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Abstract

This paper studies the effect of cultural attitudes on childcare provision, fertility, female labour supply 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 gender 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 supply and high wage gap, and one with high childcare provision, high fertility and female labour supply and low wage gap.

JEL-Code: J130, J210, J160.

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

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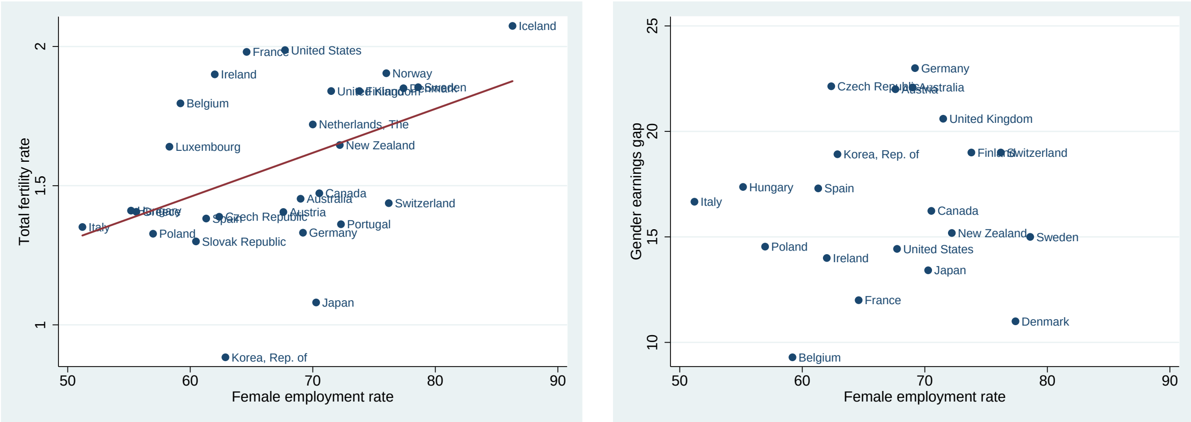


(a) Fertility

(b) Earnings gap

Figure 1: Fertility, gender earnings gap and female labour force participation in OECD countries

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 developed countries, the correlation between fertility and female labour force participation has recently turned positive. Figure 1a shows the correlation between the total fertility rate and the female employment ratein OECD countries.[1] 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 1b shows the correlation between the (full-time) gender earnings gap and female labour force participation. While there is no significant correlation between the two variables, the figure shows that there are some countries (e.g. Sweden and Denmark) with notably high female labour force participationand low earnings gaps and others (such as Germany and Austria) with low female labour force participationand high earnings gaps. Further, Olivetti and Petrongolo (2008) show

[1]Here and in the other figures below, all variables have been purged of the influence of a dummy for being a formerly communist country and of continent dummies.

that the gender wage gap is negatively correlated with the gender employment gap in a smaller sample of countries in 1999.

These correlations open up the possibility that policies might increase both fertility and 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 2a 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.[2] It is apparent from the Figure that countries with high spending on childcare and high enrollment rates also have high fertility.

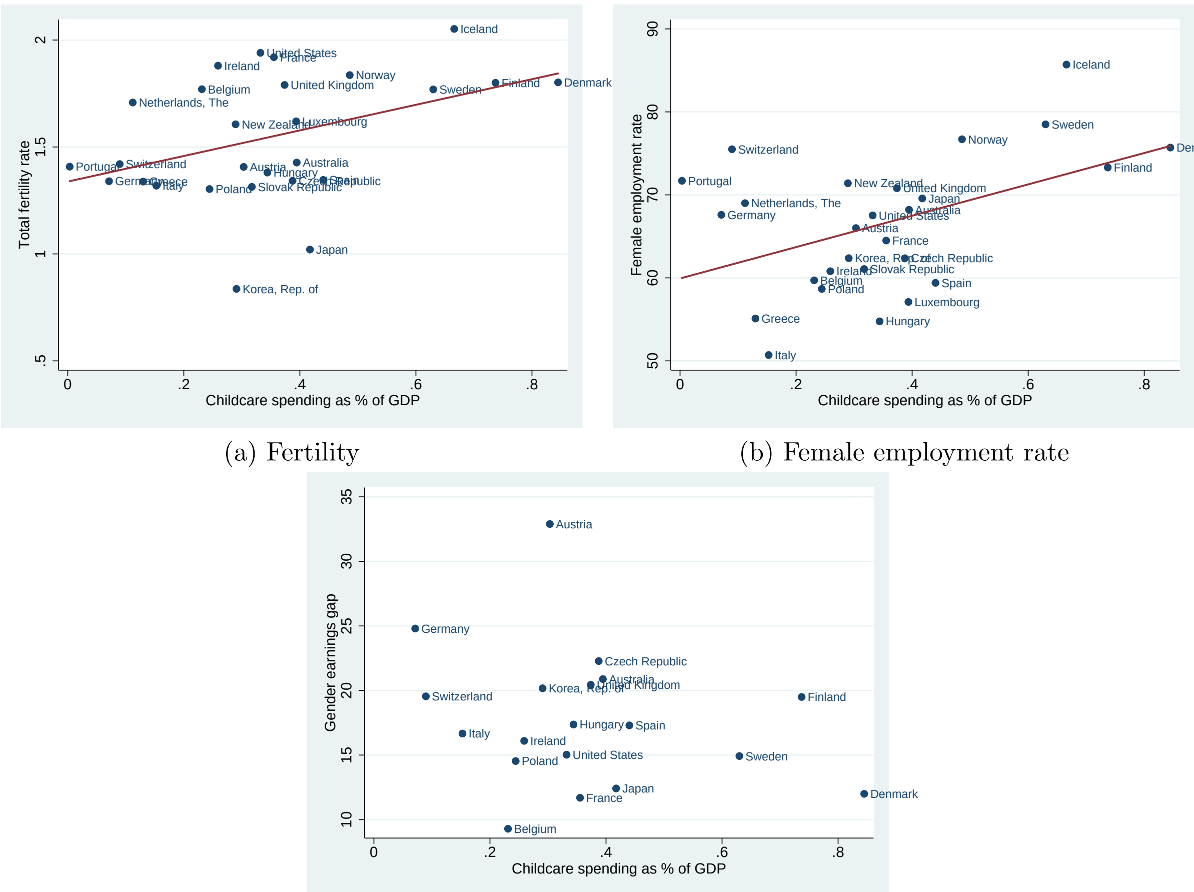
Figure 2b shows the correlation between the female labour participation rate and childcare spending as a share of GDP (again, the same correlation holds between female labour participation and enrollment in childcare). As the figure shows, there is a clear positive association between these two variables as well.

