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Bargaining over Babies: Theory, Evidence, and Policy Implications[†]

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It takes a woman and a man to make a baby. This fact suggests that for a birth to take place, the parents should first agree on wanting a child. Using newly available data on fertility preferences and outcomes, we show that indeed, babies are likely to arrive only if both parents desire one. In addition, there are many couples who disagree on having babies, and in low-fertility countries women are much more likely than men to be opposed to having another child. We account for this evidence with a quantitative model of household bargaining in which the distribution of the burden of child care between mothers and fathers is a key determinant of fertility. The model implies that fertility is highly responsive to targeted policies that lower the child care burden specifically for mothers. (*JEL* C78, D13, J13, J16)

A basic fact about babies is that it takes both a woman and a man to make one. Implied in this fact is that some form of agreement between mother and father is required before a birth can take place.[1] In this paper, we introduce this need for agreement into the economic theory of fertility choice. In particular, we provide empirical evidence that agreement (or lack thereof) between potential parents is a crucial determinant of fertility; we develop a bargaining model of fertility that can account for the empirical facts; and we argue that the need for agreement between parents has important consequences for how policy interventions affect childbearing.

Even if one accepts that agreement between the parents is important for fertility in principle, it may still be the case that most couples happen to agree on fertility in practice (i.e., either both want a child, or neither wants one). Hence, the first step in

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[1]Exceptions from this rule are possible (such as cases of rape, deception, and accidental pregnancy), but they do not account for a large fraction of births and will not be considered here. Also, while all babies start with an egg and a sperm, not all start from a mutual decision of a mother and father, for example in the case of same-sex couples and more generally whenever sperm donation or surrogacy are involved. Data limitations make it difficult to study these issues, but they raise interesting questions which we will discuss at the end of the paper.

our analysis is to document empirically the extent of disagreement on childbearing within couples. We draw on evidence from the Generations and Gender Programme (GGP), a longitudinal dataset covering 19 countries[2] that includes detailed information on fertility preferences and fertility outcomes. For each couple in the dataset, there are separate questions on whether each partner would like to have "a/another baby now." Thus, we observe agreement or disagreement on having a first/next child for each couple.[3] The data reveal that there is much disagreement about having babies. Moreover, disagreement increases with the existing number of children. Among couples who have at least two children already, in all countries in our dataset we observe more couples who disagree (i.e., one partner wants to have another baby, and the other does not) than couples who both want another child. Moreover, women are generally more likely to be opposed to having another child than are men, particularly so in countries with a very low fertility rate.

The second step in our analysis is to show that reported preferences for having babies actually matter for fertility outcomes. The GGP survey has a panel structure, so that stated fertility preferences can be linked to subsequent births. The data confirm the intuition that agreement between the potential parents is essential for having a child. We compare the fertility of couples where at least one partner desires a child to that of couples who agree not to want a baby (some of whom end up with a baby anyway). Relative to this baseline, the male partner alone wishing to have a child, with the female partner being opposed, has a very low impact on the probability of a baby's arrival (indistinguishable from zero once we condition on the existing number of children). If the female partner wants a child but the male partner does not, subsequent fertility is significantly higher compared to the baseline, but the effect on the probability of a birth is quantitatively small. Only couples who agree and both want a baby have a high probability of actually getting one. Overall, while women turn out to have some independent control over their fertility, the main finding is most of the time each partner has veto power, so that agreement between parents on wanting a baby is essential for babies to be born.

Our ultimate interest is what this need for agreement between parents implies for the economics of fertility more broadly. Specifically, we would like to know how the possibility of disagreement between mothers and fathers affects the economy-wide fertility rate, and how it matters for the impact of policy interventions (such as child subsidies or publicly provided child care) on fertility. To this end, we develop a bargaining model of fertility decisions. The woman and the man in a given relationship have separate preferences and bargain over household decisions, including fertility and the allocation of consumption. For a birth to take place, agreement is essential: both partners have to prefer an additional child over the status quo. Disagreement over having babies is possible in equilibrium, because the partners have a limited ability to compensate each other for having a baby. In particular, our household bargaining model features lack of commitment. While bargaining

[2] The countries covered are Australia, Austria, Belgium, Bulgaria, the Czech Republic, Estonia, France, Georgia, Germany, Hungary, Italy, Japan, Lithuania, Netherlands, Norway, Poland, Romania, the Russian Federation, and Sweden.

[3] Data on fertility intentions have not previously been available at this level of detail; existing data generally have been limited to the desired total number of children, which is less informative for the bargaining process for having another child.

is efficient within the period, the partners cannot commit to specific transfers or other actions in the future.[4] Instead, the allocation of resources within the household is determined period-by-period through cooperative Nash bargaining with period-specific outside options, which are given by a state of non-cooperation in a continuing relationship along the lines of the separate-spheres bargaining model of Lundberg and Pollak (1993). This matters for fertility, because having a child affects future outside options. In particular, if in the non-cooperative allocation one partner would be stuck with most of the burden of child care, this partner would lose future bargaining power if a birth were to take place, and thus may be less willing to agree to having a child.

The key novel implication of this setup is that not just the overall costs and benefits of children matter for fertility (which is the focus of models that abstract from bargaining), but also the distribution of costs and benefits within the household. Specifically, in a society where the burden of raising children is borne primarily by mothers, women will be more likely than men to disagree with having another child, and ceteris paribus the fertility rate will be lower compared to a society with a more equitable distribution of the costs and benefits of having children. This prediction can be verified directly in the GGP data. The dataset includes questions on the allocation of child care tasks within the household, i.e., whether it is the mother or the father who usually puts the children to bed, dresses them, helps them with homework, and so on. Based on the answers we construct an index of fathers' and mothers' shares in raising children. In all countries in our dataset women do the majority of the child rearing work, but there is also substantial variation across countries. As predicted by the theory, it is precisely in the countries where men do the least amount of work where the fertility rate is the lowest, and where women are especially likely to be opposed to having another child.

In the final part of our analysis, we examine the efficacy of policies that aim to increase the fertility rate. We focus on such policies because recently many industrialized countries have experienced historically unprecedented low fertility rates. In Japan, Germany, Spain, Austria, and many Eastern European countries, the total fertility rate has remained below 1.5 for more than two decades.[5] Such fertility rates, if sustained, imply rapid population aging and declining population levels in the future, creating big challenges for economic and social policy. The population of Germany, for instance, is projected to decrease by about 13 million from the current level of 80 million by 2060.[6] Hence, even though the optimal level of fertility is not obvious from a theoretical perspective,[7] the current fertility rate in these countries is widely perceived to constitute a demographic crisis, one that has so far proved resistant to many attempted interventions.

[4] We also consider an extension in which partial commitment is possible, and allow for partial commitment in the model used for quantitative analysis. See Gobbi (2018) for a related analysis of the role of lack of commitment for investments in child quality.

[5] The replacement level of the total fertility rate (at which the population would remain constant in the long run) is about 2.1.

[6] Source: "Bevölkerung Deutschlands bis 2060," German Statistical Office, April 2015. Decline of 13 million is for forecast assuming relatively low net migration; for high net migration the projected population decrease is 7 million.

[7] Decisions on optimal population size involve judgments on the value of children that are never born; see Golosov, Jones, and Tertilt (2007).

With the focus on the European fertility crisis in mind, we parameterize a dynamic, quantitative extension of our model to match fertility intentions and outcomes in the GGP data for countries with a total fertility rate of below 1.5. This model features time and goods costs of children, a market for child care services, a labor-market participation decision for mothers, and the possibility of partial commitment. A crucial aspect of the procedure for estimating model parameters is to match the evolution of couples' fertility intentions over time. Doing so is important to capture whether disagreement within couples is predominantly about the timing of births, or also about the total number of children a couple will have. We use the estimated model to compare the effectiveness of alternative policies aimed at increasing fertility. We show that policies that lower the child care burden specifically for mothers (e.g., by providing public child care that substitutes time costs that were previously borne mostly by mothers) can be more than twice as effective than policies that provide general subsidies for childbearing. This is primarily because mothers are much more likely to be opposed to having another child than are fathers. Notably, the countries in our sample that have relatively high fertility rates close to the replacement level (France, Belgium, and Norway) already have such policies in place. Other countries that highly subsidize childbearing, but in a less targeted manner (such as Germany), have much lower fertility rates.

Our work builds on different strands of the literature. Existing empirical evidence on fertility preferences has usually relied on surveys in which participants are asked about their desired total number of children. In many surveys this information is only available for women. Datasets that record responses for both women and men show that disagreement about fertility is commonplace. For example, Westoff (2010) reports that in 17 out of 18 surveyed African countries men desire more children than women do, with an average gap in desired family size of 1.5 and a maximum of 5.6 in Chad.[8]

There are a few studies in the demography literature that document how disagreement over desired future fertility correlates with actual fertility. Studies using recent data from industrialized countries find results broadly consistent with ours, namely, couples who disagree on fertility are relatively unlikely to have a birth. This is consistent with the notion of veto power for each partner.[9] Studies that use data from developing countries display different patterns. There is generally little evidence of veto power, that is, couples where only one partner reports a wish for an additional child have substantially higher fertility rates than couples where both don't want a child (Coombs and Chang 1981, Tan and Tey 1994, Gipson and Hindin 2009). Moreover, whereas in industrialized countries women usually have at least as much say over fertility as men do, in some developing-country studies men's preferences

[8] One reason why gaps in desired fertility are especially large in developing countries may be maternal mortality risk; see Ashraf et al. (2018).

[9] Testa, Cavalli, and Rosina (2014) use recent Italian data and find that disagreement has a particularly strong negative effect on fertility at higher parities, i.e., decisions on additional children after the first child is already born. Thomson (1997) (US data), Thomson and Hoem (1998) (Swedish data), and Hener (2014) (German data) find similar results, although in these studies the survey questions on fertility preferences are less informative. In studies using US data for earlier time periods (between the 1950s and 1970s) disagreement has a smaller effect on fertility (Beckman 1984; Thomson, McDonald, and Bumpass 1990).

matter more.[10] Compared to these studies, one advantage of the data used here is that we have information on the specific intention of having a/another baby at the time of the survey, which can be matched more directly into a bargaining model of fertility than a general question on future fertility intentions. Moreover, unlike in most existing studies our sample is not restricted to married couples, which is important given currently high rates of nonmarital childbearing. Finally, we are able to use comparable data for a number of countries, which makes it possible to assess county-level determinants of disagreement and its impact on realized fertility.

In terms of the application of our theory to the European fertility crisis, there is existing empirical work that has already pointed to a link between low fertility and a high child care burden on women (Feyrer, Sacerdote, and Stern 2008; de Laat and Sevilla-Sanz 2011). Relative to this literature, the contribution of our paper is to show explicitly how the large child care burden on women is reflected in high rates of women being opposed to having another child, and to develop a bargaining model of fertility that can account for the data and is useful for policy analysis. Relative to the existing literature on the response of fertility to financial incentives (e.g., Cohen, Dehejia, and Romanov 2013; Laroque and Salanié 2014; and Raute 2019), our contribution is to consider the differential impact of policies targeted at mothers versus fathers.[11]

The existing theoretical literature on fertility choice has relied mostly on unitary models of household decision making.[12] In a unitary model a common objective function for the entire household is assumed to exist, and hence there is no conflict of interest between partners and no scope for disagreement. Such models do not speak to the issues discussed in this paper. Within the small existing literature that does take bargaining over fertility into account, our paper builds most directly on Rasul (2008). Rasul develops a two-period model in which there is a possibility of lack of commitment, and where the threat point is characterized by mothers bearing the entire cost of child rearing.[13] Using household data from the Malaysian Family Life Survey, he finds evidence in favor of the limited commitment model. In terms of emphasizing the importance of bargaining and lack of commitment, our overall approach is similar to Rasul (2008). However, there are also key differences. Most importantly, in Rasul's setting the mother decides unilaterally on fertility (while taking the impact on future bargaining into account), whereas our point of departure is that both parents have to agree for a child to be born. To the best of our knowledge, our paper is the first in the fertility literature to take this perspective.[14] Moreover,

[10] See, for example, Bankole (1995) using data from Nigeria. See also Doepke and Tertilt (2018) for a recent discussion that links the developing-country evidence to the mechanism developed here.

[11] We relate our policy findings to the empirical literature in more detail in Section V.

[12] See, for example, Becker and Barro (1988) and Barro and Becker (1989).

[13] A similar, more recent contribution is Kemnitz and Thum (2014). Dynamic models of fertility that also consider the marriage market have been developed by Greenwood, Guner, and Knowles (2003); Caucutt, Guner, and Knowles (2002); and Guner and Knowles (2009). Endogenous bargaining also arises in Basu (2006) and Iyigun and Walsh (2007), although not in the context of fertility. The potential inefficiency of household decision making due to the impact of current decisions on future bargaining power was pointed out by Lundberg and Pollak (2003), and the extent of commitment within households is analyzed more generally by Mazzocco (2007). Empirical studies of the link between female bargaining power and fertility include Ashraf, Field, and Lee (2014), who suggest that more female bargaining power leads to lower fertility rates in a developing-country context.

[14] Brown, Flinn, and Mullins (2015) develop a model of marriage where both partners have to contribute for a child to be born, but the analysis is not focused on fertility and does not consider fertility intentions. The need for agreement also distinguishes our work from bargaining models where household decisions can be expressed as the

we consider a dynamic model with multiple periods of childbearing, which allows us to distinguish disagreement over the timing of fertility from disagreement over the total number of children, and we match a rich quantitative model to data from low-fertility countries to allow for policy evaluation.

