics

Proposition 1[25]: An increase in country average egalitarian attitudes may lower fertility at low levels of the country average share of housework performed by men, but may increase fertility if this share is high:

[25] Details are in appendix 7. Results hold under the simplifying assumption that $V_i''' = 0$ so that $\partial^2 V_i/\partial t_i^2 = k$, and $U''' = 0$.

$$\frac{dn}{dL} >< 0$$

The intuition for this result is simple. Suppose for example that female wages are low causing few men to engage in household activities even in egalitarian countries. This reduces the positive social externality effect in explaining cross-country variation in fertility levels, but it leaves unaffected the negative direct effect on fertility of household egalitarian attitudes. In this 1970s scenario, the individual household effect exceeds the social externality effect, and egalitarian countries experience lower levels of fertility than non-egalitarian countries. When female wages are higher, as was the case in the 1990s, a more equal division of housework becomes efficient from the household point of view, thereby elevating the size of the social externality and raising its importance in explaining cross-country variation in fertility levels. The positive social externality effect now exceeds the negative individual effect, and egalitarian countries experience higher fertility levels.

Corollary 1: Following an increase in female wages, fertility will decline at a higher rate in non-egalitarian countries:

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

This sharper decline in fertility in non-egalitarian countries is consistent with the argument in proposition 1. If fertility in non-egalitarian countries exceeds that of egalitarian countries when female wages (and thus $\bar{s}_m$) are low, but fertility is lower than that of egalitarian countries when female wages (and thus $\bar{s}_m$) are high, then fertility must have dropped faster in non-egalitarian countries following the rise in female wages.

In sum, the model is consistent with the empirical observation that a secular rise in female wages has led to a sharp decline in fertility in non-egalitarian countries.

VII Conclusion

This research was motivated by the current cross-country positive correlation between fertility and female labor force participation and the inability of existing theories of fertility and labor force participation to adequately explain it. In particular, existing theories fail to explain the lowest-low fertility levels coupled with low female labor force participation in Mediterranean countries. Our explanation was motivated by the existence of persistent differences between low and high fertility countries with respect to attitudes toward the gender division of housework. Our framework attempts to explain the fact that, contrary to conventional wisdom, countries with less egalitarian gender roles can have smaller family size and lower female labor force participation rates.

Building on a growing literature addressing social externalities, our model of efficient household decision-making is consistent with both the macro and micro evidence. We have focused on one potential channel in particular through which social norms on gender roles can shape individual behavior and generate the demographic processes previously described: the disutility that individual husbands derive from performing housework tasks, which decreases as more men in the country take up such tasks. Since such positive externality effects are greatest in egalitarian countries in which men take up housework, fertility and female labor force participation are higher in such countries. Our empirical analysis provides support for the existence of these externality effects, and is also consistent with the hypothesis that the channel of externalities is in the aggregate share of housework performed by men.

In line with our model, we also find empirical support for the notion that the rise in female education levels since the 1970s has diminished the importance of household attitudes toward the gender division of housework while increasing the importance of externality effects in explaining cross-country variation in fertility levels. This finding is sufficient to explain the unusually large drop in fertility in countries without egalitarian attitudes (coupled with the non-increase in female labor force participation), thus explaining the reversal in the sign of the correlation between fertility and female labor force participation. Further research is still needed, however. A pseudo-panel of household time use data covering households in various countries could be used, for instance, to directly assess the intertemporal effects of the social externality on household's fertility and female labor force participation choices.

Finally, understanding the interplay between social norms and household choices over time is relevant from a policy perspective. The current pension system in most OECD countries is based on the current generation of workers financing the pension benefits of the previous working generation. Below replacement fertility levels and very low female labor force participation levels endanger the pension system by decreasing the number of workers who contribute to it. Furthermore, policies related to fertility and female labor force participation have usually been characterized by the relative lack of economic rationale for intervention in family time allocation decisions. In the light of our model, the presence of externalities provides strong efficiency grounds on which to build more comprehensive family policies.

Bibliography

Ahn, N. and P. Mira, "A Note on the Changing Relationship Between Fertility and Female Employment Rates in Developed Countries," Papers 9903, Centro de Estudios Monetarios Y Financieros 1999.

Akerlof, G., and R. Kranton (2000), "Economics and Identity", Quarterly Journal of Economics, Vol. 115, Issue 3: 715-753.

Becker, G. (1965), "A Theory of the Allocation of Time", Economics Journal 75: 493-517.