Figure 2c 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 (although again this correlation is not significant).[3]

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

[2]Note that this correlation breaks down when one considers enrolment of children aged 3-5. In this age group, there is much less variability, as half the OECD countries have enrolment rates over 80%.

[3]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.



(a) Fertility

(b) Female employment rate

(c) Earnings gap

Figure 2: Fertility, female labour force participation gender earnings gap and childcare spending in OECD countries

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, female labour force participation and the wage gap. It is instructive to consider the cases of France and Germany as examples. As is well known, the total fertility rate is much higher in France, 2.0 in 2008 compared to only 1.38 in Germany. 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.[4] The argument in this paper is that these differences are (at least partly) driven by differences in cultural attitudes. In Germany, 48.6% 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%.[5] For women, the corresponding numbers are 50.7% for Germany and 36.6% for France. 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).[6] In this respect, however, even Germany looks more like two countries, East and West. In 2008, 12% of all children under three in West Germany were enrolled in 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 employment rate was 72.1% in East Germany, compared to 65.5 in the West.[7] The fertility rate in East Germany was higher than in the West until reunification,

[4]Data are from OECD (2010).

[5]Data are from International Social Survey Programme.

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

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

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), compared to 55.8% 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.[8]

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 perceived quality 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 the high-childcare equilibrium, childcare provision, fertility and female labour supply all rise with the average societal attitude towars working mothers and the wage gap falls with the average attitude.

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 values are either inherited from one's parents, or that values evolve by a combination of inheritance and learning.[9] It is shown that, starting from a zero childcare equilibrium, nothing changes

employment rates.

[8]Note that in other countries of the former Soviet bloc, the percentages agreeing that a pre-school child with a working mother was likely to suffer were much higher, over 60% for instance in Hungary, Bulgaria and Russia.

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

over time, while starting from a positive childcare equilibrium, over time childcare usage converges to one. 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 and fertility and female labour supply. Most papers have found positive effects of childcare on both fertility and labour supply. The present paper tries to formally analyse 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 – which, contrary to childcare, is mandatory – with private supplements and endogenous fertility which also produces multiple equlibria. However, their model is based on a time consistency mechanism: 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. By contrast, Hiller (2009) analyses a model where cultural norms are endogenous and in turn influence education and female labour supply. However, he takes fertility as exogenous and focuses on the dynamics of norms and female labour supply, rather than on the joint determination of policies and 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 severs 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. The present paper shows how this can be rationalised by studying parents' decisions about labour supply, fertility and childcare.

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).

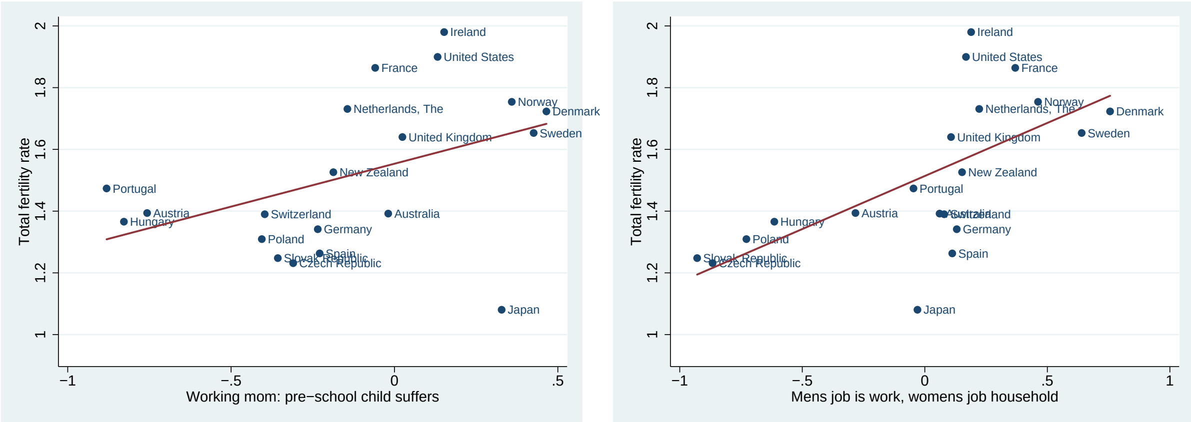
3 Evidence

I now present some descriptive evidence on the link between cultural attitudes towards female work and childcare and fertility and female 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. For each question I regress the answer to the question on gender, age, age squared, a catholic dummy, and set of country dummies. For each country, I then take the country fixed effect from that regression as the country's cultural attitude.

Figure 3a shows the correlation of the total fertility rate in OECD countries with the average disagreement with the statement:[10] "A pre-school child is likely to suffer if his or her mother works." Figure 3b 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.

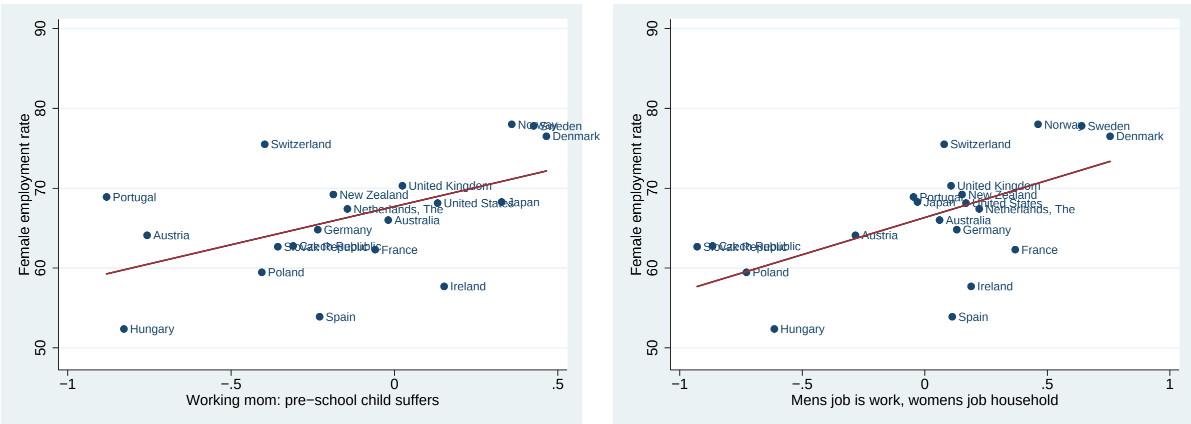
Figures 4a and 4b show the correlation of female labour force participation with the measures above. When the population tends to agree that pre-school children with a working mother suffer, or that women should look after the home and family, female