In the next section, we start our analysis by documenting the prevalence of disagreement over fertility among couples surveyed by the Generations and Gender Programme. We also show that agreement between partners is important for a birth to take place, and that across countries disagreement over fertility is closely related to the distribution of the burden of child care. In Section II, we introduce our bargaining approach to fertility in a static setting, and in Section III the full quantitative model is developed. In Section IV, we match the model to the GGP data. Policy simulations are described in Section V, and Section VI concludes. Proofs for propositions and additional theoretical and empirical findings are contained in the online Appendix.

I. Evidence from the Generations and Gender Programme

We use data from the Generations and Gender Programme (GGP) to evaluate the importance of agreement on fertility decisions.[15] The GGP is a longitudinal survey of adults in 19 mostly European countries that focuses on relationships within households, in particular between partners and between parents and children. Topics that are covered include fertility, partnership, labor force participation, and child care duties.

In this section, we use the GGP data to document a set of facts regarding agreement and disagreement over having babies. The GGP provides more detailed information on fertility intentions than do earlier datasets. The questions we use to determine fertility preferences and agreement or disagreement among partners are:

> Q1: "Do you yourself want to have a/another baby now?"

for the respondent, and:

> Q2: "Couples do not always have the same feelings about the number or timing of children. Does your partner/spouse want to have a/another baby now?"

for the respondent's partner or spouse.[16] Our sample includes all respondents who answer these two questions in Wave 1 of the survey (at most two waves are available to date) and where the female partner is of childbearing age. Given that these questions are asked of all respondents who indicate that they are in a relationship,

maximization of a weighted sum of the utility of the partners, such as Blundell, Chiappori, and Meghir (2005) and Cherchye, De Rock, and Vermeulen (2012). Eswaran (2002) considers a model where different fertility preferences between mothers and fathers (which in other studies are taken as primitives) arise endogenously.

[15] The data are available for research use at https://www.ggp-i.org/.

[16] There is only one respondent per couple. This raises the question how reliable the answer regarding the fertility intention of the non-responding partner is. While there may be some misreporting, we find that the patterns of disagreement reported by female and male respondents (which each account for about one-half of the sample) are essentially identical, which speaks against a substantial bias.

Table 1—Summary Statistics of the Wave 1 Sample

Variable	Mean
Age of female partner	33.81
Age of male partner	36.62
Respondent female (in percent)	49.85
Married couple (in percent)	68.74
Cohabiting (in percent)	87.62
Number of existing children	1.45
Women wanting a baby (in percent)	22.27
Men wanting a baby (in percent)	22.99
Couples where at least one partner wants a baby (in percent)	27.50
Couples where both partners want a baby (in percent)	16.76

Notes: 33,479 observations. Included countries are Austria, Belgium, Bulgaria, Czech Republic, France, Germany, Lithuania, Norway, Poland, Romania, and Russia.

the sample includes married and non-married couples, and both cohabitating couples and those who have separate residences. Data for these questions are available for 11 countries in Wave 1 of the survey (which was carried out between 2003 and 2009), with a total of 33,479 responses from couples where the woman is between the ages of 20 and 45 (i.e., childbearing age). The included countries are Austria, Belgium, Bulgaria, the Czech Republic, France, Germany, Lithuania, Norway, Poland, Romania, and Russia.[17] Table 1 reports summary statistics of the Wave 1 sample. The average age of the respondents is in the mid-thirties, about 70 percent of couples are married, and close to 90 percent are cohabitating. The table provides a first glimpse of disagreement over having children: in more than 27 percent of couples at least one partner desires a baby, but in less than 17 percent of couples both partners do.

The participants in the study are surveyed again in Wave 2, which takes place three years after the initial interview. So far, Wave 2 data on fertility outcomes are available for seven countries (Austria, Bulgaria, the Czech Republic, France, and Germany, Lithuania, and Russia), with more to become available in the coming years. The availability of data on fertility outcomes makes it possible to study the link between gender-specific fertility intentions and outcomes. The sample size for each country in each wave is given in online Appendix Tables A1 and A3. This Appendix also provides a detailed description of the dataset.

Here we focus on basic facts regarding fertility intentions, fertility outcomes, and the division of child care tasks between the partners within the household. These are the key variables with which to evaluate the predictions of our theory. We document three facts that inform our economic model, namely:

(i) Many couples disagree on whether to have a (or another) baby.

(ii) Without agreement, few births take place.

[17] A limitation of the GGP data is that this information is not available for low-fertility countries in Southern Europe such as Italy and Spain. For the case of Italy, Testa, Cavalli, and Rosina (2014) report some similar empirical patterns to what we document here (based on a national survey).

(iii) In countries where men do little child care work, women are more likely to be opposed to having more children.

The dataset contains a great deal of other information. In online Appendix E we provide some additional empirical analysis to show how other characteristics of individuals and couples relate to fertility intentions, agreement on fertility, and fertility outcomes. We now turn to the three main facts to be documented.

A. *Many Couples Disagree on Whether to Have a Baby*

To document the extent of disagreement over having babies, we focus on the number of couples who disagree as a fraction of all couples where at least one of the partners wants to have a baby. We condition on at least one partner wishing to have a child, because in the entire sample most couples either haven't yet started to have children or have already completed their fertility. Hence, both partners not wanting a/another baby at the present time is the most common state. In contrast, we are interested in disagreement over having babies as an obstacle to fertility among couples where there is at least some desire for having a child.

Based on the answers to questions Q1 and Q2, a couple can be in one of four states. Let *agree* denote a couple where both partners desire a baby; *she yes/he no* denotes the case where the woman desires a baby, but the man does not; and *she no/he yes* means that he desires a baby, but she does not. The remaining possibility is that neither partner wants to have a baby. Let $\nu(\cdot)$ denote the fraction of couples in a given country in one of these states. We now compute the following disagreement shares:

$$\textit{disagree male} = \frac{\nu(\textit{she yes/he no})}{\nu(\textit{agree}) + \nu(\textit{she yes/he no}) + \nu(\textit{she no/he yes})},$$

$$\textit{disagree female} = \frac{\nu(\textit{she no/he yes})}{\nu(\textit{agree}) + \nu(\textit{she yes/he no}) + \nu(\textit{she no/he yes})}.$$

Figure 1 displays the extent of disagreement over fertility across countries, where the total fertility rate for each country is shown in parentheses.[18] In this graph, if all couples in a country were in agreement on fertility (either both want one or both do not), we would get a point at the origin. In a country that is on the 45-degree line, women and men are equally likely to be opposed to having a baby.

The main facts displayed in the first panel of Figure 1 (which shows results for all couples) can be summarized as follows. First, there is a lot of disagreement; in 25 to 50 percent of couples where at least one partner desires a baby, one of the partners does not (the total disagreement is the sum of the values on the x and y axes). Second, women are more often in disagreement with their partner's desire for a baby than the other way around (i.e., most countries lie to the right of the 45-degree

[18] We obtained the total fertility rates for each country from the 2014 World Bank Development Indicators and use a simple average between the years 2000 and 2010.

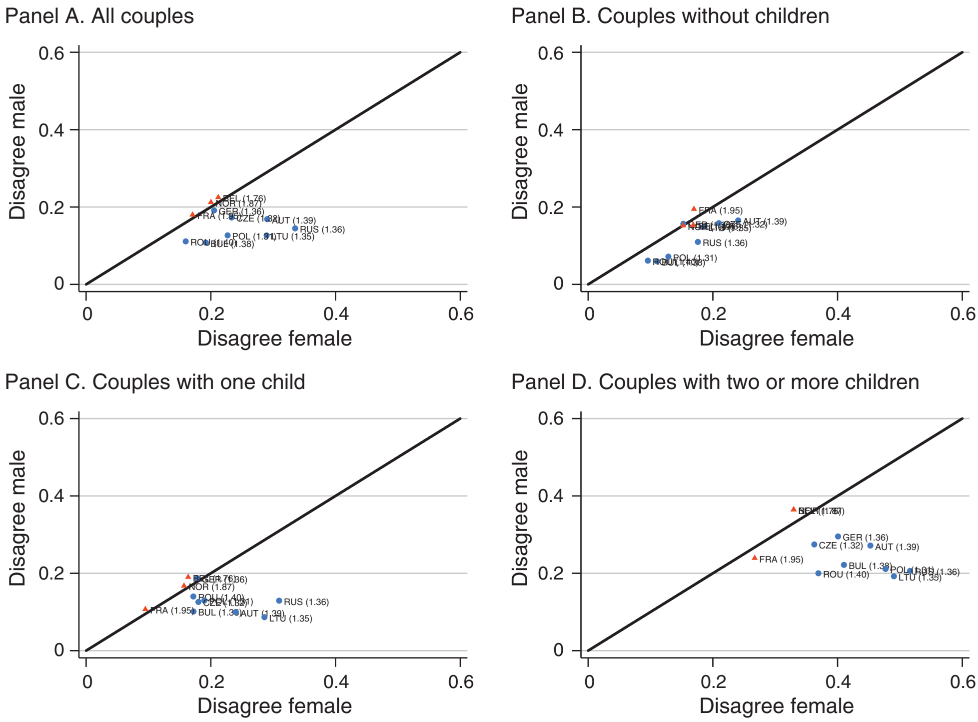

Figure 1. Disagreement over Having a Baby across Countries

Notes: Data from Generations and Gender Programme. Each dot is a country, total fertility rate displayed in parentheses. *Disagree female* is the number of couples where the woman does not want a child but the man does, as a fraction of all couples where at least one partner wants a child. *Disagree male* is the analogous fraction of couples where the man does not want a child but the woman does.

line). Third, the tilt toward more female disagreement is especially pronounced in countries with low total fertility rates, whereas disagreement is nearly balanced by gender in the countries with a relatively high fertility rate (France, Norway, and Belgium).

The picture as such does not allow conclusions about whether disagreement affects the total number of children a couple ends up with. It is possible that the disagreement is about the timing of fertility, rather than about how many children to have overall. This issue will be addressed in the quantitative analysis below by exploiting repeated information on child preferences for couples who took part in both waves of the survey. As a first pass, it is indicative to consider disagreement as a function of the existing number of children. The total fertility rate of a country is more likely to be affected by disagreement over higher-order children; e.g., if a couple has at least two children already, it is more likely that the potential baby to be born is the marginal child (so that the total number of children would be affected). The remaining panels of Figure 1 break down the data by the number of children already in the family. The main observations here are that among couples who have at least two children, the extent of disagreement is even larger (50 to 70 percent), and the tilt toward female disagreement in low-fertility countries is even more pronounced.

B. *Without Agreement*, *Few Births Take Place*

Next, we document that disagreement is an important obstacle to fertility. The basic facts can be established through simple regressions of fertility outcomes on intentions of the following form:

$$birth_i = \beta_0 + \beta_f \cdot she\ yes/he\ no_i + \beta_m \cdot she\ no/he\ yes_i$$
$$+ \beta_a \cdot agree_i + \epsilon_i.$$

Here, $birth_i$ is a binary indicator which takes a value of 1 if couple i has a baby in the three years after stating fertility intentions (as observed in Wave 2 of the survey). The right-hand-side variables denote the fertility intentions of couple i in Wave 1. The constant β_0 captures the baseline fertility rate of couples in which both partners state not to want a baby. The parameters β_f, β_m, and β_a measure the increase in the probability of having a baby compared to the baseline for couples in each of the three other states. In a world where women decide on fertility on their own, we would expect to find $\beta_f = \beta_a > 0$ and $\beta_m = 0$. If each partner's intention had an independent influence on the probability of having a baby, we would observe $\beta_f > 0$, $\beta_m > 0$, and $\beta_a = \beta_f + \beta_m$. Finally, if a birth can take place only if the partners agree on having a baby (i.e., each partner has veto power), we expect to find $\beta_f = \beta_m = 0$ and $\beta_a > 0$. Least squares estimates for this regression, using pooled data for all available countries as well as samples split by the number of existing children, are shown in Table 2.

We find that all coefficients are statistically significant at the 1 percent level for the pooled sample, but the agreement term β_a is the largest in size, and more than twice as large as the sum of β_f and β_m.[19] A couple that agrees has a more than three times higher incremental likelihood of having a baby than does a couple where the man disagrees, and a more than seven times higher likelihood than does a couple where the woman disagrees.

Next, we break down the regressions by parity, i.e., the number of children the couple already has. The need for agreement is most pronounced for couples with no children. For these couples, the probability of having a child when only one partner desires one is not significantly different from the probability of couples that agree not to want a child. Perhaps not surprisingly, for higher-order children, the woman's intention turns out to be more important than the man's. In fact, if the woman disagrees, the man's desire for a child has no statistically significant impact on the likelihood of a birth (at the 5 percent level). But even for a woman, having her partner agree greatly increases the probability of having a child.

In summary, the data show that agreement between the potential parents is essential for babies to be born. While women have some independent control over their fertility, only couples who agree on the plan to have a baby are likely to end up with one.

[19] β_a is statistically different from $\beta_m + \beta_f$ at the 1 percent level in all regressions.

