Adieu Rabenmutter – The effect of culture on fertility, female labour supply, the gender wage gap and childcare

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Abstract

This paper studies the effect of cultural attitudes on childcare provision, fertility, female labour force participation and the gender wage gap. Cross-country data show that fertility, female labour force participation and childcare are positively correlated with each other, while the wage gap seems to be negatively correlated with these variables. The paper presents a model with endogenous fertility, female labour supply and childcare choices which fits these facts. There may exist multiple equilibria: one with zero childcare provision, low fertility and female labour force participation and high wage gap, and one with high childcare provision, high fertility and female labour force participation and low wage gap.

JEL classification: J13, J21, J16

Keywords: cultural preferences, fertility, female labour supply, wage gap, childcare

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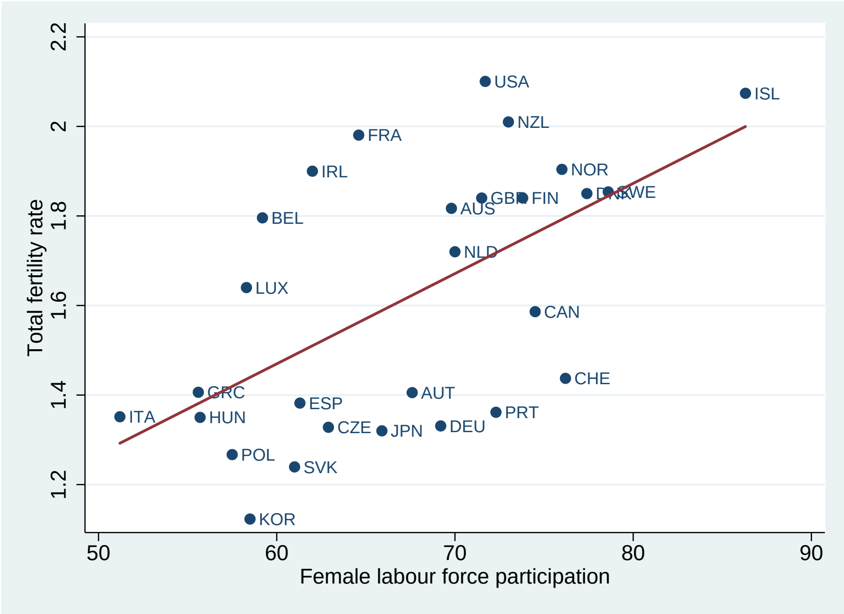


Figure 1

1 Introduction

Many developed countries have seen fertility levels fall far below replacement levels. At the same time, female labour force participation is low in many of the same countries. This puzzle has caught the attention of researchers (e.g. Ahn and Mira, 2002). Historically, industrialisation and income growth have led to rising female labour force participation and falling fertility rates in most developed countries. However, across countries, the correlation between fertility and female labour force participation has recently turned positive. Figure 1 shows the correlation between the total fertility rate and female labour force participation in OECD countries. The figure clearly shows that countries with high female labour force participation have higher fertility.

The status of women in the labour market is influenced, however, not only by their participation but also by their earnings. There has been much discussion about gender earnings gaps (see e.g. Blau and Kahn, 2007). Figure 2 shows the correlation between the (full-time) gender earnings gap and female labour force participation. The figure shows that countries with high female labour force participation also have lower earnings gaps.

These correlations open up the possibility that policies might increase both fertility and

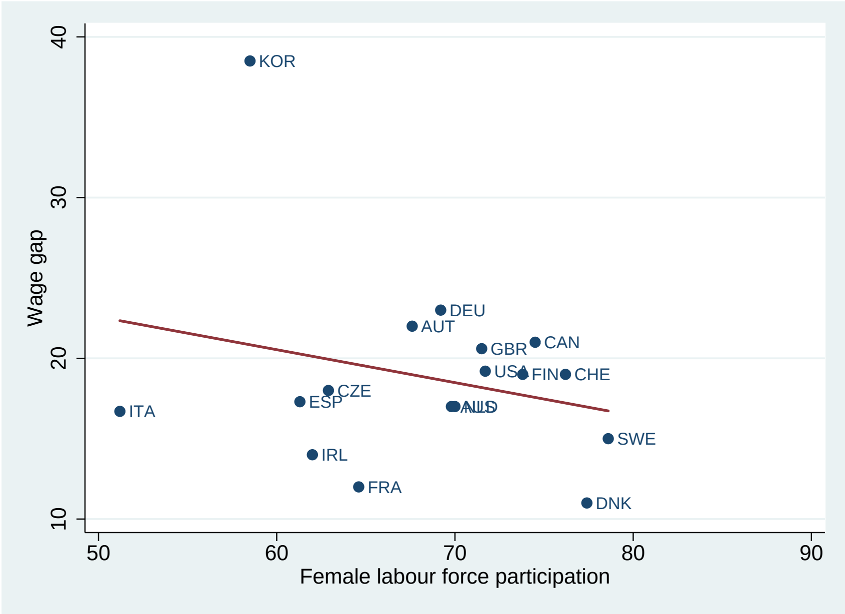


Figure 2

female labour force participation and reduce the wage gap at the same time. The provision of childcare is one measure which could enhance the compatibility of (female) work and family. The availability of childcare makes it easier for women with children to work while raising their children, and this may induce couples where the woman wants to work to have more children. Hence, some governments have increased their efforts for provision of childcare. For instance, the German government, in its recent initiative to boost the availability of childcare facilities for children under three, cited the Scandinavian standards – high childcare enrolment, fertility and female labour force participation– as a reason for aiming at providing 35% of all children under three with a childcare slot (BMFSFJ, 2008, p.5).

Figure 3 shows the correlation between the total fertility rate and childcare spending as a share of GDP in OECD countries. The same correlation holds between fertility and enrollment in childcare institutions of children under 3 years. It is apparent from the Figure that countries with high spending on childcare and high enrollment rates also have high fertility.

Figure 4 shows the correlation between the female labour participation rate and childcare spending as a share of GDP (again, the same correlation holds between female labour

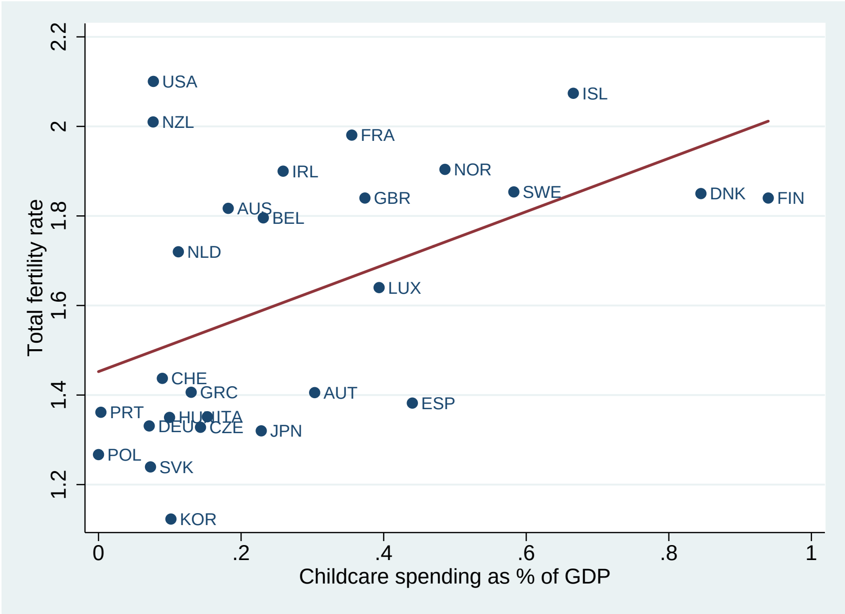


Figure 3

participation and enrollment in childcare). As the figure shows, there is a clear positive association between these two variables as well.

Figure 5 shows the correlation between the gender pay gap and childcare spending as a share of GDP. It appears that the pay gap is negatively related to childcare spending.[1]

Of course, correlation does not imply causality, and indeed, the aim of this paper is to explain the joint determination of childcare as well as fertility, female labour force participation and the wage gap. The argument will be that countries where society has a positive attitude towards working mothers or about the desirability of external childcare for children will provide more childcare, which in turn increases fertility and female labour force participation and reduces the wage gap.

In order to do so, in section 3, I will present some evidence to empirically corroborate that there is in fact a correlation between cultural attitudes, fertility and female labour force participation and the wage gap. It is instructive to consider the cases of France and

[1]Note that this figure refers to the raw gap in median earnings for full-time workers. It is not adjusted for differences in education, labour market experience, occupation, etc. However, adjusting for these measures would not necessarily be useful for current purposes, since some of these variables are themselves endogenous and influenced by the availability of childcare. For instance, it might be that increasing childcare provision increases women's labour market experience, which would reduce the pay gap.

