

Formal child care and family structure: Theory and evidence*

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Abstract

This paper studies the effect of child care provision on family structure. We present a model of a marriage market with positive assortative matching, where in equilibrium the poorest women stay single. Couples have to decide on the number of children and spousal specialization in home production of public goods and child care. We then study how child care provision affects the equilibrium. Due to specialization in home production, the incentive to use child care is smaller for married mothers than for single mothers. We show that this increases the number of single mothers and the divorce rate. Using survey data from Germany, we present suggestive empirical evidence consistent with this finding.

JEL classification: J12, J13

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1 Introduction

The last decades have seen a strong increase in women's formal education, accompanied by stronger work force attachment. At the same time, social norms have changed substantially: it has become much more acceptable for women (and in particular mothers) to pursue their own careers, which makes them financially less dependent. This development has coincided with a decline in fertility and substantial changes in family structure. In OECD countries, marriage rates have fallen from an average of 8.1 marriages per 1,000 people in 1970 to 5.0 in 2009, while divorce rates have doubled to 2.4 divorces per 1,000 people on average (OECD, 2011). As a result, many children today are born out-of-wedlock or live with single parents.

Politicians have reacted to these developments, among others by increasing public child care provision. Public child care is expected to improve the reconciliation of work and family life. This seems to be particularly important for single parents who must rely on their own income (and not the partner's) to support a family. However, changes in family structure may not only be one of the driving forces of the increase in public child care provision. Rather, public child care might itself have unintended feedback effects on family structure. By reducing the time a mother spends out of the labor force after the birth of a child, public child care improves gender equality (Milligan, 2014) and thus makes mothers less dependent from their partners. As a consequence, we might observe dissolution of low-quality partnerships, a decrease of shotgun marriages, and thus more unmarried or single mothers as external child care becomes widely available. To the best of our knowledge, this argument has so far been neglected in the literature.

In this paper, we present a model which predicts that child care provision leads to an increase in single motherhood. In our model, men and women may get married or stay single, and once married, couples decide whether to stay married or divorce. They also decide on the number of children and on home production of child care. We find that, under the assumptions made, all men are married, the poorest women are single, while richer women are married and there is positive assortative matching. We then introduce external day care into the model and analyze how it affects the marriage market equilibrium. We start from an equilibrium where, without day care, single women work, while married women specialize in home production and child care. It then turns out that day care increases the number of single mothers and the divorce rate. The reason is that day care is more attractive for single mothers, because (relatively poor) married mothers take

advantage of specialization in home production and rear their children at home.

Using survey data from Germany from 1991 to 2009, we present three pieces of empirical evidence in support of our model. First, we show that for mothers with children under six, the probability of being married has fallen over time while it stayed constant for women with no child under 17 years; this development coincides with a pronounced increase in the availability of day care. Second, we compare mothers with children under six and those with no child under 17 in East and West Germany. Consistent with the much higher child care coverage rates in East Germany, we find that substantially more mothers of young children are single in East Germany than in West Germany, while we do not find these differences for women without children under 17. Third, we find that mothers who use day care are more likely to be single and less likely to be married than those who rear their children at home. This association is more pronounced for less educated women, which is consistent with our model. Moreover, this association holds when controlling for unobserved time-invariant heterogeneity in an individual fixed effects approach. While all three empirical exercises lack the ‘as good as’ randomness of natural experiments, taken together, they provide at least suggestive evidence in support of our model.

Our paper directly relates to two so far distinct strands of the literature. First, it is related to studies investigating changes in family structure and its driving forces. It has for example been found that higher female wage rates increased single motherhood at least for blacks and Hispanics in the US (Blau and van der Klaauw, 2013). Guner and Knowles (2009) show that a US style policy of making state transfers to single mothers (coupled with lower generosity and dependence on the number of children) can account for the higher rate of single motherhood in the US compared to Canada. More generally, publicly provided earnings insurance through welfare benefits tend to reduce marriage rates (see, e.g., Anderberg, 2007; Halla *et al.*, 2015; or Rosenzweig, 1999).¹ Furthermore, going from mutual to unilateral divorce laws increases divorce rates for those already married but leads to better marriage matches in the long run (Rasul, 2006; Wolfers, 2006). Joint custody, on the other hand, increases marriage rates but at the same time increases divorce rates for older couples (Halla, 2013). Akerlof *et al.* (1996) show that legalization of abortion and increased availability of contraception can lead to a reduction in shotgun marriages, which may then increase out-of-wedlock childbearing. Finally, dramatic changes in home production technologies reduce the returns to specialization within a household. As a consequence, the opportunity cost of remaining single rather than marrying falls, leading

¹For an early overview see also Moffitt (1998).

to a decrease in marriages rates. Stevenson and Wolfers (2007) provide an excellent overview of this literature.

Second, our paper is related to the literature on the effects of public child care. **In contrast to other family policies such as child benefits, child care might increase both maternal labor force participation and fertility at the same time.**² And indeed, recent studies provide convincing empirical evidence for positive effects of public child care on maternal labor supply (see, e.g., Bauernschuster and Schlotter, 2015; Baker *et al.*, 2008; Berlinski and Galiani, 2007; Cascio, 2009; Gelbach, 2002; Nollenberger and Rodriguez-Planas, 2015; or Lefebvre and Merrigan, 2008).³ With respect to public child care and fertility, empirical evidence is still scarce. Rindfuss *et al.* (2010) provide evidence for positive fertility effects exploiting within municipality differences in child care expansion over a period of 25 years in Norway. Using a recent policy reform from Germany, Bauernschuster *et al.* (2015) show that public child care for under three year olds had positive effects on fertility.⁴ Taken together, the broad evidence suggests that public child care can indeed improve the reconciliation of work and family life, thus improve gender equality and make women more independent. However, what this in turn means for family structure has so far not been investigated in the literature.

We provide theoretical arguments and empirical evidence for the role of formal child care for family structure. But many issues revolving around this topic are still unresolved. For example, our empirical evidence is suggestive but we do not claim identifying causal effects. Furthermore, an important consequential question which we cannot address in this paper is how changes in family structure affect children. Some studies suggest negative effects (see, e.g., Chapple, 2009 and Ribar, 2004 for surveys). However, the literature is still not conclusive due to open questions about what is the right counterfactual.

²Child care reduces the cost of working outside the home. Thus, theoretically, increased availability of child care decreases the opportunity cost of having a first child and thus encourages fertility at the extensive margin. After birth, it allows mothers to return to the labor market sooner to earn wages. This in turn leads to a positive income effect encouraging fertility at the intensive margin. On the other hand, this increases the opportunity cost of having an additional child, resulting in negative substitution effects. The lower the price for child care, the more likely it is that the positive income effect dominates the negative substitution effect (Ermisch, 2003).

³Marginal decreases in the costs of available public child care do not affect maternal labor supply if employment rates and child care attendance rates are already high (Lundin *et al.*, 2008). Moreover, public child care might have zero employment effects if newly available public child care simply crowds-out existing private (Havnes and Mogstad, 2011) or comparable public child care arrangements (Fitzpatrick, 2010).

⁴Studies on child care and fertility, which do not exploit policy reforms to identify causal effects, include Del Boca (2002), Hank and Kreyenfeld (2003), or Haan and Wrohlich (2011).

We proceed as follows. The next section presents a theoretical model, which shows how external child care might increase the prevalence of single motherhood. Section 3 then provides some pieces of suggestive empirical evidence which is broadly consistent with the theoretical predictions. Section 4 concludes the paper.

2 The model

2.1 Setup

We consider a simple model of the marriage market, which is based on Chiappori *et al.* (2009). There is a continuum of men, with measure 1 and a continuum of women with measure $r > 1$. This assumption implies that men are scarce. Thus, as long as there is a positive surplus from marriage, all men will be married while some women will be single.⁵

We will study how child care provision affects the number of single women. Both men and women differ in wages. Male wages w_M are distributed on the interval $[\underline{w}_M, \overline{w}_M]$ with distribution G and female wages w_F are distributed on the interval $[\underline{w}_F, \overline{w}_F]$ with distribution H .

Individual i 's utility is given by the generalized quasi-linear utility

$$U_i = x_i v(X) + u(nQ),$$

where x_i is i 's consumption of private goods, X consumption of a household public good, n is the number of children and Q the quality of child care. We assume that $v'(X) > 0, v''(X) < 0, v(0) = 1$ and $u'(nQ) > 0, u''(nQ) < 0, u(0) = 0$. Note that this utility function satisfies transferable utility (see Bergstrom and Cornes, 1983).