Table 2—Impact of Fertility Intentions on Probability of Birth

	Whole sample	By number of children		
		$n = 0$	$n = 1$	$n \geq 2$
She yes/he no	0.100	0.019	0.130	0.062
	(0.020)	(0.038)	(0.040)	(0.024)
She no/he yes	0.044	0.052	−0.035	0.034
	(0.013)	(0.034)	(0.019)	(0.018)
Agree	0.319	0.239	0.276	0.299
	(0.013)	(0.024)	(0.020)	(0.031)
Constant	0.077	0.173	0.124	0.039
	(0.003)	(0.013)	(0.009)	(0.003)
Number of cases	10,974	2,122	3,024	5,828
R^2	0.123	0.063	0.100	0.079

Notes: Each column is a linear regression of a binary variable indicating whether a child was born between Wave 1 and Wave 2 (i.e., within three years after Wave 1) on stated fertility intentions in Wave 1. Countries included (i.e., all countries where data from both waves are available) are Austria, Bulgaria, Czech Republic, France, Germany, Lithuania, and Russia. Sample restricted to couples where the woman is between 20 and 45 years old (i.e., of childbearing age) and the man is between 20 and 55 years old during the Wave 1 interview (when intentions are recorded).

C. *When Men Do Little Child Care Work, Women Are More Likely to Be Opposed to Having More Children*

In the theory articulated below, disagreement between partners regarding fertility can arise because couples cannot commit to a specific allocation of child care duties in advance. To show that the distribution of child care between mothers and fathers matters in the GGP data, here we calculate the average share of men in caring for children at a national level by coding the answers to the following questions:

> "I am going to read out various tasks that have to be done when one lives together with children. Please tell me, who in your household does these tasks?

(i) Dressing the children or seeing that the children are properly dressed;

(ii) Putting the children to bed and/or seeing that they go to bed;

(iii) Staying at home with the children when they are ill;

(iv) Playing with the children and/or taking part in leisure activities with them;

(v) Helping the children with homework;

(vi) Taking the children to/from school, day care centre, babysitter or leisure activities."

The possible answers to these questions are "always the respondent," "usually the respondent," "about equal shares," "usually the partner," and "always the partner."

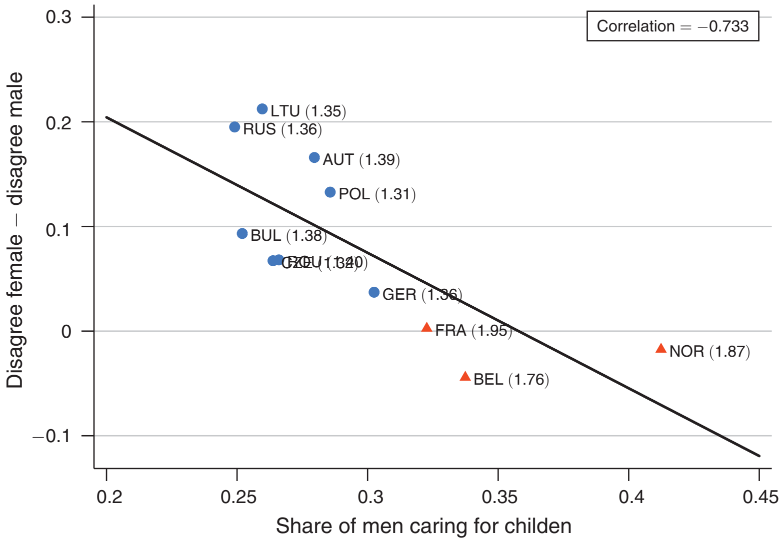

Figure 2. Disagreement over Fertility and Men's Share in Caring for Children

Notes: Data from Generations and Gender Programme. Each dot is a country, total fertility rate displayed in parentheses. Sample restricted to couples who have at least one child under age 15.

We code these answers as 0, 0.15, 0.5, 0.85, and 1 if the respondent is female and 1, 0.85, 0.5, 0.15, and 0 if the respondent is male. We aggregate the answers by forming a simple mean per couple (on the sample of couples with at least one child under the age of 15) and calculating the average for every country. This gives us a proxy for the share of men in child care for every country.[20] In all countries in the dataset, women carry out the majority of these tasks, but there is also considerable variation across countries. The countries with the highest fertility rates (Belgium, France, and Norway) also have the highest participation of men in child care. Men do the most child care work in Norway with a share of just above 40 percent, whereas Russian men do the least with a share of less than 25 percent.

To examine how the allocation of child care duties is related to fertility intentions, we plot the male share in child care against the difference between female disagreement and male disagreement with having another child (the difference between the *disagree female* and *disagree male* variable computed on couples with at least one child under the age of 15). This yields Figure 2 (which also includes a regression line). The figure shows that in countries where women do most of the work in raising children, women are more likely to be opposed to having more children, and fertility is low.

One important factor that determines the distribution of the burden of child care is the labor market impact of child birth. In some countries, many mothers drop out of the labor force for an extended period to care for young children, while in others most families use market-based child care and career interruptions are short.

[20] In online Appendix E.6, we show that our measure of the distribution of the burden of child care lines up well with time use data from other sources.

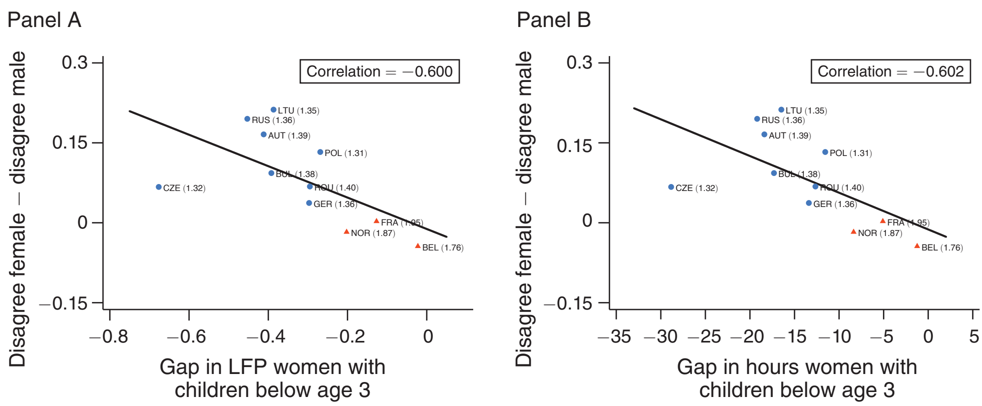

Figure 3. Disagreement over Fertility and Mother's Labor Market Behavior

Notes: Data from Generations and Gender Programme. Each dot is a country, total fertility rate displayed in parentheses. Horizontal axis of panel A displays gap in labor force participation rate between mothers with a child up to age 3 and all other women in the sample (which is restricted to women of ages 20 to 45). Horizontal axis of panel B displays gap in weekly hours of labor supply between the same groups.

Figure 3 relates the labor market impact of having a young child to disagreement over fertility. On the vertical axis we display the difference between female and male disagreement with having another child, as in Figure 2. On the horizontal axes, we display two measures of the labor market impact of having a young child. For panel A, we use the difference in the labor force participation rate between mothers with a young child (up to 3 years) and all other women in our sample (which is restricted to women of childbearing age). For panel B, we use the difference in weekly hours worked between the same groups. The figure shows that in countries where women reduce their labor supply a lot and are likely to drop out of the labor force when having a child, women are also relatively more likely to disagree with having another child. This observation suggests that differences in the ease of combining children and careers for mothers may be an important driver of variation across countries in both the distribution of the burden of child care and in disagreement over having children.

While the empirical connections between the burden of child care, mothers' labor supply decisions, disagreement over fertility, and fertility outcomes described in this section make intuitive sense, they are not suggestive of a simple causal interpretation where variation in a single exogenous variable is responsible for the variation in all the others. Instead, economic reasoning would suggest that these variables are all mutually connected, as they all emerge from the same household decision process. We therefore would like to develop a model of household decision making that can account for all the empirical findings. For this task, a baseline model of fertility choice based on the unitary model of the family is not going to work, because in such models there is no scope for disagreement between partners. Instead, a bargaining model is required where disagreement may arise. In addition, the empirical link between disagreement and realized fertility suggests that individuals with a high fertility preference are not always able to compensate their partners for their child care duties in order to get them to agree to having a baby. We take the perspective that this is due to lack of commitment within the household. Next, we describe the theoretical framework that spells out this mechanism and that can account for all the facts documented above.

II. A Bargaining Model of Fertility

In this section, we develop a bargaining model of fertility choice. We consider the decision problem of a household composed of a woman and a man. Initially the couple does not have children. To have a child, the two have to act jointly, and hence a child is created only if both partners find it in their interest to participate. Without agreement, the status quo prevails. In this section, we outline the main mechanism for the case of a one-time choice of a single child. We contrast the cases of commitment and lack of commitment, and argue that the distribution of the child care burden between the partners is an important determinant of the total fertility rate. The model analyzed here is deliberately stylized to bring out the implications of lack of commitment in a sharp way. In Section III, we expand the analysis by introducing dynamics, a richer structure for the cost of children, and the possibility of partial commitment in order to develop a quantitative model that can be matched to the data and used for policy analysis.

A. *Setup and Solution under Commitment*

Consider an initially childless couple consisting of a woman f and a man m. The couple has to decide on whether to have a child. The market wages for the woman and the man are w_f and w_m. The total cost of a child in terms of consumption is given by ϕ (time costs are introduced in the quantitative model in Section III). Utility $u_g(c_g, b)$ of partner $g \in \{f, m\}$ is given by

$$u_g(c_g, b) = c_g + bv_g, \tag{1}$$

where $c_g \geq 0$ is consumption, $b \in \{0, 1\}$ indicates whether a child is born, and v_g is the additional utility partner g receives from having a child compared to the childless status quo.[21]

In addition to the opportunity to have children, an added benefit of being in a relationship is returns to scale in consumption, for example through the joint use of an apartment, cooking together, and so on. Specifically, if a couple cooperates, their effective income increases by a factor of $\alpha > 0$ (or, equivalently, the effective cost of consumption decreases by a factor of $1/(1+\alpha)$). For a cooperating couple, the budget constraint is then given by

$$c_f + c_m = (1+\alpha)(w_f + w_m - \phi b). \tag{2}$$

[21] Linear utility in consumption has the advantage that utility is transferable between the partners, which facilitates bargaining. Non-transferable utility would introduce additional frictions and amplify the commitment problem that we introduce explicitly below.

The household reaches decisions through Nash bargaining. The timing is such that the household first needs to decide on whether to have a child, and then consumption takes place after the birth outcome $b \in \{0,1\}$ has been realized. The timing implies that bargaining will depend on the extent of commitment. Consider first the case of full commitment, in which the partners can commit to a future consumption allocation before having a child. This case amounts to choosing consumption and fertility simultaneously subject to a single outside option. The outside option is not to cooperate, in which case the couple does not have a child and forgoes the returns to scale from joint consumption. Utilities $\bar{u}_g(0)$ in the outside option are therefore given by

$$\bar{u}_f(0) = w_f \quad \text{and} \quad \bar{u}_m(0) = w_m. \tag{3}$$

We denote the ex post utility of woman and man (i.e., taking wages, costs of children, and the bargaining outcome into account) as $u_g(0)$ when no child is born and $u_g(1)$ when a child is born, where $g \in \{f,m\}$. We assume equal bargaining weights throughout.[22] The following proposition characterizes the bargaining outcome under commitment.

PROPOSITION 1 (Fertility Choice under Commitment): *Under commitment, the couple decides to have a child if the condition*

$$v_f + v_m \geq \phi(1+\alpha) \tag{4}$$

is met. Moreover, when (4) *holds, we also have*

$$u_f(1) \geq u_f(0) \quad \textit{and} \quad u_m(1) \geq u_m(0).$$

That is, each partner is individually better off when the child is born. Conversely,

$$v_f + v_m < \phi(1+\alpha)$$

implies

$$u_f(1) < u_f(0) \quad \textit{and} \quad u_m(1) < u_m(0),$$

that is, if the couple decides not to have a child, each partner individually is better off without the child. Taking together, the conditions imply that under commitment the couple always agrees about the fertility choice, and this choice is efficient.

The proof for the proposition is contained in online Appendix A.

The implication of perfect agreement on fertility among the partners conflicts with our empirical observation of many couples who disagree on having a child. The main reason for why the model is at odds with the data is the assumption of

[22] All results can be generalized to arbitrary weights.

full commitment. To see why this assumption might be problematic, consider a case where the benefits of having a baby are distributed unequally between the partners, say, the man derives high utility $v_m > \phi(1+\alpha)$ from a child (i.e., his utility alone exceeds the cost of having a child), whereas the woman does not, $v_f = 0$. Under commitment, this couple will decide to have the child, and the bargaining outcome is such that the total utility benefit is equally shared. But given that only the man derives direct utility from the child, the way utility is shared is by the woman getting a much larger share of consumption than the man, so that the woman's extra utility from consumption balances the man's extra utility from the baby. In other words, when deciding on whether to have a child, the man is implicitly promising a large future transfer to the woman if she agrees to have the child.

The problem is that the woman may not find this promise of a future transfer credible. What stops the man from reneging on the promise and renegotiating the consumption allocation after the baby is born? This possibility suggests an alternative setup with a lack of commitment. As we will see, this setting can account for disagreement between partners on fertility.

