Bargaining over Babies

Theory, Evidence, and Policy Implications

Matthias Doepke and Fabian Kindermann
How Babies are Made
How Babies are Made
How Babies are Made
How Babies are Made
The Question

- It takes two people to make a baby.
- Suggests that agreement is essential for fertility.
- Mother and father have to prefer baby over status quo.
- **Question:** Is the need for agreement important for understanding fertility choice in the data?
The Plan

- Document importance of agreement in data on fertility preferences and outcomes.
- Build a bargaining model of fertility that incorporates a need for agreement.
- Match the model to the data.
- Derive stark policy implications for low-fertility countries.
The Western World’s Fertility Crisis

Total fertility rate by country

- FRA
- NOR
- DEU
- AUT
- BEL
- ESP
- CZE
- POL
- JPN
- USA
Relationship to Literature

- Large differences in desired fertility between men and women in developing countries (e.g. Westoff 2010).

- Experimental evidence suggests important role for household bargaining (e.g. Ashraf, Field, and Lee 2014).

- Limited theoretical literature on bargaining over fertility; Rasul (2008) is closest.
The Data
Data from the Gender and Generations Programme (GGP)

- Longitudinal Survey of 18-79 year olds in 19 countries.
- Wave I (2003-2009) contains questions on fertility preferences:
  - *Do You Yourself Want Another Baby Now?*
  - *Does Your Partner Want Another Baby Now?*
- Wave II (2007-ongoing) contains information on subsequent fertility outcomes.
GGP Data on Fertility Intentions

- Four possible states for a couple:
  - Neither wants a baby.
  - Both want a baby (AGREE).
  - She wants a baby, he does not (SHE YES/HE NO).
  - He wants a baby, she does not (SHE NO/HE YES).

- Measure disagreement as a fraction of all couples where at least one spouse wants a baby:

  \[
  \text{DISAGREE MALE} = \frac{\nu(\text{SHE YES/HE NO})}{\nu(\text{AGREE}) + \nu(\text{SHE YES/HE NO}) + \nu(\text{SHE NO/HE YES})},
  \]

  \[
  \text{DISAGREE FEMALE} = \frac{\nu(\text{SHE NO/HE YES})}{\nu(\text{AGREE}) + \nu(\text{SHE NO/HE NO}) + \nu(\text{SHE NO/HE YES})}.
  \]
Fact 1:

There is a lot of disagreement within couples
GGP Data on Fertility Intentions: No Children

Couples without children

Disagree Male

Disagree Female

Disagree Male

Disagree Female

0

0

0.2

0.2

0.4

0.4

0.6

0.6

Countries and their respective values:
- BUL (1.38)
- RUS (1.36)
- GER (1.36)
- ROU (1.40)
- AUT (1.39)
- LTU (1.35)
- POL (1.31)
- CZE (1.32)
- FRA (1.95)
- NOR (1.87)
- RUS (1.36)
GGP Data on Fertility Intentions: One Child

Couples one child

Disagree Male

Disagree Female

BEL (1.76)
GER (1.36)
NOR (1.87)
RUS (1.36)
ROU (1.40)
LTU (1.35)
FRA (1.95)
BUL (1.38)
AUT (1.39)

0.2
0.4
0.6

0
0.2
0.4
0.6

Disagree Female

Disagree Male
GGP Data on Fertility Intentions: Two Children

Couples two or more children

Disagree Male vs. Disagree Female

Countries and corresponding values:
- NOR (1.87)
- BEL (1.76)
- GER (1.36)
- AUT (1.39)
- LTU (1.35)
- POL (1.31)
- CZE (1.32)
- FRA (1.95)
- NOR (1.87)
- BEL (1.76)
- GER (1.36)
- AUT (1.39)
- LTU (1.35)
- POL (1.31)
- CZE (1.32)
- FRA (1.95)
Fact 2:
Agreement matters for fertility
GGP Data on Fertility Intentions and Outcomes

- Fertility outcomes available for Bulgaria, Czech Republic, France, and Germany.

- Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE.

- Result for couples with no children:

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHE YES/HE NO</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SHE NO/HE YES</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGREE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Fertility outcomes available for Bulgaria, Czech Republic, France, and Germany.

Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE.

Result for couples with no children:

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHE YES/HE NO</td>
<td>0.026</td>
<td>(0.042)</td>
</tr>
<tr>
<td>SHE NO/HE YES</td>
<td>0.030</td>
<td>(0.037)</td>
</tr>
<tr>
<td>AGREE</td>
<td>0.266***</td>
<td>(0.029)</td>
</tr>
</tbody>
</table>
GGP Data on Fertility Intentions and Outcomes

- Fertility outcomes available for Bulgaria, Czech Republic, France, and Germany.

- Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE.

- Result for couples with one child:

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHE YES/HE NO</td>
<td>0.160***</td>
<td>(0.032)</td>
</tr>
<tr>
<td>SHE NO/HE YES</td>
<td>0.020</td>
<td>(0.011)</td>
</tr>
<tr>
<td>AGREE</td>
<td>0.325***</td>
<td>(0.052)</td>
</tr>
</tbody>
</table>
GGP Data on Fertility Intentions and Outcomes

- Fertility outcomes available for Bulgaria, Czech Republic, France, and Germany.

- Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE.

- Result for couples with two children:

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>SHE YES/HE NO</td>
<td>0.082**</td>
<td>(0.032)</td>
</tr>
<tr>
<td>SHE NO/HE YES</td>
<td>0.024</td>
<td>(0.022)</td>
</tr>
<tr>
<td>AGREE</td>
<td>0.340***</td>
<td>(0.038)</td>
</tr>
</tbody>
</table>
Fact 3:
The extent of disagreement is related to the distribution of child care
GGP Data on Fertility Intentions and Childcare

Couples without children

\[
\text{Disagree Female} - \text{Disagree Male}
\]

\[
\text{Share of men caring for children}
\]

\[
\text{coeff} = -0.2792^{***}
\]
GGP Data on Fertility Intentions and Childcare

Couples with one child

- Share of men caring for children
- Disagree Female – Disagree Male

\[ \text{coeff} = -0.9854^{**} \]
GGP Data on Fertility Intentions and Childcare

Couples with two or more children

\begin{align*}
\text{Share of men caring for children} &\quad \text{Disagree Female} - \text{Disagree Male} \\
\end{align*}

\begin{itemize}
\item \text{coeff} = -1.9556^{***}
\end{itemize}
A Bargaining Model of Fertility Choice
Static Bargaining Model of Fertility Choice

- Couple consisting of wife and husband, wages $w_f$ and $w_m$.
- Decision on
  - consumption allocation
  - whether to have a child, $b \in \{0, 1\}$.
- Child cost $\phi$.
- Returns to scale in joint consumption:
  Resources increase by factor $\alpha > 0$ if couple cooperates.
- Preferences of spouse $g \in \{f, m\}$ are:
  $$u_g(c_g, b) = c_g + bv_g,$$
Static Bargaining Model of Fertility Choice

- Nash bargaining with equal weights.

- Outside option is non-cooperation within marriage (Lundberg and Pollak 1993).

- **Under commitment:** (future) consumption and fertility are chosen simultaneously. Outside options:

  \[ \bar{u}_f = w_f, \quad \bar{u}_m = w_m. \]

- **Without commitment:** ex-post bargaining over consumption given sunk fertility choice. Outside options (as function of \( b \)):

  \[ \bar{u}_f(b) = w_f + b [v_f - \chi_f \phi], \quad \bar{u}_m(b) = w_m + b [v_m - \chi_m \phi]. \]

  with fixed cost shares \( \chi_f + \chi_m = 1 \).
The couple solves:

\[
\max_{b, c_f, c_m} \left\{ (u_f(c_f, b) - \bar{u}_f)^{\frac{1}{2}} (u_m(c_m, b) - \bar{u}_m)^{\frac{1}{2}} \right\}
\]

subject to:

\[
c_f + c_m = (1 + \alpha)(w_f + w_m - \phi b).
\]
Outcome Under Commitment

- Couple will have a child if:
  \[ v_f + v_m \geq \phi(1 + \alpha). \]

- Couple agrees on fertility and choice is efficient.

- The bargaining solution is:
  \[
  c_f + b v_f = w_f + \frac{\alpha}{2} (w_f + w_m - \phi b) + \frac{b}{2} (v_f + v_m - \phi), \\
  c_m + b v_m = w_m + \frac{\alpha}{2} (w_f + w_m - \phi b) + \frac{b}{2} (v_f + v_m - \phi).
  \]

Surplus from Consumption + Surplus from Fertility
Outcome Without Commitment

- Two-stage decision:
  1. Decide on fertility.
  2. Ex-post bargaining given fertility choice.

- Solve backwards.