Bergstrom, T., (**1997**) "A Survey of Theories of the Family," Handbook of Population Economics, ed. Mark Rosenzweig and Oded Stark. New York: North Holland, 21-74.

Bettio, F. and P. Villa (1998), "A Mediterranean Perspective on the Breakdown of the Relationship between Participation and Fertility", Cambridge Journal of Economics 22, 2: 137-71

Bongaarts, J. and G. Feeny (1998), " On the Quantum and Tempo of Fertility", Population and Development Review, Vol. 24, No. 2. 271-291.

Carrasco, C. and A. Rodriguez (2000), "Women, Families, and Work in Spain: Structural Changes and New Demands," Feminist Economics, Vol. 6 Issue 1.

Council of Europe, *Recent Demographic Developments in Europe*, Council of Europe Press 2000.

Delgado-Perez, M. and M. Livi-Bacci (1992) "Fertility in Italy and Spain: the lowest in the world", Family Planning Perspectives, Vol. 24 No.4, 162-171.

Del Boca, D., (2002), "The Effect of Childcare and Part Time Opportunities on Participation and Fertility Decisions in Italy", Discussion Paper No. 427, IZA.

Di Tommaso, M.L., (1999), "A Trivariate Model of Participation, Fertility and Wages: The Italian Case", Cambridge Journal of Economics, 23, 5: 623-40.

Engelhardt, H., and A. Prskawetz, (2002), "On the Changing Correlation Between Fertility and Female Employment over Space and Time," MPIDR Working Paper WP-2002-052.

Goldscheider, F., and G. Kaufman (1996), "Fertility and Commitment: Bringing Men Back In", Population and Development Review, 22: 87-99

Heston, A., R. Summers, and B. Aten, "Penn World Table Version 6.1", Center for International Comparisons at the University of Pennsylvania (CICUP), October 2002.

Koegler, 2001"Did the Association between Fertility and Female Employment in OECD Countries Really Change its sign? No," MPIDR Working Paper 034, 2001.

Kohler, H. (2000), "Fertility Decline as a Coordination Problem," Journal of Development Economics, Vol. 63: 231-263.

(2002), “The Emergence of Lowest Low Fertility in Europe during the 1990’s”, Population and Development Review 28(4): 641-680

Lundberg, S. and R.A. Pollak, (2001), “Efficiency in Marriage,”NBER Working Paper 8642.

McElroy, M. and M.J. Horney (1981), “Nash-Bargained Household Decisions: Toward a Generalization of the Theory of Demand”, International Economics Review, Vol. 22, Issue 2 pp. 333-349.

Meulders D., Plasman O. and R. Plasman (1994), "Atypical Employment in Europe", Dartmouth, Ashbury.Mincer, J.(1985), “Intercountry Comparisons of Labor Force Trends and of Related Developments: An Overview”, Journal of Labor Economics, v.3, Issue 1:1-32.

Munshi, K., and J. Myaux (2002), “Development as a Process of Social Change: An Application to the Fertility Transtion”, Working Paper.

O’Connell, M. (1993), “Where’s papa! Fathers role in child care”, Population trends and Public Policy, no. 20 Washington D.C.: Population Reference Bureau.

OECD Labour Force Statistics, volumes from 1965 through 1997

Rindfuss, R. and K. Brewster (1996), “Childrearing and Fertility”, Population and Development Review 22: 258-289.

(2000), “Fertility and Women’s Employment in Industrialized Nations”, Annual Review of Sociology 26: 271-296.

Rubery et al. (1994), *Changing Patterns from Work and Working Time in the European Union and the Impact on Gender Divisions,* European Network of Experts on the Situation of Women in the Labor Market, Report for the Equal Opportunities Unit, DGV, Brussels, European Comission.

United Nations, *UN Human Development Report 1995*, http://hdr.undp.org/reports/global/1995/en/

Willis, R.J. (1973), “A New Approach to the Economic Theory of Fertility Behavior”, The Journal of

Political Economy, Vol. 81, No. 2, Part 2: New Economic Approaches to Fertility, pp. S14-S64.