B. *Setup and Solution under Lack of Commitment*

Under lack of commitment, partners are not able to commit to future transfers when deciding on whether to have a baby. Hence, bargaining proceeds in two stages. In the first stage, the partners decide whether to have a child. In the second stage, resources are allocated to consumption, given the outside option after the fertility decision is sunk. Hence, for each partner there are two different outside options, one for the case where the couple has a child and one for the case where it doesn't. This setup captures lack of commitment, in the sense that the partners are not able to make binding commitments for transfers in the second stage during the first stage bargaining over fertility.

The outside options conditional on not having a child are still given by (3). To formulate the outside options when there is a child, we have to take a stand on who bears the cost of raising the child in the non-cooperation state. We assume that the cost shares of woman and man are given by fixed parameters χ_f and χ_m with $\chi_f + \chi_m = 1$. The new outside options therefore are

$$\bar{u}_f(1) = w_f + v_f - \chi_f \phi, \tag{5}$$

$$\bar{u}_m(1) = w_m + v_m - \chi_m \phi. \tag{6}$$

Notice that in the outside option, the partners still derive utility from the presence of the child. We interpret the outside option as non-cooperation within a continuing relationship, as in Lundberg and Pollak (1993). That is, the couple is still together and both partners still derive utility from the child, but bargaining regarding the allocation of consumption breaks down, the division of child care duties reverts to the defaults given by χ_f and χ_m, and the couple no longer benefits from returns to scale in joint consumption. We do not take an explicit stand on how the default cost shares χ_f and χ_m are determined. We can imagine that traditional gender roles within a country are relevant (as emphasized by Lundberg and Pollak 1993), but government policies determining the availability of market-based child care should also matter.[23] Another possibility is that the defaults for cost shares are in part controlled by the couple. For example, cost shares may depend on the couple's decision of where to live (say, close to grandparents who would be willing to help with child care) and on whether one of the parents drops out of the labor force to care for the child. Endogenous cost shares result in a model with partial commitment, which we consider as an extension in online Appendix D and which forms the basis of the quantitative model in Section III.

We now characterize the fertility choice under lack of commitment.

PROPOSITION 2 (Fertility Choice under Lack of Commitment): *Under lack of commitment, we have* $u_f(1) \geq u_f(0)$ (*the woman would like to have a child*) *if and only if the condition*

$$v_f \geq \left(\chi_f + \frac{\alpha}{2}\right)\phi \tag{7}$$

is satisfied. We have $u_m(1) \geq u_m(0)$ (*the man would like to have a child*) *if and only if the condition*

$$v_m \geq \left(\chi_m + \frac{\alpha}{2}\right)\phi \tag{8}$$

is satisfied. The right-hand sides of (7) *and* (8) *are constants. Hence, depending on* v_f *and* v_m, *it is possible that neither condition, both conditions, or just one condition is satisfied. Since child birth requires agreement, a child is born only if* (7) *and* (8) *are both met simultaneously.*

The proof for the proposition is contained in online Appendix A.

The reason why disagreement is possible is that after the child is born, the outside options of the two partners shift away from the outside options in the full commitment model. Figure 4 illustrates this issue for the case in which the woman bears a larger share of the burden of child care than the man does.

The figure displays the utility of the woman on the horizontal axis and the utility of the man on the vertical axis. Under commitment, the outside option is given by (w_f, w_m). The line $b = 0$ shows the utility possibility frontier for the case in which the couple does not have a baby, and the line $b = 1$ shows the frontier for the case of having one. In the depicted situation, having a baby yields a higher sum of utilities for the couple. Under commitment, the utility allocation between the woman and the man is given by the intersection between the utility possibility frontier and a 45-degree line starting from the initial outside option (the 45-degree slope arises because of equal bargaining weights). Note that under commitment, for each partner the utility level of having a child is higher than the utility level of not having a child, so that the partners agree and will act jointly to have a child. More generally, under commitment the partners will agree to have a child if and only if the utility possibility frontier for $b = 1$ is

[23] The role of country-specific social norms regarding the division of labor in the household for outcomes such as marriage and fertility have been empirically documented by Fernández and Fogli (2009) and Sevilla-Sanz (2010), among others.

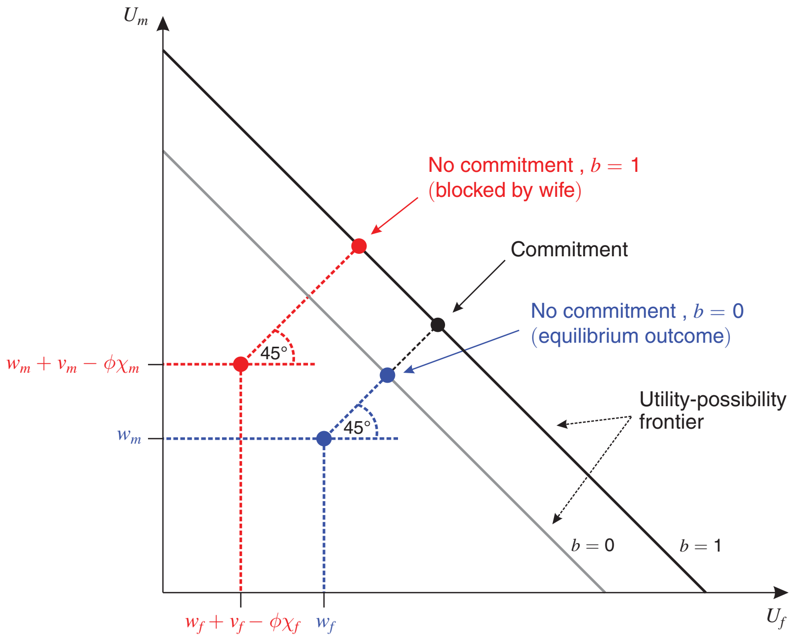

Figure 4. Bargaining under Commitment versus Lack of Commitment

higher than the frontier for $b = 0$, and they will agree not to have a child otherwise. Since along the 45-degree line from the outside option (or, more generally, any line with positive slope corresponding to a set of bargaining weights) the woman's and the man's utility move in the same direction, there cannot be disagreement, i.e., a situation where only one of the partners wishes to have a child.

In the case of lack of commitment, there are two outside options, the one without a child and the one with a child. The outside option without a child is identical to the outside option under commitment. Because she bears a large fraction of the burden of child care, the woman's outside option if a child is born $w_f + v_f - \phi\chi_f$ is lower than the initial outside option, whereas the man's outside option when a child is born $w_m + v_m - \phi\chi_m$ is higher. Again, the solution to the bargaining problem is the intersection of the utility possibility frontier and the 45-degree line starting at the relevant outside option. However, because the outside option now depends on the fertility decision, there is a possibility of disagreement over fertility, which is the case drawn here. Because she bears a large share of the child cost and hence loses bargaining power if a child is born, the woman will have a lower utility level with a child compared to without. Hence, she will not agree to a birth and the couple will remain childless, even though they could both be better off with a child if they were able to commit.

C. *Toward a Quantitative Model*

We would like to explore the ability of the lack of commitment mechanism to quantitatively account for the evidence discussed in Section I, and then go on to examine the implications of this mechanism for how various policy interventions affect fertility. Doing this requires us to extend the simple one-shot model discussed here in a number of directions. First, to account for the distribution in fertility and fertility intentions in the data, we introduce heterogeneity across couples in terms of preferences and wages. Second, there is an important distinction between partners' disagreement about the total number of children they want to have, and disagreement about when to have them. In the extreme, one can envision a setting in which all couples agree on how many children they ultimately want to have, and the only source of conflict is whether to have them early or late. In this case, an intervention that reshuffles the child care burden between the partners may affect when people have children, but it would not affect the ultimate outcome in terms of the total number of children per couple. To allow us to separate disagreement over the timing of fertility versus over the total number of children, we extend the model to a dynamic setting where child preferences evolve over time. Third, the one-period model assumes a complete lack of commitment regarding the burden of child care, and the distribution of the burden of child care in the outside option is a reduced-form parameter. In reality, there are ways for couples to achieve at least some commitment, and the burden of child care is linked at least in part to factors such as the cost of market-based child care and female labor supply. In the full model, we therefore introduce labor supply and child care decisions and an element of partial commitment.

To clarify how these extensions affect the basic mechanics of the model, in the online Appendix we work out the implications of each of these extensions in isolation in the context of the one period model described above. In particular, in online Appendix B we introduce a distribution of fertility preferences into the model, and show how the total fertility rate depends on the distribution of the burden of child care between mothers and fathers. The key insight here (which carries over to the full model) is that the impact of a policy that changes the distribution of the burden of child care depends on disagreement shares and on the density of the distribution of fertility preferences. The density matters because the fertility decision is at the extensive margin: in a given period, a couple either has a child or not. If there is, say, a decrease in the burden of child care for mothers, the number of women who now switch from not wanting a child to wanting one depends on the density of the distribution of fertility preferences at the threshold of indifference. Second, disagreement shares also matter: if a potential mother switches toward wanting a child, this increases fertility only if her partner already wants a child, i.e., if the mother's intention is pivotal for the decision. We will describe below in the full model how these factors underlie our main findings about the effects of policies designed to increase fertility rates.

In online Appendix C, we focus on the role of timing of fertility by considering a two-period setting, and show that depending on the persistence of fertility preferences, disagreement in fertility intentions may or may not affect overall fertility. We describe below how we use evidence on the persistence of fertility intentions to pin down this aspect in the full model.

In online Appendix D, we introduce partial commitment by allowing the couple to bargain over the distribution of the burden of child care in an initial stage, before deciding on fertility. We show that as long as there are limits to how much commitment is possible, this model yields qualitatively the same results as the simpler model described above. However, the degree of commitment matters for quantitative results, which is why we include an element of partial commitment in the full model below.

III. A Quantitative Model of Bargaining over Fertility under Partial Commitment

We now describe the quantitative model that we match to the evidence from the GGP data. The main additional elements compared to the simple setup described above are dynamic decision making with fertility preferences that evolve over time; a richer structure of child rearing costs including time and goods components; heterogeneity in wages; endogenous labor supply that is linked to child care decisions; and the possibility of partial commitment.

We model couples that are fertile from period 1 to period $T = 8$. Each model period corresponds to three years of calendar time. The first period corresponds to ages 20–22, the second to 23–25, and so on up to period 8 (ages 41–43). Parents raise their children for $H = 6$ periods (corresponding to 18 years). Hence, after completing fertility, the couple continues to raise its children until all children have reached adulthood by period $T+H$. Couples start out with zero children and can have up to three children.[24] We denote by b the fertility outcome in a given period, where $b = 1$ if child is born in the period and $b = 0$ otherwise. Also, n denotes the total number of children of a couple, where $0 \leq n \leq 3$.

There is heterogeneity across couples in the woman's wage w_f. We abstract from heterogeneity in the man's wage w_m, because it does not affect the fertility decision in our setting.[25] To generate wage heterogeneity, we distinguish between women who have college education co and those with less-than-college education nc. Education is denoted by $e \in \{nc, co\}$. College-educated women have higher average wages, but there is also wage heterogeneity conditional on education. Specifically, wages are distributed according to log-normal distributions with education specific means and variances. A woman's wage is constant over the life cycle.[26] There is also a fixed cost of participation p_c that has to be paid if a woman is in the labor force, which allows us to match the observation that some women do not work even before having children. To simplify the exposition below, we write the model in terms of the wage net of the participation cost. Specifically, women draw a potential wage $\tilde{w}_f$ from the log normal distribution, and then work if $\tilde{w}_f > p_c$, with the net wage given by $w_f = \max\{0, \tilde{w}_f - p_c\}$.

In a given period, a person of gender $g \in \{f, m\}$ derives utility from consumption c_g and fertility $b \in \{0,1\}$, and there is also a disutility of child care d_g. The utility v_g that a person derives from the arrival of a child is stochastic and evolves over time (to be described below). The individual utility of a household member of gender $g \in \{m, f\}$ at age t is given by the value function,

$$(9) \quad V_g^t(e, w_f, a_1, a_2, a_3, v_f, v_m) = E\Big[u(c_g, d_g, v_g, b) + \beta V_g^{t+1}(e, w_f, a_1', a_2', a_3', v_f', v_m')\Big].$$

[24] There are only few couples with more than three children in our data for low-fertility countries.

[25] This is because in the model fathers do not reduce labor supply to care for children and because utility is linear in consumption.

[26] Allowing for wage dynamics would generate additional predictions for the timing of fertility, but here the role of wage heterogeneity is simply to allow us to match broad differences across women with different labor market opportunities in terms of fertility intentions and outcomes.

Here w_f is the woman's wage, a_1, a_2, and a_3 denote the ages of the children at the beginning of the period, v_f and v_m are the child preferences of the two partners, and β is a discount factor that satisfies $0 < \beta < 1$. In writing the value function this way, it is understood that c_g and b are potentially stochastic functions of the state variables that are determined through bargaining between the partners. We have $a_i = 0$ for a potential child that has not yet been born. The a_i evolve according to

$$\begin{pmatrix} a_1' \\ a_2' \\ a_3' \end{pmatrix} = \begin{pmatrix} I(a_1 > 0)(a_1 + 1) + I(a_1 = 0)b \\ I(a_2 > 0)(a_2 + 1) + I(a_1 > 0)I(a_2 = 0)b \\ I(a_3 > 0)(a_3 + 1) + I(a_2 > 0)I(a_3 = 0)b \end{pmatrix},$$

where $I(\cdot)$ is the indicator function. Since in the model no decisions affecting fertility are made after all children are grown, we assume that parents die at that point and hence $V_g^{T+H+1} = 0$.

