Bargaining over Babies

Theory, Evidence, and Policy Implications

Matthias Doepke and Fabian Kindermann

How Babies are Made

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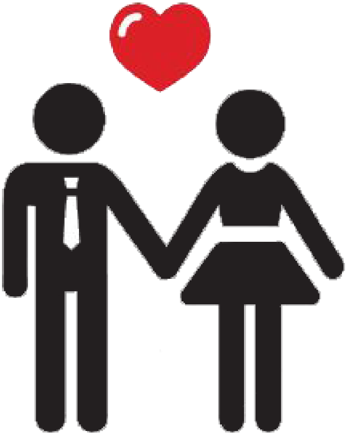


How Babies are Made

How Babies are Made

The Question

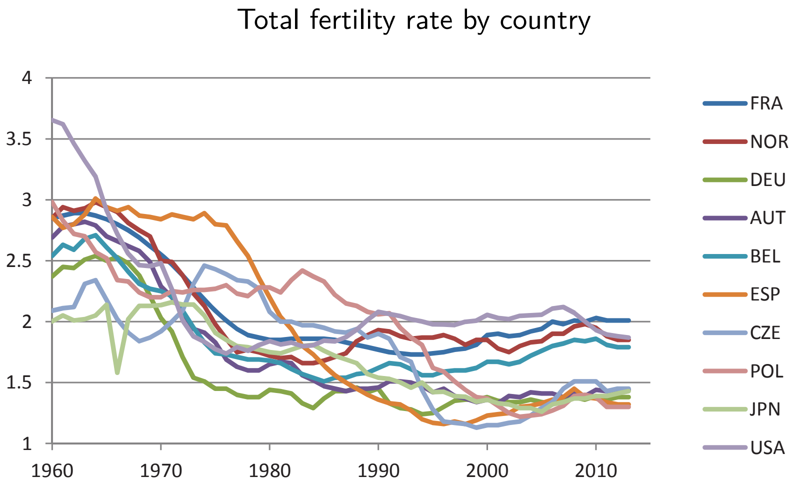
- It takes two people to make a baby
- Agreement should be essential for fertility
- Mother and father have to prefer baby over status quo
- Question:

  Is agreement important for understanding fertility choice?

The Plan

- Document importance of agreement using new data on
  - fertility preferences and
  - fertility outcomes
- Build a model that is consistent with the data
- Match the model to the data
- Derive stark policy implications for low-fertility countries

The Western World's Fertility Crisis



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

Generations and Gender Programme (GGP)

- Longitudinal Survey of 18-79 year olds in 19 countries
- Wave I (2003-2009):
  - *Do You Yourself Want Another Baby Now?*
  - *Does Your Partner Want Another Baby Now?*
- Wave II (2007-ongoing): *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)

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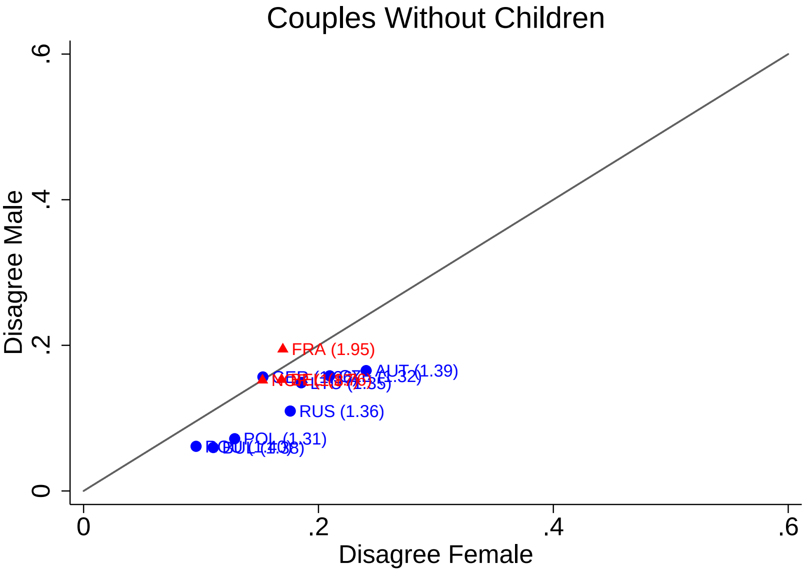
  - He wants a baby, she does not (SHE NO/HE YES)
  - AGREE + SHE YES/HE NO + SHE NO/HE YES
    $\rightarrow$ POTENTIALS