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



(a) Pre-school child suffers (b) Men's job is work

Figure 3: Fertility and cultural attitudes in OECD countries in OECD countries



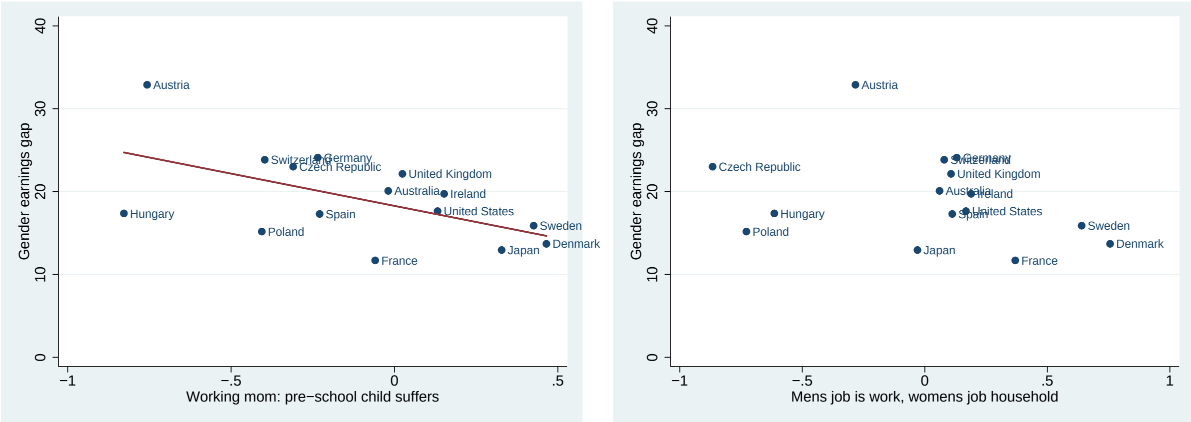
(a) Pre-school child suffers (b) Men's job is work

Figure 4: Female employment rate and cultural attitudes in OECD countries in OECD countries

labour force participation tends to be low.

Figures 5a and 5b 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 (the latter correlation is, however, insignificant).

As we have seen above, childcare spending is positively correlated with fertility and female labour force participation, so it is no surprise that childcare spending is correlated with the cultural values much in the same way as fertility and female labour force participation.



(a) Pre-school child suffers

(b) Men's job is work

Figure 5: Gender earnings gap, childcare spending and cultural attitudes in OECD countries in OECD countries

Of course, this evidence was purely descriptive with no claim of causality. In fact, according to the model presented below, the perception of childcare quality depends on childcare spending and enrolment. Hence, attitudes might well be endogenous. So the whole point of this descriptive evidence is to show 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.

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

$$u = a \log c + b \log(nQ_J) + (1 - a - b) \log L, \quad J \in \{C, N\} \tag{1}$$

where c is consumption, n the number of children and L leisure. Q is the quality of childcare, which depends on childcare usage; the subscript C stands for 'childcare' and subscript N for 'no childcare', i.e. children are reared at home.

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). For now, I assume that childcare is financed by taxes and provided free of charge to all those who use it. In Section 5, where the model is solved numerically, I present an extension which allows for partially subsidised childcare fees. 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 $w_m \in W$.[11] 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 $\beta_M = \int_{\beta \in B} \beta dF(\beta)$. Population size 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

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

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.

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, conditional on childcare usage. (Since childcare quality affects childcare usage, however, the total fertility rate will be affected by childcare quality.) Maximising utility

[11] 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.

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}.[12]

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.[13] 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, which depends on the fraction of couples using childcare, H.

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

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

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

Equation (6) shows 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.[14] If one were to drop the assumption of proportionality between male and female wages, one would find that couples with higher female wages have fewer children (see above). This would not, however, change

[12]Note that θ_J affects the price of children, but not the price of leisure.

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

[14]The couple's full income is $w_m(1 + (1-\Theta_J)^2)$ and the price of children $w_m(1-\Theta_J)$. So both income and price of children increase proportionately with w_m, and under Cobb-Douglas utility, the income and substitution effects are both one in absolute value.

the main results of the paper in any fundamental way.

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 further reduces labour supply, but it increases fertility since the price of children falls with a falling wage. So female labour supply surely increases with a fall in Θ_J. However, the combined effect of the direct and indirect 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. In the numerical model below (Section 5), it can be shown that for the parameters of b, θ_C, θ_N and Θ_N chosen, this assumption holds for all $0 \leq \Theta_C \leq 1$.

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 β is a couple-specific factor (the 'cultural attitude' towards childcare), H is the fraction of children in childcare and g is level of childcare service per child, which equals spending per child, adjusted for possible crowding (see Section 4.3 below). 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.

Note that in principle, β could take on any value on the real line, so there is no a priori restriction on the relationship between Q_C and Q_N. For instance, even if the quality of external care is much larger than one, some low β parents may nonetheless choose to rear their children at home, and conversely, high-β parents may want to use childcare even if $Q_C < Q_N$. This couple specific attitude is assumed to be heterogeneous. For concreteness, I will assume that 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 detrimental to their child, or the social stigma associated to putting children in daycare is lower.[15]

The childcare decision depends on the indirect utility in the case of childcare relative to the indirect utility in the case the children are raised at home. Let $V_J(\cdot), J \in \{C, N\}$ denote indirect utility as a function of whether or not the children are in childcare. 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 $V_C(\bullet) > V_N(\bullet)$. Using (8) to solve $V_C(\bullet) = V_N(\bullet)$ for β 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 the level of childcare service g. A higher service level 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 participation by 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 6 shows the curve $1 - F(\hat{\beta})$ against the "expected" fraction of families using childcare, H^e (see Section 5 for

[15] 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.