As in Section II, utility is linear in consumption and additively separable in felicity derived from the presence of children, and the disutility of child care d_g enters linearly also. Instantaneous utility is given by

$$u(c_g, d_g, v_g, b) = c_g - d_g + v_g \cdot b.$$

Notice that the couple derives utility from a child only in the period when the child is born. However, this is without loss of generality, since only the present value of the added utility of a child matters for the fertility decision.

Children are costly as long as they live with their parents. For each child, there is a fixed monetary cost ϕ_c and a fixed utility cost ϕ_u. We think of the utility cost as a time cost that accrues outside of typical work hours, such as the time spent caring for school-age children on nights or weekends.[27] Hence, this cost is not denominated by the market wage, but directly enters utility through the term d_g.

There is an additional time cost of taking care of children during work hours, which accrues until the child is three years old (i.e., for one model period). There are two options for how this cost can be covered. One option is for the mother of the young child to stay at home instead of working. This choice is denoted by $h = 1$. In this case, the opportunity cost of caring for the young child is given by the woman's wage w_f. The alternative is for the woman to keep working, $h = 0$, and buy child care on the market (e.g., use a daycare center) at price w_y. The child care decision is discrete, $h \in \{0, 1\}$, i.e., we abstract from the possibility of working part time, and also from the option of the father staying at home with the child.[28]

Given the age distribution of children a_i, we can calculate the total number of children living in the household as

$$n_h = \sum_i \mathbf{1}(0 < a_i < H) + b,$$

[27] See Schoonbroodt (2018) for an analysis that points out the importance of distinguishing between child care that competes with work hours versus child care that does not.

[28] Allowing for this possibility would be straightforward and would not change the main results. However, it would also complicate notation, and given that in the GGP data very few men stay at home as primary care givers for children, we abstract from this option here.

where H is the duration of childhood. The total monetary cost of raising children is $n_h \phi_c + b(1-h) w_y$, the forgone wage if the mother cares for a young child is bhw_f, and the total utility cost is $n_h \phi_u$.

Couples bargain over fertility, child care, and consumption under partial commitment. The sense in which there is partial commitment is that the distribution of the burden of child care between mother and father is not entirely exogenous (as in the model in Section II), but instead depends in part on earlier decisions by the couple. Specifically, we assume that the couple can decide ahead of time whether, if a baby arrives, the mother will stay home to take care of the child for the first period ($h = 1$), or whether they will use market child care instead ($h = 0$). The couple can commit to this decision. In contrast, it is not possible to pre-commit to a specific distribution of the other child costs ϕ_c and ϕ_u. Given that commitment is possible for only a part of the child rearing cost, the lack of commitment mechanism outlined in Section II is still operative, which is essential for the model to be able to match disagreement between partners on having children.

The motivation for allowing commitment with regards to the child care arrangement $h \in \{0,1\}$ is twofold. First, how to arrange child care is a major decision that is subject to switching costs and requires advance planning; it is not unheard of to apply for daycare slots long before a child is born. Moreover, the child care decision interacts with other major choices that also have the characteristics of being lumpy and persistent, such as in which city or neighborhood to live (which may differ in the availability of child care). Arguably, it should be easier to commit to such decisions compared to other aspects of child care that can be easily changed on an everyday basis. Second, because the child care decision for young children interacts with the mother's labor market opportunities, allowing for partial commitment in this particular dimension generates empirical implications that we can take to the data.

Building on the partial commitment framework outlined in online Appendix D, the bargaining process between the partners in every period proceeds in three stages. In the first stage, the couple decides on the child care arrangement $h \in \{0,1\}$ conditional on a child being born in that period. The default choice is the one that minimizes the total cost of child care, that is, $h = 1$ if $w_f < w_y$ and $h = 0$ otherwise. However, the partners can change the default if both of them agree. This may be attractive because of the repercussions of the choice of h on the decision to have a baby.

As an example, consider a couple where the woman's wage w_f is slightly lower than the cost of market-based child care w_y, so that the default is for the woman to stay home if a child is born, $h = 1$. However, staying at home lowers the woman's outside option, so that if $h = 1$ she may not agree to have the child. If the husband wants to have a child, the partners may agree that they would both be better off by committing to $h = 0$, i.e., the woman keeps working and the couple uses market child care. Relative to the default of $h = 1$, the woman would gain through a better outside option and hence more bargaining power, and the man would gain through a higher probability of getting a child. The reverse scenario is also possible: a woman with a relatively high wage may offer to stay home with the child if she really wants one and her partner is opposed, because the woman staying home increases the man's relative bargaining power and, hence, his incentive to agree to having a child.

The second stage of bargaining concerns the fertility choice $b \in \{0,1\}$. However, it is useful to first consider the third stage of bargaining over the allocation of consumption, where the outside options come into play. As in the model of Section II, the outside option is a temporary state of non-cooperation in which each partner consumes her or his own earnings (if any) and provides her or his share of the burden of child care for one period. Future utility is the same in the outside option as on the equilibrium path, and given that the consumption allocation within a period does not affect state variables, we can treat the consumption decision as a static bargaining problem. In terms of the distribution of the burden of child care in the outside option, we aim to capture the intuition that the man (who often has higher earnings) is relatively more likely to contribute to monetary costs compared to nonmonetary costs. Hence, we assume that in the outside option monetary expenses (the child cost ϕ_c and, potentially, the cost of market child care w_y) are paid in equal shares by woman and man. In contrast, the utility cost ϕ_u (which captures child care outside of market hours) is divided according to the cost shares χ_f and χ_m, where $\chi_f + \chi_m = 1$. The utility cost of raising children for gender $g \in \{f,m\}$ is then given by $d_f = \chi_g n_h \phi_u$. The cost shares χ_f and χ_m, which may reflect comparative advantage but which we interpret as primarily being due to social norms, will later be matched to data on the actual distribution of child care between parents. The within-period outside option for the wife, analogous to (5), is then given by[29]

$$(10)\quad \bar{u}_f(w_f, v_f, h, n_h, b) = (1-bh)\,w_f - \frac{1}{2}\big(\phi_c n_h + (1-h)\,w_y b\big) - \chi_f \phi_u n_h + v_f \cdot b,$$

and for the husband we have, analogous to (6),

$$(11)\quad \bar{u}_m(w_m, v_m, h, n_h, b) = w_m - \frac{1}{2}\big(\phi_c n_h + (1-h)\,w_y b\big) - \chi_m \phi_u n_h + v_m \cdot b.$$

Given these outside options, the couple negotiates how to divide consumption given the budget constraint. The couple's budget constraint in the case of cooperation reads

$$(12)\qquad c_f + c_m = (1+\alpha)\big[(1-bh)\,w_f + w_m - \phi_c n_h - (1-h)\,w_y b\big],$$

that is, total consumption is equal to total income minus the goods cost of raising children, scaled up by the increasing returns from cooperation α. With equal bargaining weights, the Nash bargaining outcome is the solution of the maximization problem

$$\max_{c_f, c_m} \left[c_f - \left((1-bh)\,w_f - \frac{1}{2}\big(\phi_c n_h + (1-h)\,w_y b\big)\right)\right]^{0.5} \times \left[c_m - \left(w_m - \frac{1}{2}\big(\phi_c n_h + (1-h)\,w_y b\big)\right)\right]^{0.5},$$

[29] Notice that we do no impose a non-negativity constraint on consumption, which does not cause problems because utility is linear in consumption. Alternatively, one could add additional endowments to ensure that consumption is possible even in the outside option. For our analysis, the only feature that is crucial is that the outside option depends on whether the couple decides to have a child.

subject to the budget constraint above. Notice that the utility derived from children and the direct utility cost of children drop out here, because they enter equilibrium utility and the outside option equally.[30] Similarly, future utility does not enter because the evolution of the state variables is unaffected by the current consumption allocation: the bargaining problem regarding consumption is static. Analogous to A2 and A3 in the proof of Proposition 2, the solution to the maximization problem is

$$c_f(n_h) = \left(1+\frac{\alpha}{2}\right)(1-bh)\,w_f + \frac{\alpha}{2}w_m - \frac{1}{2}(1+\alpha)\big(\phi_c n_h + (1-h)\,w_y b\big),$$
$$c_m(n_h) = \frac{\alpha}{2}(1-bh)\,w_f + \left(1+\frac{\alpha}{2}\right)w_m - \frac{1}{2}(1+\alpha)\big(\phi_c n_h + (1-h)\,w_y b\big).$$

As before, each partner receives its outside option plus a fixed share of the surplus generated by cooperation.

We now go back to the second stage of bargaining, when fertility is decided on. In this stage, the partners form their intentions for having a child during the period, taking as given the child care decision $h \in \{0,1\}$ taken at the beginning of the period, and anticipating how having a child $b \in \{0,1\}$ would affect the bargaining outcome over consumption at the end of the period and the continuation utility in future periods. Let $i_g \in \{0,1\}$ denote the intention of partner g, where $i_g = 1$ denotes that the partner would like to have a baby. Formally, i_g is determined as follows:

$$(13)\qquad i_g = I\Big\{u\big(c_g, d_g, v_g, 1\big) + \beta E\Big[V_g^{t+1}\big(e, w_f, a_1', a_2', a_3', v_f', v_m'\big)\,|\, b = 1\Big] \geq u\big(c_g, d_g, v_g, 0\big) + \beta E\Big[V_g^{t+1}\big(e, w_f, a_1', a_2', a_3', v_f', v_m'\big)\,|\, b = 0\Big]\Big\},$$

where $I(\cdot)$ is the indicator function and it is understood that consumption and child care costs depend on b. Equation (13) expresses that a partner intends to have a child if having a child increases expected utility. In Section II, we assumed that having a baby requires agreement, i.e., a child was born $(b = 1)$ if and only if $i_f = 1$ and $i_m = 1$. In the GGP data explored in Section I, we found that although agreement between the partners greatly increases the likelihood of having a baby, some births occur nevertheless without perfect agreement. We therefore allow for a general mapping of fertility intentions to outcomes that also depend on the existing number of children. Given fertility intentions and the existing number of children n, the probability of having a baby in a given period is given by a function $\gamma(i_f, i_m, e, n)$. Later on, we will choose this function to match the observed birth probability for each combination of intention and existing number of children in the GGP data, separately for women with college education and less-than-college education. We take this function as exogenous; some factors that are likely to play a role in reality are natural fecundity (births are not guaranteed even if the partners agree), imperfect birth control, and change over time in fertility intentions.

[30] We assume that the allocation of the utility costs d_g is the same in equilibrium and outside option. This is without loss of generality, since utility only depends on the sum $c_g + d_g$. A different allocation of the utility cost in equilibrium would result in an exactly offsetting change in consumption and leave overall utility and fertility decisions unchanged.

Regarding child preferences, we show in online Appendix C that the persistence of child preferences over time determines the extent to which disagreement over having babies matters for the timing of fertility versus total lifetime fertility. Specifically, transitory disagreement (i.e., couples who disagree today are likely to agree in the future) primarily delays fertility, whereas persistent disagreement lowers the total number of children a couple will have. To be able to match the degree of persistence to the data, we model child preferences as follows. In every period, a couple draws potential fertility preferences $\tilde{v}_f$, $\tilde{v}_m$ from a joint uniform distribution[31] that depends on the existing number of children n:

$$\begin{bmatrix} \tilde{v}_f \\ \tilde{v}_m \end{bmatrix} \sim U\left(\begin{bmatrix} \mu_{f,e,n} \\ \mu_{m,e,n} \end{bmatrix}, \begin{bmatrix} \sigma_f^2 & \rho\sigma_f\sigma_m \\ \rho\sigma_f\sigma_m & \sigma_m^2 \end{bmatrix} \right).$$

The means $\mu_{g,e,n}$ of the distribution are gender-specific and also depend on the woman's education e and the existing number of children n. The dependence of fertility preferences on the number of existing children captures the possibility of declining marginal utility from additional children. The variances σ_g^2 are also gender specific, and the correlation between the partners' preference draws is given by a parameter ρ. In the first period, actual preferences v_f, v_m are equal to potential preferences, $v_g = \tilde{v}_g$ for $g \in \{f, m\}$. In subsequent periods, if no child is born $(b = 0)$, with probability π the couple's fertility preferences are unchanged in the next period. With probability $1 - \pi$, the couple draws new fertility preferences from the same distribution. When a birth takes place $(b = 1)$, the couple always draws new fertility preferences. Formally, this implies that the couple retains the existing preference draw with probability $\pi(1 - b)$, and adopts a new draw with probability $1 - \pi(1 - b)$:

$$\begin{bmatrix} v_f' \\ v_m' \end{bmatrix} = \begin{cases} \begin{bmatrix} v_f \\ v_m \end{bmatrix} & \text{with probability } \pi(1-b) \\ \begin{bmatrix} \tilde{v}_f \\ \tilde{v}_m \end{bmatrix} & \text{with probability } 1 - \pi(1-b). \end{cases}$$

Here v_g' denotes fertility preferences in the following period. By matching the evolution of fertility preferences to the GGP data (where fertility preferences for the same couple are observed in repeated waves), we can ensure that the model reproduces the proper mapping from current fertility preferences to long-run fertility outcomes.