Without child care, single women choose how many children to have from unidentified

⁵ The assumption that there are more adult men than women may or may not hold in reality in a particular place and time (roughly, while the gender ratio at birth is about 1.05 men to women in developed countries, it declines with age and falls below 1 for adults over 65). We need this assumption in order to ensure that there are single mothers. If $r \leq 1$ all women would be married without child care. An alternative to the frictionless matching model would be a model with search frictions. This would allow for equilibria with unmarried men and women even if $r \leq 1$ due to search frictions. In these models, the assumptions for assortative matching become slightly more restrictive in the transferable utility case, but our main conclusions would also obtain in such models under suitable assumptions, in particular, positive assortative matching and a higher probability of being unmarried for poorer women, see Browning *et al.* (2014) and Smith (2011).

fathers. A single female's utility is

$$u_F^{S,N} = x_F^{S,N} + u(n_F^{S,N}), \quad (1)$$

where the superscript ' S, N ' denotes a single in the absence of child care. We normalize the quality of child care at home to one. Her budget constraint is

$$x_F^{S,N} = (1 - \phi_{NF} n_F^{S,N}) w_F, \quad (2)$$

where ϕ_{NF} is the wage loss suffered by a woman who rears her children at home. This might be due to career interruptions or loss of human capital caused by child birth.

Maximizing (1) subject to (2) gives the optimal number of children

$$n_F^{S,N}(w_F) = u'^{-1}(\phi_{NF} w_F). \quad (3)$$

The single mother's indirect utility is denoted $v_F^{S,N}(w_F)$.

A single male can father children, but we assume that he cannot enjoy the benefits of fatherhood if he does not cohabit with the mother.⁶ A single male's utility is then given by $v_M^{S,N}(w_M) = w_M$.

2.2 Marriage, matching and divorce

A man and woman can marry in order to share the cost of children and the household public good, which is consumed equally by both partners. We assume that the match quality is revealed to a couple right after marriage, but before they decide on consumption, household production and fertility. We use the term 'marriage' synonymously with cohabitation here. In the empirical analysis, however, we will differentiate between married and cohabitating couples, since marriage may imply a different degree of commitment among the partners. If a man and a woman form a union, their joint utility is

$$U^{C,N} = (x_F^{C,N} + x_M^{C,N})v(X) + 2u(n^{C,N}) + 2(\theta + b(w_F + w_M)), \quad (4)$$

⁶See also Neal (2004) and Chiappori and Oreffice (2008). By contrast, Willis (1999) and Chiappori *et al.* (2009) assume that absent fathers do enjoy benefits from their children. We assume that divorced fathers can also not enjoy the benefits from fatherhood, even if they can make transfers to their divorced wife, because child custody resides with the mother.

where $x_i^{C,N}$, $i = F, M$ is i 's consumption.⁷

We assume that after marriage – **that is, after consumption, fertility and child care choices have been made** –, each partner receives a match-specific benefit $\theta + b(w_F + w_M)$, where we assume $b'(\cdot) > 0, b''(\cdot) > 0$.⁸ Here, θ is distributed according to the distribution function Φ with mean $\bar{\theta} > 0$. This benefit also depends on the partners' wages and is only revealed when the couple is married. We can think of some benefit of interacting with the partner which depends on both partners' wages and is partly unknown. The reason for this assumption is that it creates a complementarity in the partners' wages, which tends to lead to positive assortative matching, even if one partner specializes in home production.⁹ Couples may divorce if their draw of θ is too low relative to the utility they would receive as singles. When deciding whether to marry, individuals take into account the expected value $\bar{\theta}$, which is identical for all couples. **If the expected benefit is large enough, some (especially poor) men marry and later get divorced, even though they then do not receive utility from their children any longer.**

Let $\alpha, 0 \leq \alpha \leq 1$, be the probability of divorce, and $\hat{\theta}$ be the match quality below which a couple would choose to divorce. Both α and $\hat{\theta}$ are endogenous, as shown below; in particular, α is the probability that θ falls below the divorce threshold $\hat{\theta}$, and is couple-specific. Taking into account the possibility of divorce, the couple's expected utility is then

$$EU^N(w_F, w_M) = (1 - \alpha)[(x_F^{C,N} + x_M^{C,N})v(X) + 2u(n^{C,N}) + 2(\hat{\theta} + b(w_F + w_M))] + \alpha[w_M + x_F^{S,N} + u(n^{S,N})]. \quad (5)$$

The couple's budget constraint is

$$x_F^{C,N} + x_M^{C,N} = w_F + w_M - \min\{\hat{\phi}_{NF}w_F, \hat{\phi}_{NM}w_M\}n^{C,N} - \min\{\phi_{XF}w_F, \phi_{XM}w_M\}X^{C,N}. \quad (6)$$

⁷The superscript 'C, N' denotes a couple without child care.

⁸Chiappori *et al.* (2009) use a similar assumption except for the 'matching benefit' function $b(\cdot)$. **Whether θ is revealed before or after fertility decisions is inconsequential for consumption and fertility decisions due to the assumption that the matching benefit is additive in the utility function. To allow for divorced single parents, however, we have to assume that the match quality is revealed after fertility choices have been made. Otherwise, all single parents would be those who never married.**

⁹In fact, it would be easy to derive this from an underlying problem where interaction with the partner is another marital public good. If this were a normal good, the spouses' incomes would be complimentary in the marital surplus (Lam, 1988). Moreover, wages are at least partly determined by education, and there may be some complementarity from the benefit of interacting with a more educated partner.

We assume that the wage loss caused by rearing children at home differs between men and women. An equivalent interpretation is that the productivity at child rearing differs between the sexes. In line with reality, we assume that $\hat{\phi}_{NF} < \hat{\phi}_{NM}$, so that if husband and wife were earning the same wage, the wife would stay at home to rear the children. Home production of public goods requires a time input of ϕ_{XF} if provided by the wife. Here, too, we assume that women are more productive at home production so $\phi_{XF} < \phi_{XM}$. For simplicity, we will assume that household goods other than day care cannot be purchased in the market, but this assumption could be relaxed. We will assume that the wage cost of home child care is reduced by home production of other household goods: $\hat{\phi}_{NJ} < \phi_{NJ}$ for $J = F, M$. That is, the time cost of child care is lower for married women who produce other household goods besides child care than for single women. In other words, home production of child care and other households goods are complements. For simplicity, we assume that the productivity of home production of other household goods does not depend on the presence of children in the home. Assuming that home production gets more productive when children are reared at home would strengthen our results.¹⁰

Since utility is transferable, the couple maximizes the sum of their utilities. The couple's optimal number of children and public goods consumption are defined by

$$2u'(n^{C,N}) - \min\{\hat{\phi}_{NF}w_F, \hat{\phi}_{NM}w_M\}v(X^{C,N}) = 0 \quad (7)$$

$$(x_F^{C,N} + x_M^{C,N})v'(X^{C,N}) - \min\{\phi_{XF}w_F, \phi_{XM}w_M\}v(X^{C,N}) = 0. \quad (8)$$

An important determinant of marital matching is whether the couple's home production of household public goods rises with the female wage; however, this is in general ambiguous: on the one hand, there is a positive income effect, but on the other hand, there is a negative substitution effect since the price of home production rises with the female wage (assuming that she specializes in home production). We denote the couple's (joint) indirect utility by $v^{C,N}(w_F, w_M) + 2(\theta + \mathbf{b}(\mathbf{w}_F + \mathbf{w}_M))$. There is a surplus from marriage, since the two partners can jointly enjoy the utility from having children and consuming the household public good, while sharing the cost. In addition, there is the matching benefit, which may or may not be positive.

Consider now who marries whom. Let $S^N(w_F, w_M) = v^{C,N}(w_F, w_M) - v_F^{S,N}(w_F) - v_M^{S,N}(w_M)$ be the surplus from marriage, with $ES^N(w_F, w_M)$ denoting the expected surplus.

¹⁰Readers with children might think that the presence of children actually makes home production less productive.