World Bank, *Personal Income Tax*, www1.worldbank.org/publicsector/tax/personalincometaxes.html

Appendix 1:

Table 1. Total Fertility Rates and Female Labor Force Participation

Country	1965		1970		1975		1980		1985		1990		1996	
	FLF	TFR	FLF	TFR	FLF	TFR	FLF	TFR	FLF	TFR	FLF	TFR	FLF	TFR
Canada	39	3.1	43	2.3	50	1.8	57	1.9	63	1.8	68	1.7	65	1.7
United States	44	2.9	49	2.5	53	1.8	60	1.8	64	1.8	68	2	71	2.1
Australia	40	3	45	2.9	49	2.2	53	2.1	54	1.9	62	1.8	65	1.8
Japan	56	2.1	55	2.1	52	1.9	55	1.8	57	1.7	60	1.6	62	1.4
Austria	—	2.7	49	2.3	48	1.8	49	1.6	51	1.7	55	1.4	62	1.4
Belgium	38	2.6	40	2.3	44	1.7	48	1.7	51	1.6	52	1.6	56	1.5
Denmark	49	2.5	58	2	64	1.9	70	1.7	75	1.4	78	1.8	74	1.8
Finland	63	2.4	63	1.8	66	1.7	70	1.7	74	1.6	73	1.6	71	1.8
France	—	2.8	48	2.5	51	1.9	54	1.9	55	1.9	57	1.8	60	1.7
Germany												1.3	61	1.4
East	—	2.5	—	2.2	—	1.5	—	1.8	—	1.7	—	1.7		—
West	49	2.5	48	2	50	1.5	50	1.4	50	1.3	56	1.4	—	—
Greece	—	2.2	32	2.4	31	2.4	33	2.3	42	2.1	44	1.5	46	1.3
Iceland	—	3.7	45	2.8	45	2.6	—	2.3	—	2.2	—	2.3	80	2.2
Ireland	35	4	34	3.9	35	3.4	36	3.4	37	3	39	2.2	49	1.9
Italy	35	2.5	30	2.4	31	2.2	40	1.9	41	1.6	45	1.3	43	1.2
Luxembourg	—	2.3	34	2	38	1.6	40	1.5	43	1.6	47	1.4	58	1.8
Netherlands	—	3	30	2.6	32	1.7	35	1.6	41	1.5	53	1.5	58	1.5
Norway	37	2.9	39	2.5	53	2	63	1.8	68	1.7	71	1.8	66	1.9
Spain	—	2.9	29	2.9	32	2.8	32	2.6	34	2	41	1.5	46	1.2
Sweden	54	2.4	59	1.9	68	1.8	74	1.7	78	1.6	81	2	74	1.6
Switzerland	52	2.6	51	2.1	52	1.6	54	1.5	53	1.6	59	1.6	67	1.5
United Kingdom	49	2.7	50.5	2.4	55.3	1.8	58.3	1.7	60.1	1.8	65.1	1.8	66.4	1.8

Source: Rindfuss and Brewster (1996)

Appendix 2

Figure 2: Fertility estimates[26] [27]

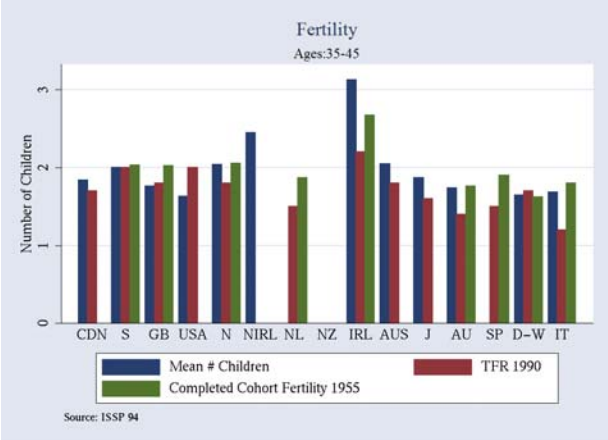


TABLE 4.1 COHORT COMPLETED FERTILITY

Country/Cohort	1930	1935	1940	1945	1950	1955	1960
Austria	2.32	2.45	2.12	1.96	1.87	1.76	1.69
Belgium	2.28	2.27	2.16	1.93	1.83	1.83	1.84
France	2.63	2.57	2.41	2.22	2.11	2.13	2.1
Germany	2.18	2.16	1.97	1.8	1.72	1.67	1.65
- FRG bef.unif.	2.14	2.17	1.97	1.78	1.69	1.62	1.59
Greece	...	...	...	...	2.04	2	1.93
Ireland	...	...	...	...	3.04	2.67	2.41
Italy	2.28	2.28	2.14	2.07	1.89	1.8	1.65
Luxembourg	...	...	...	1.82	1.73	1.69	1.75
Netherlands	2.67	2.49	2.22	2	1.89	1.87	1.85
Norway	2.48	2.57	2.45	2.21	2.09	2.05	2.09
Portugal	2.94	2.88	2.66	2.42	2.08	2.04	1.9
Spain	...	...	...	2.43	2.1	1.9	1.75
Sweden	2.12	2.14	2.05	1.98	2	2.03	2.04
U.K. (England an	...	...	...	...	...	2.02	1.96
Mean	2.40	2.40	2.22	2.05	2.01	1.94	1.88
Std	0.27	0.24	0.23	0.22	0.33	0.26	0.22