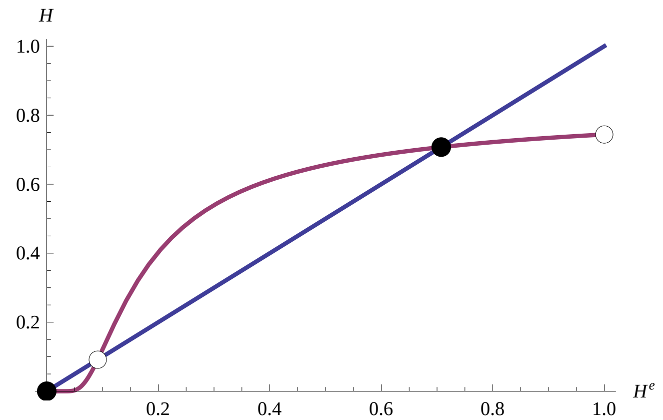


Figure 6: Equilibrium childcare usage

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.

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

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

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

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

The left hand side of (11) shows the total service level, which is the service level per

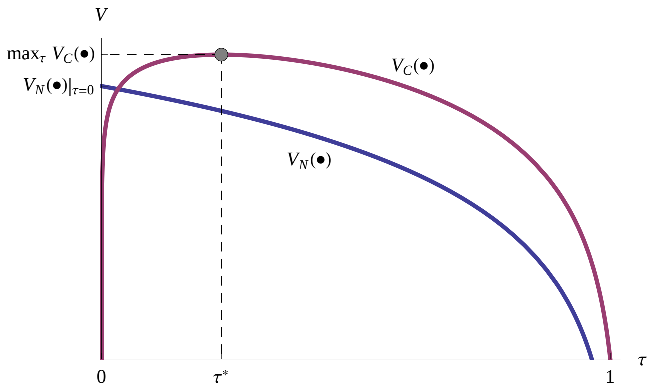


Figure 7: Preferences over taxes to finance childcare provision

child times the number of children in childcare. This is equal to per capita tax revenue (tax rate times the labour income of men plus labour income of the $1-H$ women who raise their children at home plus that of the H women whose children are in childcare), adjusted for crowding. The parameter $\gamma \in [0,1]$ measures the effect of crowding in childcare spending. For $\gamma = 0$, there is no crowding (pure public good), so each child would receive a service level which equals total spending. Conversely, if $\gamma = 1$, childcare would be a purely private good so the service level would equal total spending divided by the number of users.[16] I will assume that $\gamma \leq \alpha$, i.e. that the externality from average childcare usage exceeds the crowding externality. Since perceived quality is proportional to average tax revenue times $H^{\alpha-\gamma}$, this implies that the net externality is positive, so that perceived quality is nondecreasing in total childcare usage.[17]

The couple's problem is thus to maximise $\max\{V_C(\bullet), V_N(\bullet)\}$ subject to the budget constraint (11). I assume that voting is myopic in the sense that when voting, voters treat childcare usage H as given. Figure 7 shows a typical couple's indirect utility as a function of the tax rate, 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

[16] It might be preferable to make the crowding factor depend on the children using childcare instead of families using it, but this would not change the qualitative nature of results. It can also be shown that the quantitative results would barely change.

[17] If this were not the case, the median couple would vote for positive taxes 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.

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) together with the government budget constraint (11) shows that the optimal tax rate 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.[18] The next result characterises the voting equilibrium, for given childcare usage H.

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

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

Proof. See Appendix B. ■

The cutoff $\tilde{\beta}$ defines the value of β where a couple is just indifferent between a zero tax rate and rearing children at home, and a positive tax rate and sending children to childcare, for given expected childcare usage H^e. Equivalently, 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 $\frac{b}{a+b}$.

Equation (13) shows that the cutoff is proportional to $H^{\gamma-\alpha}$. As long as $\alpha > \gamma$, i.e. the net externality of childcare usage is positive, this cutoff falls with H, which means that the

[18]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.

median couple would be more likely to vote for positive childcare provision. Likewise, if congestion increases relative to the cultural externality ($\gamma - \alpha$ increases), this cutoff rises, which would mean that the median couple would need a higher value of H to vote for positive childcare provision. It is also apparent that $\tilde{\beta}$ falls with mean income $\bar{w}_m$. When the tax base increases, the median couple will be more likely to vote for positive childcare. Moreover, $\tilde{\beta}$ is decreasing in θ_N and Θ_N and increasing in Θ_C.

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 cultural attitude, 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 private 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. ■

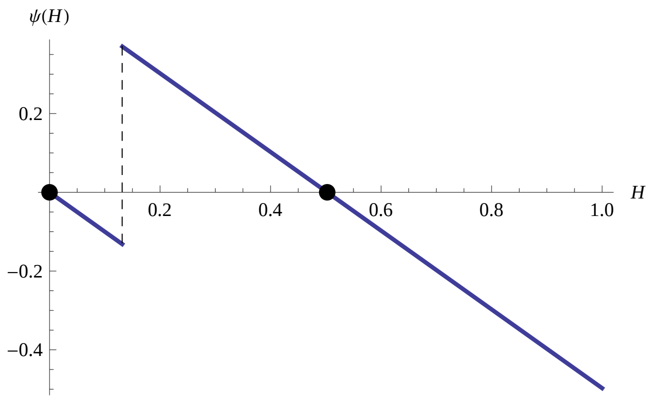


Figure 8: Equilibrium childcare usage

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 $H^e = 0$, they 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 8 shows the determination of equilibrium graphically. The figure plots the function $\psi(H) \equiv 1 - F(\hat{\beta}) - H$ (for particular parameters described in the next section). As long as the expected childcare usage H^e falls short of $\tilde{H}$, the median couple votes for $g = \tau = 0$. Then 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 $\max_\tau V_C(\bullet)$. 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, namely larger than $\tilde{\beta}$. 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*