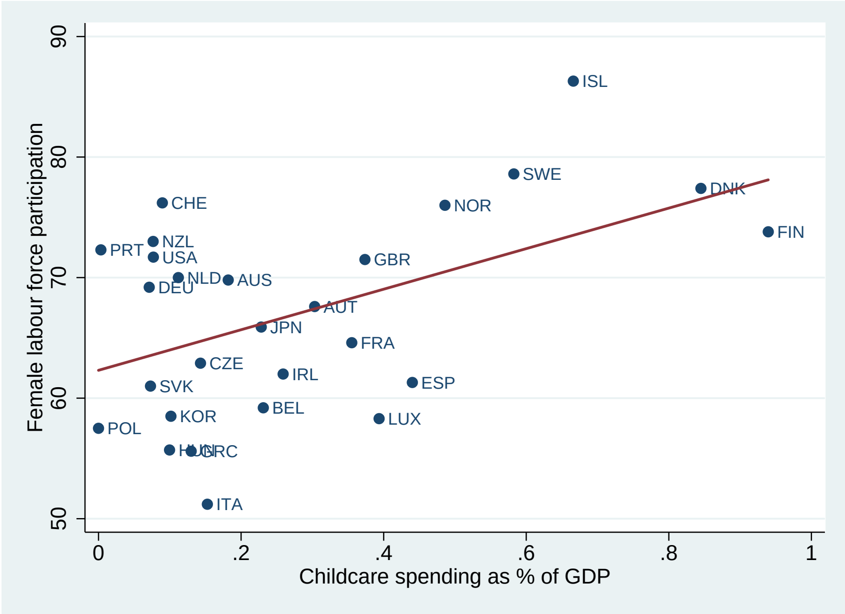


Figure 4

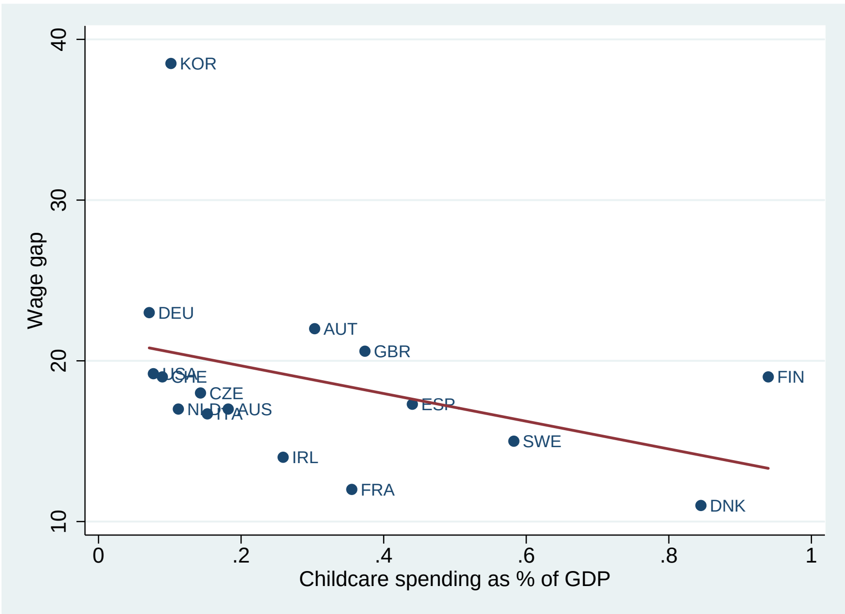


Figure 5

Germany as examples. As is well known, the total fertility rate in France is much higher than in Germany, 2.0 in 2008 compared to only 1.38. The maternal employment rate was 72.8% in 2007 in France and 68.1% in Germany. Childcare arrangements also differ widely between the countries. In France, 42.9% of children under 3 years were enrolled in childcare, compared to 13.6% in Germany. The gender earnings gap was 12% in France and 23% in Germany.[2] The argument in this paper is that these differences are (at least partly) driven by differences in cultural attitudes. In Germany, 55.8% of all individuals in 2002 agreed with the statement "A pre-school child is likely to suffer if his or her mother works". In France, the corresponding figure was 42.5%.[3] Thus, cultural attitudes differ in a way that seems to go conform with differences in childcare provision, female labour supply, fertility and the gender pay gap. In fact, in Germany, for a long time, mothers with small children who worked would be called raven mothers ('*Rabenmütter*'), since working while the children were cared for by someone else was seen as neglect of one's children. In France, the attitude towards working mothers has been much more positive, and women often return to work shortly after giving birth (Fagnani, 2002).[4] In this respect, however, even Germany looks more like two countries, East and West. In 2008, 12% of all children in West Germany were using external childcare, compared to 41.3% in East Germany (Statistisches Bundesamt, 2010a). In 2002, the corresponding figures had been 37% in the East and only 3% in West Germany. The gender wage gap was 24% in West Germany in 2006 and only 6% in East Germany (Statistisches Bundesamt, 2010b). The female labour force participation has been higher in East than in West Germany. In 2006, the female participation rate was 72.1% in East Germany, compared to 65.5 in the West.[5] The fertility rate in East Germany was higher than in the West until reunification, approximately 1.6 compared to 1.3, (see Kröhnert, 2010), when it took a plunge, probably due to rising unemployment and economic uncertainty. Correspondingly, the share of individuals who agreed that a pre-school child with working mother is likely to suffer was only 32.7% in East Germany (28% for women), more than 40% lower than the corresponding percentage

[2] All data were obtained from the OECD family database.

[3] Data are from International Social Survey Programme, see below. For women, the corresponding numbers are 50.7% for Germany and 36.6% for France.

[4] See also an article by Henkel (2003) in the German newspaper *Süddeutsche Zeitung* from whom the title of this paper was borrowed.

[5] See Bundesagentur für Arbeit (2007). In recent years there has been some convergence in female employment rates.

in the West. In an econometric analysis, Bauernschuster and Rainer (2010) show that no only are these differences in gender-role attitudes within Germany large, they have actually grown over time.

In section 4, I present a model which formalises the interaction of cultural attitudes, childcare provision, fertility and female labour supply. In the model, couples decide on fertility and female labour supply, and whether to use publicly provided childcare or care for the children at home. External childcare reduces the time input necessary to rear children which increases fertility and labour supply and decreases the gender wage gap. The supply of public childcare is financed by income taxes and determined by majority voting. There are two crucial assumptions about the perceived quality of external childcare: first it differs between couples, depending on their cultural values, and second, it is a positive function of the number of families who use childcare. This externality gives rise to multiple equilibria: if everyone believes that childcare usage will be zero, the provision of childcare will be zero, which leads to zero usage ex post. Fertility and female labour supply will be correspondingly low and the wage gap high. Conversely, if voters expect childcare usage to be high, they vote for high provision, which leads to high usage ex post. Fertility and female labour supply will then be high and the wage gap low.

In Section 5, I present a numerical example which can generate reasonable predictions and also shows the sensitivity of the results to parameter variations. Section 6 extends the model by considering the evolution of key variables over time, assuming that children inherit their parents' values.[6] It is shown that, starting from a zero childcare equilibrium, nothing changes over time, while starting from a positive childcare equilibrium, over time childcare usage converges to one. Section 7 discusses the results and the last section concludes.

2 Related Literature

There are several related strands of literature, both theoretical and empirical. There is a large literature on childcare, female labour supply and fertility. Much of this literature has examined the link between childcare provision on fertility and female labour supply.

[6] See Farré and Vella (2007) and and Blau *et al.* (2008) for evidence on the intergenerational transmission of values.

Most papers have found positive effects of childcare on both fertility and labour supply. The present paper tries to formally model this link in a simple model. An early formal model was presented by Ermisch (1989). See also Bick (2010) and Haan and Wrohlich (2009) for simulation models that jointly determine fertility and female labour supply as a function of childcare provision. However, these models have exogenous childcare provision and abstract from cultural attitudes.

Kimura and Yasui (2009) analyse a model of voting on public education with private supplements and endogenous fertility which also produces multiple equlibria. However, their model is based on a time consistency problem: since households must decide on fertility before decisions on public education are made, low fertility-low public provision equilibria and high fertility-high public provision equilibria may coexist. In fact, if the timing in their model is changed, the equilibrium multiplicity disappears. By contrast, in the present model, multiple equilibria arise from the interaction of individual beliefs and aggregate childcare choices even in the absence of time inconsistency. Furthermore, Kimura and Yasui (2009) assume that women's labour supply falls inversely with the number of children. Since education is provided to all families, this implies that fertility and female labour supply are (mechanically) negatively related, while in this paper, in equilibrium they are positively related. Lastly, there is no wage gap in their model.

Yasuoka and Miyake (2010) also analyse a model with endogenous fertility and labour supply. They also find multiple equilibria characterised by either high fertility and female labour supply or low fertility and female labour supply. However, in contrast to the present paper, their model has no cultural values and childcare policies are exogenous. The multiplicity of equilibria is due to the presence of endogenous growth.

Baudin (2010) studies a model of cultural transmission in fertility decisions, focussing on how this can generate a fertility transition. In the model, parents transmit their culture to their children, where culture is interpreted as a fertility norm. Productivity shocks in favour of low fertility individuals can generate a transition to a low-fertility state. However, in contrast to the present paper, Baudin (2010) does not focus on the interaction of norms and policies. He also does not endogenise labour supply.

Fernandez (2007a) and Fogli and Veldkamp (2009) study the evolution of female labor force participation, where beliefs about the effect of working are formed by observing other women. Their focus, however, is on the propagation of beliefs for exogenous policies. Instead, this paper focuses on the endogenous determination of policy and on the interaction of policies and beliefs or cultural attitudes.

There is a large literature on the gender pay gap which aims to explain why women earn less than men. One important line of argument is that because of career interruptions and shorter accumulated working experience due to childbirth, women have fewer incentives to invest in human capital which implies lower lifetime wages (Mincer and Polachek, 1974). For instance, Blau and Kahn (1997) found that about one third of the wage gap in their sample could be explained by women working fewer hours. Waldfogel (1988) finds that children lower women's wages even controlling for labor market experience, perhaps because having children in the past severed the ties between women and their employers, thereby destroying returns to firm specific human capital. Erosa *et al.* (2010) present a quantitative model of the gender wage gap. They assume that childbirth involves a forced reduction of working hours. This leads to lower human capital accumulation by females, which generates the wage gap. The present model includes a similar mechanism to determine the wage gap. However, the reduction of hours is partly endogenous since it depends on the choice of childcare.

Fernandez and Fogli (2009) empirically examine the effect of cultural values on fertility and labour supply using second-generation immigrants in the U.S. and find that culture matters for both. Their measures of culture are female labour supply or fertility in the country of the immigrant's parents lagged 50 years. Fernandez (2007b) presents a similar exercise, using immigrants' country of origin cultural values. van Gameren and Ooms (2009) study childcare usage and labour force participation by mothers with pre-school children in the Netherlands. They show that attitudes and opinions are important. See also Fortin (2005, 2009). Farré and Vella (2007) and Blau *et al.* (2008) study the intergenerational transmission of cultural attitudes and find that this can explain female labour force decisions. See also Fernandez *et al.* (2004). Fortin (2006) studies the influence of gender attitudes on the gender wage gap empirically and finds that these values do influence the wage gap. Thus this empirical literature provides clear evidence that there exists a cultural influence on fertility and female labour supply.

More generally, there is a growing literature which studies cultural influences on economic outcomes. For recent overviews, see Guiso *et al.* (2006) and Fernandez (2010).