Differentiating $S(w_F, w_M)$, using the envelope theorem, gives:

$$\frac{\partial^2 S^N(w_F, w_M)}{\partial w_M \partial w_F} = v'(X^{C,N}) \frac{\partial X^{C,N}(w_F, w_M)}{\partial w_F} + 2b''(\mathbf{w}_F + \mathbf{w}_M). \quad (9)$$

In general, this derivative may be of either sign. It depends on the convexity of the couple-specific benefit from matching, and the effect of the wife's wage on the demand for the household good. When household goods are produced at home, this latter effect is ambiguous, as argued above, since the income and substitution effects go in opposite directions if the wife specializes in home production.¹¹ Hence, there are offsetting forces at work: while marital specialization generates incentives for negative assortative matching (Becker, 1991), the demand for public goods generates incentives for positive assortative matching (Lam, 1988). In the following, we assume that the cross derivative in (9) is positive. This implies that the spouses' incomes are complements, which leads to positive assortative matching (see Lam, 1988). In the present setup, it can be shown that $S(w_M, w_F)$ is a function of total income, with positive first derivative. If the second derivative (i.e. the cross partial) is positive, then the expected marital surplus $ES(w_m, w_F)$ is also convex in total income, which implies positive assortative matching (Chiappori *et al.*, 2009). Because of positive assortative matching, if a man with wage w_M and a woman with wage w_F are married, the mass of men with wage above w_M must equal the mass of women with wage above w_F for the marriage market to clear. The implied market clearing condition is:

$$1 - G(w_M) = r(1 - H(w_F)). \quad (10)$$

This implies the following matching functions:

$$w_M = G^{-1}(1 - r(1 - H(w_F))) \equiv \psi(w_F), \quad (11)$$

$$w_F = H^{-1}\left(1 - \frac{1}{r}(1 - G(w_M))\right) \equiv \chi(w_M). \quad (12)$$

We will make the following assumptions. First, in order to concentrate on the case where there are always some single mothers, we assume $r > 1$ so that men are relatively scarce. Second, in line with Chiappori *et al.* (2009), we assume that the male distribution

¹¹If the man specializes in home production, demand for the household public good is increasing in the female wage.

dominates the female distribution:

$$H(w_F) = G(\lambda w_M + \delta), \quad (13)$$

with $\lambda \geq 1, \delta \geq 0$. As long as r is not too large, this will imply that husbands have larger incomes than their wives. Therefore, women will tend to specialize in home production.¹²

Standard arguments (see, e.g. Browning *et al.*, 2014) then imply that all men are married, while all women with wage $w_F \geq w_F^*$ are married and all women with $w_F < w_F^*$ are single, where

$$w_F^* = H^{-1}(1 - 1/r). \quad (14)$$

Further, the utility of the married woman with the lowest wage is

$$v_F^{C,N}(w_F^*) = v_F^{S,N}(w_F^*) = v_F^{S,N}(H^{-1}(1 - 1/r)) \quad (15)$$

and the utility of another married woman with wage w_F is

$$v_F^{C,N}(w_F) = v_F^{S,N}(w_F^*) + \int_{w_F^*}^{w_F} \frac{\partial v_F^{C,N}}{\partial w_F}(t, \psi(t)) dt. \quad (16)$$

Since there is a continuum of agents, each woman has a close substitute, and since men are assumed to be scarce, the woman with the lowest wage among all married women receives no surplus from marriage. All other married women receive their (marginal) contribution to the marital surplus. Let us denote the expected surplus received by the marginal couple by $K = ES^N(w_F^*, \underline{w}_M)$. In the following we will assume that this surplus is small. If it were too large, child care provision might not affect the marriage market equilibrium.

Upon marriage, couples' marriage specific match quality θ is revealed and they may divorce if this quality is too low. Following Chiappori *et al.* (2009) we assume that utility is transferable after divorce, so couples divorce if and only if their joint utility as singles exceeds their joint utility in marriage. The condition for divorce to occur is

$$\begin{aligned} & v^{C,N}(w_F, w_M) + 2\theta + \mathbf{b}(\mathbf{w}_F + \mathbf{w}_M) < v_F^{S,N}(w_F) + v_M^S(w_M) \\ \Leftrightarrow \theta < \hat{\theta}^N(w_F, w_M) & \equiv \mathbf{v}_F^{S,N}(\mathbf{w}_F) + \mathbf{v}_M^S(\mathbf{w}_M) - \mathbf{v}^{C,N}(\mathbf{w}_F, \mathbf{w}_M) - 2\mathbf{b}(\mathbf{w}_F + \mathbf{w}_M). \end{aligned} \quad (17)$$

¹²This assumption is not necessary for our results but makes the analysis simpler.

The couple specific (ex ante) divorce probability is $\alpha^N(w_F, w_M) = \Phi(\widehat{\theta}^N(w_F, w_M))$.

2.3 Child care

Let us now consider the introduction of child care services. All parents can decide whether to use day care or raise their children at home, before deciding on consumption and fertility.¹³

We assume that child care is available for all who demand it at a fee of p per child.¹⁴ We abstract from rationing **and also do not introduce special conditions for single parents. In Germany, a few implicit and explicit rules for child care provision give preferential treatment to single parents. Exactly how this would affect our results depends on the details of the rules, but in general, our results should be strengthened. If fees are lower for single parents, incentives to stay single or divorce would clearly be strengthened. If there is rationing, and places are allocated preferentially to single parents, things might become more complicated as we would have to deal with uncertainty and the question of how risk aversion changes with income.**

Utility for a single woman who chooses to put her children in day care is

$$u_F^{S,C} = x_F^{S,C} + u(n_F^{S,C}Q), \quad (18)$$

where Q is the quality of child care. Her budget constraint is:

$$x_F^{S,C} = w_F - pn_F^{S,C}. \quad (19)$$

Note that we assume that if she uses child care, the woman does not incur the wage loss she would incur if she were to care for her children at home.¹⁵ The optimal number of

¹³Since couples make their choices efficiently to maximize joint surplus, and there are no externalities, their choices are independent of the exact timing of events.

¹⁴For simplicity, think of child care as being privately provided child care only. It would, however, be relatively straightforward to extend the analysis to publicly subsidized child care. In that case, subsidies would have to be financed by taxes, which would raise the question which parents (single versus married, rich versus poor) would benefit most from public child care. This would not qualitatively affect our results as long as taxes and subsidies are treated as given. However, this would raise some interesting issues, such as who benefits from publicly subsidized child care. This issue is, however, beyond the scope of this paper. See Borck and Wrohlich (2011) for an analysis of the redistributive effects of publicly financed child care in Germany.

¹⁵The results would not change qualitatively if we assumed that in the case of child care usage, there

children is

$$n_F^{S,C}(p) = \frac{u'^{-1}(p)}{Q} \quad (20)$$

and indirect utility is $v_F^{S,C}(w_F, p, Q)$.

Couples' utility with child care is

$$u^C = (x_F^{C,C} + x_M^{C,C})v(X^{C,C}) + 2u(n^{C,C}Q) + 2(\theta + \mathbf{b}(\mathbf{w}_F + \mathbf{w}_M)), \quad (21)$$

and their budget constraint is

$$x_F^{C,C} + x_M^{C,C} = w_F + w_M - pn^{C,C} - \min\{\phi_{XF}w_F, \phi_{XM}w_M\}X^{C,C}. \quad (22)$$

The couple's optimal number of children and consumption of the household good are defined by

$$2u'(n^{C,C}Q) - pv(X^{C,C}) = 0 \quad (23)$$

$$(x_F^{C,C} + x_M^{C,C})v'(X^{C,C}) - \min\{\phi_{XF}w_F, \phi_{XM}w_M\}v(X^{C,C}) = 0, \quad (24)$$

and its indirect utility is $v^{C,C}(w_F, w_M, p, Q) + 2(\theta + \mathbf{b}(\mathbf{w}_F + \mathbf{w}_M))$.

As in the case without child care, we will assume that there is positive assortative matching. The condition is the same as that in (9), and as before, there are offsetting effects of a higher female wage on the production of the household good. We will denote by w_F^{**} the wage of the marginal woman who, with child care provision, is just indifferent between marrying or staying single.

Let us consider child care choices for singles and couples. Suppose for now that $Q = 1$. A single woman will put her children in day care if $p < \phi_{NF}w_F$. Hence, there is a critical female wage, $\hat{w}_F = p/\phi_{NF}$, such that all women with $w_F > \hat{w}_F$ prefer to put their children in day care, and all others rear their children at home. Note that for single women who use child care, fertility does not depend on the wage, since the price effect of a higher wage disappears. Also, a single woman will have more children if child care is available, since the price of rearing children is lower for all women who do use child care.

For couples, since we have assumed that women have a comparative advantage in home production and the husband always has a higher wage, the wife will specialize in home production. Hence, the condition to prefer child care to child rearing at home is

would be a proportional wage loss which is smaller than in the absence of child care, $\phi_{NF}^C < \phi_{NF}$.

$p < \hat{\phi}_{NF} w_F$. Again, a couple where the woman's wage is $w_F \geq \tilde{w}_F = p/\hat{\phi}_{NF}$ will use child care and all other couples don't. Since $\hat{\phi}_{NF} < \phi_{NF}$, it follows that $\tilde{w}_F > \hat{w}_F$. Hence, the complementarity between child care and home production implies that single mothers will be more likely to use child care than couples.