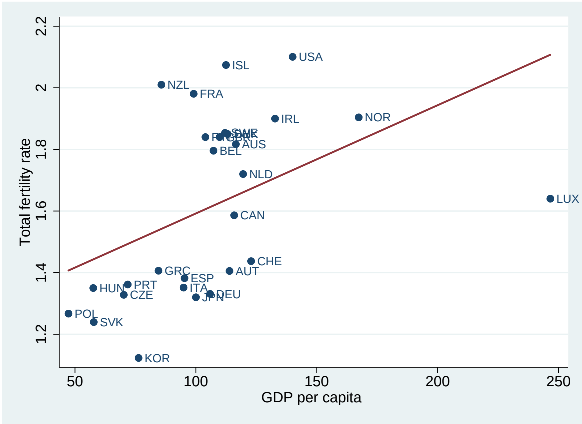


Figure 9: Fertility and GDP per capita in OECD countries

decreasing in Θ_C.

Proof. See Appendix B. ■

The proposition shows how childcare usage, fertility, female labour supply and the wage gap 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, and hence the larger 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 (Θ_C) reduces childcare usage whereas increasing the fixed or variable time costs of raising children at home (Θ_C of θ_C) increases it.

A higher average wage $\bar{w}_m$ also increases childcare usage. Societies which are richer on average have a larger tax base, which increases equilibrium childcare spending and thus leads to higher usage. This prediction seems to be at odds with the observation that developed countries tend to have lower fertility rates than the less developed ones. However, Myrskylä *et al.* (2009) have recently argued that beyond a certain level of development, fertility increases with further development (measured by the Human Development Index). Figure 9 shows that, for the OECD countries the total fertility rate in 2006 is positively correlated with GDP per capita.

Table 1: Target values for calibration

Regime	Enrolment	TFR	FLS	Wage gap	Tax rate
High	0.50	1.93	5.58	0.127	0.015
Low	0	1.37	4.58	0.21	NA

5 Calibration

Benchmark model. The model is now calibrated in the following way. Parameters are chosen to replicate the total fertility rate, female labour supply, childcare enrolment for children under three and gender earnings gap in two stylised regimes: a high-childcare regime and a low-childcare regime. The high-childcare regime consists of the following countries, all of which have enrolment rates larger than 40%: Denmark, Iceland, Sweden, France and Norway. The low childcare regime consists of Germany, Austria and Switzerland, which had enrolment rates of 13.6% (Germany) and 10.5% (Austria) in 2006.[19] The target values for the calibration are shown in Table 1 (where TFR stands for total fertility rate and FLS for female labour supply). Given that the low childcare regime in the model necessarily has zero enrolment, the actual enrolment cannot be targeted in the low childcare regime. The other values are computed as the unweighted averages of the corresponding values across the corresponding countries.[20]

I set $\Theta_N = 0.21$, which is the target earnings gap in the low-childcare regime. Using (7) to solve the target value for female labour supply in the low-childcare equilibrium, $24\ell_N^* = 4.58$ (noting that the time unit is a day), then yields $a = 0.709$. The targeted tax rate is $\tau = \frac{b}{a+b}$, which implies $b = 0.011$. Since the unit of analysis is the couple, fertility in the low childcare equilibrium is $2n_N^* = 1.37$. Using (6), we can solve for $\theta_N = 0.032$. The remaining parameters are calibrated to approximate the target values in the high-childcare equilibrium. In particular, I set $\Theta_C = 0.13, \theta_C = 0.018, \mu = 0.0075, \sigma = 1, \alpha = 1.5$, and $\gamma = 0.9$.[21] The wage rate is set equal to the average male wage in Germany. Taking the unit of time to be a day and letting the male hourly wage be 17.8, I set $\bar{w}_m = 430$.[22] The

[19] There are no data for children under 3 for Switzerland, but I group it along with Austria and Germany, since its enrolment rate for children aged 3-6 is 48%, among the lowest of the OECD countries.

[20] See OECD (2010) for the data. Female labour supply is found by averaging women's usual working hours (Table LMF2.1 in the OECD family database) and multiplying by the maternal employment rate from Table LMF1.2.

[21] Borge and Rattsø (2008) estimate a population elasticity between −0.69 and −0.79 for per capita spending on childcare. Older studies have estimated crowding elasticities for local education close to one. Hence, I take $\gamma = 0.9$ as a reasonable value for the crowding elasticity.

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

resulting labour supply and fertility choices are $n_C^* = 1.235, n_N^* = 0.685, \ell_C^* = 0.282, \ell_N^* = 0.191$. Couples with children in childcare will have $2n_C^* = 2.47$ children and those who care for their children at home have $2n_N^* = 1.37$ children. Women with children in childcare will work $24\ell_C^* = 6.76$ hours per day and those whose children are not in childcare work $24\ell_N^* = 4.58$ hours per day. The female wage equals 371 Euros per day for women with children in childcare and 337 Euros per day for those who don't.

Figure 8 shows the two stable equilibria in the example: one at $H_l = 0$ and one at $H_h = 0.503$ so that 50% of families use childcare. In the high-usage equilibrium, the tax rate is $\tau_h = 0.015$ and the service level per capita is $g = 11.60$. Thus, spending is 1.5% of income, a little higher than what the high spending OECD countries spent on childcare and pre-primary education in 2005 (1.2% in Iceland and Denmark). Assuming 200 working days per year, expenditure would correspond to an annual expenditure of EUR 2491 (adjusting for congestion). This is above the average of what OECD countries spend on childcare support, which in 2005 spent 2 549 USD (converted to purchasing power parity) per child on childcare support (see OECD family database). Taking an exchange rate of 1.25 dollars per Euro, this corresponds to 2039 Euro. Note, however, that this is only the subsidised part of total childcare costs. Furthermore, some countries spent much more, for instance, Sweden spent 5928 USD (4742 EUR) and Denmark spent 6376 USD (5100 EUR). The interpretation is that countries like Germany or Austria *could* reach close to Scandinavian enrolment and childcare provision levels if society were to coordinate on the high-provision equilibrium.

