

# The effect of child care on 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 also present empirical evidence which is consistent with this finding.

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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 outside marriage and live with single parents.

Politicians have reacted to these developments, amongst others by increasing public child care provision. Public child care is expected to improve the reconciliation of work and family life and thus increase fertility. Public child care seems to be particularly important for single parents, because it gives them the chance of being employed to support a family. Recent empirical studies find that public child care provision can increase maternal employment, while the evidence on the effects of public child care for fertility is still scarce.<sup>1</sup> However, changes in family structure may not only be one of the driving factors for the increase in public child care provision. Rather, public child care might itself have unintended feedback effects on family structure.

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

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<sup>1</sup>Recent empirical evidence for the effects of public child care on maternal employment has been provided e.g. by Baker *et al.* (2008), Berlinski and Galiani (2007), Cascio (2009), Havnes and Mogstad (2011a), Fitzpatrick (2010), or Lefebvre and Merrigan (2008), while Del Boca (2002) or Schlosser (2011) also provide evidence on fertility effects. Apart from employment and fertility effects, economic research on public child care has also dealt with the effects on child outcomes (see e.g. Baker *et al.* (2008), Berlinski *et al.* (2009), or Havnes and Mogstad (2011b)).

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 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. Moreover, this effect is more pronounced for less educated women, which is also consistent with our model. Second, we find 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 coincided with a pronounced increase in the availability of day care. Third, 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. While all three empirical exercises lack the ‘as good as’ randomness of true natural experiments, taken together, they provide suggestive evidence in support of our model.

Our paper focuses on the (perhaps unintended) effects of public child care on family structure. Thus, we contribute to the economic literature that has tried to identify determinants of the substantial changes in family structure which emerged during the last decades. In order to draw policy conclusions from our research, it is crucial to understand whether single motherhood has negative effects on children and mothers. Some studies have addressed this question (see Section 2.2 below), yet the results are partly ambiguous and further research is necessary to gauge the welfare effects of changing family structure.

We proceed as follows. The next section looks in more detail at related literature dealing with the causes and effects of changing family structure. Section 3 presents the model, and section 4 our empirical evidence. Finally, the last section concludes the paper.

## 2 Related literature

### 2.1 Causes of changing family structure

Although the effects of public child care on family structure have not been investigated yet, there is a growing literature on a number of other driving forces behind the observed

changes in family structure.

On the one hand, changes in contraception technologies, in particular the pill, household technologies, changes in sex ratios (or, more precisely, changes in numbers of ‘marriageable’ men and women), and changing social norms have probably contributed to declining marriage rates and rising divorce rates, as well as the rise in single parenthood. On the other hand, the evolution of wages and different policies may also have contributed to the observed evolution of family structures. Economic research has emphasized changes in divorce laws (‘no-fault’ divorce), abortion laws, welfare benefits (in particular those targeted at single parents), alimony and custody laws, and taxes (in particular, the tax treatment of children). Ellwood and Jencks (2004) and Stevenson and Wolfers (2007) provide excellent overviews of this literature. Furthermore, ‘soft’ policies, for instance, information campaigns about contraception or policies addressing father involvement, may also play a role in changing family structures (Sawhill *et al.*, 2010).

Focusing on the role of policies, Akerlof *et al.* (1996) analyze how the legalization of abortion and increased availability of contraception can lead to a reduction in shotgun marriages, which may then increase out-of-wedlock childbearing. At the heart of their analysis is how abortion and contraception change women’s ability to obtain a shotgun marriage in case of an unwanted pregnancy, and how men’s obligations towards non-marital children is changed by the fact that pregnancy is *de facto* under the woman’s control. Looking at changes in welfare policies, some (but not all) studies have found that these changes led to an increase in marriage and a decrease in divorce (e.g. Bitler *et al.*, 2006).<sup>2</sup> Neal (2004) considers the effect of welfare payments to single mothers and marriage market prospects on single motherhood. He shows that reducing the number of men will reduce the number of marriages and increase the number of single mothers. The same effect obtains if the welfare benefit to single mothers is increased.<sup>3</sup> Rosenzweig (1999) finds that higher benefits to families with dependent children and lower marital prospects were conducive to nonmarital childbearing. Blau and van der Klaauw (2012) use data from the NLSY and find that family structure is significantly determined by male and female wages for blacks and Hispanics, but not for whites. The tax treatment of children also affects family structure, while they find small effects of welfare benefits, welfare reform, and unilateral divorce laws.

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<sup>2</sup>In the US, welfare policies used to be aimed at single parents in particular, but this focus has been reversed starting in the 1990s. For an early overview see also Moffitt (1998).

<sup>3</sup>In fact, Neal (2004) shows that increasing welfare benefits does not increase the number of marriages and does not decrease the number of single mothers.

Guner and Knowles (2009) analyze a dynamic equilibrium model calibrated to Canadian data. Using simulations, they show that a U.S. style policy of making 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. Regalia *et al.* (2011) find that the increase of single motherhood in the US can be explained by changes in the wage structure, namely, increasing wage premia for skilled men and women and a reduced gender wage gap.