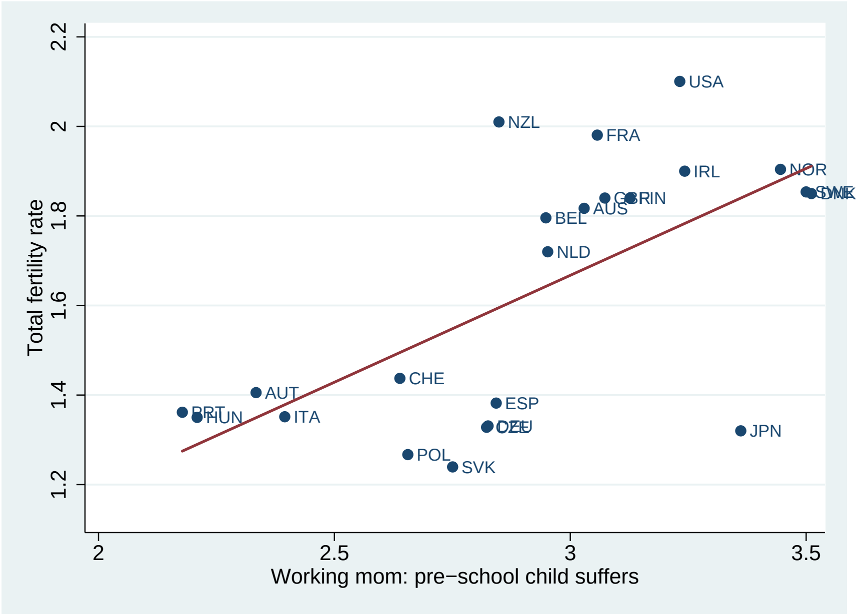


Figure 6

3 Evidence

I now present some evidence on the link between cultural attitudes towards female work and childcare and fertility and labour supply decisions. The cultural attitude variables are taken from answers to different questions asked to individuals from different countries in the International Social Survey Programme. These answers are then averaged across countries.[7]

Figure 6 shows the correlation of the total fertility rate in OECD countries with the average disagreement with the statement:[8] "A pre-school child is likely to suffer if his or her mother works." Figure 7 shows the correlation of fertility with disagreement with the statement: "A man's job is to earn money, a woman's job is to look after the home and family." As the Figures show, fertility rises with the disagreement with these statements.

[7]These question about family and gender values were asked in 1988, 1994 and 2002. I take the average of these three waves – for the countries which did not take part in all waves, averaging is for the waves that the country participated in. The average is computed with individuals weighted according to the weights provided in the ISSP datasets.

[8]The answers are coded from 1 to 5 where strong agreement is coded as 1 and strong disagreement as 5.

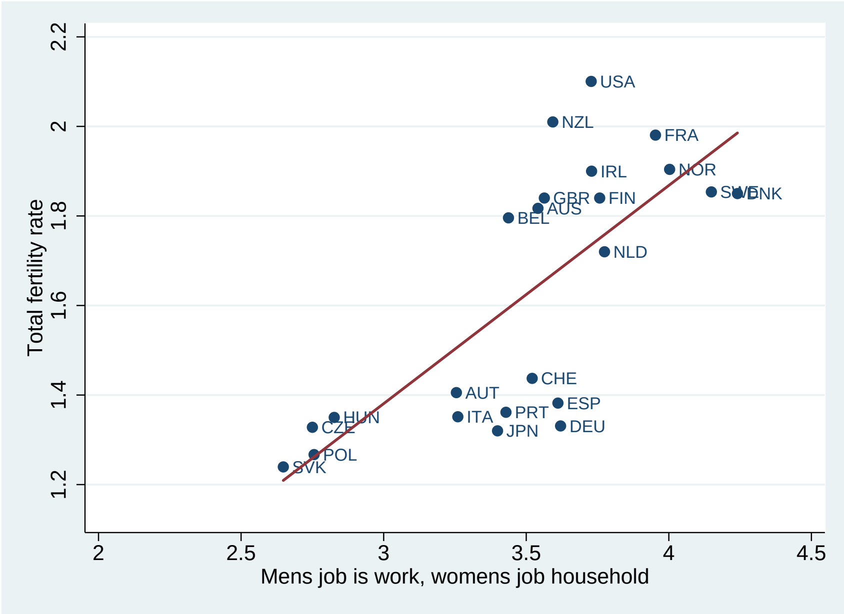


Figure 7

Figures 8 and 9 show the correlation of female labour force participation with the measures above. Again, when the population tends to agree that pre-school children with a working mother suffer, or that women should look after the home and family, female labour force participation is low.

Figures 10 and 11 show the correlation between the wage gap and the measures above. Again, when the population tends to agree that pre-school children with a working mother suffer, or that women should look after the home and family, the wage gap is high.

Of course, this evidence was purely descriptive with no claim of causality. In fact, in cross country studies such as these, causal inference will be hard in the absence of reliable instrumental variables. But what this descriptive evidence shows is that cultural beliefs or attitudes are correlated with fertility and female labour supply decisions. In particular, it seems that fertility and female labour supply as well as the gender wage gap are affected by society's attitudes towards working women or working mothers. The evidence discussed in section 2 further corroborates such a link. In the next section, I present a model which can generate the correlations described heretofore.

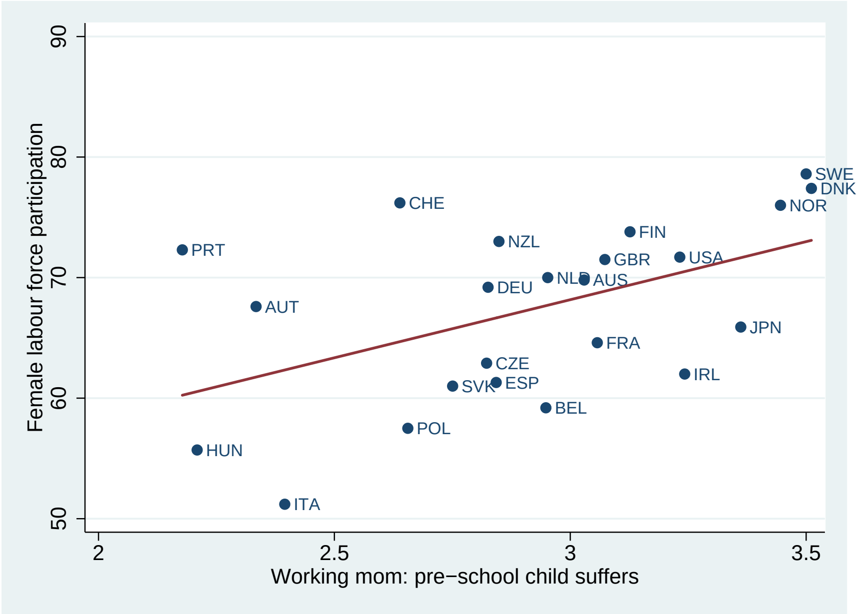


Figure 8

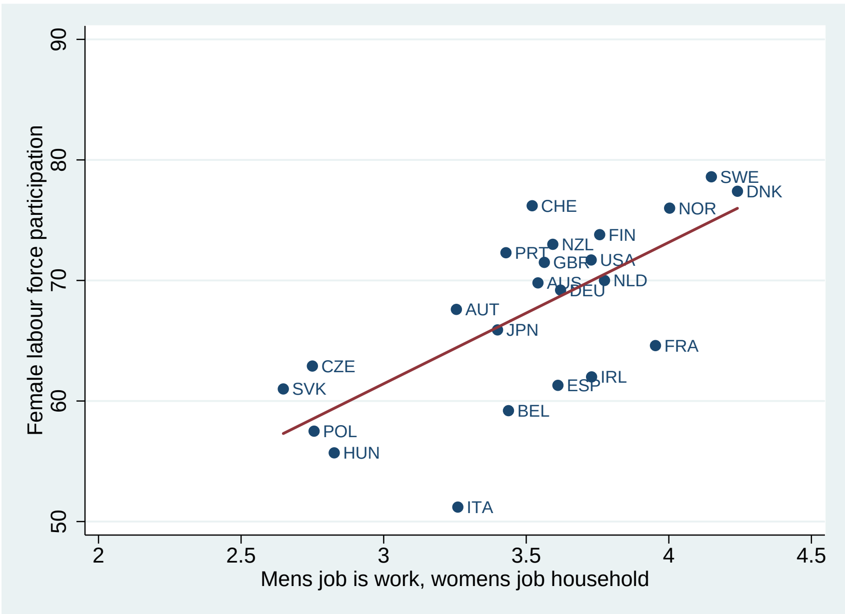


Figure 9

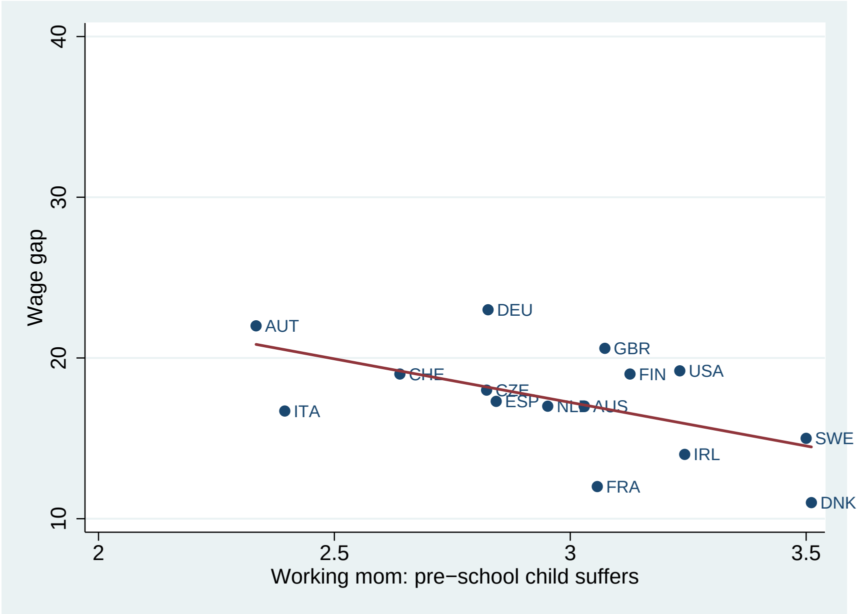


Figure 10

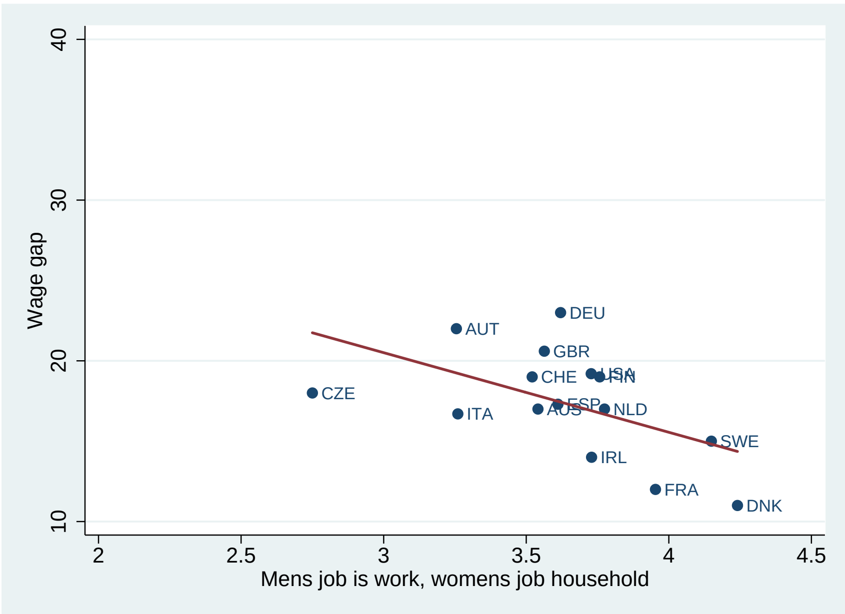


Figure 11

4 The model

4.1 The economy

I consider an economy populated by couples who have to make three private decisions: how many children to have, whether to send their children to an external childcare institution and how much the woman should work. Moreover, society has to decide on how much childcare to provide.