The calibration results are shown in Table 2. Given the functional forms, we cannot perfectly replicate female labour supply *and* the earnings gap in the high-childcare equilibrium. Under the chosen parameters, female labour supply exceeds the target value by 1.7% while the earnings gap is 33% above the target value. Reducing the equilibrium earnings gap would be possible only at the price of increasing equilibrium female labour supply even further above the target. Comparing the two equilibria, in the equilibrium with $H_l = 0$ we have $2\bar{n} = 1.37, 24\bar{\ell} = 4.58$ and $\omega_l = 0.21$. In the equilibrium with $H_h = 0.503$ we have $2\bar{n} = 2(F(\hat{\beta})n_N^* + (1 - F(\hat{\beta}))n_C^*) = 1.92, 24\bar{\ell} = 24(F(\hat{\beta})\ell_N^* + (1 - F(\hat{\beta}))\ell_C^*) = 5.68$ and $\omega_h = 0.169$. Hence, in the high childcare usage equilibrium, the total fertility rate is about 40% higher and female labour supply 24% higher than in the zero childcare equilibrium. The wage gap is 19% lower in the high-childcare equilibrium.

Table 2: Calibration results

	Enrolment	TFR	FLS	Wage gap
	0	1.37	4.58	21%
	50.3%	1.92	5.68	16.9%
Δ	–	40%	24%	−19%

Table 3: Sensitivity analysis

		Enrolment	TFR	FLS	Wage gap
Benchmark		0	1.37	4.58	21%
		50.3%	1.92	5.68	16.9%
	Δ	–	40%	24%	−19%
$\mu = 0.5075$		0	1.37	4.58	21%
		69.4%	2.13	6.09	15.4%
	Δ	–	56%	33%	−26%
$\bar{w}_m = 215$		0	1.37	4.58	21%
		50.2%	1.92	5.67	16.9%
	Δ	–	40%	24%	−19%
$\alpha = 2.25$		0	1.37	4.58	21%
		50.2%	1.92	5.67	16.9%
	Δ	–	40%	24%	−19%

Sensitivity analysis. Table 3 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 supply barely change. Small changes also occur for a 50% increase of α to 2.25.[23] The major exception is a change in the median cultural preference μ. When this is increased by half a standard deviation to 0.5075, Table 3 shows a marked increase in childcare usage to 69% (an increase of 38%). Correspondingly, total fertility and female labour supply increase by about 11% and 7%, while the wage gap falls by 9%.

A change in the time costs of rearing children also has relatively strong effects, but as Table 4 shows, this change is mostly directly on the fertility and labour supply of those women rearing their children at home.[24] For instance, increasing θ_N by 25% to 0.04 reduces fertility of those women to 1.09. This increases the fertility differential between the high-

[23] The effect of changing γ is not analysed separately, since what matters for the equilibrium is only the difference $\alpha - \gamma$.

[24] From Proposition 5, we know that the equilibrium does not change with θ_C, while an increase of Θ_C works like a decrease in Θ_N.

Table 4: Sensitivity analysis (2)

		Enrolment	TFR	FLS	Wage gap
Benchmark		0	1.37	4.58	21%
		50.3%	1.92	5.68	16.9%
	Δ	–	40%	24%	−19%
$\theta_N = 0.04$		0	1.09	4.58	21%
		50.3%	1.79	5.67	16.9%
	Δ	–	63%	24%	−19%
$\Theta_N = 0.26$		0	1.36	2.72	26%
		50.3%	1.94	4.92	19.6%
	Δ	–	39%	61%	−25%

childcare and zero-childcare equilibrium, while aggregate childcare usage barely changes. Likewise, when Θ_N increases to 0.26, labour supply of women who care for their children at home falls to 3.06 hours, while their fertility increases slightly to 1.39. This increases the differential in labour supply and the wage gap between the two equilibria, while again childcare usage changes only by little.

These comparative statics results seem interesting if we were to try to explain the observed variation in fertility, childcare, female labour supply and the wage gap among developed nations. Taken at face value, the results would mean that observable differences in incomes and exogenous childcare costs cannot explain the large differences in outcomes across these nations. Rather, there would seem to be two other possible explanations. One is that these differences are due to the fact that different countries have coordinated on different equilibria, some on the high-childcare-high fertility and female labour supply equilibrium and others on the low-childcare-low fertility and female labour supply equilibrium. In fact, the model was calibrated so that the low-childcare equilibrium has just the observed low fertility and female labour supply of countries such as Austria, Switzerland and Germany, while the high-childcare equilibrium generates the high fertility and high female labour supply of the Nordic countries and France. Hence, even if the German speaking countries might be no less 'conservative' in their inherent preferences than the Nordic ones, coordination failure may prevent them from achieving the high-childcare equilibrium. The other potential interpretation is that countries differ in childcare enrolment, fertility, female labour supply and wage gap because they differ in the cultural attitudes held by their societies.

Childcare fees. Up to now, childcare was assumed to be freely available to all. Obviously, if parents have to pay fees for childcare (as they have to in most countries), the price of rearing children increases for those who plan to use childcare.

Therefore, in this subsection, I assume that parents have to pay some fees for childcare. Let p be the (daily) cost of a childcare slot to a couple. This will include childcare fees, net of direct cash benefits by the governments, tax credits, and other reductions. It is easy to see that fertility decreases with p but female labour supply rises. The government budget now has to cover only that part of expenditure not covered by parents' fees.

In order to simplify the analysis, I assume that all couples earn the same wage $w_m = \bar{w}_m$, but the distribution of β remains unchanged.[25] All other parameters are the same as in the benchmark solution. For the childcare fee, a couple in Germany in 2005 would have to pay on average 124 Euro per month for a child under 3 years, which corresponded to roughly 15% of the cost per slot (Borck and Wrohlich, 2010).[26] I use this figure and assume that it has to be paid for 4 years, whereas the couple earns wages for 35 years. These numbers are then discounted using a 3% discount rate and converted to daily figures. Using these numbers, fertility of couples who use childcare falls from 2.47 if there were no fees to 2.12 with fees. In fact, as long as the subsidy rate exceeds 28%, in this example fertility would be higher for those couples who use childcare than for those who don't.