## 2.2 Effects of changing family structure

The observed changes in family structure may be important for social and economic outcomes. Single parenthood may reduce the resources available to families, and lead to adverse consequences for mothers and children. Kalil and Ryan (2010) summarize the economic conditions of single mothers in the US. Compared to mothers who are married or cohabiting, single mothers are more likely to be teen mothers, significantly less educated, poorer, have more severe health problems, including depression, and are more likely to drink or take drugs. While cohabiting mothers fare better on a number of measures, they are also significantly poorer than married mothers. The primary cause of poverty seems to be single mothers' low earnings capacity, which could be driven by low education as well as physical or mental health problems (Kalil and Ryan, 2010, p.57).

Both the economic conditions of single parents and the parents' relationship influence children's outcomes. Waldfogel *et al.* (2010) present results on the effects of fragile families on children's well-being in the US. A large body of research has shown that children in fragile families (i.e. those who have lived in divorced families and unwed-mother families) tend to fare worse in terms of academic achievement, teenage motherhood, behavior and health problems, crime and delinquency, depression, social relations, self-esteem, health, employment and income, and child abuse (see also Ellwood and Jencks, 2004 and Chapple, 2009). Research on other countries has also shown negative consequences of single motherhood (see e.g. Chapple, 2009). If family structure affects parents' and children's economic status, it will also have macroeconomic consequences. For instance, Greenwood *et al.* (2003) show that family structure affects the evolution of inequality.

A crucial question in this literature concerns the identification of causal effects of family structure. Obviously, single parents differ from married parents along many dimensions, some of which may not be observed. An essential question is therefore separating the effect

of divorce from the characteristics of divorced couples. It is entirely possible that children of parents who separate are better off after separation, compared to the counterfactual of living with parents in a badly working relationship. Research using mother fixed effects or instrumental variables generally tends to find smaller effects of family structure, but the associations described remain significant in many (though not all) carefully designed studies (see, e.g., Chapple, 2009 and Ribar, 2004 for surveys). In summary, much of the literature has found negative effects of divorce and single motherhood on parents' and children's outcomes, although these negative findings are not unequivocal and addressing identification properly may reduce or even eliminate (in some instances even reverse) these effects. In any event, we think that family structure is an important determinant of children's and parents' well-being. Therefore, investigating whether family policies have (perhaps unintended) effects on family structure is a valuable task.

## 3 The model

### 3.1 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. 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  $[\underline{w}_M, \bar{w}_M]$  with distribution  $G$  and female wages  $w_F$  are distributed on the interval  $[\underline{w}_F, \bar{w}_F]$  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

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  $\phi_{NF}$  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

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

Equation (3) implies that richer mothers have fewer children, since the wage loss implied by child birth implies that the 'price' of children rises with the mother's income. 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.<sup>4</sup> A single male's utility is then given by  $v_M^{S,N}(w_M) = w_M$ .

### 3.2 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.

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<sup>4</sup>See also Neal (2004) and Chiappori and Orefice (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.

If a man and a woman form a union, their joint utility is

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

where  $x_i^{C,N}, i = F, M$  is  $i$ 's consumption.<sup>5</sup>

We assume that upon marriage, each partner receives a match-specific benefit  $\theta b(w_F + w_M)$ , where we assume  $b'(\cdot) > 0, b''(\cdot) > 0$ .<sup>6</sup> Here,  $\theta$  is distributed according to the distribution function  $\Phi$  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.<sup>7</sup> Couples may divorce if their draw of  $\theta$  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.

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  $\alpha$  and  $\hat{\theta}$  are endogenous, as shown below; in particular,  $\alpha$  is the probability that  $\theta$  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

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

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

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<sup>5</sup>The superscript 'C, N' denotes a couple without child care.

<sup>6</sup>Chiappori *et al.* (2009) use a similar assumption except for the 'matching benefit' function  $b(\cdot)$ .

<sup>7</sup>In 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.

between the sexes. In line with reality, we assume that  $\widehat{\phi}_{NF} < \widehat{\phi}_{NM}$ , 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  $\phi_{XF}$  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:  $\widehat{\phi}_{NJ} < \phi_{NJ}$  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.<sup>8</sup>

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

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

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

Equation (7) shows that couples tend to have more children than single women, because of the public goods nature of children. In addition, the cost of children is lower because we have assumed that  $\widehat{\phi}_{NF} < \phi_{NF}$  from which follows that  $\min\{\widehat{\phi}_{NF}w_F, \widehat{\phi}_{NM}w_M\} < \phi_{NF}w_F$ . Countering this is the effect of household public goods: Since  $v(X) \geq 1$ , the cost of children rises for couples since the utility cost of reduced income rises. Fertility is still likely to fall with the female wage, at least if the net effect of a rising female wage is to increase the marginal benefit of household good production. Whether or not the couple's home production of household public goods rises with the female wage is 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  $v^{C,N}(w_F, w_M) + 2\theta b(w_F + w_M)$ . There is a surplus from marriage, since the two partners can jointly enjoy the utility from having children and consuming the household public good,

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<sup>8</sup>Readers with children might think that the presence of children actually makes home production less productive.