[26] Female sample. **Correlation**
Our Fertility Estimates – *Council of Europe* Cohort 1955 Fertility (7 countries) Estimates: 0.9619
Our Fertility Estimates – *Council of Europe* TFR 1990 (11 countries) Estimates: 0.6501
[27] Recent Demographic Development in Europe 2000, Council of Europe

Appendix 3: Transferable Utility

In order to show that the household optimization problem exhibits transferable utility, we need to show 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 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:

$$\max_{t_m,t_w,x_m,x_w,\tau} U(n) - (1-\bar{s}_\gamma)V_m(t_m) - L_m V_w(t_w) + x_m$$

$$subject\ to:$$

$$n = t_m + t_w$$

$$x_m = (1-t_m)w_m - \tau$$

$$x_w = (1-t_w)w_w + \tau$$

$$U(n) - L_w V_w(t_w) + x_w \geq \bar{U}$$

the lagrangian function is given by:

$$L(t_m,t_w,x_m,x_w,\tau) =$$

$$= U(t_m+t_w) - (1-\bar{s}_\gamma)V_m(t_m) - L_m V_w(t_w) + x_m + \mu[\bar{U} - U(t_m+t_w) + L_w V_w(t_w) - x_w] +$$
$$+ \lambda_m\left((T-t_m)w_m - \tau - x_m\right) + \lambda_w\left((T-t_w)w_w + \tau - x_w\right)$$

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

$$t_m : \frac{\partial U}{\partial n}(1-\mu) = (1-\bar{s}_\gamma)V'_m(t_m) + \lambda_m w_m$$

$$t_w : \frac{\partial U}{\partial n}(1-\mu) = L_m V'_w(t_w) - \mu L_w V_w'(t_w) + \lambda_w w_w$$

$$x_m : 1 = \lambda_m$$

$$x_w : \mu = -\lambda_w$$

$$\tau : \lambda_m = \lambda_w$$

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

$$t_m : \frac{\partial U}{\partial n} = (1 - \bar{s}_\gamma) * V'_m (t_m) + w_m$$
$$t_f : \frac{\partial U}{\partial n} = (L_m + L_w) * V'_w (t_w) + w_w$$

These are the same FOC of that the unitary household would solve for t_m, t_w and therefore n. <*Q.E.D*>

The above proof also shows that the efficient amount of public goods produced, in this case children, is independent of the division of private consumption between spouses. The difference between the principal-agent problem and the unitary household problem arises from the division of private consumption. While in the former the division of private good is well-defined given the fact that the husband owns all the resources, in the latter it is not. The bargaining consideration on the division of private consumption are however irrelevant for the main implications of our model, i.e. the allocation of time.

Appendix 4: 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 family specific parameter that denotes the degree to which the husband (or family) cares about the wife's disutility from performing housework. Thus an increase in L suggests that husbands favor a more equitable distribution of housework tasks. Further, let $\bar{s}_m = \frac{\bar{t}_m}{\bar{t}_m + \bar{t}_w}$ be the average proportion (share) of housework contributions in the population of men (husbands), where $\bar{t}_i$ represents average share or housework

Given transferable utility, the problem simplifies to:

$$\max_{t_h, t_w} U(t_m + t_w) - (1 - s_m)V_m(t_m) - (1 + L)V_w(t_w) + (1 - t_m)w_m + (1 - t_w)w_w$$

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

$$|H| =$$

$$-\frac{d^2U(n)}{dn^2}\left[(1-\bar{s})\frac{d^2V_m(t_m)}{dt_m^{\,2}} + (1+L)\frac{d^2V_w(t_w)}{dt_w^{\,2}}\right] + (1-\bar{s})\frac{d^2V_m(t_m)}{dt_m^{\,2}}\frac{d^2V_w(t_w)}{dt_w^{\,2}}(1+L) > 0$$

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

Below, the numerators of the comparative statics are given and the sign of these expressions equals the sign of the overall effects.