Likewise, it would be possible to introduce monetary costs of children, such as those for food, clothing and shelter. These costs would obviously reduce fertility for all families, regardless of whether they use childcare or not. One study found monthly monetary costs of 550 EUR in Germany for a family with two children.[27] Suppose all other parameters are unchanged (in particular, the childcare fee remains as described). Assuming that monetary costs have to be incurred for 20 years, fertility would drop to 0.59 for couples who use childcare and 0.49 for couples not using childcare.

[25]The reason is that the optimal tax rate now depends on the wage. This would complicate the determination of a voting equilibrium. Since this is not the central focus of the analysis, I assume homogeneous wages in this subsection.

[26]According to data from the OECD family database, net childcare fees in OECD countries represent between 0% and 33% of net family income, with an average of 12%.

[27]See Statistisches Bundesamt, Press release Nr.314 dated 01 August 2006.

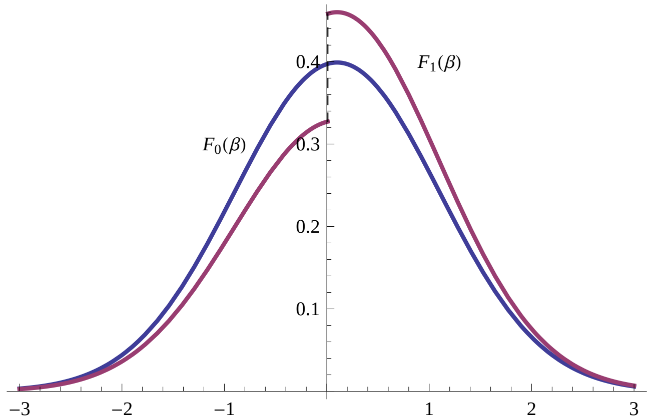


Figure 10: Change in the distribution of cultural attitudes

6 Dynamics

6.1 Inherited attitudes

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 described 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 10 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 $\mu = 0.02$ in period 0 to a value of 0.2 in period 1.

In any period, given the period's distribution of β, the determination of the equilibrium remains unchanged. Of course, the equilibrium values change since the distribution has changed. Note that since the distribution of β changes, the median value of β changes. In fact, from period t to $t+1$, the median β increases, if equilibrium childcare usage is positive. Referring to Figure 8, this implies that 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.[28] So the only thing that matters for the determination of the equilibrium is that from period t to $t+1$, the function $\psi(\bullet)$ shifts according to the shift of the distribution of β induced by childcare usage and its effect on fertility. The next proposition describes the result of these changes.

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 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 childcare. 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

[28]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.

limit, however, childcare usage converges to one as time goes to infinity and the proportion of families not in childcare goes to zero.

Figure 11 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.

6.2 Learning

I now briefly explore the role of learning in the model. 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.

In this subsection, I assume that couples learn about the effects of childcare by observing the fraction of children who are in external childcare. A simple way of modeling this is that a couple's attitude towards childcare is governed by

$$\beta_t = \lambda\beta_{t-1} + (1-\lambda)H_{t-1} \tag{15}$$

With $\lambda = 1$ this corresponds to perfect inheritance of values, while $\lambda = 0$ would be the opposite, which would imply that society's values converge immediately.[29]

When the economy is at an equilibrium with $H_l = 0$, learning obviously cannot take place since there is no one to learn from.[30] However, when the equilibrium in period t has positive childcare usage, individual and aggregate beliefs evolve over time. Figure 12 displays the evolution of childcare usage and female labour supply over time, comparing the case without learning ($\lambda = 1$, shown by the light curves) with the learning case, where $\lambda = 0.25$ (shown by the dark curves). It is apparent that learning speeds up the evolution of childcare usage and female labour supply, but the learning process slows down very quickly. Hence, female labour supply levels off when childcare usage is getting high. This resembles

[29] Hiller (2009) makes a similar assumption.

[30] Kimura and Yasui (2009) study a model with endogenous fertility and publicly provided education, where families can top up public education with privately bought education. Using this approach here, there could be learning even with zero public childcare spending, if some families used private childcare and couples would observe the fraction of families doing so.