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

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

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.<sup>9</sup> 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:

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

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

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<sup>9</sup>If the man specializes in home production, demand for the household public good is increasing in the female wage.

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 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.<sup>10</sup>

Standard arguments (see, e.g. Browning *et al.*, 2011) 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

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

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  $\theta$  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

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<sup>10</sup>This assumption is not necessary for our results but makes the analysis simpler.

exceeds their joint utility in marriage. The condition for divorce to occur is

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

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

### 3.3 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. We assume that child care is available for all who demand it at a fee of  $p$  per child. That is, we abstract from rationing, special conditions for single parents, and so on. In Germany, many implicit and explicit provisions favor single parents in child care provision, which would reinforce our main results.

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.<sup>11</sup> The optimal number of 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

$$u^C = (x_F^{C,C} + x_M^{C,C})v(X^{C,C}) + 2u(n^{C,C}Q) + 2\theta b(w_F + w_M), \quad (21)$$

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<sup>11</sup>The results would not change qualitatively if we assumed that in the case of child care usage, there would be a proportional wage loss which is smaller than in the absence of child care,  $\phi_{NF}^C < \phi_{NF}$ .

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  $v^{C,C}(w_F, w_M, p, Q) + 2\theta b(w_F + w_M)$ .

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,  $\widehat{w}_F = p/\phi_{NF}$ , such that all women with  $w_F > \widehat{w}_F$  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  $p < \widehat{\phi}_{NF}w_F$ . Again, a couple where the woman's wage is  $w_F \geq \widetilde{w}_F = p/\widehat{\phi}_{NF}$  will use child care and all other couples don't. Since  $\widehat{\phi}_{NF} < \phi_{NF}$ , it follows that  $\widetilde{w}_F > \widehat{w}_F$ . 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  $p > \phi_{NF}w_F$ , the lowest wage woman will not use child care when single, and if  $\overline{w}_F > p/\widehat{\phi}_{NF}$ , the wealthiest married woman prefers child care to staying at home. The important assumption, however, is that  $p/\phi_{NF} < w_F^* < p/\widehat{\phi}_{NF}$ . 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.<sup>12</sup> 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 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. We then get the next result:

**Proposition 2** *Consider an equilibrium with  $w_F^{**} > w_F^*$ . The number of single mothers increases with the quality of child care  $Q$  and falls with the child care fee  $p$ .*

**Proof.** See Appendix. ■

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<sup>12</sup>The 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.

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

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

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

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

**Proposition 3** (i) *There is a wage  $\widehat{w}_F$  with  $w_F^{**} < \widetilde{w}_F < \widehat{w}_F$  such that for all couples with wages in the interval  $[(w_F^{**}, \psi(w_F^{**})), (\widehat{w}_F, \psi(\widehat{w}_F))]$ , 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.

## 4 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). Focusing on micro survey data of

one specific country, we can avoid some problems of unobserved heterogeneity which are typical of cross-country studies. At the same time, of course, we have to be cautious when making claims about the external validity of our findings for other countries.

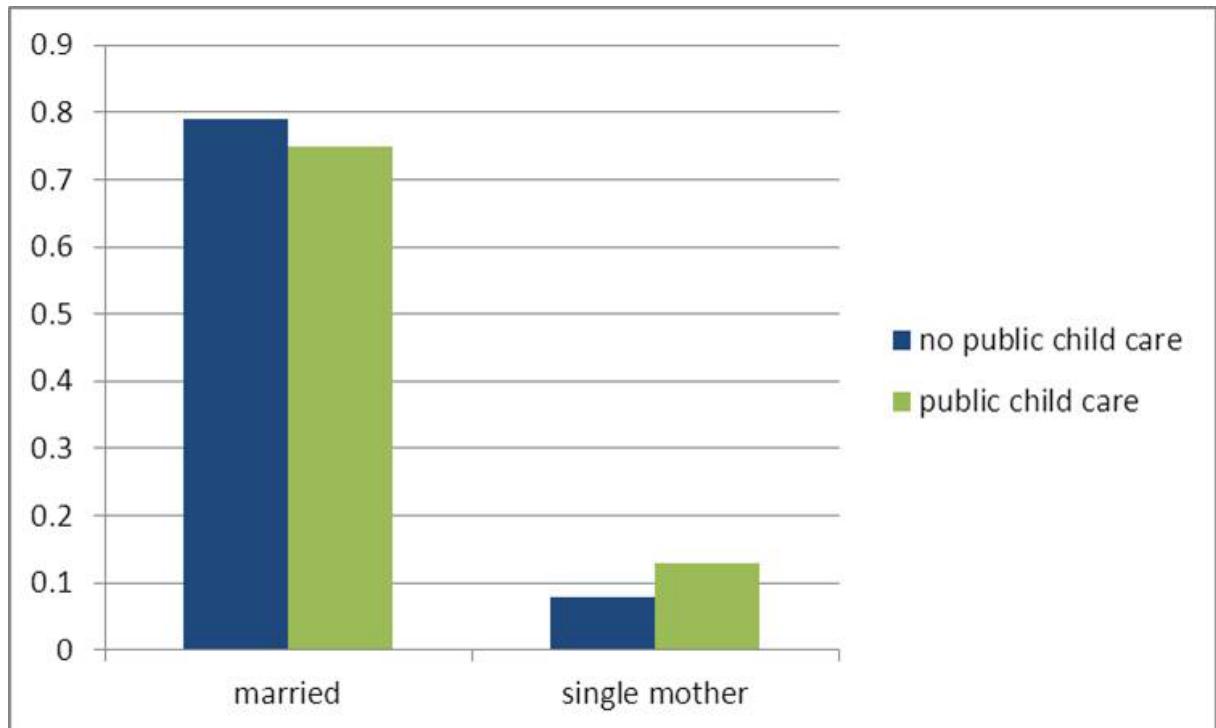
The SOEP is a large individual level data set representative of the whole German population. It provides information on an annual basis about a wide range of variables for an individual's labor market participation, education, socio-economic background, demographic characteristics, leisure activities, health status, but also on a substantial set of values, norms, and attitudes. 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. We also have information on the state the respective household is located in. 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.