The comparative statics with respect to the individual "egalitarian attitude" are:

1. $$\frac{dn}{dL} = -\frac{dV_w(t_w)}{dt_w} f_m(\bar{s}_m) \frac{dV^2{}_m(t_m)}{dt^2{}_m} < 0$$

As families become more egalitarian, their family size will go down.

2. $$\frac{dt_m}{dL} = -\frac{dV_w(t_w)}{dt_w}\frac{d^2U}{dn^2} > 0$$

As families become more egalitarian, husbands will provide more housework.

3. $$\frac{dt_w}{dL} = [\frac{d^2U}{dn^2} - \frac{d^2V_m(t_m)}{dt^2{}_m} f_m(\bar{s})]\frac{dV_w}{dt_w} < 0$$

As families become more egalitarian, wives will provide less housework.

The numerators of the comparative statics with respect to the social externality effect is.

4. $$\frac{dn}{d\,\bar{s}_m} = \left[\frac{d^2V_w(t_w)}{dt^2{}_w}(1+L)\right]\frac{dV_m(t_m)}{dt_m} > 0$$

This means that as a greater average share of housework is done by men in a particular county, the family size is increased.

5. $$\frac{dt_m}{d\,\bar{s}_m} = -\frac{d^2U(n)}{dn^2}\left[\frac{d^2V_w(t_w)}{dt^2{}_w}(1+L)\right]\frac{dV_m(t_m)}{dt_m} > 0$$

The numerator of comparative static 5 indicates that an increase in the average share of housework performed by men, will always lead to a higher share of housework performed by individual men (therefore further increasing the average share).

6. $$\frac{dt_w}{d\,\bar{s}_m} = \frac{d^2U(n)}{dn^2}\frac{dV_m(t_m)}{dt_m} < 0$$

The numerator of comparative static 6 indicates that an increase in the average share of housework performed by men, will always lead to a smaller share of housework performed by individual women. This decrease in women's share of housework is not compensated by the increase in the share of the individual men's, which in turns reduces family size as seen in 4.

The numerators for the comparative statics with respect to the female wage are

7. $$\frac{dn}{dw_w} = -f_m(\bar{s}_m)\frac{d^2V_m(t_m)}{dt_m{}^2} < 0$$

The numerator of the comparative static above indicates that an increase in the female wage will lower the number of children. An increase in the male wage will similarly lower fertility, an unambiguous result which follows from the quasilinearity of the utility function, which bestows all income effects on total consumption of the private good.

8. $$\frac{dt_m}{dw_w} = -\frac{d^2U(n)}{dn^2} > 0$$

The numerator of the comparative static above indicates that an increase in the female wage leads to an increase in the husband's contribution to housework. As the result above, indicates however, this increase is insufficient to compensate for the decrease in the wife's contribution (below) and prevent fertility from falling.

9. $$\frac{dt_w}{dw_w} = \frac{d^2U(n)}{dn^2} - f_m(\bar{s}_m)\frac{d^2V_m(t_m)}{dt^2{}_m} < 0$$

This comparative statics simply ratifies that, in the absence of income effects, an increase in women's wage will reduce the time she spends at home.

Appendix 5: Comparative Statics of a More General Utility Specification

Comparative statics for the more general specification where the country average share of husband's housework, s_m, and the egalitarian attitudes toward housework, L, affect both the disutility associated with the husband's and the wife's home time. Previously we had that $f_s < 0$ (i.e. an increase in the country average housework by men lowers individual men's disutility of housework), and $g_L > 0$ (i.e. more egalitarian households place greater disutility on the wife spending home time).

The utility specification after simplifying thus becomes:

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

The comparative statics are derived below. The denominator of each of these comparative statics is given below and is positive:

$$-\left[g(s_m, L) * \frac{\partial^2 V_w}{\partial t_w^{\,2}} + f(s_m, L) * \frac{\partial^2 V_m}{\partial t_m^{\,2}} \right] * \frac{\partial^2 U}{\partial n^2} + f(s_m, L) * \frac{\partial^2 V_m}{\partial t_m^{\,2}} * g(s_m, L) * \frac{\partial^2 V_w}{\partial t_w^{\,2}} \quad (+)$$