- $U_g(b)$ ex-post utility of spouse $g$ given fertility choice $b$. 
Outcome Without Commitment

- **Ex-post utilities without child:**
  
  \[
  U_f(0) = w_f + \frac{\alpha}{2} (w_f + w_m),
  \]
  
  \[
  U_m(0) = w_m + \frac{\alpha}{2} (w_f + w_m).
  \]

- **Ex-post utilities with child:**
  
  \[
  U_f(1) = w_f + v_f - \chi_f \phi + \frac{\alpha}{2} (w_f + w_m - \phi),
  \]
  
  \[
  U_m(1) = w_m + v_m - \chi_m \phi + \frac{\alpha}{2} (w_f + w_m - \phi).
  \]

- Spouses still share consumption surplus equally, but partners are not compensated for reduction in outside option.
Fertility Choice Without Commitment

- Spouses have to agree for child to be born:
  \[ b = \begin{cases} 
  1 & \text{if } U_f(1) \geq U_f(0) \text{ and } U_m(1) \geq U_m(0), \\
  0 & \text{else}. 
\end{cases} \]

- Wife agrees to birth if:
  \[ v_f \geq \left( \chi_f + \frac{\alpha}{2} \right) \phi. \]

- Husband agrees to birth if:
  \[ v_m \geq \left( \chi_m + \frac{\alpha}{2} \right) \phi. \]

- Disagreement is possible and outcome may be inefficient.
Graphical Representation
Child Bearing Decisions With and Without Commitment

[Graph showing a two-dimensional coordinate system with axes labeled $U_m$, $U_f$, $w_m$, and $w_f$. The graph illustrates a decision process with commitment factors and utility measures.]
Child Bearing Decisions With and Without Commitment

\[ U_m = (1-\theta)w + v \]

utility-possibility frontier

\[ n = 0 \]

\[ W_m \]

\[ W_f \]
Child Bearing Decisions With and Without Commitment

Utility-possibility frontier

\[ n = 0 \]

\[ (1-\ )w + v \Phi f + v m \]
Child Bearing Decisions With and Without Commitment

\[ (1- )w +v \]

utility-possibility frontier

\[ n = 0 \]
Child Bearing Decisions With and Without Commitment

Utility-possibility frontier

\[ (1-\epsilon)w + v_f + (1-\epsilon)m + v_m = 0 \]
Child Bearing Decisions With and Without Commitment

Utility-possibility frontier

$n = 0$

$n = 1$

With commitment
Child Bearing Decisions With and Without Commitment

\[ U_m \]

\[ f \]

\[ (1-\Phi)w_f + v_f \]

\[ w_f \]

\[ n = 0 \]

\[ n = 1 \]

utility-possibility frontier

with commitment
Child Bearing Decisions With and Without Commitment

\[
U_m = \text{utility-possibility frontier}
\]

\[
(1-\Phi)w_f + v_f \leq w_m + v_m
\]

\[
w_m \leq w_f
\]

\[
n = 0
\]

\[
n = 1
\]

\[
\text{with commitment}
\]
Child Bearing Decisions With and Without Commitment

\[ U_m = (1-\Phi)w_f + v_f \]

**Utility-Possibility Frontier**

- Without commitment
- With commitment

Points:
- \( w_m + v_m \)
- \( w_m \)
- \( w_f \)

Conditions:
- \( n = 0 \)
- \( n = 1 \)
The Distribution of Child Care Burden
Consider economy with continuum of couples.

Child preferences distributed independently across genders.

Distribution functions $F_g(v_g)$.

Cutoffs for agreeing to have a child are:

\[ \tilde{v}_f = (\chi_f + \alpha/2) \phi, \]
\[ \tilde{v}_m = (\chi_m + \alpha/2) \phi = (1 - \chi_f + \alpha/2) \phi. \]
Distribution of the Burden of Child Care and Fertility

- Fertility rate is:

\[ E(b) = P(\{v_f \geq \tilde{v}_f \lor v_m \geq \tilde{v}_m\}) \]

\[ = 1 - F_f(\tilde{v}_f) - F_m(\tilde{v}_m) + F_f(\tilde{v}_f)F_m(\tilde{v}_m). \]

- Effect of change in female cost share \( \chi_f \) on fertility:

\[ \frac{\partial E(b)}{\partial \chi_f} = \phi F_m'(\tilde{v}_m)[1 - F_f(\tilde{v}_f)] - \phi F_f'(\tilde{v}_f)[1 - F_m(\tilde{v}_m)]. \]

- Two determinants:
  - Fraction of each gender agreeing to have a child \( 1 - F_g(\tilde{v}_g) \).
  - Marginal density of child preferences \( F_g'(\tilde{v}_g) \)

- Condition for highest fertility:

\[ \frac{1 - F_f(\tilde{v}_f)}{1 - F_m(\tilde{v}_m)} = \frac{F'(\tilde{v}_f)}{F'(\tilde{v}_m)}. \]
Consider uniform densities for child preferences.