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

We start our empirical investigation of child care and family structure by comparing mothers whose youngest child attends public child care and mothers whose youngest child does not attend public child care. Figure 1 gives a first graphical impression. We see that mothers whose youngest child attends public child care are roughly 4 percentage points less likely to be married; at the same time, they are roughly 5 percentage points more likely to be single.

Obviously, mothers whose youngest child attends public child care might be different from mothers whose youngest child does not attend public child care along several dimensions. We know that child care attendance increases with the child's age; if the probability of single motherhood also increases with the child's age, the child's age is a confounding factor and could as such drive the pattern in Figure 1. We might also expect that better educated women are more likely to use public child care for their youngest child, for example if public child care allows them to pursue their careers and the likelihood of

Figure 1: Family status and public child care: Graphical evidence



Notes: The figure is based on the sample of mothers whose youngest child is six or younger and does not attend school. It shows the proportions of married and single mothers in the subgroups of mothers using public child care and not using public child care. Data source: SOEP 2000-2009

working increases with the level of education. If better educated women are at the same time less likely to be single, Figure 1 might underestimate the real effect of public child care on the probability of being single. Further, public child care coverage has increased over time. At the same time, we might expect that the probability of being a single mother has universally increased over time. These time trends could again confound the bivariate association between public child care and the probability of being a single mother. In order to check whether the pattern from Figure 1 is merely driven by these confounding factors, we now turn to a multivariate setting.

We run a probit estimation where 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 1 depicts the marginal effects of this probit regression. The negative association between public child care and being married is confirmed and turns out to be highly significant. 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.<sup>13</sup> We also find that being married is an inverted U-shaped function of the mother's age. We obtain very similar results if we use a linear probability model instead of a probit model (see column (2) of Table 1).

In columns (4) and (5) of Table 1, we run the same regressions as in columns (1) and (2). However, now we use the alternative outcome variable indicating whether the mother is single or not. Again, the pattern that emerges from Figure 1 is confirmed in a multivariate setting. Mothers whose youngest child attends child care are roughly 2 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 in our multivariate model an interaction term between child care and years of schooling. The coefficient on this interaction term shows how the effect of public child care on being married, or being a single mother respectively, 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 of the effect of public child care with respect to years of education (column (3) of Table 1). However, taking the dummy variable indicating single mothers as the outcome variable, we find that the positive effect of public child care on being a single mother significantly decreases with years of education, which is indeed in line with the predictions of our theoretical model (column (6) of Table 1).

Although we control for a variety of potential confounding factors in our multivariate

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<sup>13</sup>An 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.

Table 1: Family status and public child care: Multivariate evidence

	Married			Single mother		
	Probit mfx (1)	OLS (2)	OLS (3)	Probit mfx (4)	OLS (5)	OLS (6)
Public child care	-0.052*** (0.012)	-0.047*** (0.011)	-0.041 (0.040)	0.019** (0.008)	0.017** (0.009)	0.070** (0.030)
Public child care × Years of education			-0.001 (0.003)			-0.004** (0.002)
Years of education	0.013*** (0.003)	0.012*** (0.003)	0.012*** (0.003)	-0.011*** (0.002)	-0.010*** (0.002)	-0.008*** (0.002)
Age	0.094*** (0.010)	0.105*** (0.010)	0.105*** (0.010)	-0.041*** (0.006)	-0.058*** (0.009)	-0.059*** (0.009)
$Age^2$	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)	0.001*** (0.000)
Migration background						
Direct	0.143*** (0.018)	0.144*** (0.018)	0.144*** (0.018)	-0.039*** (0.012)	-0.050*** (0.014)	-0.050*** (0.014)
Indirect	0.039 (0.032)	0.042 (0.031)	0.042 (0.031)	-0.010 (0.003)	-0.011 (0.022)	-0.011 (0.022)
Child's age	-0.000 (0.004)	-0.000 (0.004)	-0.000 (0.004)	0.015*** (0.003)	0.016*** (0.003)	0.016*** (0.003)
Year dummies (9)	Yes	Yes	Yes	Yes	Yes	Yes
State dummies (16)	Yes	Yes	Yes	Yes	Yes	Yes
N	12,847	12,847	12,847	12,847	12,847	12,847
Pseudo $R^2$	0.149			0.083		
$R^2$		0.168	0.168		0.058	0.058