Hence, the sign of the comparative statics equals the sign of the numerator, which is displayed below. Recall that $\frac{\partial V_i}{\partial t_i} > 0$, $\frac{\partial^2 V_i}{\partial t_i^{\,2}} > 0$, $\frac{\partial^2 U}{\partial n^2} < 0$, $\frac{\partial g(s_m, L)}{\partial L} > 0$, and $\frac{\partial f(s_m, L)}{\partial s_m} < 0$. Intuitively, one might also expect $\frac{\partial g(s_m, L)}{\partial s_m} > 0$, which would imply that the disutility of women's home time increases as the country average husbands' (wives') home time increases (decreases), and $\frac{\partial f(s_m, L)}{\partial L} < 0$, which would imply that in more egalitarian households, the husband's disutility is lower for a given level of time spent by him on housework tasks.

I. The effect of an increase in the household level of *egalitarian*.

1a.

$$\frac{dt_m}{dL} \Rightarrow -\left[\overbrace{\left[\frac{\partial g(s_m,L)}{\partial L} * \frac{\partial V_w}{\partial t_w} - \frac{\partial f(s_m,L)}{\partial L} * \frac{\partial V_m}{\partial t_m} \right] * \frac{\partial^2 U}{\partial n^2}}^{(-)} + \overbrace{g(s_m,L) * \frac{\partial^2 V_w}{\partial t_w{}^2} * \frac{\partial f(s_m,L)}{\partial L} * \frac{\partial V_m}{\partial t_m}}^{(-)} \right] > 0$$

1b.

$$\frac{dt_w}{dL} \Rightarrow -\left[\overbrace{-\left[\frac{\partial g(s_m,L)}{\partial L} * \frac{\partial V_w}{\partial t_w} - \frac{\partial f(s_m,L)}{\partial L} * \frac{\partial V_m}{\partial t_m} \right] * \frac{\partial^2 U}{\partial n^2}}^{(+)} + \overbrace{f(s_m,L) * \frac{\partial^2 V_m}{\partial t_m{}^2} * \frac{\partial g(s_m,L)}{\partial L} * \frac{\partial V_w}{\partial t_w}}^{(+)} \right] < 0$$

1c.

$$\frac{dn}{dL} \Rightarrow -\left[\overbrace{g(s_m,L) * \frac{\partial^2 V_w}{\partial t_w{}^2} * \frac{\partial f(s_m,L)}{\partial L} * \frac{\partial V_m}{\partial t_m}}^{(-)} + \overbrace{f(s_m,L) * \frac{\partial^2 V_m}{\partial t_m{}^2} * \frac{\partial g(s_m,L)}{\partial L} * \frac{\partial V_w}{\partial t_w}}^{(+)} \right] <> 0$$

Unlike the simplified specification, more egalitarian families in this set-up no longer always have smaller family sizes. This will only be the case if increasing the extent to which the household is egalitarian has a relatively greater impact on increasing the disutility associated with the wife's housework than on decreasing the disutility the husband derives when he engages in housework. In other words, we have to make the additional assumption that over the relevant range $\frac{\partial f(s_m,L)}{\partial L}$ is small relative to $\frac{\partial g(s_m,L)}{\partial L}$.

II. The effect of an increase in the husbands' country average share of housework.

2a.

$$\frac{dt_m}{ds_m} \Rightarrow -\left[\overbrace{\left[\frac{\partial g(s_m,L)}{\partial s_m} * \frac{\partial V_w}{\partial t_w} - \frac{\partial f(s_m,L)}{\partial s_m} * \frac{\partial V_m}{\partial t_m} \right] * \frac{\partial^2 U}{\partial n^2}}^{(-)} + \overbrace{g(s_m,L) * \frac{\partial^2 V_w}{\partial t_w{}^2} * \frac{\partial f(s_m,L)}{\partial s_m} * \frac{\partial V_m}{\partial t_m}}^{(-)} \right] > 0$$

2b.

$$\frac{dt_w}{ds_m} \Rightarrow -\left[\overbrace{-\left[\frac{\partial g(s_m,L)}{\partial s_m} * \frac{\partial V_w}{\partial t_w} - \frac{\partial f(s_m,L)}{\partial s_m} * \frac{\partial V_m}{\partial t_m} \right] * \frac{\partial^2 U}{\partial n^2}}^{(+)} + \overbrace{f(s_m,L) * \frac{\partial^2 V_m}{\partial t_m{}^2} * \frac{\partial g(s_m,L)}{\partial s_m} * \frac{\partial V_w}{\partial t_w}}^{(+)} \right] > 0$$