The couple's utility is given by

$$u = a \log c + b \log(nQ) + (1 - a - b) \log L \tag{1}$$

where c is consumption, n the number of children, Q the quality of childcare and L leisure.

The couple's budget constraint is

$$c_J = (1 - \tau)(w_m + w_{fJ} \ell_J), \quad J \in \{C, N\} \tag{2}$$

where w_m is the man's wage, ℓ is the woman's labour supply depending on childcare usage and w_{fJ} the woman's wage, which also depends on childcare usage (see below). All men are assumed to work full-time. Couples differ in their cultural attitude towards external childcare, captured by the parameter β (see below), and by the male wage (because of assortative matching, I assume that the female wage is proportional to the male wage). I will assume that β and w_m are independently distributed with (marginal) distribution functions given by $F(\beta)$ for $\beta \in B$ and $G(w_m)$ for $w_m \in W$.[9] The mean wage is denoted by $\bar{w}_m = \int_{w_m \in W} w_m dG(w_m)$. The distribution of β is assumed to be symmetric with mean and median equal to $\beta_M = \int_{\beta \in B} \beta dF(\beta)$. The population is normalised to one.

Women's labour supply depends on the take-up of childcare. I assume that raising children takes women's time. Letting subscript C refer to the case where children are in childcare and N when they are not, the time constraints in the two cases are

$$L_J \quad = \quad 1 - \ell_J - \Theta_J - \theta_J n_J, \quad J \in \{C, N\} \tag{3}$$

Here $\Theta_J, J \in \{C, N\}$ is a fixed requirement for raising children and θ_J the variable time requirement per child. I will assume that $\Theta_C < \Theta_N, \theta_C < \theta_N$, so that raising children takes less of the woman's time when they are in childcare.

[9]It will be shown below that wage heterogeneity plays no major role in the model (due to the assumption of Cobb-Douglas preferences) and, hence, this assumption is inconsequential.

Couples have to decide on fertility, female labour supply and childcare. Due to the assumption on the utility function, fertility and labour supply are independent of childcare quality. Maximising utility subject to (2) and (3) gives the couple's fertility and the woman's labour supply:

$$n_J^* = \frac{b(w_m + (1-\Theta_J)w_{fJ})}{\theta_J w_{fJ}}, \quad J \in \{C, N\} \tag{4}$$

$$\ell_J^* = \frac{a(1-\Theta_J)w_{fJ} - (1-a)w_m}{w_{fJ}} \quad J \in \{C, N\} \tag{5}$$

Fertility is increasing in full income $w_m + (1-\Theta_J)w_{fJ}$. Since consumption, children and leisure are all normal goods, higher full income increases fertility, leisure and consumption and hence also labour supply. Fertility is also decreasing in the "price of children", $\theta_J w_{fJ}$, and female labour supply is increasing in the price of leisure, w_{fJ}.

I assume that the female wage is given by $w_{fJ} = (1-\Theta_J)w_m$. This embodies two assumptions: first, due to assortative matching, female wages are proportional to male wages. Second, childbirth is associated with absence from work which reduces women's human capital and hence their wage.[10] This depreciation of human capital gives rise to a wage gap (defined as the difference between the male and female wage, as a percentage of the male wage) equal to Θ_J, which depends on childcare usage. I will denote the equilibrium wage gap by $\omega = \frac{\bar{w}_m - \bar{w}_f}{\bar{w}_m}$, where $\bar{w}_f = \bar{w}_m((1-H)(1-\Theta_N) + H(1-\Theta_C))$ is the equilibrium female wage, and H the fraction of couples using childcare.

Using the definition of w_{fJ} in (4) and (5) gives:

$$n_J^* = \frac{b(1+(1-\Theta_J)^2)}{\theta_J(1-\Theta_J)}, \quad J \in \{C, N\} \tag{6}$$

$$\ell_J^* = \frac{a(1-\Theta_J)^2 - (1-a)}{(1-\Theta_J)} \quad J \in \{C, N\} \tag{7}$$

Equations (6) and (7) show that fertility is decreasing in θ_J (this is the price effect discussed above). Since female wages are proportional to male wages, neither fertility nor labour supply depend on the wage, which simply reflects the fact that with Cobb-Douglas utility, income and substitution effects of higher wages just cancel out. The effect of Θ_J is composed of a direct effect, which lowers full income and hence decreases fertility and labour supply, and an indirect effect through the reduced female wage. This indirect effect

[10] See the classic work by Mincer and Polachek (1974) and, more recently, Erosa *et al.* (2010).

further reduces labour supply, but it increases fertility since the price of children falls with a falling wage. The total effect is that fertility is decreasing in θ_J and *increasing* in Θ_J. In the following, I will assume that the effect of θ dominates the effect of Θ so that fertility is higher under usage of external childcare than if children are raised at home.

4.2 Equilibrium with exogenous policy

The quality of childcare is normalised to one if the child is raised at home, $Q_N = 1$. If the child is in childcare, the perceived quality of childcare is assumed to be $Q_C = \beta H^{\alpha} g$, where H is the fraction of children in childcare and g is childcare spending per child and $\alpha \geq 0$ is a parameter measuring the externality from usage to beliefs. The quality of childcare is perceived to be higher, the more is spent on each child. Moreover, the perceived quality of childcare is assumed to depend on the couple-specific factor β and on the fraction of children in childcare H.

The couple specific factor is assumed to be heterogeneous. For concreteness, I will assume it follows a normal distribution with mean μ and variance σ^2 so the distribution function is given by $\Phi\left(\frac{\beta-\mu}{\sigma}\right)$ where $\Phi(\bullet)$ is the CDF of the standard normal distribution. In addition to this individual factor, all couples perceive childcare to be more beneficial for their child the more children already use childcare, where α is a measure of the strength of this externality. This externality is essential to generate multiple equilibria. The reasoning behind this assumption is that if childcare usage is high, either couples learn from observing others that childcare is not necessarily detrimental to their child, or the social stigma associated to putting children in daycare is lower.[11]

The childcare decision depends on the indirect utility in the case of childcare versus the indirect utility in the case the children are raised at home. Let $V_J(\cdot), J \in \{C, N\}$ denote the indirect utility function as a function of whether or not the children are in childcare.

[11]Fernandez (2007b) and Fogli and Veldkamp (2009) both use learning models to study the evolution of female labour force participation. In their models, women have some prior belief about the cost of labour supply, which they update using information from women around them. This amounts to using the observed female labour force participation in the reference group (assumed to be all women in Fernandez (2007b) and only a local sample in Fogli and Veldkamp (2009)) to infer the cost of labour supply. Translated to the current setting, the learning framework implies that couples use aggregate childcare usage to infer the effect of childcare on their children.

Using (4) and (5) and simplifying yields

$$\begin{aligned} V_J(\cdot) = {} & a\log a + b\log b + (1-a-b)\log(1-a-b) + a\log w_m \\ & + \log(1+(1-\Theta_J)^2) - (1-a)\log(1-\Theta_J) - b\log\theta_J \\ & + a\log(1-\tau) + \mathbf{1}b(\log\beta + \log g + \alpha\log H) \end{aligned} \tag{8}$$

Here, $\mathbf{1}$ is an indicator function which is equal to one if $J = C$ and zero otherwise.

The couple will send their children to childcare if and only if $\Delta \equiv V_C(\cdot) - V_N(\cdot) > 0$. Using (8) gives the following result.

Proposition 1 *The fraction of families who use childcare, $1 - F(\hat{\beta})$, is implicitly defined by*

$$H = 1 - F(\hat{\beta}) \tag{9}$$

where

$$\hat{\beta} = \frac{\theta_C}{\theta_N H^\alpha g}\left(\frac{1-\Theta_C}{1-\Theta_N}\right)^{\frac{1-a}{b}}\left(\frac{1+(1-\Theta_N)^2}{1+(1-\Theta_C)^2}\right)^{\frac{1}{b}} \tag{10}$$

Since utility is Cobb-Douglas, the childcare choice is independent of the wage. Obviously, the cutoff value $\hat{\beta}$ is falling with per capita childcare spending g. Higher spending increases the quality of external childcare, which will lead to more couples using childcare. While individual fertility and labour supply choices are unaffected by childcare provision (see (6) and (7)), this will affect aggregate fertility and female labour force participationby changing the composition of couples who use or don't use childcare.

Before turning to the endogenous determination of childcare spending, let us first look at the equilibrium decision on childcare, for given spending. Figure 12 shows the curve $1 - F(\hat{\beta})$ against the "expected" fraction of families using childcare, H^e (see Section 5 for details on the parameter values). Possible equilibria are given by the intersection of this curve with the 45° line. Stable equilibria are shown by the black circles. As can be seen from the figure, there is a stable equilibrium with $H = 0$ and one where H is relatively large (about 70% in this example). The reasoning is simple. If everyone expects that others will put their children in childcare, the perceived quality of childcare is high and actual participation will also be high. Conversely, if couples expect that no one else will use childcare, the perceived childcare quality is zero and all couples will raise their children at home. It is this interaction of the perceived quality of childcare and aggregate childcare usage which leads to multiple equilibria.