Notes: The table shows probit marginal effects and OLS 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.

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, respectively), 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 in 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, 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. For example, sometimes it is easier for single mothers than for mothers with partners to get a place in a public child care institution due to specific institutional regulations favoring single mothers.

In order to collect further evidence for an effect of public child care on family structure, we now draw on empirical patterns that emerge when exploiting the time dimension.

## 4.2 Evidence from a comparison of the 1990s and 2000s

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 2007, the German government passed a law including 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. Therefore, and for the fact that the reunification ‘shock’ makes East German data on family and children very noisy in the 1990s<sup>14</sup>, we restrict the data for the following empirical analysis to West Germany.

Using SOEP data from 1991 to 1999 and 2000 to 2009, we explore the change in public child care and family status over the past two decades in West Germany. As we can see from Figure 2, 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 turn to women without children under the age of 17.<sup>15</sup> It turns out that the likelihood of being married as well as the likelihood of being single did not substantially change for this group from the 1990s to the 2000s. If anything, we observe more married women and fewer singles over time. Though not presented in Figure 2, the same is true for women without any children at all. 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 with young children. This is exactly the group of women for whom the increase in public child care was relevant.

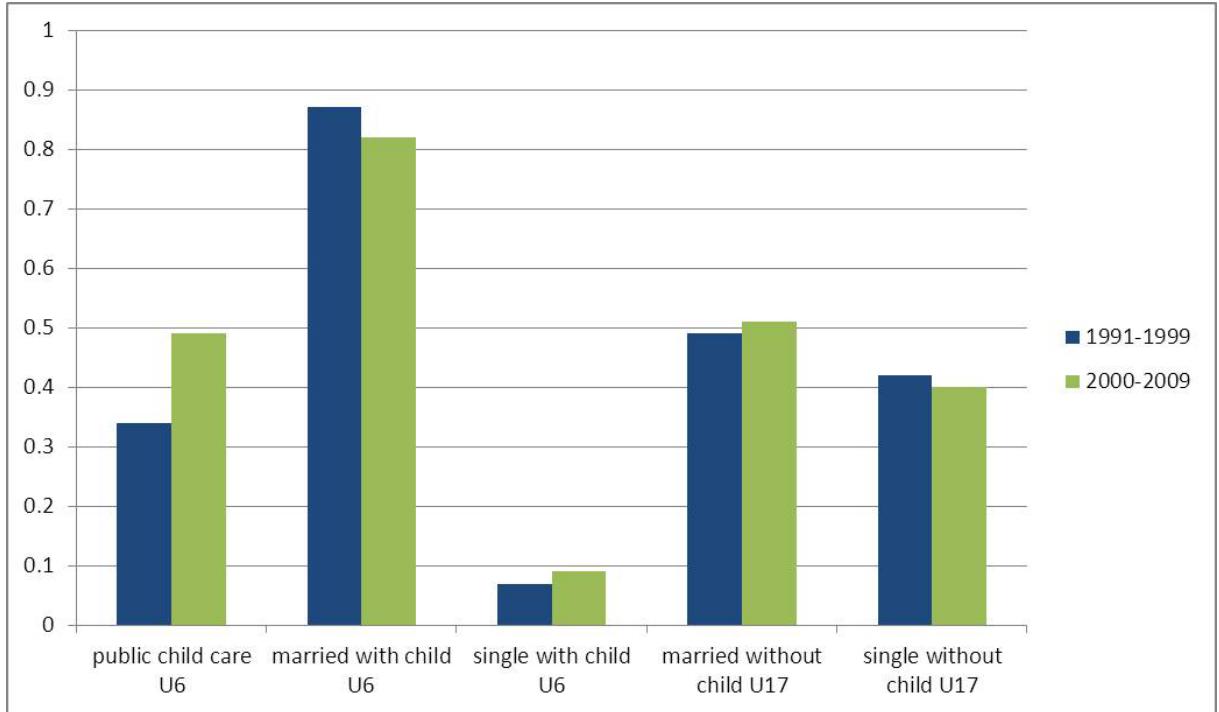
In order to make sure that these empirical patterns are not confounded by gradually and systematically emerging differences in observable group characteristics, we run multivariate double difference regressions. To this end, we generate a dummy variable  $U6_i$  that takes on the value of unity for women 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

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<sup>14</sup>Note that we observed the lowest fertility rate (0.77) ever measured worldwide in East Germany in 1994.