2c.

$$\frac{dn}{ds_m} \Rightarrow -\left[\overbrace{g(s_m,L) * \frac{\partial^2 V_w}{\partial t_w{}^2} * \frac{\partial f(s_m,L)}{\partial s_m} * \frac{\partial V_m}{\partial t_m}}^{(-)} + \overbrace{f(s_m,L) * \frac{\partial^2 V_m}{\partial t_m{}^2} * \frac{\partial g(s_m,L)}{\partial s_m} * \frac{\partial V_w}{\partial t_w}}^{(+)} \right] <> 0$$

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

III. The effect of an increase in the female wage.

3a.

$$\frac{dt_m}{dw_w} \Rightarrow -\overbrace{\left[\frac{\partial^2 U}{\partial n^2}\right]}^{(-)} > 0$$

3b.

$$\frac{dt_w}{dw_w} \Rightarrow -\overbrace{\left[-\frac{\partial^2 U}{\partial n^2} + f(s_{m,}, L) * \frac{\partial^2 V_m}{\partial t_m{}^2}\right]}^{(+)} < 0$$

3c.

$$\frac{dn}{dw_w} \Rightarrow -\overbrace{\left[f(s_{m,}, L) * \frac{\partial^2 V_m}{\partial t_m{}^2}\right]}^{(+)} < 0$$

Appendix 6: Division of Housework and Labor Force Participation: Include Aggregates

Table 5.3: Fertility [in text]

Table 5.4: Wife's labor force participation [in text]

Table 5.5:

TABLE 5.5 SHARE OF HOUSEWORK (INDIVIDUAL AND SOCIAL EFFECTS)

Variables	**4a**	**4b**	**4c**	**5a**	**5b**	**5c**
	Husband's Share of Housework					
Egalitarian	0.121	0.123	0.124	0.121	0.119	0.118
	5.27	5.3	5.48	5.23	5.09	5.1
Female Years of	0.078	0.086	0.079	0.073	0.072	0.072
Education	3.23	3.41	3.42	3.8	3.83	3.83
Log of Male Wage	-0.228	-0.193	-0.22	-0.215	-0.212	-0.221
	(-3.30)	(-2.76)	(-3.13)	(-3.08)	(-2.98)	(-2.94)
Country Mean 'Share' of House- Work by Husbands*				0.774	. 808	. 825
				14.12	15.57	18.35
Country Mean	0.503	. 758	. 986			
Egalitarian	2.96	3.83	5.27	IV	IV	IV
Country Mean Level of Female Education		-0.382	-0.597			
		(-2.26)	(-3.99)		IV	IV
Country Mean Level of Male (log) Income			1.025			
			1.95			IV
	Reduced Form Regressions			Instrumented Regressions		
No. of Countries	11	11	11	11	11	11
Cohort Dummies	Yes	Yes	Yes	Yes	Yes	Yes
N	1763	1763	1763	1763	1763	1763
R-squared	0.1779	0.1932	0.1985	0.2173	0.2176	0.2176

Robust standard errors clustered on a country indicator variable. T-statistics in parentheses

APPENDIX 7

Exploring Dynamics: The Representative Household

1. Change in Attitudes

TABLE 7.1 ATTITUDES OVER TIME AND ACROSS COUNTRIES

Mean Attitudes	(1)	(2)	(3) 85	(4) 94
five year cohort- 16 to 90	-0.15	-0.153	-0.158	-0.149
	(21.33)***	(39.17)***	(28.07)***	(26.68)***
year==94	0.223	0.233		
	(4.64)***	(8.74)***		
Germany		0.29	0.313	0.278
		(5.75)***	(4.23)***	(3.92)***
Italy		0.35	0.394	0.319
		(6.86)***	(5.31)***	(4.40)***
Ireland		0.432	0.475	0.399
		(8.54)***	(6.40)***	(5.64)***
UK		0.705	0.769	0.651
		(13.95)***	(10.37)***	(9.20)***
NL		0.715	0.734	0.707
		(14.15)***	(9.89)***	(9.99)***
USA		0.768	0.824	0.722
		(15.20)***	(11.11)***	(10.21)***
N	165	165	82	83
R-squared	0.75	0.92	0.93	0.92