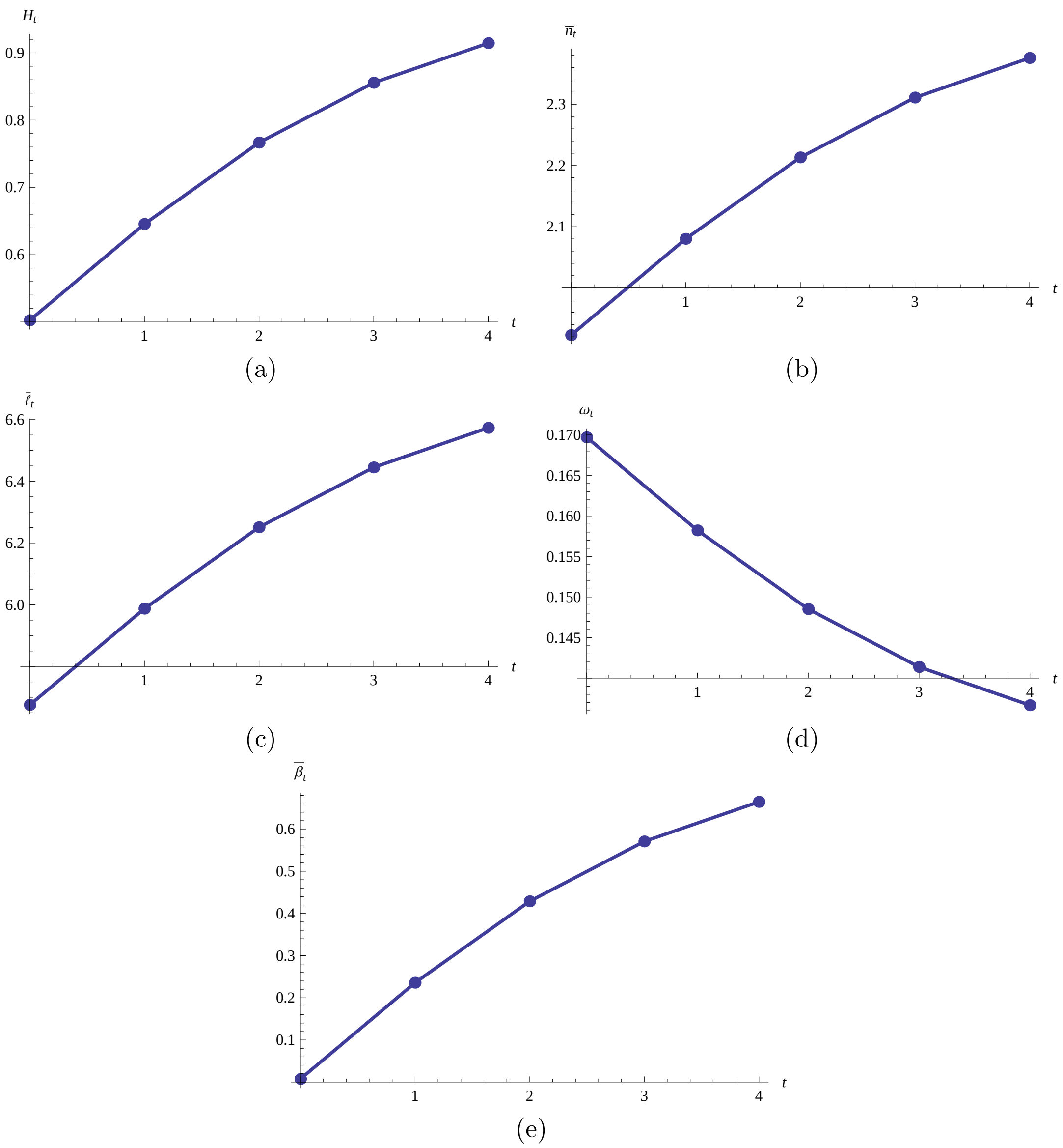
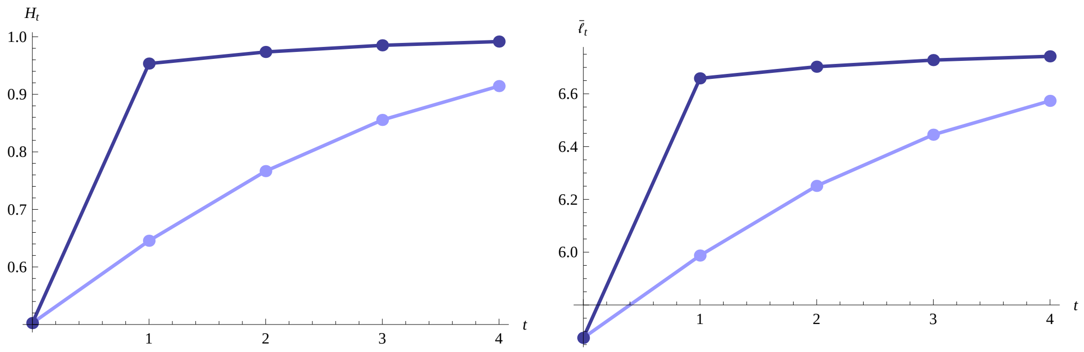


Figure 11: Evolution of equilibrium values over time



(a) (b)

Figure 12: Evolution of equilibrium values with learning

the S-shaped evolution of female labour force participation generated in Fernandez (2007a).

7 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 plausible exogenous variation in cultural values.

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 affect society's expectations, they might induce a country to switch from a low-childcare equilibrium to a high-childcare equilibrium. Whether and how such policies

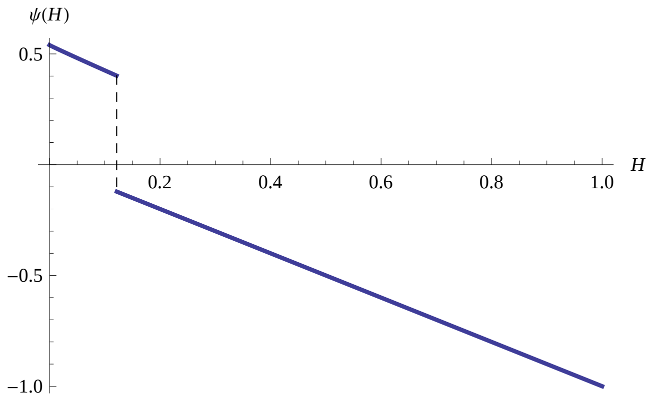


Figure A.1: Non-existence of equilibrium with $\gamma > \alpha$

could work remains to be shown.

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:

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

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

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

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

Solving $V_N(\bullet)|_{\tau=0} = \max_\tau V_C(\bullet)$ for β gives $\tilde{\beta}$ in (13). ■

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 and ω_h decreasing 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 $\frac{d\psi(\bullet)}{d\hat{\beta}} = -\phi(\bullet) < 0$. ■

Proof of Proposition 6. (i) Given that $H_t = 0$ implies $\hat{\beta}_t = \infty$, the distribution does not change from period t to $t+1$, since no one uses childcare and fertility equals n_N^* for all β. Hence, $F_{t+1}(\beta) = F_t(\beta)$ for all t. Therefore, the equilibrium is given by $\tau_t = g_t = H_t = 0$ for all t.

(ii) We first show that the distribution $F_t(\beta)$ first-order stochastically dominates $F_{t-1}(\beta)$ (which is apparent from Figure 10). 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.

Borck, R. and Wrohlich, K. (2010). Preferences for childcare policies: Theory and evidence. *European Journal of Political Economy*. forthcoming.

Borge, L.-E. and Rattsø, J. (2008). Young and old competing for public welfare services. CESifo Working Paper Series 2223, CESifo Group Munich.

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 women's 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.

Hiller, V. (2009). Gender inequality, endogenous cultural norms and economic development. Mimeo.

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.

Myrskylä, M., Kohler, H.-P., and Billari, F. (2009). Advances in development reverse fertility declines. *Nature*, **460**, 741–743.

OECD (2010). OECD Family Database. `www.oecd.org/els/social/family/database`.

Olivetti, C. and Petrongolo, B. (2008). Unequal pay or unequal employment? a cross-country analysis of gender gaps. *Journal of Labor Economics*, **26**(4), 621–654.

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.