<sup>15</sup>From 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 2: 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

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:

$$Y_i = \alpha + \beta After2000_i + \gamma U6_i + \tau After2000_i \times U6_i + X_i \delta + \epsilon_i. \quad (26)$$

Here,  $\beta$  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  $\gamma$  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  $\tau$  is the coefficient of interest since it 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.

In column (1) of Table 2 we can see that the coefficient on the interaction term is negative and rather larger in size than the raw differences presented in Figure 2. The same is true if we take the dichotomous variable indicating women who are single as our outcome variable. 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. This leaves us with the conclusion that the observed decrease of married mothers and the increase of single mothers within the group of mothers with young children is not driven by emerging differences in observed characteristics of mothers with small children compared to women without any children under the age of 17.<sup>16</sup>

The point estimates from Table 2 suggest very large effects. A potential issue with these estimates is that they might pick up effects other than the increase in public child care. For instance, apart from the expansion of public child care, macroeconomic or social conditions might 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. A similar problem for our estimates would arise 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 public child care expansion.<sup>17</sup> Therefore, we exploit another dimension of public child care, namely differences between East and West Germany, in order to find further evidence concerning the role of public child care for family structure.

### 4.3 Evidence from a comparison of East and West Germany

The socialist 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. One major reason was that the regime wanted to control education and socialization of its citizens from the

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<sup>16</sup>In line with our model, a triple differences specification again confirms that these effects are stronger for less educated women. Detailed results are available from the authors upon request.

<sup>17</sup>Although 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 2: Double difference estimations exploiting the increase of public child care

	Married		Single	
	(1) coeff.	(2) s.e.	(3) coeff.	(4) s.e.
After 2000 $\times$ Child U6	-0.103*** (0.012)		0.088*** (0.010)	
Child U6	0.468*** (0.010)		-0.377*** (0.008)	
After 2000	0.008 (0.006)		-0.018*** (0.006)	
Years of education	-0.011*** (0.002)		0.004*** (0.002)	
Age	0.065*** (0.001)		-0.060*** (0.001)	
$Age^2$	-0.001*** (0.000)		0.001*** (0.000)	
Migration background				
Direct	0.092*** (0.010)		-0.038*** (0.010)	
Indirect	-0.004 (0.015)		0.069*** (0.015)	
State dummies (10)	Yes		Yes	
N	104,704		104,704	
$R^2$	0.288		0.250	

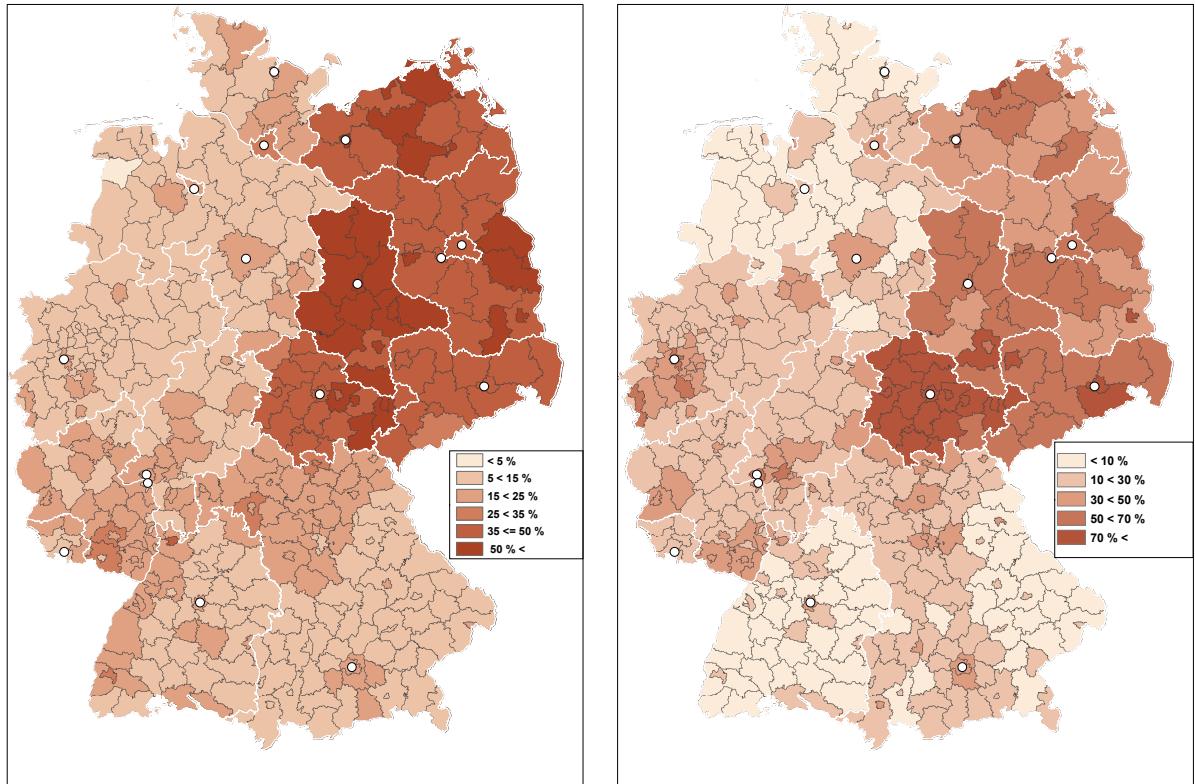
Notes: The table shows OLS double difference estimates. The sample consists of West German mothers whose youngest child is not older than six and does not attend school as well as West German women without a child under the age of 17. Standard errors are clustered at the individual level. \*\*\* significant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