Mean $\mu_g$ and density $d_g$.

Fertility is concave in $\chi_f$ and maximized at:

$$\hat{\chi}_f = \frac{1}{2} + \frac{1}{2\phi} \left[ \mu_f - \mu_m + \frac{1}{2} \frac{d_m - d_f}{d_f d_m} \right].$$

We can raise fertility by favoring gender that is

- more likely to be opposed to having a child or
- more reactive to changes in the cost share
The Timing of Births
Timing of Births versus Total Fertility

- In dynamic model, disagreement may be about timing of births or about the total number of children.
- Matters if policy intends to raise population growth.
- Important to measure persistence of preferences over time.
A Quantitative Model
The Quantitative Model

- Model period is three years.
- Couples fertile until age 43.
- Raise children for $H = 6$ periods (18 years).
- Utility from children is stochastic and evolves over time.
- Probability of birth given intentions exogenous.
Preferences and Costs of Children

- $b$ indicates birth in a period.
- $n \leq 3$ is total number of existing children.
- $a_i$ denotes age of the $i$th child.

Utility of spouse $g$:

$$V^t_g(a_1, a_2, a_3, v_f, v_m) = E \left[ u(c_g, v_g, b) + \beta V^{t+1}_g(a'_1, a'_2, a'_3, v'_f, v'_m) \right].$$

Costs of children:

$$k(n_h) = \phi \cdot (n_h)^\psi,$$

where

$$n_h = \sum_i (0 < a_i < H) + b.$$
The Fertility Decision

- Fertility intentions:

\[
i_g = l\left\{ E \left[ u(c_g, v_g, 1) + \beta V_{g}^{t+1}(a'_1, a'_2, a'_3, v'_f, v'_m)|b = 1 \right] \\
- E \left[ u(c_g, v_g, 0) + \beta V_{g}^{t+1}(a'_1, a'_2, a'_3, v'_f, v'_m)|b = 0 \right] \geq 0 \right\},
\]

- Probability of having a child given by function:

\[ \kappa(i_f, i_m, n) \]

- Calibrated to match GGP data.
Evolution of Fertility Preferences

- Fertility preferences drawn from uniform distribution with gender specific means and densities and correlation $\rho$ between spouses.

- If $b = 0$, retain same preferences with probability $\pi$.

- If $b = 1$, draw new preferences.

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

\[
\begin{bmatrix}
\tilde{v}_f \\
\tilde{v}_m
\end{bmatrix} \sim U\left(\begin{bmatrix}
\mu_f, n \\
\mu_m, n
\end{bmatrix}, \begin{bmatrix}
\sigma_f^2 & \rho \sigma_f \sigma_m \\
\rho \sigma_f \sigma_m & \sigma_m^2
\end{bmatrix}\right).
\]
Parameter Choice
Matching the Model to the Data: Exogenous Parameters

- Patience ($\beta = 0.95$)
- Returns to scale ($\alpha = 0.4$)
- Economies of scale in child rearing ($\psi = 1$)
- Annual cost of children ($\phi = €10,000$)
- Male share in child care ($\chi_m = 0.24$)
  - $\rightarrow$ Equals mean share for low fertility countries in GGP
- Birth probabilities $\kappa(i_f, i_m, n)$
Matching the Model to the Data: Endogenous Parameters

- **Means and correlation of fertility preferences:**
  Match agreement shares by number of existing children.

- **Persistence of fertility preferences over time:**
  Match repeated observation of child preferences for people who don’t have a birth in the first wave in Bulgaria, the Czech Republic, and Germany.
Matching the Model to the Data: Endogenous Parameters

- **Key parameter**: Gender-specific densities $d_f$ and $d_m$.
- Determine how strongly preferences react to $\chi_g$.
- Exploit variation across low-fertility countries.
- Vary $\chi_m$ from 0.22 to 0.27, and match regression of male on female intentions across countries.
- Implies higher density for women.
### Estimated Child Preferences