We are interested in an equilibrium where some families use child care and some do not. If $p > \phi_{NF} \underline{w}_F$, the lowest wage woman will not use child care when single, and if $\bar{w}_F > p/\hat{\phi}_{NF}$, the wealthiest married woman prefers child care to staying at home. The important assumption, however, is that $p/\phi_{NF} < w_F^* < p/\hat{\phi}_{NF}$. This implies that the woman with wage w_F^* opts for child care if single, whereas as a married woman she would rear her children at home.¹⁶ We then get our main result:

Proposition 1 *In the matching equilibrium with child care, (i) there is a child care fee p^* such that if $p < p^*$, fewer women choose to marry than without child care, while if $p \geq p^*$, the number of women who marry is unchanged, (ii) all women are as well off or better off than without child care.*

Proof. See Appendix. ■

Part (i) of the Proposition states that child care provision may increase and cannot decrease the number of women who choose to be single. The intuition is relatively simple. Without child care, all women want to marry, and the woman with the lowest wage among all married women, w_F^* is indifferent between marrying or not. When child care becomes available, we have assumed that the woman with wage w_F^* will choose child care if she is single, but the complementarity with home production of the household good would lead her to stay at home if married. Since her utility as single increases while the surplus from marriage is the same as without child care, her incentive not to marry increases. Because utility is transferable, if the surplus from marriage remains positive, the husband would have to compensate his wife for the loss in consumption she would incur if, by marrying she had to devote part of her time to child care. However, since we have assumed that the surplus from marriage is small for the marginal couple without child care provision, this surplus becomes negative if the child care fee is sufficiently low, so the marginal woman would choose not to marry, and, therefore, the number of women who marry would fall.

This Proposition is our main result about the effect of child care policy on the number

¹⁶The interesting equilibrium is that where $\hat{w}_F < w_F^* < \tilde{w}_F$. If $w_F^* < \hat{w}_F < \tilde{w}_F$, child care would not affect the equilibrium number of married women, since the marginal woman would not use child care.

of single mothers. Instead of comparing child care provision to a world without child care, one may also consider marginal changes of child care quality and fees. Intuitively, one can show that marginal increases of quality or decreases of child care fees increase the number of single women.

Let us now look at the effect of child care on the probability of divorce. The condition for divorce is now

$$\max\{v^{C,N}(w_F, w_M), v^{C,C}(w_F, w_M)\} + 2(\theta + \mathbf{b}(w_F + w_M)) < v_F^{S,C}(w_F) + v_M^S(w_M) \quad (25)$$

$$\Leftrightarrow \theta < \hat{\theta}^C(w_F, w_M), \quad (26)$$

$$\theta^C(w_F, w_M) \equiv v_F^{S,C}(w_F) + v_M^S(w_M) - \max\{v^{C,N}(w_F, w_M), v^{C,C}(w_F, w_M)\} - 2\mathbf{b}(w_F + w_M),$$

and the corresponding probability of divorce is $\alpha^C = \Phi(\hat{\theta}^C)$.

The next result summarizes how child care provision affects divorce probabilities.

Proposition 2 (i) *There is a wage \hat{w}_F with $w_F^{**} < \tilde{w}_F < \hat{w}_F$ such that for all couples with wages in the interval $[(w_F^{**}, \psi(w_F^{**})), (\hat{w}_F, \psi(\hat{w}_F))]$, the probability of divorce is higher when child care is available than when there is no child care.* (ii) *For couples who do not use child care, the divorce probability increases with the quality of child care Q and decreases with the child care fee, p .*

Proof. See Appendix. ■

For couples who do not choose child care, revealed preference implies that the surplus after divorce rises while the surplus in marriage stays the same when child care becomes available. Hence, their divorce probability must rise. (By continuity, this also holds for some couples who do use child care.) Likewise, a higher child care quality or lower fee raises the divorce probability, since the utility of being single and using child care rises.

To sum up, the model generates several testable hypothesis. It predicts that in a matching equilibrium, low-wage women will be single and high-wage women will be married. Moreover, comparing a regime with and without provision of external child care, we find that child care provision increases the number of single mothers and increases the likelihood of divorce.

3 Empirical evidence on public child care and family structure

In order to provide empirical evidence for the theoretical predictions of our model we use data from the German Socio-Economic Panel (SOEP). The SOEP is a large individual level data set representative of the whole German population. It provides annual information on a rich set of socio-economic and demographic characteristics. In 2009, about 20,000 adult individuals living in more than 11,000 households participated in the interviews. For our purpose, the crucial feature of the SOEP data is that we can merge mothers to their children. For children, we make use of information on their age and public child care attendance. Further, we draw on information about the woman’s age, education, and migration background.¹⁷ We also have information on the state where the household lives. Our two outcome variables are the dichotomous variables “married” and “single”. The variable “married” takes on the value of unity if a woman is married, and is zero otherwise. The variable “single” takes on the value of unity if a woman is single, i.e., has neither a husband nor a cohabitant, and is zero otherwise. Descriptive statistics for our main sample of mothers whose youngest child is not older than six in the period from 2000 to 2009 can be found in Table A.1 of the Appendix.

We provide three pieces of empirical evidence on the role of formal child care for family structure. First, we investigate the evolution of child care and family structure over time, then we look at differences in child care and family structure between East and West Germany, before we finally compare mothers using formal child care to those not using formal child care in a repeated cross-section as well as in a panel analysis. We focus on public child care throughout the complete empirical part of this paper since public child care is the predominant mode of formal child care in Germany. Indeed, there is hardly any market for private child care at all (see, e.g., Bauernschuster and Schlotter, 2015).

¹⁷An individual has a direct migration background if she moved from a foreign country to Germany. She has an indirect migration background if she was born in Germany but her parents moved from a foreign country to Germany.

3.1 Evidence from a comparison of the 1990s and 2000s

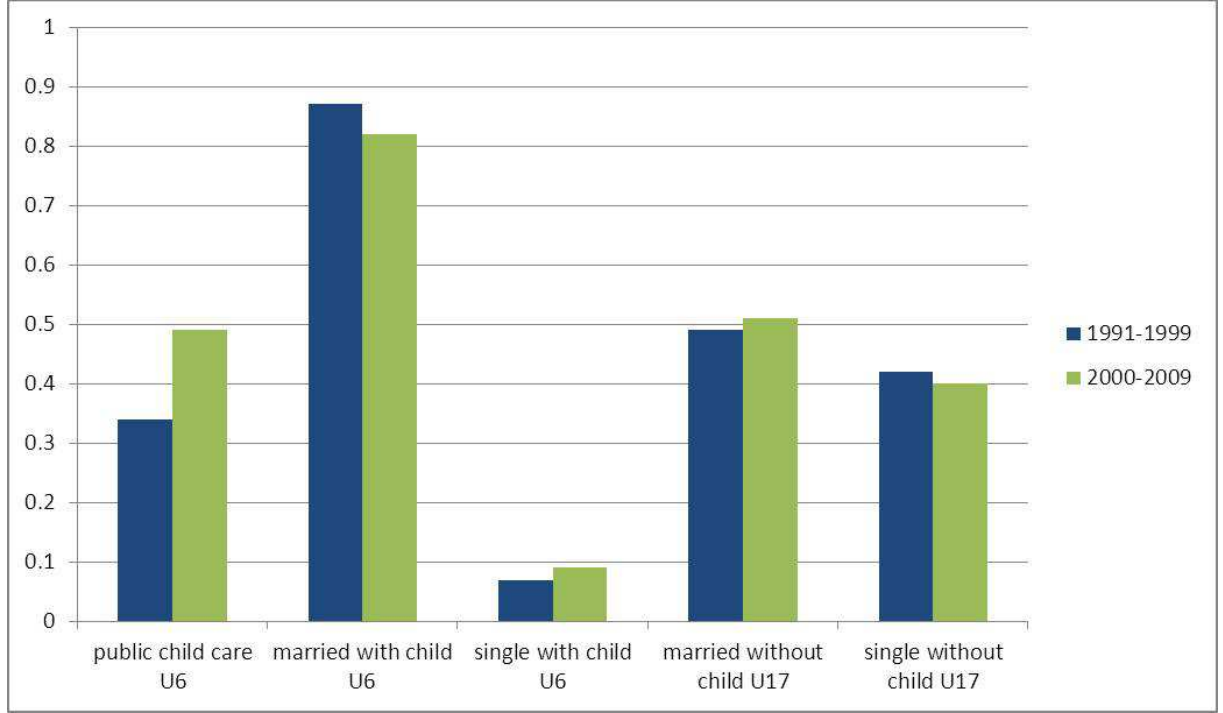
Let us start by looking at some broad time patterns of changes in family structure and formal child care. During the last two decades, we have witnessed substantial political efforts to improve the reconciliation of work and family life in Germany. The expansion of public child care has been a central means to reach this goal. In 1996, the German government introduced a legal claim to a place in public child care for children turning three. This led to a sharp increase in child care attendance of three and four year olds in the following years. In recent years, the focus of German family policy turned to public child care for even younger children. In 2005, the German government started a series of political initiatives which culminated in the commitment that, by 2013, parents should have a legal claim to a place in public child care as soon as their child turns one. In order to meet the expected demand, public child care coverage for under three year olds has been expanded during the last few years. Note that these political reforms have had substantial impacts in West Germany. In East Germany, to the contrary, the former socialist regime established a universal public child care system already for very young children, and this full child care coverage has survived reunification. Because of this and the fact that the reunification ‘shock’ makes East German data on family and children very noisy in the 1990s,¹⁸ we restrict the data for the following empirical analysis to West Germany.