very start of their lives. Further, socialist ideology promotes equality, and in particular also equality of males and females. Since it was argued that this equality could only be reached by equality in the labor market, the socialist regime supported female employment by various policies that aimed at reconciling work and family life, amongst them the provision of public child care already for very young children. 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 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 3 shows the regional distribution of public child care for children under the age of three in 2009, i.e., at the end of our period of observation. We observe a substantial gap in public child care provision for very young children between East and West Germany. Concerning public child care for three to six year olds, a legal claim for a place in public child care was introduced in Germany in 1996. This is why there are no substantial differences between East and West Germany on the extensive margin of public child care for three to six year olds anymore. Yet, on the intensive margin, public child care provision still differs dramatically between East and West Germany. As can be seen in the right panel of Figure 3, the fraction of three to six year old children with 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

Figure 3: Child care coverage for under three year olds (general) and three to six year olds (full-time only) in Germany, 2009

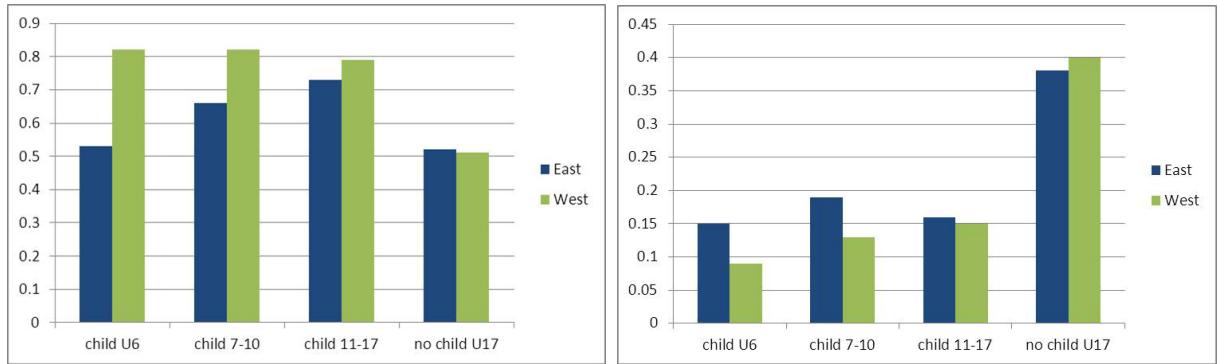


Notes: The left figure shows child care coverage rates for under three year olds in German counties in 2009, whereas the right figure depicts full-time child care coverage rates for three to six year olds in German counties in 2009. Data source: German Federal Statistical Office.

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 should observe an empirical pattern of married and single mothers in East and West Germany that mirrors the differences in child care constraints between East and West Germany. In particular, we would 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 differences should decline with the youngest child's age. In Figure 4, 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

Figure 4: 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

any children under the age of 17, separately for East and West Germany. The emerging pattern is intriguing since it 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 difference 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 multivariate double difference framework in order to make sure that this pattern is not driven by systematic group differences between East and West German mothers with children of different age groups. 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:

$$Y_i = \mu + \nu East_i + \pi U6_i + \sigma East_i \times U6_i + X_i \rho + \zeta_i, \quad (27)$$

where  $\nu$  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  $\pi$  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  $\sigma$  is the coefficient of interest since it 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.

Column (1) and (2) of Table 3 present the results of this empirical exercise. The estimates show that accounting for observable characteristics, East German mothers of children aged six or younger are 23 percentage points less likely to be married than West German mothers. The size of this effect is substantial, yet slightly smaller than the raw difference we observed in Figure 4. In columns (3) and (4) of Table 3, we run the same regressions using the alternative outcome variable indicating whether a woman is single or not. The coefficient on the interaction term is imprecisely measured in this estimation. However, considering that overall only 10 percent of all mothers of children aged six or younger are single mothers, the point estimate of 2.4 percentage points represents an economically substantial effect.