IV. Matching the Model to Data from the Generations and Gender Programme

We now describe the procedure for matching the dynamic model to the GGP data. Our quantitative exercise has two objectives: to show that the partial commitment framework is able to account for the evidence described in Section I, and to use the model to compare the performance of alternative policies intended to raise

[31] Empirically, we do not have information on the global shape of child preferences away from the thresholds of indifference, because we observe only a binary variable on child preferences. We therefore use uniform distributions in the quantitative implementation of our model, while noting that the measured policy effects should be considered to be locally valid.

fertility in low-fertility countries. We interpret the data from the various countries in our dataset as driven by the same structural model, with differences across countries in the distribution of the child care burden and the cost of market child care. We use all available data to estimate model parameters that are assumed identical across countries (such as the mapping of fertility intentions into outcomes). The remaining parameters are chosen to match evidence from the countries in our dataset with a total fertility rate below 1.5 (Austria, Bulgaria, Czech Republic, Germany, Lithuania, Poland, Romania, and Russia). Accordingly, our policy experiments in the following section should be interpreted as being valid for the initial conditions of a low-fertility country.

We choose the model parameters in two steps. First, we pin down a number of parameters individually, either by setting them to standard values or by estimating them directly from the data. Second, we jointly estimate the remaining parameters, concerning the distribution of child preferences, the evolution of preferences over time, the female labor market, and the cost of child care, to match data from the low-fertility countries.

A. *Preset and Individually Estimated Parameters*

Two parameters that are less central to our analysis are set to standard values: we set the discount factor to $\beta = 0.95$, which corresponds to an annual interest rate of about 2 percent, and we set the economies of scale in the family to $\alpha = 0.4$, as in Greenwood, Guner, and Knowles (2003).

Next, we turn to parameters that we estimate directly from the data. The parameter χ_m determines the distribution of the nonmonetary burden of child care between mother and father. We pin down this parameter using our data on the distribution of the burden of child care in the GGP data (see Section I, Figure 2). However, note that the parameter is specifically about the distribution of child care outside of working hours, and hence we do not want to capture that women do a larger share of the work simply because they are more likely to be stay-at-home parents. Accordingly, we pin down χ_m using the distribution of child care in the GGP data among those couples in the low-fertility countries where the woman is in the labor force.[32] The resulting estimate is $\chi_m = 0.307$, that is, the male share in child care outside working hours is about 30 percent, leaving the remaining 70 percent to the mothers.

A number of parameters are estimated separately for two groups of couples, namely those where the woman has a college education (or above), and those where she does not.[33] The fraction of college-educated women in the low-fertility countries in our GGP sample is 25.3 percent, and hence we impose the same percentage in the model. We normalize the mean wage of women with less-than-college education to 1.0, and then set the mean of the wage distribution for college-educated women to

[32] In addition to the woman being in the labor force, we also require that the couple has at least one child under the age of 14 and that we observe the fertility intention for both partners.

[33] Given that only women bear a time cost of children during working hours, in our setting the man's wage does not affect decisions, and hence we do not consider variation in men's education or wages. However, the male wage does matter when we introduce taxation policies below.

Table 3—Fertility Rates in GGP Data by Fertility Intention

	High school					
Existing children	$n = 0$		$n = 1$		$n = 2$	
	He no	He yes	He no	He yes	He no	He yes
She no	17.89	17.89	13.06	13.06	4.28	4.28
She yes	17.89	40.21	23.60	39.84	12.21	36.15
	College					
Existing children	$n = 0$		$n = 1$		$n = 2$	
	He no	He yes	He no	He yes	He no	He yes
She no	17.03	17.03	11.42	11.42	2.48	2.48
She yes	17.03	43.78	26.67	42.48	2.48	30.91

Notes: Percent of couples with each combination of female intent, male intent, and existing number of children that will have a baby within three years.

1.5, i.e., the college wage premium is 50 percent, which is the average premium for European countries documented by Strauss and de la Maisonneuve (2009).[34]

We also use the GGP data to estimate the probabilities of having a child within three years conditional on the intentions of the male and the female partner, the woman's education, and the existing number of children. We assume that these parameters do not vary across countries, and hence we construct them from the whole sample of countries for which we have two waves of data (Austria, Bulgaria, Czech Republic, France, Germany, Lithuania, and Russia), allowing us to link intentions and outcomes.[35] We choose $\gamma(i_f, i_m, e, n)$ to match regression results as reported in Table 2, but separately by education. From these regression results, we derive the numbers shown in Table 3. We use a value of zero where the coefficients are not significantly different from zero. Using the point estimates instead does not substantially alter our findings.

To calibrate the monetary cost of children ϕ_c, we focus on data from Germany, the largest of the low-fertility countries. The statistical office of Germany estimates the consumption expenditure of couples with children to average at €38,000 in 2011. The OECD consumption equivalence scale quantifies the consumption cost of a child to be around 0.3 times the consumption of an adult, and Adda, Dustmann, and Stevens (2017) estimate this equivalence scale to be 0.4. Using the OECD equivalence scale for a couple with two children together with the average expenditures of German couples with children, we arrive at an annual expenditure of around €5,000 per year. Given that we normalize the mean wage of women without college education to 1, we scale this estimate by the average annual earnings of women without college education in Germany, which we estimate to be €30,000.[36] Hence, we set $\phi_c = 5{,}000/30{,}000 = 1/6$.

There are also two time costs for children. The time cost of caring for young children (if no market-based child care is used) is equivalent to full-time labor supply,

[34] See Table 2 in Strauss and de la Maisonneuve (2009), column *Multi-period average*.

[35] We use all available data because the number of data in each cell would become too small if we estimated the regressions separately by country.

[36] Finke (2010) puts the average hourly wage of German women with high school education at €15, which corresponds to €30,000 annually for a full-time worker with 2,000 hours of labor supply per year.

which we normalize to 1 (i.e., time is measured relative to full-time labor supply). In addition, there is the utility cost ϕ_u that is interpreted as child care outside of typical work hours, i.e., child care during mornings, nights, and weekends. If there are 16 non-sleep hours per day and full-time work corresponds to 40 hours per week, in principle there are almost twice as many hours of child care needed outside work hours compared to during work hours. However, children (especially older ones) do not need to be monitored all the time and it is also possible to combine watching children with other activities. We therefore assume that the two types of time costs are of the same magnitude and set $\phi_u = 1$.[37]

B. *Jointly Estimated Parameters*

The remaining parameters to be determined concern the distribution of female and male child preferences, the persistence of child preferences over time, the dispersion of wages, the cost of market-based child care, and participation costs in the labor market. We calibrate these parameters jointly by matching a set of target moments. While all parameters affect all target moments to some extent, for each set of parameters there is a set of directly related moments. For the distribution of female and male child preferences, these moments are the reported fertility intentions conditional on the number of existing children and on the education of the female partner. Given that fertility can be at most three in the model, for fertility intentions given $n = 2$ we group all couples with two or more children. We generate this data from a pooled sample of the low-fertility countries in the GGP data. To pool the sample, we calculate the country-specific cross tables of fertility intentions of men and women, using the sample weights. We then take the non-weighted average across countries to derive the pooled intention tables. The results are shown in the first part of Table 4. These 24 data moments are the primary drivers of 13 model parameters, namely 12 mean parameters for child preferences and the correlation parameter.

In order to calibrate the preference persistence parameter π, we use data from all low-fertility countries for which we have two waves, namely Austria, Bulgaria, Czech Republic, Germany, Lithuania, and Russia. In these countries we select couples that didn't have a baby in between Waves 1 and 2. We drop couples in which the female partner is beyond the age of 35 in the first wave. We look at these couples' combinations of fertility preferences in Wave 1 and calculate the share that reports to have the same preferences in Wave 2. These statistics should tell us how persistent certain combinations of child preferences are over time. The result is shown in Table 5. The four data moments in the table pin down the persistence parameter π.

Next, we turn to female labor force participation. Table 6 displays the labor force participation rates of women in our sample broken down by education and by the presence of young children (under age 3). Participation is lower for women with young children, consistent with the assumption of a larger time cost for raising young children in the model. We also observe that labor force participation is higher

[37] In practice, making different choices for the basic costs of children ϕ_c and ϕ_u has little impact on our overall results. If we choose higher costs, the estimation procedure for child preferences delivers a proportionally higher utility derived from children, so as to match target moments on fertility intentions.

Table 4—Distribution of Fertility Intentions in GGP Data and Model

	$n = 0$		$n = 1$		$n = 2$	
	He no	He yes	He no	He yes	He no	He yes
High school						
Data						
She no	56.36	6.92	66.05	7.55	90.25	4.39
She yes	5.55	31.16	4.29	22.10	2.31	3.05
Model						
She no	55.67	5.51	68.37	7.25	85.62	6.35
She yes	4.74	34.08	3.14	21.23	3.40	4.64
College						
Data						
She no	49.09	7.04	56.56	9.92	86.34	5.78
She yes	6.37	37.50	5.08	28.45	3.29	4.58
Model						
She no	50.20	5.55	59.76	8.66	84.84	6.92
She yes	4.84	39.40	2.41	29.18	3.23	5.01

Table 5—Share of Couples with Same Fertility Intentions in Both Waves

	Data		Model	
	He no	He yes	He no	He yes
She no	79.89	25.42	69.17	32.77
She yes	22.63	65.24	29.91	52.63

Notes: Comparison of GGP data (population 35 and under) and model output.

Table 6—Women's Labor Force Participation in GGP Data and Model

	Data Child under 3		Model Child under 3	
	No	Yes	No	Yes
High school	62.60	22.14	62.60	21.98
College	80.50	43.17	80.50	43.19

for women with more education, consistent with the notion of a higher opportunity cost of time for these women. These four target moments help pin down the dispersion of women's wages $\sigma_{w,e}$, the labor market participation cost p_c, and the cost of market based child care w_y.

The last two parameters to set are the standard deviations of child preferences σ_f and σ_m. These standard deviations determine how strongly men and women react to changes in the cost of children. Intuitively, if the standard deviation is small, the density of preferences around the cutoff between wanting and not wanting a child is high. A small change in child costs will then change the fertility intentions of many individuals, leading to a large change in the fertility rate. The standard deviations therefore are important determinants of the effectiveness of policies aimed at raising fertility. We cannot identify the standard deviations from the distribution of child preferences in Table 4 alone; intuitively, the table provides information on the total number of people with child preferences above and below a certain threshold, but not on the density close to the threshold (this is analogous to the reason why standard deviations are fixed in a probit model). Instead, we make use of the cross-country variation in disagreement shares in our sample of low-fertility countries. We interpret this variation as being driven by variation in the share of men in caring for children, as captured by Figure 2, and by variation in the availability of market child care. Intuitively speaking, if across countries the female disagreement share varies a lot but the male disagreement share varies little, this indicates that women's preferences react more strongly to changes in the relative child care burden, and hence suggests that women's fertility preferences are more concentrated than men's ($\sigma_f < \sigma_m$).

Formally, we measure the relative variation of female and male disagreement by running cross-country regressions of the form

$$\textit{disagree male}_i = \beta_0 + \beta_1 \cdot \textit{disagree female}_i + \epsilon_i,$$

with i denoting the country index, separately for couples with one child and couples with two or more children.[38] Figure 5 displays the data and the resulting regression lines. The target moments used to pin down the standard deviations σ_f and σ_m are the left and right endpoints of the regression lines (i.e., evaluated at the lowest and highest value for the *Disagree Female* variable in the sample). To compute the corresponding regressions in the model, we need to take a stand on what drives the variation in male and female disagreement across countries. The male cost share χ_m is one candidate, but the cost of market-based child care w_y also matters. To capture the relationship between these variables, we regress the female labor force participation rate of women with small children on χ_m among the low-fertility countries. Then, we take the extremes of the distribution of χ_m among the low-fertility countries, which are 0.28 and 0.34 (recall that χ_m is measured by the average male share in child care among couples who are both working full time). We choose corresponding child care costs w_y for these two extremes to exactly match the predicted female labor force participation rates for mothers with small children from the regression, which are 21.5 and 34.7 percent, respectively. This gives us two parameter combinations of χ_m and w_y. We then compute the model-generated disagreement shares in the two hypothetical countries, and use these to compute the model-generated regression line. The relationships generated by the estimated model are displayed in Figure 5 as solid lines. By matching the target moments, we ensure that the estimated model generates an empirically plausible response in male and female fertility intentions to variations in cost shares and child care costs.

C. *Parameter Choices and Model Fit*

Let Y denote the 36 target moments we describe above, i.e., the 24 values for the distribution of fertility intentions, the 4 values for the persistence of child preferences, the 4 values for labor force participation, and the 4 endpoints of the

[38] We focus on couples who already have children because preferences for the marginal (last) child are what matters for predictions for overall fertility rates.