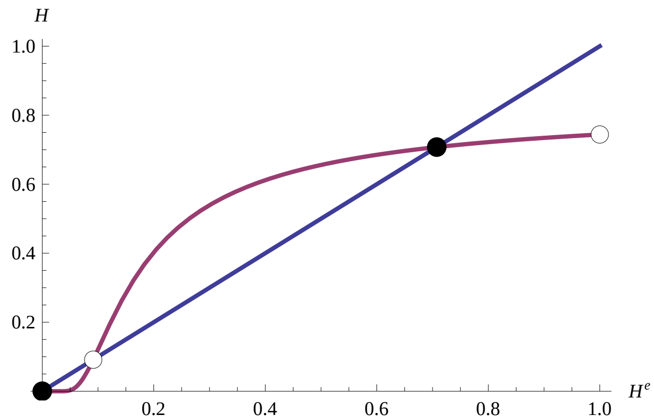


Figure 12

4.3 Voting on childcare spending

Let us now look at the determination of childcare spending. Spending is determined by simple majority voting. Each couple votes for the spending level which maximises its utility, subject to the government budget constraint

$$H^\gamma n_C^* g = \tau \bar{w}_m \left((1-H)(1-\Theta_N)\ell_N^* + H(1-\Theta_C)\ell_C^*\right)$$

or, using (6) and (7) and simplifying,

$$H^\gamma \frac{b(1+(1-\Theta_C)^2)}{\theta_C(1-\Theta_C)} g = \tau \bar{w}_m a \left((1-H)(1-\Theta_N)^2 + H(1-\Theta_C)^2\right) \tag{11}$$

The left hand side of (11) shows total spending, which is spending per child times the number of children in childcare. The parameter $\gamma \in [0,1]$ measures the effect of crowding in childcare spending. For $\gamma = 0$, there is no crowding (pure public good), whereas $\gamma = 1$ implies a purely private good. I will assume that $\gamma \leq \alpha$. Since perceived quality is proportional to average tax revenue times $H^{\gamma-\alpha}$, this implies that the externality from average childcare usage exceeds crowding so that perceived quality is nondecreasing in total childcare usage.[12] The right hand side shows total tax revenue from parents where children are at home and those where children are in childcare. I assume that voting is myopic in the sense that when voting, voters treat childcare usage H as given.

[12]If this were not the case, the median couple would vote for positive spending only if total usage is small enough. It can then be shown that an equilibrium might not exist, and if an equilibrium does exist, it will be unique. See Appendix A.

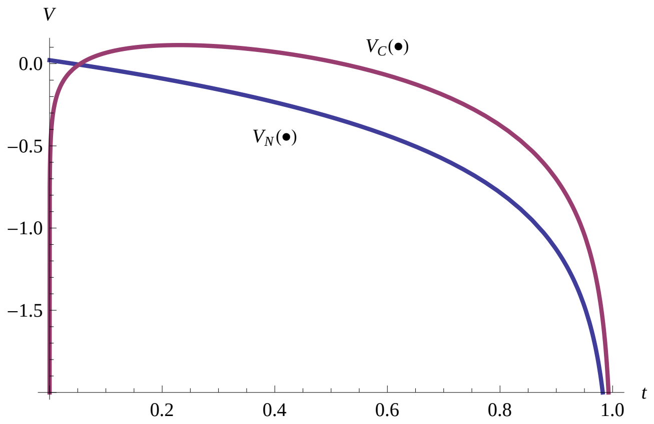


Figure 13

The couple's problem is thus to maximise $\max\{V_C(\bullet), V_N(\bullet)\}$ subject to the budget constraint (11). Figure 13 shows a typical couple's indirect utility as a function of the spending level, where the budget constraint has already been used in the utility function. The downward sloping curve $V_N(\bullet)$ is the couple's utility when children are at home and the bell-shaped curve $V_C(\bullet)$ is utility when children are in childcare. Hence, the couple would vote for a zero tax rate if $V_N(\bullet)|_{\tau=0} > \max_\tau V_C(\bullet)$, i.e. if the utility with the children staying at home and zero tax rate exceeds the utility with children in childcare and the couple's optimal tax rate. Otherwise the optimal tax rate is that which maximises $V_C(\bullet)$.

As can be seen from the figure, utility is generically non-single peaked. However, in this simple model, a voting equilibrium nonetheless exists: looking at (8) shows that the optimal tax rate and spending level is identical for all couples regardless of β, conditional on childcare usage. The only effect of β is that $V_C(\bullet)$ shifts up so that high β couples will vote for a positive tax rate and low β couples for a zero tax rate. Hence, utility satisfies the single crossing property, and the voting equilibrium is given by the optimal tax rate and spending level of the couple with the median belief μ.[13] The next result characterises the voting equilibrium, for given childcare usage H.

[13]Note also that the logarithmic utility implies that the optimal tax rate is independent of the wage: when the wage rises, couples want higher spending since childcare quality is a normal good, but lower taxes since the tax price of childcare increases with the wage. Given that the income and substitution elasticity are both one (in absolute value) with Cobb-Douglas utility, this is a wash. Furthermore, $V_N(\bullet)|_{\tau=0}$ and $\max_\tau V_C(\bullet)$ both shift up with w_m by the same amount (see (8)) so that in effect the wage is inconsequential for the voting decision.

Proposition 2 *The voting equilibrium is given by*

$$\tau = \begin{cases} \frac{b}{a+b} & \text{if } \mu \geq \tilde{\beta} \\ 0 & \text{otherwise} \end{cases} \tag{12}$$

where

$$\tilde{\beta} \equiv \frac{\left(\frac{a+b}{a}\right)^{\frac{a+b}{b}} H^{\gamma-\alpha}(1+(1-\Theta_N)^2)^{\frac{1}{b}}(1+(1-\Theta_C)^2)^{\frac{b-1}{b}}}{\theta_N \bar{w}_m (1-\Theta_N)^{\frac{1-a}{b}}(1-\Theta_C)^{\frac{a+b-1}{b}}\left(1+(1-\Theta_N)^2+H(\Theta_C-\Theta_N)(\Theta_C+\Theta_N-2)\right)} \tag{13}$$

Proof. See Appendix B. ■

The cutoff $\tilde{\beta}$ defines the value of β where a couple would vote for a positive level of childcare spending, given their expected level of childcare usage H^e. Conversely, the median couple would vote for zero taxes and spending if they expect a level $H^e < \tilde{H}$, where $\tilde{H}$ is found by solving (13) for H. When H^e exceeds this critical level, the median couple's preferred tax rate is $\frac{b}{a+b}$.

4.4 Equilibrium

We can now define the equilibrium.

Definition 1 *An equilibrium in childcare provision must satisfy:*

(i) The tax rate and level of childcare spending maximise the utility of the household with median belief, β^M, given the government budget constraint and this household's expected level of childcare usage, H^e,

(ii) all households choose the female's labour supply and fertility as well as outside or home childcare to maximise utility, given their budget constraint, and

(iii) the expected level of childcare usage equals equilibrium usage.

From our previous discussion, the equilibrium is characterised by (12), (11), and (9). The first result is:

Proposition 3 *An equilibrium exists.*

Proof. See Appendix B. ■

We can now characterise the possible equilibria. Here $\bar{n}$ and $\bar{\ell}$ are the averages of these variables in the population.

Proposition 4 *(i) If $\mu < \tilde{\beta}|_{H=1}$, there is a unique equilibrium with $\tau_l = g_l = H_l = 0$, $\bar{n}_l = \frac{b(1+(1-\Theta_N)^2)}{\theta_N(1-\Theta_N)}, \bar{\ell}_l = \frac{a(1-\Theta_N)^2-(1-a)}{(1-\Theta_N)}$ and $\omega_l = \Theta_N$.*

(ii) If $\mu > \tilde{\beta}|_{H=1}$, there may exist a second equilibrium with $\tau_h, g_h, H_h > 0$, $\bar{n}_h = F(\hat{\beta})\frac{b(1+(1-\Theta_N)^2)}{\theta_N(1-\Theta_N)} + (1-F(\hat{\beta}))\frac{b(1+(1-\Theta_C)^2)}{\theta_C(1-\Theta_C)}, \bar{\ell}_h = F(\hat{\beta})\frac{a(1-\Theta_N)^2-(1-a)}{(1-\Theta_N)} + (1-F(\hat{\beta}))\frac{a(1-\Theta_C)^2-(1-a)}{(1-\Theta_C)}$ and $\omega_h = F(\hat{\beta})\Theta_N + (1-F(\hat{\beta}))\Theta_C$.

Proof. See Appendix B. ■

This result shows that the existence of multiple equilibria carries over to the case of endogenously determined policies. Here, the intuition is that when the median couple expects $H^e = 0$, she will vote for zero childcare spending, which obviously makes all couples prefer to raise their children at home since the quality of external care will be zero. So this is always an equilibrium. However, when the median couple expects a positive level of childcare usage, they may vote for a positive level of spending, which yields positive childcare usage in equilibrium.

Figure 14 shows the determination of equilibrium: As long as the expected childcare usage H^e falls short of $\tilde{H}$, the median couple votes for $g = 0$. For $H^e \geq \tilde{H}$, the median couple starts voting for positive spending. In fact, when H^e is large enough, in this example the median couple votes for a level of spending which attracts exactly H^e families to use external childcare.

An obvious implication of Proposition 4 is that if the median cultural attitude is low, there will never be an equilibrium with positive childcare. This equilibrium can only occur if the median β is large enough. The next result derives comparative statics of the equilibrium with high childcare usage.

Proposition 5 *If there is an equilibrium with $\tau_h, g_h, H_h > 0$, $H_h, \bar{n}_h$ and $\bar{\ell}_h$ are all increasing and ω_h is decreasing in μ; $H_h, \bar{n}_h$ and $\bar{\ell}_h$ are decreasing and ω_h is increasing in σ iff $\mu > \hat{\beta}$. Furthermore, H_h is independent of θ_C, increasing in θ_N, Θ_N and $\bar{w}_m$, and decreasing in Θ_C.*

Proof. See Appendix B. ■

The proposition shows how childcare usage, fertility and female labour supply vary with a society's observed characteristics. Obviously, the more "pro-childcare" a society is in the sense of a high median value of β, the larger will be childcare usage, fertility and female labour supply and the lower the wage gap. These are also related in intuitive ways to the other parameters: increasing the fixed time costs of childcare reduces all of these variables whereas increasing the fixed or variable time costs of raising children at home increases them. A higher average wage also increases childcare usage, fertility and female labour supply. Societies which are richer on average have a larger tax base, which increases equilibrium childcare spending.

5 Numerical Example

I now present a numerical example to illustrate the results from the previous section. The distribution of β is assumed to be normal with mean μ and variance σ. In the benchmark, I set $\mu = 0.4$ and $\sigma = 1$. The other parameters are: $\theta_N = 0.365, \theta_C = 0.255, \Theta_N = 0.18, \Theta_C = 0.1, a = 0.675, b = 0.12, \alpha = 0.8$, and $\gamma = 0.2$. Taking the unit of time to be a day and letting the male hourly wage be 17.8, I set $\bar{w}_m = 427$.[14] The resulting labour supply and fertility choices are $n_C^* = 0.946, n_N^* = 0.67, \ell_C^* = 0.267, \ell_N^* = 0.177$. Thus, couples with children in childcare will have 1.89 children and those who care for their children at home have 1.34 children. Women with children in childcare will work 6.40 hours and those whose children are not in childcare work 4.26 hours. The female wage equals 384.3 for women with children in childcare and 350.14 for those who don't.