Absolute value of t statistics in parentheses:
*significant at 10%; **significant at 5%; ***significant at 1%
(1)no country fe (2)country fe (3)year 85 (4)year 94 (5)country dummies and country fe
Answer to question: Do you agree or disagree: A man's job is to earn money,
a woman's job is to look after the home and family (1 stronly agree; 5 strongly disagree)
Country dummy coefficients relative to Austria

The dependent variable in the table above are answers to the question "Do you agree or disagree: a man's job is to earn money," which appeared in both the 1985 and 1994 ISSP survey. Higher values indicate greater disagreement. The positive coefficient on the 1994 time dummy in regression 2, and the negative coefficient on the cohort variable suggest that over time, people increasingly disagree with this statement. In other words, that there has been an upward trend in egalitarian attitudes. A comparison of regressions (3) and (4) indicates that the ranking has not changed over time.

2. Decreasing Female Wage Gap

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

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

where

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

The effect of an increase in egalitarian attitudes in the representative household on the country (i.e. representative household) average housework share by husbands is:

$$\frac{\partial \bar{s}_m}{\partial L} = \frac{\partial h/\partial L}{1 - \partial h/\partial \bar{s}_m} > 0$$

This must be positive since the numerator, the direct effect, is greater than 0 and $\partial h/\partial \bar{s}_m < 1$, which must hold for an equilibrium value for $\bar{s}_m$ to exist. Further, since $f_{\bar{s}_m} < 0$, we know that $\partial\theta/\partial L < 0$. A similar exercise can be done to show that $\partial\theta/\partial w_w < 0$. Substituting $f(\bar{s}_m) = \theta(L, w_w, w_m)$ in the objective function, the maximization problem becomes:

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

Comparative Statics:

After solving for t_m and t_w, and if we make the simplifying assumption $V_i''' = 0$ so that $\frac{\partial^2 V_i}{\partial t_i^{\,2}} = k$, the denominator of the comparative static is give by:

$$\left(g(L) + f(\bar{s}_m)\right)k\frac{\partial^2 U}{\partial n^2} - \left(g(L)f(\bar{s}_m)\right)k^2 < 0$$

1. dn / dL

The numerator of this comparative static is:

$$num\frac{dn}{dL} = \overbrace{\left(k * g(L)\frac{\partial V_m}{\partial t_m}\right)}^{(+)} * \overbrace{\frac{\partial\theta}{\partial L}}^{(-)} + \overbrace{\left(k * f(\bar{s}_m)\frac{\partial V_w}{\partial t_w}\right)}^{(+)} * \overbrace{\frac{\partial g}{\partial L}}^{(+)} >< 0$$

Because the denominator of the comparative static is <0, this implies that $\frac{dn}{dL} < 0$ if

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

Since $f_{\bar{s}_m} < 0$, an increase in the (country average) egalitarian attitudes is more likely to reduce fertility if $\bar{s}_m$ is small. This is consistent with the evidence from the 1970s, where low female

wages caused $\bar{s}_m$ to be small, and more egalitarian countries were experiencing lower fertility levels. A formal derivation of this cross-partial is given below.

2. $d^2 n / dw_w dL$

If we make the simplifying assumption that $V_i''' = 0$ so that $\frac{\partial^2 V_i}{\partial t_i^{\,2}} = k$, and that $U''' = 0$, then the denominator of this comparative static is given by:

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

The numerator is given by:

$$num \frac{\partial^2 n}{\partial w_w \partial L} = k^2 \left(\overbrace{\left(2 f_w g^2 f_L V_{t_m}^m k \right)}^{(+)} + \overbrace{\left(U_{nn} f_L g \right)}^{(+)} + \overbrace{\left(U_{nn} f_w g_L V_{t_w}^w g \right)}^{(+)} \right) +$$

$$k^2 \left(\overbrace{\left(-2 f_w g f_L V_{t_m}^m U_{nn} \right)}^{(+)} + \overbrace{\left(-U_{nn} g_L f \right)}^{(+)} + \overbrace{\left(U_{nn} g_w f_w V_{t_w}^m f \right)}^{(+)} \right) + k^2 \overbrace{\left(k g_L f^2 \right)}^{(+)} > 0$$

Thus, $\frac{\partial^2 n}{\partial w_w \partial L} > 0$

This suggests that a rise in country average female wages will cause fertility to decrease faster in non-egalitarian countries. This is consistent with the fertility dynamics observed since the 1970s, where fertility has dropped much faster in the non-egalitarian southern European countries than in more egalitarian northern European countries, following the steady decline in the female wage gap in both regions.