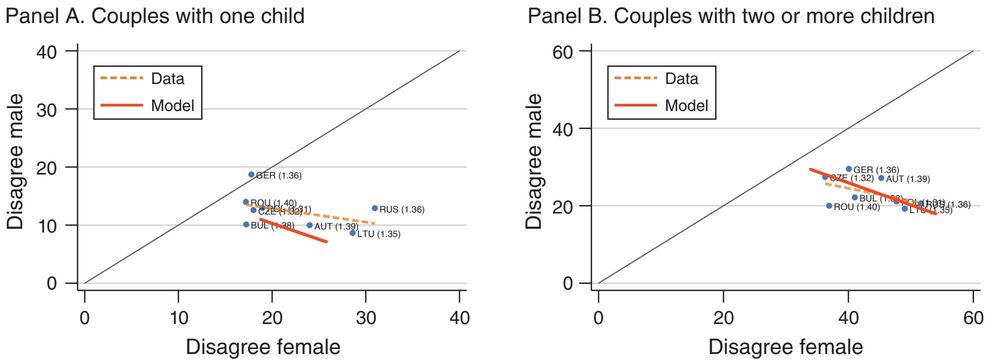

Figure 5. Fertility Intentions across Countries, GGP Data and Model

regression lines in Figure 5. Let θ denote the vector of the 20 parameter choices, namely the mean child preferences $\mu_{g,e,n}$ depending on gender, education, and the existing number of children (12 parameters), the dispersions σ_g of child preferences by gender (2 parameters), the correlation ρ and persistence π of child preferences (2 parameters), the child care cost w_y and participation cost p_c (2 parameters), and the dispersions of women's wages $\sigma_{w,e}$ by education (2 parameters). Let $\hat{Y}(\theta)$ denote the model simulated counterparts for a set of parameters θ. To pin down the parameters, we numerically solve the problem

$$\min_{\theta} \left[\hat{Y}(\theta) - Y\right]' \cdot \left[\hat{Y}(\theta) - Y\right],$$

i.e., we minimize a simple residual sum of squares. The solution is computed using a parallelized simulated annealing method. The resulting set of parameters is shown in Table 7. The model-predicted distributions of fertility intentions, the predictions about the persistence of child preferences, and the predictions for female labor force participation are shown in Tables 4, 5, and 6. The cross-country predictions for fertility intentions are shown as solid lines in Figure 5.

The calibrated model provides a good fit for the data on fertility intentions and the persistence of child preferences over time, especially for couples in which at least one of the partners wants to have a baby. For us these couples are the most important ones, since they will be most prone to changing their fertility intentions in reaction to policy. The model also does well at fitting the slope of the relationship between male and female disagreement across countries in Figure 5, and particularly so for couples that have two or more children.

The estimated parameters suggest steeply declining marginal utility from having children, especially for men. From the second child onward, women are estimated to have stronger child preferences than men. Intuitively, this arises because the estimated cost share implies that women carry most of the child care burden, yet there are still at least some women who desire a second or third child. The estimation rationalizes this pattern by assigning a stronger child preference to women. In fact, from the second child onward, mean child preferences for men are estimated to be negative. This occurs because most couples agree on not currently wanting a child,

Table 7—Jointly Calibrated Parameters

Description	Parameter	Value: High school	Value: College
Child preference parameters			
Mean women first child	$\mu_{f,e,1}$	5.07	5.78
Mean women second child	$\mu_{f,e,2}$	1.79	3.06
Mean women third child	$\mu_{f,e,3}$	−0.15	0.05
SD women	σ_f	3.07	
Mean men first child	$\mu_{m,e,1}$	3.64	4.85
Mean men second child	$\mu_{m,e,2}$	−6.44	0.00
Mean men third child	$\mu_{m,e,3}$	−15.54	−14.63
SD men	σ_m	12.72	
Correlation	ρ	0.93	
Persistence	π	0.29	
Child care and labor market parameters			
Child care cost	w_y	0.58	
Participation cost	p_c	0.36	
SD female wages	$\sigma_{w,e}$	0.89	0.94

so that the couples desiring one are in the upper tail of the distribution of child preferences. Moreover, men benefit from having children not just in terms of direct utility, but also through an improved bargaining position.

Child preferences turn out not to be highly persistent but strongly correlated within couples. As argued above, the persistence of preferences is important for shaping how disagreement versus agreement on children translates into lifetime fertility rates. The high correlation may appear surprising, given that we document substantial disagreement among couples about having children. However, at all parities the majority of couples agree that they don't want to have a child, which the model accounts for with highly correlated preferences. The less-than-perfect correlation leaves enough room for disagreement to arise for a substantial portion of couples.

Overall, the quantitative exercise shows that the partial commitment model does an excellent job at accounting for the facts described in Section I. We can further evaluate the performance of the model by considering non-targeted moments. Table 8 reports some basic demographic statistics for the model. The model predicts a total fertility rate of the low-fertility countries of 1.56, which is a little higher than the average in these countries of 1.36.[39] Some of the gap is due to the fact that our calibration is to a dataset consisting of couples, whereas the actual fertility rate is pulled down to some extent by women who are not in a relationship and do not have children. With this adjustment in mind and given that the fertility rate was not targeted, the close fit suggests that the measured fertility intentions translate into overall outcomes in an accurate manner. The model also predicts that after having completed the fertile period, i.e., at the age of 45, most couples have one or two children, which is also true in the data. Only a small fraction has three children, and

[39]This is the average total fertility rate for our low-fertility countries for the years 2000–2010, from World Development Indicators.

Table 8—Demographic Statistics Generated by Estimated Model

Total fertility rate	1.56
Fraction of couples without children	0.12
Fraction of couples with one child	0.39
Fraction of couples with two children	0.43
Fraction of couples with more than two children	0.06

12 percent of couples are childless.[40] For comparison, the German Statistical Office reports that in 2008, about 19 percent of women between the ages 40 and 49 had no children. Some of these women presumably will go on to have children later, and the group also contains single women and women unable to have children who are not part of our analysis.

V. Policy Experiments: The Effectiveness of Targeted Child Subsidies

We now turn to the policy implications of our analysis. In many countries, historically low fertility rates are considered a major challenge for future economic prospects, because it is difficult to sustain economic growth with a shrinking population and to maintain social insurance systems with an aging population. Already, child bearing is subsidized and publicly supported in various ways in many countries, but there are doubts about how effective such policies are. Here, we study the effect of policies that aim to promote fertility within our quantitative model.

Our analysis suggests that the effectiveness of policy interventions will depend on their separate effect on women's and men's incentives for having children. It therefore matters how effectively a policy can lower the burden of child care specifically for, say, mothers as opposed to fathers. We consider two scenarios. We start with the polar case in which interventions can be precisely targeted. Specifically, we consider child subsidies that are paid to either the mother or the father and increase the outside option of this parent one-for-one, without an effect on the outside option of the other parent (similar to the interpretation of Lundberg, Pollak, and Wales 1997). This scenario gives sharp results on the desirability of subsidizing either mothers' or fathers' desire for children. However, it is not obvious whether such polar policies are feasible, because how a given subsidy is used ultimately depends on how this subsidy enters intra-household bargaining. Hence, we also consider "real world" policies modeled to be comparable to specific policies that we can observe in the data, such as parental leave policies or subsidized daycare.

We evaluate the effectiveness of policies by measuring the cost of increasing the total fertility rate by 0.1, i.e., from 1.56 to 1.66. This is a sizable increase, although still well short of moving fertility to the replacement level. We first consider the case of child subsidies targeted at either mothers or fathers. Formally, let $s_g(n_h)$ denote the total subsidy paid to the partner g for the n_h children currently living in the household. The joint budget constraint (12) then becomes

$$c_f + c_m \;=\; (1+\alpha)\big[(1-bh)\,w_f + w_m - \phi_c n_h - (1-h)\,w_y b + s_f(n_h) + s_m(n_h)\big],$$

[40] See Baudin, de la Croix, and Gobbi (2015) for a discussion of the economics of childlessness and related empirical evidence.

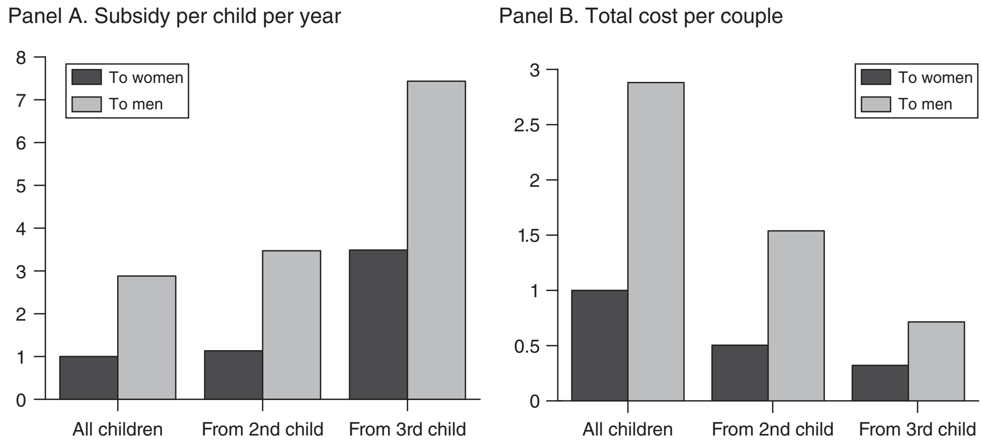

FIGURE 6. RELATIVE COST OF TARGETED SUBSIDIES NEEDED TO RAISE THE TOTAL FERTILITY RATE BY 0.1

Note: Bars display the cost of child subsidies paid to either mothers and fathers needed to raise the total fertility rate by 0.1, relative to a subsidy paid to mothers for all children.

and the outside options (10) and (11) are changed to

$$\bar{u}_f\big(w_f, h, n_h, b, v_f\big) \;=\; \big(1 - bh\big)w_f - \frac{1}{2}\Big(\phi_c n_h + \big(1-h\big)w_y b\Big) - \chi_f \phi_u n_h + v_f \cdot b + s_f\big(n_h\big),$$

$$\bar{u}_m\big(w_m, h, n_h, b, v_f\big) \;=\; w_m - \frac{1}{2}\Big(\phi_c n_h + \big(1-h\big)\,w_y b\Big) - \chi_m \phi_u n_h + v_m \cdot b + s_m\big(n_h\big).$$

In addition to targeting subsidies to either mothers or fathers, we also consider the possibility of subsidies that are only paid for higher-order children, i.e., from the second or the third child onward. We focus on the steady-state cost of policies that are in place over the entire life course of couples.

Figure 6 shows the relative cost of these subsidies (each of which raise fertility by 0.1), both in terms of the cost per subsidized child and the total cost per couple (over their whole life course). When comparing along the margin of paying subsidies for all or only higher-order children, the subsidy amount necessarily increases when fewer children are eligible for the subsidy (panel A). However, the total cost of the subsidies declines when only higher-order births are subsidized, especially so when the subsidy is only paid for third children. This is because most couples would have had one or two children even without the subsidy (see the distribution of completed fertility in Table 8). When all births are subsidized, this results in high sunk costs for inframarginal births that make the policy costly in the aggregate. Targeting subsidies to higher-order children is more cost effective, since the program is better targeted toward marginal children.

Next, consider the margin of paying the subsidy either to mothers or fathers. Here, the key finding is that it is much more effective to target subsidies toward women than toward men. Specifically, the subsidy needs to be 2.2 to 3.1 times larger when targeted toward men than toward women. This finding is novel to our analysis and would not arise in a model that abstracts from bargaining. There are three features of our analysis that can create a gap between the effectiveness of child subsidies paid to women versus men, and it turns out that all three push in the direction of favoring subsidies to women. First, as displayed in Figure 1, in the low-fertility countries that we calibrate to, many more women than men are opposed to having another child. Thus, women are more likely to be pivotal in the household decision (see Proposition A1 in the online Appendix), which means that subsidies directed to women are more effective. The second reason for our finding is related to the distribution of fertility preferences. Looking at the estimation results in Table 7, we can see that the women's child preferences are less dispersed than those of men, indicating that there are relatively more women close to the preference threshold at which they switch to wanting a baby. Consequently, a given subsidy can incentivize more women than men to switch their opinion toward having another baby. Third, even with symmetric fertility intentions and child preferences, women's and men's preferences may also have a differential direct effect on fertility. Indeed, we can see in the fertility regressions in Table 2 that women have a larger impact on the fertility decision in the household than men. These three reasons combined imply that subsidies that are targeted toward women are much more likely to succeed in raising the total fertility rate.

In absolute terms, the present value of the per-couple subsidy needed to increase fertility by 0.1 ranges from about 15,000 euros in the best-case scenario (subsidizing mothers from the third child onward) to more than 130,000 euros in the worst case (subsidizing fathers from the first child onward).[41] As a comparison, estimates based on a recent reform of child benefits in Germany by Raute (2019) imply a cost of about 25,000 euros per couple for achieving the same increase in fertility. The reform provides benefits from the first child onward and is targeted primarily to women. In the model, for the same scenario the cost would be about 45,000 euros. Hence, while fertility is somewhat less responsive to financial incentives in the model compared to the estimate by Raute (2019), the required subsidies have the same order of magnitude. Moreover, our experiment measures the long-run impact whereas Raute (2019) focuses on the first five years after the reform, and other empirical findings suggests that the long-run impact on fertility is usually smaller than the short-run impact (e.g., Adda, Dustmann, and Stevens 2017). Hence, the impact of financial incentives in our model is broadly consistent with independent empirical estimates.

The results in Figure 6 rely on the notion that subsidies paid to either mother or father affect the outside option of this partner one-for-one. However, it is not obvious how outside options will respond. At the other extreme, we can envision a case where partners consider a subsidy, no matter to whom it is paid, as joint income that enters their outside options in a parallel way, so that it does not make a difference to whom the subsidy is paid. Even then, it is possible to design policies that affect mothers and fathers in different ways, because of mothers' specific role in child care. To evaluate this possibility, we next consider policies under the alternative

[41] The mean unskilled wage for women is normalized to 1 in the calibration. To compute the absolute subsidy, we assume that this wage corresponds to 30,000 euros per year, which approximates the annual earnings of women with a high school degree in Germany.