Figure 14 shows the function $\psi(H) \equiv 1-F(\hat{\beta})-H$ in this example. As can be seen, there is a jump in this function at the level $\tilde{H}$ where the median couple is just indifferent between $V_N(\bullet)|_{\tau=0}$ and $\max_\tau V_C(\bullet)$. Thus, there are two stable equilibria: one at $H_l = 0$ and one at $H_h = 0.639$ so that 64% of families use childcare.[15] In the high-usage equilibrium, the tax rate is $\tau_h = 0.149$ and spending per capita is $g = 15.25$. Assuming 200 working days per year, this would correspond to an annual expenditure of EUR 3049. This is above the average of the OECD countries, which in 2005 spent 3667 USD (converted to purchasing power parity) per child on childcare (see OECD family database). Taking an exchange rate

[14]According to Krause *et al.* (2010), this was the hourly male wage in Germany in 2005-2009 (in Euros).

[15]This corresponds to the enrolment of children under 3 in childcare in Denmark in 2006, which at 63% was actually the highest of the OECD countries.

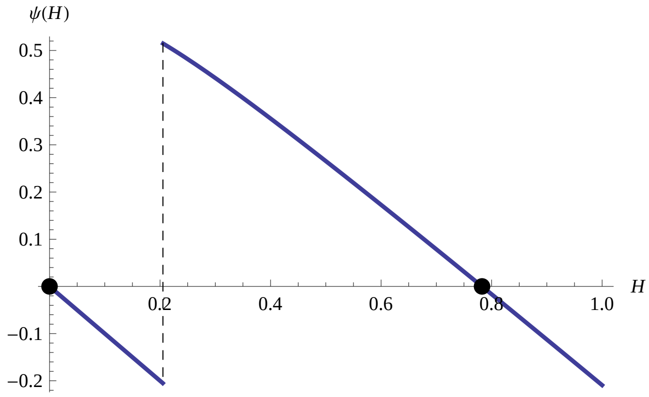


Figure 14

Table 1: Example

	Childcare usage	TFR	FLS	Wage gap
	0	1.34	4.26	18%
	63.9%	1.69	5.63	12.9%
Δ	–	26%	32%	−28%

of 1.25 dollars per Euro, this corresponds to 2715 Euro. Some countries, however, spent much more, for instance, Sweden spent 5309 USD (4246 EUR) and Denmark spent 4886 USD (3908 EUR). The interpretation is that a country like Germany *could* reach close to Scandinavian enrolment and childcare provision levels if society were to coordinate on the high-provision equilibrium.

Results are shown in Table 1. Comparing the two equilibria, in the equilibrium with $H_l = 0$ we have $2\bar{n} = 1.34, 24\bar{\ell} = 4.26$ and $\omega_l = 0.18$. In the equilibrium with $H_h = 0.639$ we have $2\bar{n} = 2(F(\hat{\beta})n_N^* + (1 - F(\hat{\beta}))n_C^*) = 1.69, 24\bar{\ell} = 24(F(\hat{\beta})\ell_N^* + (1 - F(\hat{\beta}))\ell_C^*) = 5.63$ and $\omega_h = 0.129$. Hence, in the high childcare usage equilibrium, the total fertility rate is about 26% higher and female labour supply 21% higher than in the zero childcare equilibrium. The wage gap is 27% lower in the high-childcare equilibrium. In 2006, the earnings gap was 23% in Germany and 19% in Switzerland, but only 15% in Sweden an d11% in Denmark.

Table 2 depicts some sensitivity analyses. Interestingly, most parameter variations have only minor effects on the equilibrium. For instance, if the average male wage falls by 100% to 215, there is a small reduction in childcare usage, but total fertility and female labour

Table 2: Sensitivity analysis

		Childcare usage	TFR	FLS	Wage gap
Benchmark		0	1.34	4.26	18%
		63.9%	1.69	5.63	12.9%
	Δ	–	26%	32%	−28%
$\mu = 0.9$		0	1.34	4.26	18%
		80.6%	1.79	5.98	11.5%
	Δ	–	33%	40%	−36%
$\bar{w}_m = 215$		0	1.34	4.26	18%
		62.2%	1.68	5.59	13%
	Δ	–	26%	31%	−28%
$\alpha = 1.6$		0	1.34	4.26	18%
		63.2%	1.69	5.61	12.9%
	Δ	–	26%	32%	−28%

supply barely change. The major exception is a change in the median cultural preference μ. When this is increased by half a standard deviation to 0.9, Table 2 shows a marked increase in childcare usage to 81% (an increase of 26%). Correspondingly, total fertility and female labour supply increase by about 6% and 5%.

A change in the time costs of rearing children also has relatively strong effects, but as Table 3 shows, this change is mostly directly on the fertility and labour supply of those women rearing their children at home. For instance, increasing θ_N by 25% to 0.46 reduces fertility of those women to 1.07. This increases the fertility differential between the high-childcare and zero-childcare equilibrium, while aggregate childcare usage barely changes. Likewise, when Θ_N increases to 0.225, labour supply of women who care for their children at home falls to 2.99 hours, while fertility increases slightly to 1.36. This increases the differential in labour supply and the wage gap between the two equilibria, while again childcare usage changes only by little.

Table 3: Sensitivity analysis (2)

		Childcare usage	TFR	FLS	Wage gap
Benchmark		0	1.34	4.26	18%
		63.9%	1.69	5.63	12.9%
	Δ	–	26%	32%	−28%
$\theta_N = 0.46$		0	1.07	4.26	18%
		64.3%	1.6	5.63	12.9%
	Δ	–	49%	32%	−29%
$\Theta_N = 0.225$		0	1.36	2.99	23%
		64.1%	1.7	5.17	14.5%
	Δ	–	25%	73%	−36%

6 Dynamics

The purpose of this section is to make the model dynamic. Time is discrete and runs from $t = 0$ to infinity. Each period t, a new generation is born. Obviously, these will be the children of the previous generation. Within each generation, the model proceeds as prescribed previously. The central assumption is that children inherit their parents' wage and their cultural attitude.

The main change is that over time, the distribution of β evolves. In particular, the distribution in period t is

$$F_t(\beta) = \begin{cases} \frac{n_N^*}{\bar{n}_{t-1}} F_{t-1}(\beta) & \text{if } \beta \leq \hat{\beta}_{t-1} \\ \frac{n_C^*}{\bar{n}_{t-1}} F_{t-1}(\beta) & \text{if } \beta > \hat{\beta}_{t-1} \end{cases} \tag{14}$$

where $\bar{n}_{t-1} = F_{t-1}(\hat{\beta}_{t-1})n_N^* + (1 - F_{t-1}(\hat{\beta}_{t-1}))n_C^*$ is the average number of children born in $t - 1$.

Figure 15 shows how the distribution changes from period 0 to period 1. In period 0, the distribution is given by the normal distribution $F_0(\beta)$. In period 1, since all couples with $\beta > \hat{\beta}$ have more children than those with lower β, the distribution shifts to $F_1(\beta)$. In our example, the mean value of β shifts from $\mu = 0.1$ in the period 0 to a value of 0.23 in period 1.

For any given period, given the period's distribution of β, the determination of the equilibrium remains unchanged. Of course, the equilibrium values change since the dis-

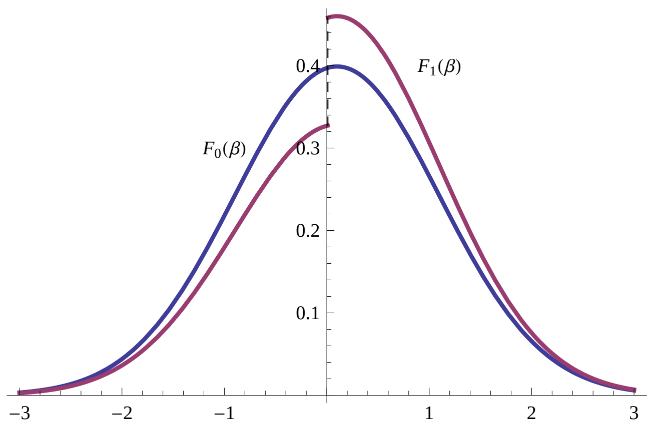


Figure 15

tribution has changed. Note also that over time, the median value of β changes. In fact, from period 0 to period 1, the median β increases. Referring to Figure 14, the value $\tilde{H}$, where the new median couple votes for positive childcare shifts to the left. The function $\psi(H)$ is, however, independent of the individual value of β. Since the preferred tax rate is independent of β, the equilibrium value of H is therefore independent of the median value of β, as long as the median couple votes for positive childcare provision.[16]

In order to characterise the evolution of the key variables, I shall assume that if – for historical reasons – we start in period 0 from one of the two stable equilibria, the equilibrium will remain of the same type in the next period. The next proposition shows the resulting evolution.

Proposition 6 *(i) Starting from an equilibrium with* $\tau_0 = g_0 = H_0 = 0$*, the equilibrium will be* $\tau_t = g_t = H_t = 0$ *and* $\bar{n}_t = n_N^*, \bar{\ell}_t = \ell_N^*, \omega_t = \omega_N$ *for every period* $t = 1, ..., \infty$*.*

(ii) Starting from an equilibrium with $\tau_0 = \frac{b}{a+b}, g_0, H_0 > 0$*, as* $t \to \infty$*, we get* $\lim_{t\to\infty} H_t = 1, \lim_{t\to\infty} \bar{n}_t = n_C^*, \lim_{t\to\infty} \bar{\ell}_t = \ell_C^*$ *and* $\lim_{t\to\infty} \omega_t = \omega_C$*.*

Proof. See Appendix B. ■

The intuition is simple. Part (i) says that starting from a zero childcare equilibrium, there is no possibility for evolution of the endogenous variables as long as the exogenous

[16]Since below we will start from an equilibrium where the median couple votes for $H_h > 0$ in period 0, it is easy to see that this will hold true in every period.

parameters remain unchanged, since childcare provision and usage will remain zero for every period. If, however, we start from an equilibrium with positive childcare provision, in the long run all couples will use children. Correspondingly, female labour supply and fertility reach their maximum value and the wage gap its minimum. This follows from the fact that the distribution $F_{t+1}(\beta)$ puts more weight on high-β couples than $F_t(\beta)$. Hence, equilibrium childcare provision and usage must be higher in $t+1$ than in t.