As we can see from Figure 1, the fraction of up to six year olds attending public child care was on average 15 percentage points higher in the 2000s than in the 1990s. At the same time, the fraction of mothers of young children who are married declined by 5 percentage points whereas the fraction of single mothers increased by 2 percentage points. In order to see whether there was a general tendency towards being single (or not being married) for all females, we consider women without children under the age of 17.¹⁹ It turns out that the likelihood of being married as well as the likelihood of being single did not change substantially for this group from the 1990s to the 2000s. If anything, we observe more married women and fewer singles over time. Thus, we conclude that there was no general development towards being single (or not being married) for all women. The increased fraction of singles (or unmarried women) is indeed a particularity of the group of mothers

¹⁸Note that we observed the lowest fertility rate (0.77) ever measured worldwide in East Germany in 1994.

¹⁹From the 1990s to the 2000s, full-day schooling increased in West Germany after the federal government invested 4 billion Euros in the program “Zukunft Bildung und Betreuung”. Since this increase might have affected single motherhood, mothers of school children do not form an appropriate control group. Therefore, we exclude mothers of school children from this analysis.

Figure 1: Child care and family status in the 1990s and 2000s



Notes: The figure shows the development of child care usage for children aged six or younger from the 1990s to the 2000s in West Germany. Further, it shows the development of the proportions of married and single women from the 1990s to the 2000s in West Germany, for two subgroups of women, namely mothers whose youngest child is six or younger and women without a child under the age of 17. Data source: SOEP 1991-2009

with young children. This is exactly the group of women for whom the increase in public child care was relevant.

Now, we bring these first empirical patterns to a multivariate framework. To this end, we generate a dummy variable $U6_i$ that takes on the value of unity for women whose youngest child is at the age of six or younger, and is zero for women without any children under the age of 17. Further, we generate a dummy variable $After2000_i$, which takes the value of unity for observations from the years from 2000 until 2009, and is zero for observations from the years 1991 until 1999. We then regress our dichotomous outcome variable Y_i , which indicates whether woman i is married, on the interaction of the two dummy variables $U6_i$ and $After2000_i$. We also include the two dummy variables of the interaction separately and control for a vector of covariates X_i , including the woman's years of education, age (and its square), migration background, as well as for a set of state

dummies. In short, the equation can be expressed as follows:

$$Y_i = \alpha + \beta After2000_i + \gamma U6_i + \tau After2000_i \times U6_i + X_i\delta + \epsilon_i. \quad (27)$$

Here, β captures any unobserved differences between the 1990s and the 2000s which affect mothers of young children in the same way as women without any children under the age of 17. The coefficient γ captures any unobserved time-invariant differences between mothers with children up to the age of six and mothers without any children under the age of 17. The coefficient τ is the coefficient of interest and depicts how much less (or more) likely mothers of young children became to be married from the 1990s to 2000s, as compared to women without any children under the age of 17.

From columns (1) and (3) of Table 1 we can see that the coefficient on the interaction term is highly significant for both outcomes. From the 1990s to the 2000s, mothers of children at the age of six or younger became 10.3 percentage points less likely to be married and 8.8 percentage points more likely to be single compared to mothers without any children under the age of 17. Indeed, for the latter group, we observe no general time trend in marriage behavior, while we even find lower probabilities of being single in the 2000s than in the 1990s. These results provide some first interesting insights. Yet, we cannot clearly ascribe these patterns to the expansion of public child care. If macroeconomic or social conditions have changed in a way that made it easier for women with young children not to be married or be single than for women without any children under the age of 17, our estimates would be biased.²⁰ A similar problem for our estimates arises if cultural attitudes changed from the 1990s to the 2000s in a way that made it relatively more acceptable for mothers of young children not to be married or to be single than for women without any children under the age of 17, and if these changes are at the same time not themselves endogenous to the expansion of public child care.²¹

3.2 Evidence from a comparison of East and West Germany

In a next step, we look at differences between East and West Germany in order to find further evidence concerning the role of public child care for family structure. The socialist

²⁰An example might be the increasing use of family friendly workplace policies by firms that make it easier for mothers of young children to work.

²¹Although we cannot completely rule out this possibility, there is at least some evidence against it. Analyzing attitude variables from the ALLBUS data used by Bauernschuster and Rainer (2012), we find that conditional on child care coverage, attitudes towards mothers in particular did not become more progressive than attitudes towards women in general over time.

Table 1: Double difference estimations exploiting the increase of public child care

	Married		Single	
	(1)	(2)	(3)	(4)
	coeff.	s.e.	coeff.	s.e.
After 2000 \times Child under 6	-0.104***	(0.011)	0.087***	(0.009)
Child under 6	0.465***	(0.009)	-0.380***	(0.008)
After 2000	0.007	(0.006)	-0.012**	(0.006)
Years of schooling	-0.011***	(0.002)	0.004**	(0.001)
Age	0.064***	(0.001)	-0.060***	(0.001)
Age ²	-0.001***	(0.000)	0.001***	(0.000)
Migration background				
Direct	0.095***	(0.010)	-0.042***	(0.010)
Indirect	0.004	(0.013)	0.058***	(0.014)
State dummies (10)	Yes		Yes	
<i>N</i>	111,552		111,552	
<i>R</i> ²	0.311		0.281	

Notes: The table shows OLS double difference estimates. The sample consists of West German mothers whose youngest child is not older than six and does not attend school as well as West German women without a child under the age of 17. Standard errors are clustered at the individual level. *** significant at 1 %, ** significant at 5 %, * significant at 10 %. Data source: SOEP 1991-2009.

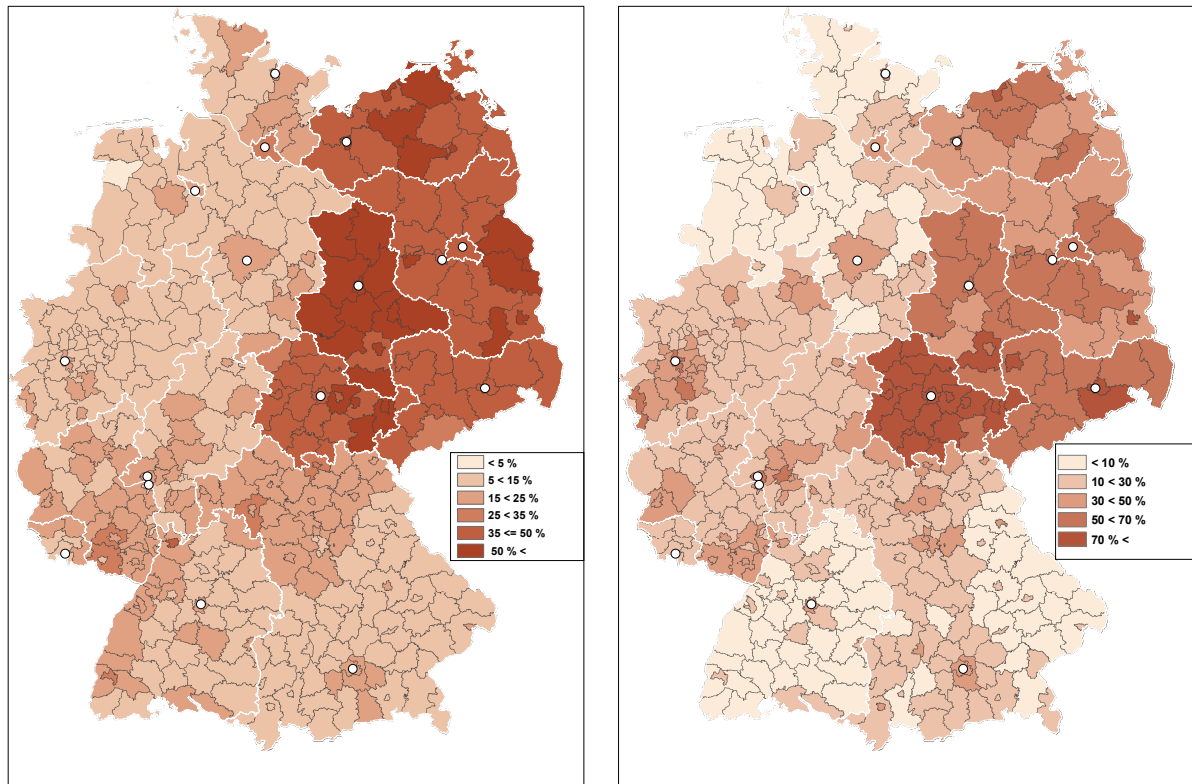
regime in the former German Democratic Republic (GDR) built up a universal child care system already for very young children below the age of three. In the democratic Federal Republic of Germany (FRG), quite to the contrary, public child care played a far less prominent role; for very young children below the age of three public child care was virtually non-existent.