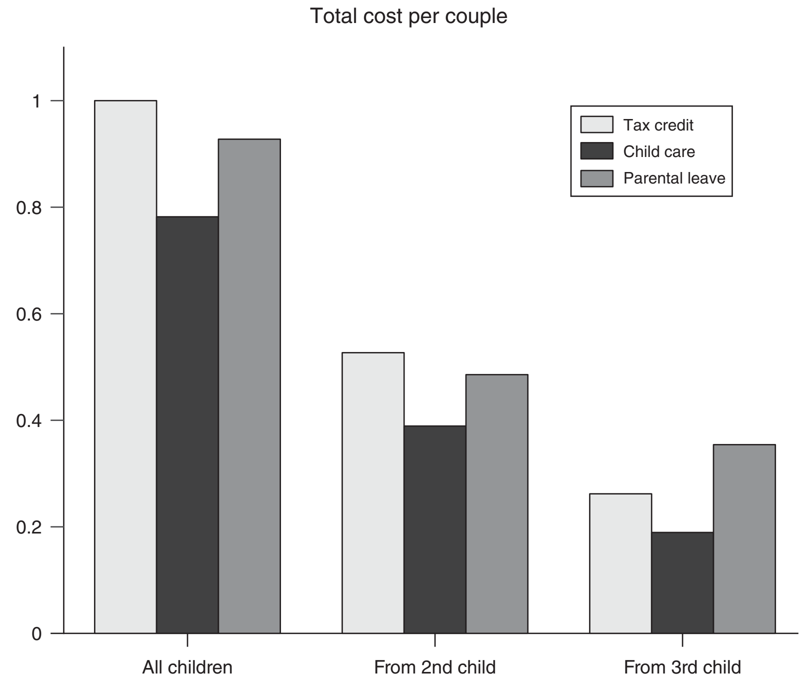

FIGURE 7. RELATIVE COST OF REAL-LIFE POLICIES RAISING THE TOTAL FERTILITY RATE BY 0.1

Notes: Tax credit is a per-child subsidy that is proportional to each partner's labor income. *Child care* is a subsidy to the cost of market-based child care. *Parental leave* is a subsidy paid to mothers who take care of a young child at home. Cost is displayed relative to a tax credit for all children.

assumption that cash subsidies cannot be arbitrarily targeted, and instead the impact on outside options depends on the details of the policy design. We compare the cost of three policies. The first is a "tax credit," that is, a per-child subsidy that is proportional to each parent's labor income. Given that men have higher average wages, this policy benefits fathers relatively more.[42] The second policy is a child care subsidy that subsidizes the use of market-based child care. The benefit itself shifts up both parents' outside options in a parallel way. However, the policy also incentives women to work rather than stay at home to care for young children (so that they are eligible for the subsidy), and working increases mothers' outside option. The third policy is a parental leave benefit that pays a subsidy to women who do not work while home with a young child. In this policy scenario, the benefit increases the outside option of mothers who stay at home, but it also provides incentives for dropping out of the labor force for mothers who without the policy would be working, which lowers the outside option.

Figure 7 compares the cost of these policies, again broken down by whether the policy applies to all or only higher-order children. The costs are expressed relative

[42] We assume an average gender wage gap of 25 percent. In addition, partners of college-educated women are assumed to have proportionally higher wages, but there is no additional variation in male wages conditional on the woman's education.

to the cost of increasing fertility by 0.1 through a tax credit paid for all children. As before, costs are lower when only higher-order births are incentivized. Comparing across policies, the most effective way to raise fertility is to provide child care benefits. The intuition follows from Figure 6: ideally the government would like to subsidize mothers, and by subsidizing child care (a component of the burden of children that otherwise would be primarily borne by mothers) the policy can be targeted more effectively compared to the other policies. More precisely, for couples who otherwise would not have used market-based child care but switch to using child care because of the policy, the higher earnings of the mother directly improve her outside option (10), whereas the cost of child care is borne by both partners. Endogenous labor supply is crucial for the ranking of the policies. This is apparent from the fact that parental leave benefits are less effective than the child care subsidy: under the parental leave policy mothers are directly subsidized, but they are also given incentives not to work, which lowers the outside option and increases bargaining frictions.

The cost differences in Figure 7 are smaller compared to Figure 6 because targeting is less precise, but the results still suggest that the design of real-life policies matters. In absolute terms, the present value of the per-couple cost of the policies varies from about 18,000 to about 95,000 euros. The cheapest policy, namely child care benefits from the third child onward, is only 3,000 euros more expensive than the (potentially infeasible) policy of targeting subsidies entirely to mothers, suggesting that this policy does rather well at incentivizing mothers. Overall, accounting for the pattern of agreement and disagreement on having babies makes a big difference for policy effectiveness.

In summary, our results suggest that, in a low fertility environment, policies that focus on making childbearing and working compatible for mothers of young children (such as subsidies for market-based child care) are likely to be the most effective. It is interesting to compare these predictions to empirical studies of the effect of different types of policy interventions on fertility. Our findings are consistent with the observation that across countries, there is a close empirical link between low fertility and a high child care burden on women (Feyrer, Sacerdote, and Stern 2008; de Laat and Sevilla-Sanz 2011). At the micro level, while there is a sizable literature on the role of financial incentives for fertility (e.g., Cohen, Dehejia, and Romanov 2013; Laroque and Salanié 2014; and Raute 2019), most papers do not compare alternative policies, and the estimated effects vary too much across settings to yield a straightforward meta-analysis for comparing different types of policies. One exception is Goldstein et al. (2018), who compare the cost effectiveness of child allowances and daycare subsidies for raising fertility, and find, consistent with our results, that daycare subsidies are more effective. However, one limitation of the study is that it is based on vignette-survey experiments that provide information on desired rather than actual fertility. Regarding the specific role of access to child care, D'Albis, Gobbi, and Greulich (2017) provide cross-country evidence showing that differences in fertility across Europe result from fewer women having two children in low-fertility countries, and that child care services are crucial for the transition to a second child to occur. For the case of Germany, Bauernschuster, Hener, and Rainer (2016) find that a large expansion of public child care for young children in Germany substantially increased fertility.[43] A historical example of a transformation that specifically lowered the cost of childbearing for mothers is the introduction of infant formula, which reduced mother's need to breastfeed and hence greatly enhanced their flexibility in dealing with the needs of young children. Albanesi and Olivetti (2016) argue that the introduction of infant formula contributed to the simultaneous rise in female employment and fertility observed in the United States between the 1930s and 1960s. Regarding parental leave benefits, Dahl et al. (2016) find that expansions of paid maternity leave in Norway increased mothers' time out of the labor market after a birth, but did not increase fertility. All these findings are consistent with our results.

Perhaps the strongest indication that policy design matters comes from the study by Olivetti and Petrongolo (2016) of the effects of various family policies (such as the length of parental leave for mothers and fathers, the pay rate during parental leave, and public spending on early childhood care and education) on household decisions and outcomes across high-income countries. They find that public support for early childhood care is the *only* policy that has a positive and significant association with fertility. These results are confirmed by a regression analysis with time and country fixed effects, where once again public spending on early childhood education and care is the only policy having a positive and substantial impact on fertility. While these results are not sufficient to establish causality, they line up well with our finding that policies that specifically support mothers (such as public daycare for young children) are the most effective at raising fertility.

VI. Conclusions

In this paper, we have examined the demographic and economic implications of the simple fact that it takes agreement between a woman and a man to make a baby. Using newly available data from the Generations and Gender Programme, we have shown that disagreement between partners about having babies is not just a theoretical possibility, but a commonplace occurrence: for higher-parity births, there are more couples who disagree about having a baby than couples who agree on wanting one. We have also shown that disagreement matters for outcomes, in the sense that a baby is unlikely to be born unless both parents desire one. We interpret the data using a model of marital bargaining under partial commitment, and show that our calibrated model provides a close match for the data on fertility intentions and outcomes.

Our findings have both positive and normative implications for the economics of fertility choice. On the positive side, our theory suggests a novel determinant of a country's average fertility rate, namely the distribution of the child care burden between mothers and fathers. If one gender carries most of the burden, we would expect to observe a lopsided distribution of fertility intentions, and the fertility rate can be low even if childbearing is highly subsidized overall. Indeed, in the sample of

[43] A 10 percentage point increase in child care coverage is estimated to increase the incidence of second and third births by 4 and 7 percent. However, Bick (2016) comes to a different conclusion and argues (based on a quantitative model that abstracts from bargaining) that providing more subsidized child care would do little to raise fertility in Germany, as it would mostly crowd out private child care arrangements within the extended family.

European countries in the GGP data, we find that all low-fertility countries are characterized by many more women than men being opposed to having another child.

In terms of normative implications, the analysis suggests that policies that aim at raising the fertility rate will be more effective if they specifically target the gender more likely to disagree with having another child. In our quantitative model calibrated to the European low-fertility countries, we find that a child subsidy that specifically lowers women's child care burden is, euro for euro, up to three times as effective at raising fertility than is a subsidy targeted at fathers. In many industrialized countries, today's extremely low fertility rates are projected to cause major problems for the sustainability of social insurance systems in the future. Examining policies from the perspective of their effect on agreement and disagreement within couples on fertility will play an important role in designing an effective response to this policy challenge. One immediate implication is that optimal policy will be country-specific, because patterns of disagreement over fertility vary widely across countries. In the GGP sample, it is notable that the high-fertility countries (Belgium, France, and Norway) already have broadly balanced fertility intentions between women and men, so that there is less need for targeted policies.

Our analysis suggests a number of promising directions for future research. First, the paper points to a close link between mothers' labor market opportunities and disagreement over child care and fertility between parents. In our model, women's labor market opportunities are modeled in a simple way through a fixed wage that provides earning opportunities that are not directly affected by having children. It would be interesting to combine our analysis with a richer model of the accumulation of work experience and career choices, where having children may have more profound repercussions (see, for example, Adda, Dustmann, and Stevens 2017 and Gallen 2018). Such a model would also yield richer implications for the effects of the distribution of the burden of child care on the timing and spacing of births, which would make it possible to address the difference between high- and low-fertility countries in more dimensions.

Second, our analysis has focused on contemporary fertility choices in high-income countries. A natural next step is to consider how the mechanisms explored here also contributed to the historical changes throughout the fertility transition and its aftermath. Given that the opportunity cost of mothers' time plays a central role in our analysis, it is interesting to ask what the model predicts if there is a secular change in women's labor market opportunities over time. The novel feature of our model is that a rise in women's wages affects both the total cost of children and the how the burden of this cost is distributed between the parents. As an example, consider a version of our model in which the only cost of children is the time cost of caring for young children during work hours. In this setting, a rise in women's wages will gradually increase the opportunity cost of children, until the level is reached where market-based child care is used, after which the cost of children is constant. In terms of the distribution of the burden of child care, at low wages the entire burden falls on women, who experience a decrease in their outside option as they drop out of the labor force to care for children. However, once the female wage is sufficiently high for market-based child care to be used, the time cost is transformed into a monetary cost, and the burden of child care is shared between mother and father. This feature implies that close to the threshold where market child care is used, women's utility from having children is actually increasing in the female wage, and hence fertility will be increasing in the wage also if women are pivotal in the fertility decision. Combining these features, the model can generate a U-shaped evolution of fertility as women's wages and female labor-force participation rise. This rhymes well with the empirical observation that during the early phase of the demographic transition, there is a negative relationship between fertility and female labor force participation, whereas the relationship is positive across countries in recent data.[44]

Third, the analysis could be applied to understand fertility choices in low-income countries. As documented in Doepke and Tertilt (2018), there is evidence that in developing countries there is even more disagreement over fertility compared to high-income countries. There is only little research to date on how this disagreement affects fertility outcomes. A key question when applying a bargaining model of fertility to developing countries is how much power women and men have within the family. Our results for rich countries point to a veto model, where each partner has enough power to block the decision to have an additional child. If the distribution of power within the household is more lopsided, outcomes may be quite different. In addition, if there is an shift in relative power within households over time (specifically, through improvements in women's rights), this may have substantial effects on fertility outcomes even if gender-specific fertility preferences are unchanged.

Fourth and last, while our analysis goes beyond the unitary model of the household, it is still based on the "standard" case of a baby born as the result of a mutual decision of a mother and father. This is a limitation, because it excludes same-sex couples having babies using sperm donors or surrogacy, single women using a sperm donor, or any type of family using an adoption agency. At this time, these family types still account for a relatively small fraction of children and are difficult to study with survey data. Nevertheless, other family types in general and same-sex parenting more specifically are phenomena that grow in importance over time. While much of our analysis should extend to same-sex couples (as the burden of child care still needs to be shared in some way, leading to the same commitment issues as in our analysis), there are also important differences, for example concerning the impact of traditional role models. Another increasingly important trend is the development of technologies such as egg freezing and in vitro fertilization that give women a lot more control on when to have babies and who to have them with. As these trends grow in importance and more data become available, it will be interesting to study how the bargaining perspective on fertility choice can be applied more widely.

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[44] See Feyrer, Sacerdote, and Stern (2008) and Doepke and Tertilt (2016) on the empirical pattern, and Da Rocha and Fuster (2006), de Laat and Sevilla-Sanz (2011), Hazan and Zoabi (2015), Siegel (2017), and Bar et al. (2018) on potential channels that can account for some of the changing relationships between women's education, labor supply, and fertility.

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