Note that, strictly speaking, this is only a limit result. Couples with $\beta \leq 0$ will never use childcare, and since they reproduce, childcare usage will always be below 100%. In the limit, however, childcare usage converges to one as time goes to infinity and the proportion of families not in childcare goes to zero.

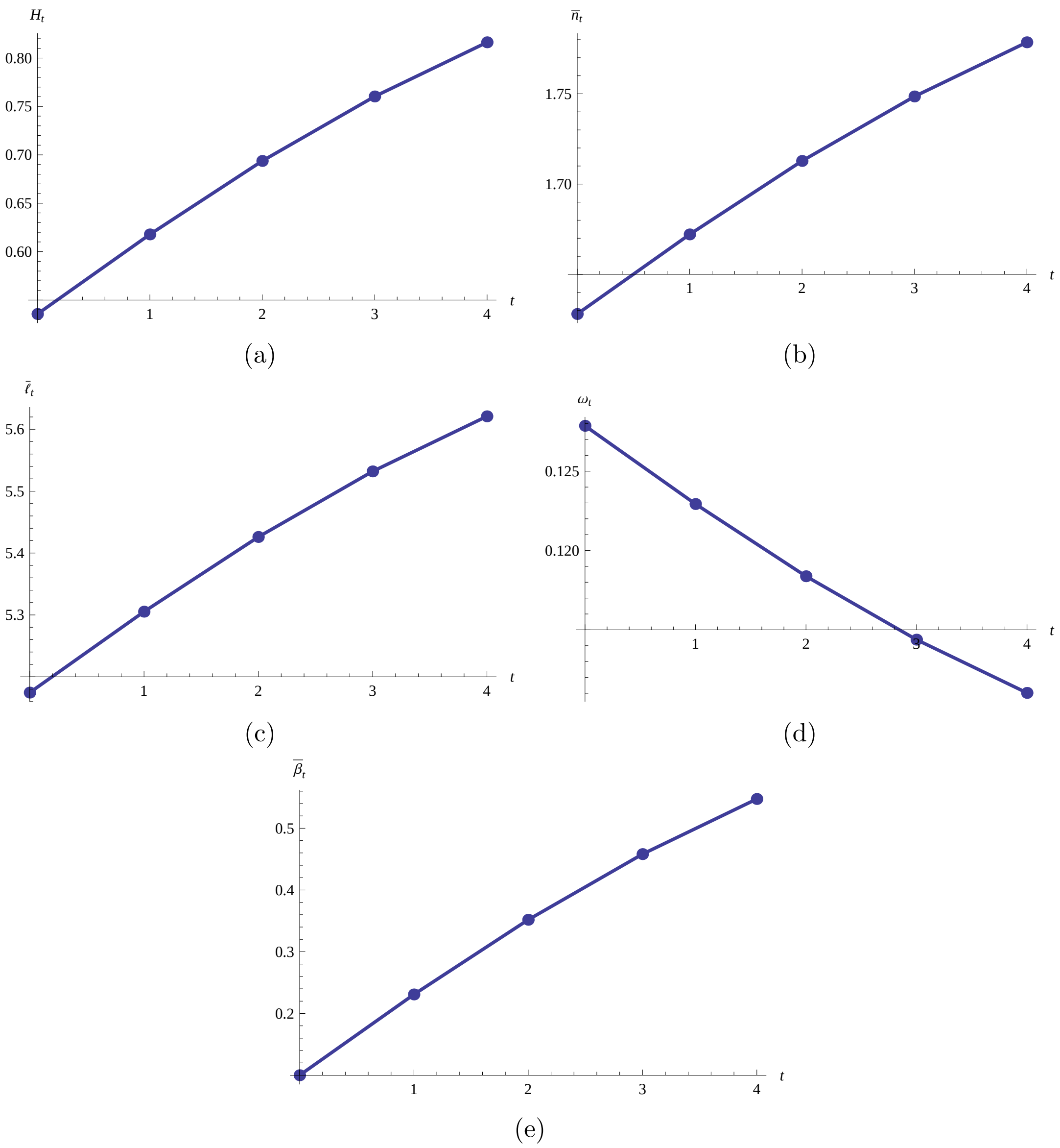
Figure 16 shows how the key endogenous variables evolve over time, using the benchmark parameters from the example in the last section. Here, $\bar{\beta}$ denotes the average cultural attitude parameter. Note that within 5 generations, this increases by more than a factor 5.

7 Discussion

Learning. Fernandez (2007a) and Fogli and Veldkamp (2009) both study the effect of culture on female labour force participation in learning models. They assume that women use information about the effects of labour supply using samples of other women around them. This learning process gives rise to slowly evolving female labour force participation.

Could the same sort of learning model in the present context also lead to a slow evolution of childcare, fertility and female labour force participation? The key difference to the learning models of Fernandez (2007a) and Fogli and Veldkamp (2009) is that in our model, childcare policy is endogenously chosen. Learning can be effective only when it changes policy. But, as we have shown, the zero childcare equilibrium is immune to small changes in childcare usage. Hence, learning could only happen in an equilibrium with positive childcare provision and usage.

Private childcare. Kimura and Yasui (2009) study a similar model where voting is on (compulsory) education but individuals can choose private education to top up publicly provided education. This may open up the possibility that if public childcare were zero,



H_t
0.80
0.75
0.70
0.65
0.60
1
2
3
4
t
(a)
$\overline{n}_t$
1.75
1.70
1
2
3
4
t
(b)
$\bar{\ell}_t$
5.6
5.5
5.4
5.3
1
2
3
4
t
(c)
ω_t
0.125
0.120
1
2
3
4
t
(d)
$\overline{\beta}_t$
0.5
0.4
0.3
0.2
1
2
3
4
t
(e)

Figure 16

some couples would choose to buy private childcare. That would also provide a role for learning (or an alternative transmission mechanism such as intergenerational inheritance of cultural values) which would change the zero childcare provision equilibrium over time.

8 Conclusion

This paper has examined the role of cultural attitudes for the provision of childcare, fertility, female labour supply and the gender wage gap. In particular, the simple assumption that perceived childcare quality depends on cultural attitudes and on aggregate childcare usage leads to multiple equilibria, where equilibria with zero childcare provision, low fertility and female labour supply and high wage gap exist alongside equilibria with high childcare provision, high fertility and female labour supply and low wage gap. This observation could potentially explain the large variation in these variables observed among some otherwise similar countries such as the OECD countries.

The paper has also presented some descriptive evidence which is consistent with these theoretical results. Clearly, it would be desirable to explore whether these correlations are causal. However, since cultural attitudes and childcare policies are endogenously determined, this would necessitate some credible instrumental variables.

What are the implications of the model for policy makers? One obvious remark is that increased childcare provision may not affect fertility or female labour supply if a society's attitude towards external childcare remains unchanged. However, while this outcome may seem bleak to politicians, the link between attitudes and policies also opens up a channel for influencing fertility and female labour force participation. In particular, if politicians could somehow change cultural attitudes, a low fertility-low female labour force participation country might be transformed into a high fertility-high female labour force participation one. Whether and how such policies could work remains an issue to be explored in future work.

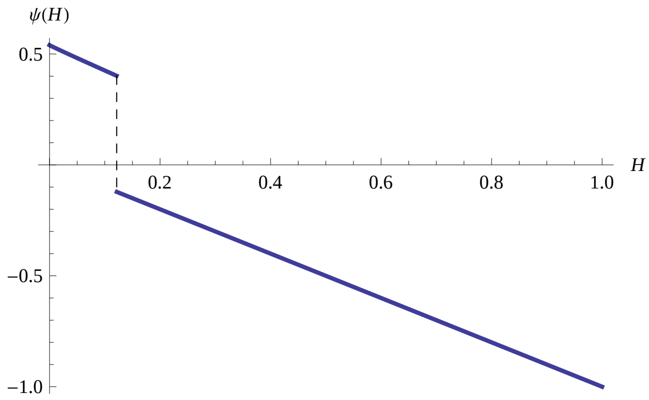


Figure A.1

Appendix

A The case when $\alpha < \gamma$

When $\alpha < \gamma$, $\tilde{\beta}$ is increasing in H. This implies that the median couple will vote for positive taxes and spending only if H is low enough, because then crowding is dominated by the externality in beliefs. Hence, the function $\psi(H)$ *may* look as shown in Figure A.1: to the left of $\tilde{H}$, the median couple votes for positive taxes and spending and H is positive; then at $\tilde{H}$ there is a downward jump. In this case, as can be seen from the figure, an equilibrium does not exist.

If an equilibrium exists – if the value of $\psi(H)$ just to the right of the jump is positive – then it will be unique (since $\psi(H)$ is downward sloping and $\psi(1) < 0$).

B Proofs

Proof of Proposition 2. Using (8) utility can be rewritten as

$$\begin{aligned} V_J(\cdot) = K &+ a\log(1-\tau) + \log(1+(1-\Theta_J)^2) - (1-a)\log(1-\Theta_J) - b\log\theta_J \\ &+ \mathbf{1}b(\log\beta + \log g + \log H^{\alpha}) \end{aligned} \tag{A.1}$$

where K is a constant depending on a, b and w_m. Substituting from (11) and simplifying gives:

$$\begin{aligned} V_C(\cdot) &= K + \log(1 + (1-\Theta_C)^2) - (1-a)\log(1-\Theta_C) - b\log\theta_C \\ &+ a\log(1-\tau) + b\log\tau + b\log\beta + b\log\bar{w}_m + b\log H^{\alpha-\gamma} \\ &+ \log\left[\frac{a\theta_C(1-\Theta_C)}{b(1+(1-\Theta_C)^2}\left((1-H)(1-\Theta_N) + H(1-\Theta_C)\right)\right] \end{aligned} \tag{A.2}$$

Maximising (A.2) with respect to τ gives $\tau^* = \frac{b}{a+b}$. Inserting into (A.2) shows that the couple will vote for $\tau = 0$ if $V_N(\bullet)|_{\tau=0} > \max_\tau V_C(\bullet)$ and $\tau = \frac{b}{a+b}$ otherwise, where

$$\begin{aligned} \max_\tau V_C(\cdot) &= K + \log(1 + (1-\Theta_C)^2) - (1-a)\log(1-\Theta_C) - b\log\theta_C \\ &+ a\log\frac{a}{a+b} + b\log\frac{b}{a+b} + b\log\beta + b\log\bar{w}_m + b\log H^{\alpha-\gamma} \\ &+ \log\left[\frac{a\theta_C(1-\Theta_C)}{b(1+(1-\Theta_C)^2}\left((1-H)(1-\Theta_N) + H(1-\Theta_C)\right)\right] \end{aligned} \tag{A.3}$$

$$V_N(\bullet)|_{\tau=0} = K + \log(1 + (1-\Theta_N)^2) - (1-a)\log(1-\Theta_N) - b\log\theta_N \tag{A.4}$$

Solving $V_N(\bullet)|_{\tau=0} = \max_\tau V_C(\bullet)$ for β gives $\tilde{\beta}$. ■

Proof of Proposition 3. It suffices to show that $\tau = g = 0$ is always an equilibrium for $\alpha > \gamma$. From Proposition 2, the median couple will vote for $\tau = g = 0$ if $H < \tilde{H}(\beta_M)$, where $\tilde{H}$ is implicitly defined by $\beta_M = \tilde{\beta}(H)$. Given $g = 0$, no one will choose childcare so $H = 0$. Hence, if the median couple expects $H^e = 0$, the equilibrium is given by $\tau = g = H = 0$. ■

Proof of Proposition 4. (i) Differentiating $\tilde{\beta}$ in (13) shows that $\frac{d\tilde{\beta}}{dH} < 0$ since $\alpha > \gamma$, and $\lim_{H\to 0}\tilde{\beta} = \infty$. Hence, if $\mu < \tilde{\beta}|_{H=1}$, the median couple will vote for zero taxes and spending whatever her expected H^e, and hence, in equilibrium $\tau = g = H = 0$.