<table>
<thead>
<tr>
<th>Description</th>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean women first child</td>
<td>$\mu_{f,1}$</td>
<td>200,387</td>
</tr>
<tr>
<td>Mean women second child</td>
<td>$\mu_{f,2}$</td>
<td>97,436</td>
</tr>
<tr>
<td>Mean women third child</td>
<td>$\mu_{f,3}$</td>
<td>42,069</td>
</tr>
<tr>
<td>Std. dev. women</td>
<td>$\sigma_f$</td>
<td>73,705</td>
</tr>
<tr>
<td>Mean men first child</td>
<td>$\mu_{m,1}$</td>
<td>224,732</td>
</tr>
<tr>
<td>Mean men second child</td>
<td>$\mu_{m,2}$</td>
<td>-117,530</td>
</tr>
<tr>
<td>Mean men third child</td>
<td>$\mu_{m,3}$</td>
<td>-410,880</td>
</tr>
<tr>
<td>Std. dev. men</td>
<td>$\sigma_m$</td>
<td>347,746</td>
</tr>
<tr>
<td>Correlation</td>
<td>$\rho$</td>
<td>0.7890</td>
</tr>
<tr>
<td>Persistence</td>
<td>$\pi$</td>
<td>0.2299</td>
</tr>
</tbody>
</table>
Model Fit
## Fit for Fertility Intentions

<table>
<thead>
<tr>
<th></th>
<th>n = 0</th>
<th>n = 1</th>
<th>n = 2</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>He no</td>
<td>He yes</td>
<td>He no</td>
</tr>
<tr>
<td>Data</td>
<td>She no</td>
<td>50.74</td>
<td>7.40</td>
</tr>
<tr>
<td></td>
<td>She yes</td>
<td>5.64</td>
<td>36.22</td>
</tr>
<tr>
<td>Model</td>
<td>She no</td>
<td>49.11</td>
<td>5.18</td>
</tr>
<tr>
<td></td>
<td>She yes</td>
<td>5.87</td>
<td>39.83</td>
</tr>
</tbody>
</table>
Fit for Persistence over Time

<table>
<thead>
<tr>
<th></th>
<th>Data</th>
<th></th>
<th>Model</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>He no</td>
<td>He yes</td>
<td>He no</td>
<td>He yes</td>
</tr>
<tr>
<td>She no</td>
<td>85.20</td>
<td>22.56</td>
<td>62.63</td>
<td>26.47</td>
</tr>
<tr>
<td>She yes</td>
<td>24.30</td>
<td>59.08</td>
<td>25.15</td>
<td>52.41</td>
</tr>
</tbody>
</table>
Fit for Variation in Agreement Shares: One Child

Couples with one child

Data

Model
Fit for Variation in Agreement Shares: Two Children

Couples with two or more children

Data

Model
## Predictions for Demographic Variables

<table>
<thead>
<tr>
<th>Prediction</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total fertility rate</td>
<td>1.4726</td>
</tr>
<tr>
<td>Fraction of couples without children</td>
<td>0.1546</td>
</tr>
<tr>
<td>Fraction of couples with one child</td>
<td>0.4059</td>
</tr>
<tr>
<td>Fraction of couples with two children</td>
<td>0.3905</td>
</tr>
<tr>
<td>Fraction of couples with more than two children</td>
<td>0.0490</td>
</tr>
</tbody>
</table>
Policy Experiments
Policy Experiment

- Increase fertility by either:
  - Subsidizing cost born by mothers.
  - Subsidizing cost born by fathers.
- Consider subsidy for all children or higher-order children.
- Compare cost of raising fertility a given amount.
Cost of Subsidy per Child

- **All children**
  - 0
  - 2500
  - 5000
  - 7500
  - 10000
  - 12500
  - 15000
  - 17500
  - 20000

- **From 2nd child**
  - 2500
  - 5000
  - 7500
  - 10000
  - 12500
  - 15000
  - 17500
  - 20000

- **From 3rd child**
  - 2500
  - 5000
  - 7500
  - 10000
  - 12500
  - 15000
  - 17500
  - 20000

Legend:
- **to women**
- **to men**
Total Cost of Subsidy per Couple

<table>
<thead>
<tr>
<th>Total Cost of Subsidy per Couple</th>
<th>0</th>
<th>25000</th>
<th>50000</th>
<th>75000</th>
<th>100000</th>
<th>125000</th>
<th>150000</th>
</tr>
</thead>
<tbody>
<tr>
<td>all children</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from 2nd child</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>from 3rd child</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- to women
- to men
Why Does Targeting Matter?

- Targeting towards higher order children:
  - Only 20 percent of population actually childless.
  - Targeting higher order children concentrates subsidy on marginal births.

- Targeting towards women:
  - Women have more power over fertility decision.
  - Women tend to be blockers of fertility decision.
  - Women more responsive to changes in cost of children.
Summing Up
Conclusions

- Agreement, and lack thereof, is crucial determinant of fertility.
- Bargaining model with limited commitment matches data well.
- Appropriate targeting of pro-fertility policies hugely important.