In the wake of German Unification, East Germany adopted the West German political, legal and economic institutions quasi overnight. However, the universal public child care system in East Germany largely survived unification. As a consequence, we observe large differences in public child care coverage between East and West Germany even today, although we have witnessed an increase in public child care coverage during the last decades in West Germany. The left panel of Figure 2 shows the spatial distribution of public child care for children under the age of three in 2009, i.e., at the end of our period of observation. Clearly, there is a substantial gap in public child care coverage for very young children between East and West Germany. Concerning public child care for three to six year olds, there are no substantial differences between East and West Germany on the extensive margin anymore due to the legal claim for a place in public child care introduced in 1996. Yet, on the intensive margin, public child care provision still differs enormously between East and West Germany. As can be seen in the right panel of Figure 2, the fraction of three to six year old children in full-time public child care is substantially larger in East Germany than in West Germany in 2009.

There is general compulsory schooling for all children which comprises nine, and in some federal states ten, years of schooling. Unfortunately, we do not have detailed information on full-day care in schools. However, if we look at the limited evidence available, it seems that full-day care in primary schools is somewhat less prominent in West Germany than in East Germany. For secondary schools, the differences in full-day care between East and West Germany tend to be slightly smaller (see Figure A.1 in the Appendix). Anyway, children attending secondary school should already be more independent from their parents in East as well as in West Germany. Thus, the availability of full-day schooling should be only a minor constraint for mothers of secondary school children. Taking this into consideration, the differences in child care constraints between East and West Germany should be most important for very young children, whereas this gap decreases with the age of the child.

If the availability of external child care has indeed an effect on family structure, we expect the largest differences in the ratio of married mothers (or single mothers, respectively) between East and West Germany for mothers with very young children while the

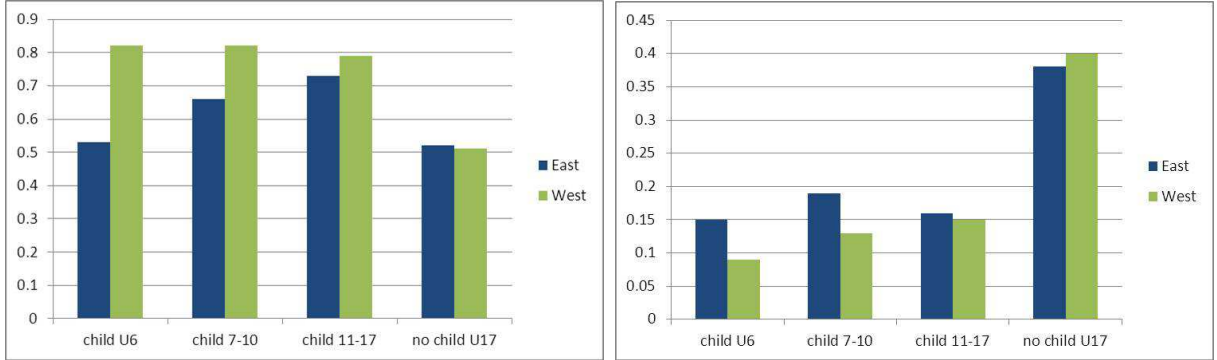
Figure 2: Child care coverage for under three year olds (general) and three to six year olds (full-time only) in Germany, 2009



Notes: The left figure shows child care coverage rates for under three year olds in German counties in 2009, whereas the right figure depicts full-time child care coverage rates for three to six year olds in German counties in 2009. Data source: German Federal Statistical Office.

differences should decline with the youngest child's age. In Figure 3, we present the ratio of married women a) in the group of mothers with children aged six or younger, b) in the group of mothers with children older than six and up to ten, c) in the group of mothers with children aged 11 to 17, and d) in the group of women without any children under the age of 17, separately for East and West Germany. The emerging pattern perfectly mirrors the differences in child care constraints between East and West Germany. In the group of mothers with children aged six or younger, East German mothers are 29 percentage points less likely to be married than West German mothers. This difference declines with the age of the child. In the group of mothers with children aged six to ten, East German mothers are 16 percentage points less likely to be married than West Germans. The differ-

Figure 3: Being married and being single in East and West Germany



Notes: The figure shows the proportions of married women (left figure) and single women (right figure) for subgroups of women, separately for East and West Germany. The subgroups consist of mothers whose youngest child is six or younger, mothers whose youngest child is older than six but not older than ten, mothers whose youngest child is older than ten but not older than 17, and women without a child under the age of 17. Data source: SOEP 2000-2009

ence shrinks to six percentage points for mothers of children at secondary school age and virtually vanishes for women without a child under the age of 17.

A very similar picture emerges if we look at the ratio of single mothers instead of unmarried mothers. In the group of mothers with children aged six or younger, East Germans are six percentage points more likely than West Germans to be single mothers. For mothers of children at secondary school age, this difference has decreased to merely one percentage point. When it comes to women without any children under the age of 17, West Germans are even more likely to be single than East Germans. In sum, we find that the difference in single motherhood is largest in the group of mothers where we also find the largest differences in public child care provision, whereas the difference declines as soon as the differences in child care constraints become smaller. Finally, for women for whom public child care constraints are not directly relevant, the difference disappears or is even reversed.

Again, we set up a double difference framework to test the robustness of this pattern in a multivariate setting. To this end, we regress our outcome variable Y_i indicating whether woman i is married on an interaction term of an East Germany dummy $East_i$ and a dummy variable $U6_i$ which is unity for mothers of children aged six or younger, and zero for women without any children under the age of 17. At the same time, we include the two dummy variables of the interaction into the regression, and control for a vector of covariates X_i ,

including the mother's years of education, age (and its square), and migration background. Finally, we include year dummies to capture time trends. Thus, the estimation equation can be written as:

$$Y_i = \mu + \nu East_i + \pi U6_i + \sigma East_i \times U6_i + X_i \rho + \zeta_i, \quad (28)$$

where ν captures any unobserved differences between East and West Germans which affect mothers of young children in the same way as women without any children under the age of 17. The coefficient π captures any unobserved common differences between mothers with children up to the age of six and mothers without any children under the age of 17. The coefficient σ is the coefficient of interest and shows by how much East German mothers of young children are less (or more) likely to be married than West German mothers of under six year olds, conditional on any differences between East and West German women without any children under the age of 17.

The estimates presented in column (1) of Table 2 show that although we already account for differences between East and West German women in general, East German mothers of children aged six or younger are still 22 percentage points less likely to be married than West German mothers. Column (3) of Table 2 suggests that at the same time, the likelihood of being single for mothers of children aged six or younger is 1.9 percentage points higher. Yet, due to large standard errors, this estimate does not reach conventional significance levels.

Previously, we raised the concern that single motherhood might not be driven by public child care but rather by some other kinds of family political institutions that make it easier for mothers of young children than for women without any children under the age of 17 to be single mothers. The comparison of East and West German mothers makes us now rather confident that other family political institutions are not a confounding factor. If there were any family political institutions that would favor mothers of young children, these institutions would affect both East and West German mothers alike.²² A more subtle point which could affect our estimates has to do with cultural attitudes. Bauernschuster and Rainer (2012) show that cultural attitudes towards the role of women in general, and mothers in particular, differ enormously between East and West Germans. In general, this does not pose a threat to our estimates from Table 2 which draw not only on East-West

²²In 2006, the East German state of Thuringia introduced subsidies for families that do not use public daycare for their child. To make sure that this state regulated family policy does not confound our analysis, we ran our regressions on a sample excluding Thuringia and find that our results are virtually unaffected.