(ii) Since $\frac{d\tilde{\beta}}{dH} < 0$, $\mu > \tilde{\beta}|_{H=1}$ implies that there is an expected level of childcare usage where the median couple votes for $\tau_h = \frac{b}{a+b}$ and a positive spending level. Call this level of childcare usage $\tilde{H}$. For $H < \tilde{H}$, $\psi(H) = -H$, which implies that $H = 0$ is a locally stable equilibrium. At $H = \tilde{H}$, there is a jump in $\psi(H)$. If $\psi(\tilde{H}) < 0$, the equilibrium with $H = 0$ is unique. Suppose that $\psi(\tilde{H}) > 0$. It can be shown numerically that over the relevant parameter range, $\psi(1) < 0$. By continuity of $\psi(H)$, the intermediate value theorem implies that there is at least one other equilibrium with $H_h > 0$ where $\psi(H) = 0$, and since $\psi'(H) < 0$, this is the only other equilibrium. ■

Proof of Proposition 5. Since the equilibrium is locally stable we have $\psi'(H_h) < 0$ and $\text{sign}\left(\frac{dH_h}{d\mu}\right) = \text{sign}\left(\frac{d\psi(H,\bullet)}{d\mu}\right)$. Differentiating $\psi(H) = 1 - \Phi\left(\frac{\hat{\beta}-\mu}{\sigma}\right) - H = 0$ with respect to μ gives

$$\frac{d\psi(H,\bullet)}{d\mu} = \frac{1}{\sigma}\phi\left(\frac{\hat{\beta}-\mu}{\sigma}\right) > 0 \tag{A.5}$$

where $\phi(\bullet)$ is the pdf of the standard normal distribution. Since n_h and ℓ_h are increasing in H_h, the result follows. Likewise, differentiating with respect to σ gives

$$\frac{d\psi(H,\bullet)}{d\sigma} = \frac{\hat{\beta}-\mu}{\sigma^2}\phi\left(\frac{\hat{\beta}-\mu}{\sigma}\right) \tag{A.6}$$

so $\text{sign}\left(\frac{dH_l}{d\sigma}\right) = \text{sign}(\hat{\beta}-\mu)$. The other results follow from differentiating $\hat{\beta}$ and noting that $\frac{d\psi(\bullet)}{d\hat{\beta}} < 0$. ■

Proof of Proposition 6. (i) Given that $H = 0$ implies $\hat{\beta} = \infty$, the distribution does not change, $F_{t+1}(\beta) = F_t(\beta)$ for all t. Hence, the equilibrium will remain at $t = g = H = 0$.

(ii) We first show that the distribution $F_t(\beta)$ first-order stochastically dominates $F_{t-1}(\beta)$ (which is apparent from Figure 15). Let $A \equiv \frac{n_N}{\bar{n}_{t-1}}$ and $B \equiv \frac{n_C}{\bar{n}_{t-1}}$. From the definition of $F_t(\beta)$,

$$F_t(\beta) = \begin{cases} AF_{t-1}(\beta) & \text{for } \beta \leq \hat{\beta}_{t-1} \\ AF_{t-1}(\hat{\beta}_{t-1}) + B(F_{t-1}(\beta) - F_{t-1}(\hat{\beta}_{t-1})) & \text{for } \beta > \hat{\beta}_{t-1} \end{cases} \tag{A.7}$$

Note that $AF_{t-1}(\hat{\beta}_{t-1}) + B(1 - F_{t-1}(\hat{\beta}_{t-1})) = 1$. Substituting in (A.7) and rearranging gives

$$F_t(\beta) = \begin{cases} AF_{t-1}(\beta) & \text{for } \beta \leq \hat{\beta}_{t-1} \\ F_{t-1}(\beta) + (1-B)(1 - F_{t-1}(\beta)) & \text{for } \beta > \hat{\beta}_{t-1} \end{cases} \tag{A.8}$$

Since $A < 1 < B$, it follows that $F_t(\beta) < F_{t-1}(\beta)$ for all β. This implies that $\psi_t(H) = 1 - F_t(\beta) - H_t > \psi_{t-1}(H) = 1 - F_{t-1}(\beta) - H_{t-1}$ for all t. Since the equilibrium is locally stable at H_t, it follows that $H_t > H_{t-1}$. ■

References

Ahn, N. and Mira, P. (2002). A note on the changing relationship between fertility and female employment rates in developed countries. *Journal of Population Economics*, **15**, 667–682.

Baudin, T. (2010). A role for cultural transmission in fertility dynamics. *Macroeconomic Dynamics*, pages 454–481.

Bauernschuster, S. and Rainer, H. (2010). From politics to the family: How sex-role attitudes keep on diverging in reunified germany. CESifo Working Paper No. 2957.

Bick, A. (2010). The quantitative role of child care for female labor force participation and fertility. MPRA Paper No. 25474.

Blau, F. D. and Kahn, L. M. (1997). Swimming upstream: Trends in the gender wage differential in the 1980s. *Journal of Labor Economics*, **15**, 1–42.

Blau, F. D. and Kahn, L. M. (2007). The gender pay gap. *Economists' Voice*, **Vol. 4**, Iss. 4, Article 5.

Blau, F. D., Kahn, L. M., Liu, A. Y., and Papps, K. L. (2008). The transmission of women's fertility, human capital and work orientation across immigrant generations. NBER Working Paper No. W14388.

Bundesagentur für Arbeit (2007). Arbeitsmarktbericht 2006. Bundesagentur für Arbeit, Nürnberg.

Bundesministerium für Familie, Senioren, Frauen und Jugend (2008). Dossier: Ausbau der Kinderbetreuung – Kosten, Nutzen, Finanzierung. Berlin.

Ermisch, J. F. (1989). Purchased child care, optimal family size and mother's employment: Theory and econometric analysis. *Journal of Population Economics*, **2**, 79–102.

Erosa, A., Fuster, L., and Restuccia, D. (2010). A quantitative theory of the gender gap in wages. IMDEA working paper 2010/04.

Fagnani, J. (2002). Why do French women have more children than German women? Family policies and attitudes towards child care outside the home. *Community, Work & Family*, **5**, 103 – 119.

Farré, L. and Vella, F. (2007). The intergenerational transmission of gender role attitudes and its implications for female labor force participation. IZA Discussion Paper No. 2802.

Fernandez, R. (2007a). Culture as learning: The evolution of female labor force participation over a century. mimeo.

Fernandez, R. (2007b). Women, work, and culture. *Journal of the European Economic Association*, **5**, 305–332.

Fernandez, R. (2010). Does culture matter? In *Handbook of Social Economics*. Elsevier. forthcoming.

Fernandez, R. and Fogli, A. (2009). Culture: An empirical investigation of beliefs, work, and fertility. *American Economic Journal: Macroeconomics*, **1**, 147–177.

Fernandez, R., Fogli, A., and Olivetti, C. (2004). Mothers and sons: Preference formation and female labor force dynamics. *Quarterly Journal of Economics*, **119**(4), pp. 1249–1299.

Fogli, A. and Veldkamp, L. (2009). Nature or nurture? Learning and the geography of female labor force participation. mimeo.

Fortin, N. M. (2005). Gender role attitudes and the labour-market outcomes of women across oecd countries. *Oxford Review of Economic Policy*, **21**(3), 416–438.

Fortin, N. M. (2006). Greed, altruism, and the gender wage gap. Mimeo.

Fortin, N. M. (2009). Gender role attitudes and womens labor market participation: Opting-out, aids, and the persistent appeal of housewifery. Mimeo.

Guiso, L., Sapienza, P., and Zingales, L. (2006). Does culture affect economic outcomes? *Journal of Economic Perspectives*, **20**, 23–48.

Haan, P. and Wrohlich, K. (2009). Can child care policy encourage employment and fertility? Evidence from a structural model. IZA Discussion paper No. 4503.

Henkel, I. (2003). Adieu, Rabenmutter. *Süddeutsche Zeitung*. 26 July.

Kimura, M. and Yasui, D. (2009). Public provision of private child goods. *Journal of Public Economics*, **93**(5-6), 741 – 751.

Krause, P., Goebel, J., Kroh, M., and Wagner, G. G. (2010). 20 Jahre Wiedervereinigung: Wie weit Ost- und Westdeutschland zusammengerückt sind. *DIW Wochenbericht*, **77**(44), 2–12.

Kröhnert, S. (2010). Bevölkerungsentwicklung in Ostdeutschland. Berlin-Institut für Bevölkerung und Entwicklung.

Mincer, J. and Polachek, S. (1974). Family investments in human capital: Earnings of women. *Journal of Political Economy*, **82**(2), S76–S108.

Statistisches Bundesamt (2010a). Kindertagesbetreuung regional 2009. Statistisches Bundesamt, Wiesbaden.

Statistisches Bundesamt (2010b). Verdienstunterschiede zwischen Männern und Frauen 2006. Statistisches Bundesamt, Wiesbaden.

van Gameren, E. and Ooms, I. (2009). Childcare and labor force participation in the Netherlands: The importance of attitudes and opinions. *Review of Economics of the Household*, **7**, 395–421.

Waldfogel, J. (1988). Understanding the 'family gap' in pay for women with children. *Journal of Economic Perspectives*, **12**, 157–170.

Yasuoka, M. and Miyake, A. (2010). Child-care support policy and fertility in a model based on the supply of child-care services. Mimeo.