Previously, we raised the concern that single motherhood might not be driven by public child care but rather by any other kind of family political institutions that make it easier

Table 3: Double difference estimations exploiting East-West differences in child care

	Married		Single	
	(1) coeff.	(2) s.e.	(3) coeff.	(4) s.e.
East × Child U6	-0.227*** (0.022)	0.024	(0.017)	
Child U6	0.392*** (0.009)	-0.310*** (0.008)		
East	0.010 (0.009)	-0.012	(0.009)	
Years of education	-0.006*** (0.002)	0.002	(0.001)	
Age	0.069*** (0.001)	-0.062*** (0.001)		
$Age^2$	-0.001*** (0.002)	0.001*** (0.000)		
Migration background				
Direct	0.088*** (0.012)	-0.038*** (0.011)		
Indirect	0.005 (0.017)	0.040** (0.017)		
Year dummies (9)	Yes		Yes	
N	90,117		90,117	
$R^2$	0.268		0.228	

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.

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.<sup>18</sup> 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 3 which draw not only on East-West differences but also 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. The data set used by Bauernschuster and Rainer (2012) does not provide information on the age of the youngest child of the respondent. At the same time, the SOEP data used in our paper do not provide information on sex-role attitudes. Thus, we cannot investigate whether the differences in sex-role attitudes between East and West Germans vary systematically with the youngest child's age. However, Bauernschuster and Rainer (2012) can distinguish between attitudes about the role of mothers with (young) children in particular and attitudes about the role of women in society in general. Their results show that, conditional on child care coverage, the East-West differences do not seem to be systematically larger for attitudes about mothers of (young) children than for attitudes about women in general.

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 (2012) exploit two quasi-experiments to identify causal effects of public child care on maternal employment

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<sup>18</sup>In 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.

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 or the 1990s versus the 2000s. Yet, both 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.

## 5 Conclusion

This paper examines the effect of child care provision on family structure. The economic analysis of policy effects on family structure has largely concentrated on welfare policies, but the effect of child care policies on family structure has to our knowledge not yet been examined. There is a large literature on the effects of family structure on parents and children. Some of this literature (but not all of it) finds negative effects of divorce or single motherhood on parents' and children's outcome. Hence, it is important to consider the possibility that child care provision may have unintended effects on families.

In fact, 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. We have also presented evidence showing that 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. However, this correlation may not reflect a causal effect of child care provision on family structure. To gain additional evidence, we have compared mothers with children up to six years with women without children under 17, both over time and between East and West Germany. The evidence shows that mothers with young children have become more likely to be single over time, and are more likely to be single in East Germany. This is consistent with the increase in public child care provision over time and the much wider availability of child care in the East.

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, 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. Second, we have not modelled the effects of family structure on child outcomes, and while the literature on the effects of family structure suggests negative effects on children, this finding is not entirely conclusive. 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.** The equilibrium is defined by

$$v_F^{S,C}(w_F^{**}) = v^{C,N}(w_F^{**}, \psi(w_F^{**})) + \theta b(w_F^{**}, \psi(w_F^{**})). \quad (\text{A.1})$$

Since the left hand side of (A.1) is increasing in  $Q$  and decreasing in  $p$ , the result follows since the equilibrium is stable. ■

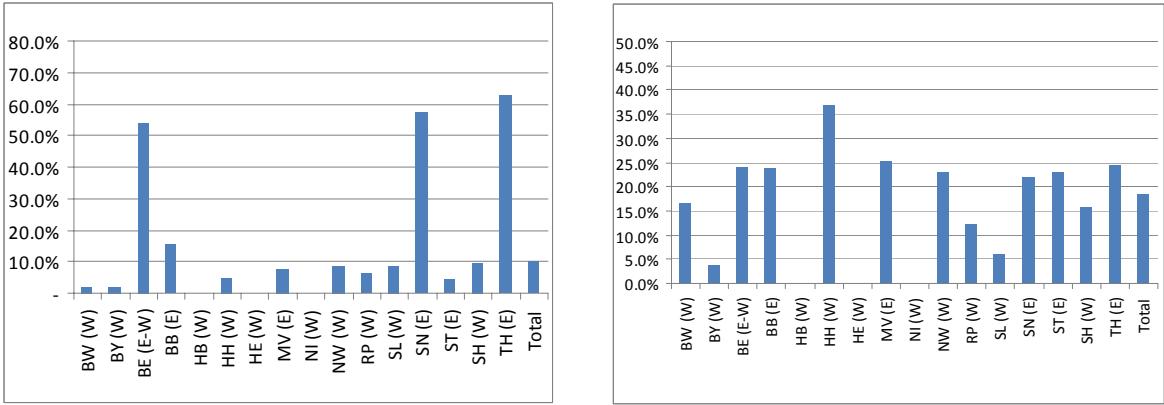
**Proof of Proposition 3.** (i) For all couples who do not use child care, comparing (25) and (17) implies

$$\widehat{\theta}^C(w_F, w_M) - \widehat{\theta}^N(w_F, w_M) = \frac{v_F^{S,C}(w_F) - v_F^{S,N}(w_F)}{2b(w_F + w_M)} > 0 \quad (\text{A.2})$$

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,  $\widehat{\theta}^C$  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.

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