Table 2: Double difference estimations exploiting East-West differences in child care

	Married		Single	
	(1)	(2)	(3)	(4)
	coeff.	s.e.	coeff.	s.e.
East \times Child under 6	-0.223***	(0.022)	0.019	(0.016)
Child under 6	0.382***	(0.009)	-0.311***	(0.008)
East	0.010	(0.009)	-0.009	(0.008)
Years of schooling	-0.007***	(0.001)	0.002	(0.001)
Age	0.067***	(0.001)	-0.062***	(0.001)
Age ²	-0.001***	(0.000)	0.001***	(0.000)
Migration background				
Direct	0.088***	(0.011)	-0.040***	(0.011)
Indirect	0.013	(0.015)	0.031**	(0.015)
Year dummies (9)	Yes		Yes	
<i>N</i>	97,250		97,250	
<i>R</i> ²	0.299		0.275	

Notes: The table shows OLS double difference estimates. The sample consists of mothers whose youngest child is not older than six and does not attend school as well as women without a child under the age of 17. Standard errors are clustered at the individual level. *** significant at 1 %, ** significant at 5 %, * significant at 10 %. Data source: SOEP 2000-2009.

differences but in addition on differences in child age. As long as the cultural differences between East and West Germany are independent of the youngest child's age, they are accounted for by the East dummy. Yet, a problem for our estimates would arise if the East-West difference in cultural attitudes towards the role of women in society is larger for mothers with young children than for mothers of older children, if (at the same time) these attitudes actually affect a young mother's decision not to marry or to be a single mother, and if (at the same time) these cultural differences between East and West Germany that vary with the child's age are not themselves the result of differences in public child care provision. Due to a lack of data, it is hard to investigate this issue more carefully. However, it is at least interesting to note that the results from Bauernschuster and Rainer (2012) do not suggest that the East-West differences are systematically larger for attitudes about mothers of (young) children than for attitudes about women in general.

3.3 Evidence from a comparison of mothers using and not using public child care

We now more directly exploit information on child care attendance on an individual level by comparing mothers whose youngest child attends public child care and mothers whose youngest child does not attend public child care. To this end, we regress our dichotomous outcome variable indicating whether a mother is married on a dummy variable indicating whether the youngest child attends public child care while holding constant a set of covariates. These covariates include the mother's years of schooling, her age (and its square), her migration background, and the child's age. Further, we include a set of year dummies to capture time trends as well as a set of state dummies to capture some time-invariant regional differences. Column (1) of Table 3 depicts a simple bivariate correlation between child care and being married. The likelihood of being married is 3.8 percentage points lower if the youngest child attends public child care. Adding the covariates in column (2), we find that this negative coefficient stays highly significant and even increases. Furthermore, our results show that better educated women are more likely to be married. The same is true for mothers with a direct migration background. We also find that being married is an inverted U-shaped function of the mother's age. Although not presented here, we obtain very similar results if we use a probit model and compute marginal effects at the mean of the covariates.

In Table 4, we run the same regressions as in Table 3 but use the alternative outcome

variable indicating whether the mother is single or not. The emerging picture further qualifies the previous results. There is a positive, highly significant correlation between using public child care and being single (column 1). The association decreases but stays significant at conventional levels if we add the covariates (column 2). Mothers whose youngest child attends child care are 1.6 percentage points more likely to be single than mothers whose youngest child does not attend child care. At the same time, better educated mothers are less likely to be single; the same is true for mothers with a direct migration background. The likelihood of being a single mother increases with the child's age and is a U-shaped function of the mother's age.

Our theoretical model predicts that the effect of public child care on being a single mother should be particularly strong for mothers with a low wage (and thus by assumption with a low matching quality). Since the observed wage of a woman might itself be endogenous to her family status, we use a woman's years of education as a proxy for her wage in order to test the theoretical prediction. Hence, we include an interaction term between child care and years of schooling in our multivariate model. The coefficient on this interaction term shows how the association of public child care and being married, or being a single mother, varies with a mother's years of education. Using the dummy variable indicating whether a mother is married as an outcome variable, we do not detect any heterogeneity with respect to years of education (column (3) of Table 3). However, taking the dummy variable indicating single mothers as the outcome variable, we find that the positive association of public child care and being a single mother significantly decreases with years of education, which is indeed in line with the predictions of our theoretical model (column (3) of Table 4).

Although we control for a variety of potential confounding factors in the multivariate regressions, several concerns remain. There might be other variables which are unobserved and systematically differ between the group of mothers whose child attends public child care and the group of mothers whose child does not attend public child care. If these unobserved characteristics are at the same time correlated with being married (or being a single mother), this would give rise to omitted variable bias. For example, we might think of a non-employed mother with bad labor market prospects who has no need of using public child care and, at the same time, has problems finding a partner for life. These specific features of this mother might confound our analysis if they cannot be fully captured by her years of education. By contrast, we might also think of a mother with very progressive attitudes who uses public child care already for her very young child and also,

Table 3: Child care and being married: Evidence from OLS and fixed effects models

	Married			
	OLS (1)	OLS (2)	OLS (3)	FE (4)
Public child care	-0.038*** (0.009)	-0.047*** (0.011)	-0.033 (0.040)	-0.011* (0.006)
Public child care \times Years of schooling			-0.001 (0.003)	
Years of schooling		0.011*** (0.003)	0.012*** (0.003)	
Age		0.105*** (0.010)	0.105*** (0.010)	0.049*** (0.014)
Age ²		-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Migration background				
Direct		0.146*** (0.017)	0.146*** (0.017)	
Indirect		0.038 (0.031)	0.038 (0.031)	
Child's age		-0.001 (0.003)	-0.001 (0.003)	
Year dummies (9)	No	Yes	Yes	Yes
State dummies (16)	No	Yes	Yes	Yes
Individual fixed effects	No	No	No	Yes
N	13,385	13,385	13,385	13,385
R^2	0.002	0.168	0.168	.
F - value				2.51
Prob > F				0.000

Notes: The table shows OLS and individual fixed effects estimates on the sample of mothers whose youngest child is not older than six and does not attend school; standard errors are clustered at the individual level. *** significant at 1 %, ** significant at 5 %, * significant at 10 %. Data source: SOEP 2000-2009.

Table 4: Child care and being single: Evidence from OLS and fixed effects models

	OLS	Single		FE
	(1)	OLS (2)	OLS (3)	(4)
Public child care	0.047*** (0.006)	0.016* (0.009)	0.059** (0.030)	0.010* (0.006)
Public child care \times Years of schooling			-0.004* (0.002)	
Years of schooling		-0.010*** (0.002)	-0.008*** (0.002)	
Age		-0.056*** (0.009)	-0.057*** (0.009)	0.015 (0.012)
Age ²		0.001*** (0.000)	0.001*** (0.000)	-0.000 (0.000)
Migration background				
Direct		-0.052*** (0.014)	-0.052*** (0.014)	
Indirect		-0.013 (0.022)	-0.013 (0.022)	
Child's age		0.018*** (0.003)	0.017*** (0.003)	
Year dummies (9)	No	Yes	Yes	Yes
State dummies (16)	No	Yes	Yes	Yes
Individual fixed effects	No	No	No	Yes
N	13,385	13,385	13,385	13,385
R^2	0.006	0.060	0.061	.
F - value				4.02
Prob > F				0.000

Notes: The table shows OLS and individual fixed effects estimates on the sample of mothers whose youngest child is not older than six and does not attend school; standard errors are clustered at the individual level. *** significant at 1 %, ** significant at 5 %, * significant at 10 %. Data source: SOEP 2000-2009.

due to her attitudes, feels generally independent and is single. The progressive attitudes could then be a confounding factor that leads to an upward biased estimate of the causal effect of public child care on the probability of being single. Further, it is not clear from our multivariate setting whether public child care leads to a higher probability of being a single mother, or whether being a single mother increases the likelihood of using public child care. **This reverse causality problem might arise because of institutional regulations which give preferential treatment to single mothers when assigning scarce child care slots.**

To address some of these concerns, we now make use of the panel dimension of the data by estimating individual fixed effects models. Including individual fixed effects, we control for time-invariant unobserved heterogeneity between mothers using public child care and mothers not using public child care for their youngest child. In this model, we exploit within-mother changes in child care usage over time and relate them to changes in being married, or being single respectively. Despite the fact that we now only use a small part of the overall variation available in the data, the results presented in column (4) of Table 3 reveal that the association between public child care and being married is still negative and significant at the 10 percent level. An analogous pattern is found for the probability of being a single mother (column (4) of Table 4). However, it also becomes clear that controlling for unobserved time-invariant heterogeneity reduces the coefficients as compared to the results from the repeated cross-section analyses presented in columns (1) and (2). One reason for that might be that unobserved heterogeneity leads to an upward bias in the OLS results. Another explanation might be that measurement error in the child care variable leads to attenuation bias, which usually has much more impact in fixed effects models than in cross-sectional models. Finally, note that any time-varying unobserved variables that affect child care usage and being married or being single simultaneously, would bias our estimates.

Ideally, we would like to use a quasi-experimental setting which would give us truly exogenous variation in public child care and thus allow for causal estimates. However, this is particularly difficult in our context. Bauernschuster and Schlotter (2015) exploit two quasi-experiments to identify causal effects of public child care on maternal employment in Germany. Yet, identification comes from rather marginal changes in public child care where, in an extreme case, children can enter public child care at the age of three rather than at the age of four. This marginal change is relevant for mothers in their decision to work. Yet, in order to really affect family structure, we probably need more than marginal changes

in public child care. Ideally, we would like to compare two regimes which are identical to each other with the sole exception that the one regime provides universal public child care whereas the other regime provides hardly any public child care at all. This systemic difference might affect decisions with long-run consequences such as getting married or divorced. Our empirical approaches try to exploit systemic differences by looking at East versus West Germany, the 1990s versus the 2000s or mothers using and not using public child care. Yet, all approaches lack a clear (quasi-)experimental identification. Therefore, we have to conclude that although the presented empirical patterns are suggestive, they should be interpreted with caution.

4 Conclusion

This paper examines the effect of child care provision on family structure, a topic which has, to the best of our knowledge, not yet been examined. The model we have presented predicts that child care provision will lead to an increase in divorce and a decrease in marriage. Hence the number of single mothers increases. In addition to the model, we have provided several pieces of empirical evidence which are consistent with the model predictions. First, in contrast to women without children, mothers with young children have become more likely to be single over time. This development coincides with the expansion of public child care facilities. Second, in particular mothers with young children are less likely to be married in East Germany than in West Germany, while this is not true for women in general. This pattern is consistent with much wider availability of public child care in East than in West Germany. Third, mothers whose youngest child is in public child care are less likely to be married and more likely to be single than mothers whose youngest child is not in child care. This association holds in repeated cross sections as well as in an individual fixed effects setting exploiting the panel dimension of the data. These multivariate descriptive patterns are, we think, interesting and suggestive. Due to a lack of plausibly exogenous variation, they should however be interpreted with caution. More work is surely necessary to make plausibly causal statements about the effects of public child care on family structure.

Child care policies have been high on the political agenda of many developed countries in recent years. The main arguments in the discussion about the expansion of high quality public child care have been facilitation of mothers' labor force participation and effects on children's cognitive and non-cognitive outcomes. We believe that possibly unintended

effects of child care policies, as we have discussed, should also be taken into account. However, this does not, in our view, imply that expanding child care provision is bad policy. In fact, this cannot be inferred from our analysis, for three reasons. First, in our model, it can be shown that even those women who choose not to marry or divorce their husband are better off with child care than without.²³ Second, we have not modelled the effects of family structure on child outcomes. Although some studies have suggested adverse effects of single motherhood for children (see, e.g., Chapple, 2009 and Ribar, 2004 for surveys), the literature is generally not conclusive due to questions revolving around the right counterfactual. And third, even if the change in family structure had a negative effect on children, there may be offsetting effects because at least some mothers earn higher (net) wages than before, and perhaps because of beneficial effects of child care on the cognitive and non-cognitive development of children. A normative evaluation of child care policies would have to take all these effects into account.

Appendix

Proof of Proposition 1. (i) Since by assumption, the woman with wage w_F^* uses child care when she is single, but not when she is married, the surplus from marriage for the couple $(w_F^*, \psi(w_F^*))$ must fall. Since $\lim_{p \rightarrow 0} S^C(w_F, w_M) = -\infty$, there is a child care fee p^* such that $S^C(w_F^*, \underline{w}_M) = 0$. Hence, if $p < p^*$, the woman with wage w_F^* prefers to be single and the number of women who choose to marry falls. If $p \geq p^*$, the couple (w_F^*, \underline{w}_M) stays married, and since the surplus remains positive for all wealthier couples, the number of women who marry stays the same.

(ii) All women with wages $w_F < \hat{w}_F$ remain single and don't use child care, so their utility does not change. All women with wages $w_F \in [\hat{w}_F, w_F^*]$ choose child care and remain single. Their utility must rise by revealed preference. ■

Proof of Proposition 2. (i) For all couples who do not use child care, comparing (25) and (17) implies

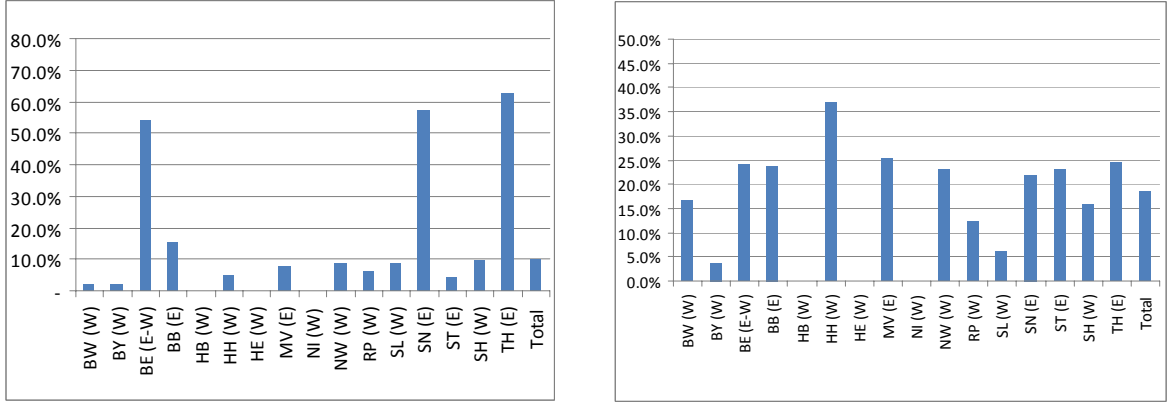
$$\hat{\theta}^C(w_F, w_M) - \hat{\theta}^N(w_F, w_M) = v_F^{S,C}(\mathbf{w}_F) - v_F^{S,N}(\mathbf{w}_F) > 0 \quad (\text{A.1})$$

²³On the other hand, some husbands who cannot find a partner in the childcare regime are made worse off. In this sense, child care redistributes welfare from men to women, and the welfare consequences depends on one's valuation of the individual welfare gains and losses of women and men.

by revealed preference (since the wife would use child care when single), so their divorce probability rises. By continuity, this also holds for some couples who do use child care.

(ii) This follows since $v_F^{S,C}(w_F)$ is increasing in Q and decreasing in p . Hence, $\hat{\theta}^C$ is increasing in Q and decreasing in p . ■

Figure A.1: Full-time schooling (primary and secondary schools) in Germany



Notes: The left figure shows the ratio of children in primary school age who attend full-time schools in German federal states in 2005, whereas the right figure depicts the ratio of children in secondary school age who attend full-time schools in German federal states in 2005. BW=Baden-Wuerttemberg, BY=Bavaria, BE=Berlin, BB=Bremen, HB=Hamburg, HE=Hesse, MV=Mecklenburg Western Pomerania, NI=Lower Saxony, NW=Northrhine Westfalia, RP=Rhineland Palatinate, SL=Saarland, SN=Saxony, ST=Saxony Anhalt, TH=Thuringia. "W" in parentheses indicates West Germany and "E" in parentheses indicates East Germany. There are no data available for Bremen (HB), Hesse (HE), and Lower Saxony (NI). Data source: Standing Conference of the Ministers of Education and Cultural Affairs of the Laender in the Federal Republic of Germany.

Table A.1: Descriptive statistics for main sample

	N	Mean	Std.dev.	Min	Max
Married	13,385	0.767	0.423	0	1
Single	13,385	0.103	0.304	0	1
Public child care	13,385	0.521	0.500	0	1
Age	13,385	33.338	5.655	17	56
Age of the youngest child	13,385	3.126	1.778	0	6
Years of education	13,385	12.362	2.586	7	18
<i>Migration background</i>					
No migration background	13,385	0.753	0.431	0	1
Direct migration background	13,385	0.167	0.373	0	1
Indirect migration background	13,385	0.066	0.248	0	1
Missing value in migration background	13,385	0.015	0.120	0	1

Notes: The table shows descriptives statistics for the sample used in Table 3. The sample consists of mothers whose youngest child is not older than six and does not attend school observed in the SOEP from 2000-2009.

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