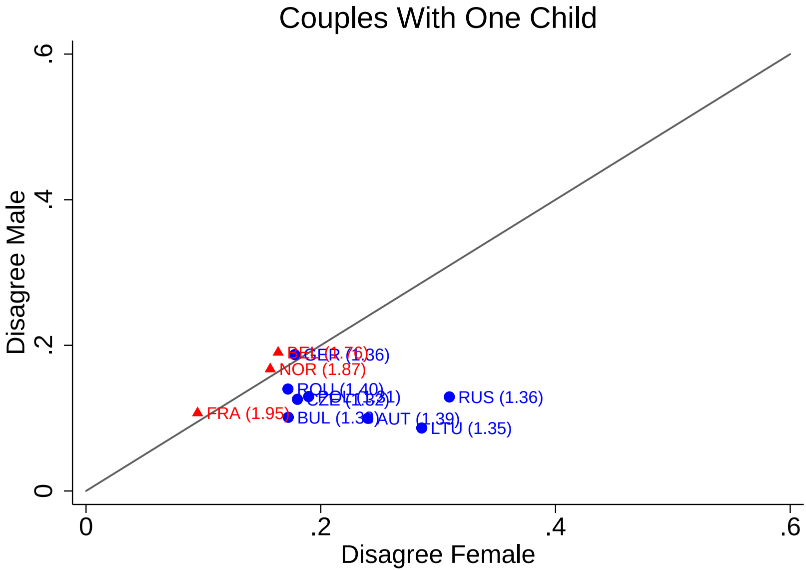
Fact 1:

There is a lot of disagreement within couples

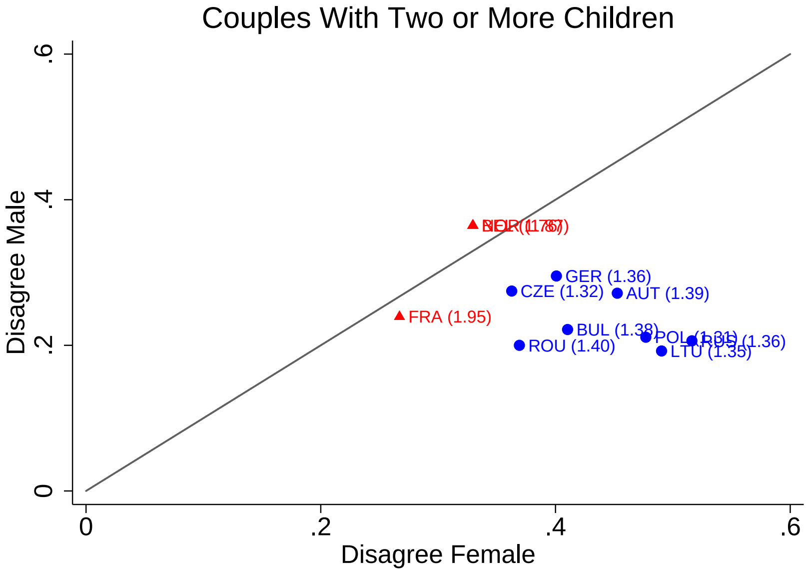
GGP Data on Fertility Intentions: No Children



GGP Data on Fertility Intentions: One Child



GGP Data on Fertility Intentions: Two Children



Fact 2:

Agreement matters for fertility

GGP Data on Fertility Intentions and Outcomes

- Fertility outcomes available for Austria, Bulgaria, Czech Republic, France, Germany, Lithuania, and Russia
- Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE
- Result for couples with no children:

	Coefficient	Std. Error
SHE YES/HE NO		
SHE NO/HE YES		
AGREE		

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	Coefficient	Std. Error
SHE YES/HE NO	0.02	(0.04)
SHE NO/HE YES	0.05	(0.03)
AGREE	0.24***	(0.02)

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- Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE
- Result for couples with one child:

	Coefficient	Std. Error
SHE YES/HE NO	0.13***	(0.04)
SHE NO/HE YES	−0.04*	(0.02)
AGREE	0.27***	(0.02)

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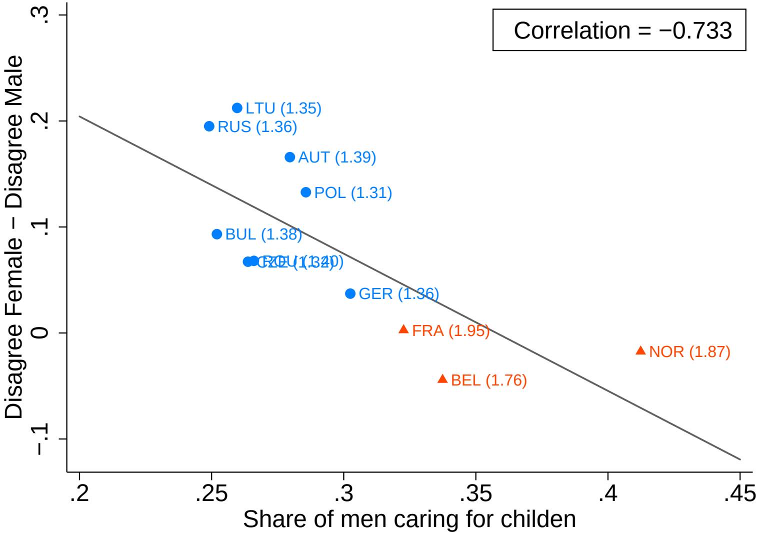
- Fertility outcomes available for Austria, Bulgaria, Czech Republic, France, Germany, Lithuania, and Russia
- Regress birth outcome on constant, SHE YES/HE NO, SHE NO/HE YES, and AGREE
- Result for couples with two children:

	Coefficient	Std. Error
SHE YES/HE NO	0.06***	(0.02)
SHE NO/HE YES	0.03*	(0.02)
AGREE	0.30***	(0.03)

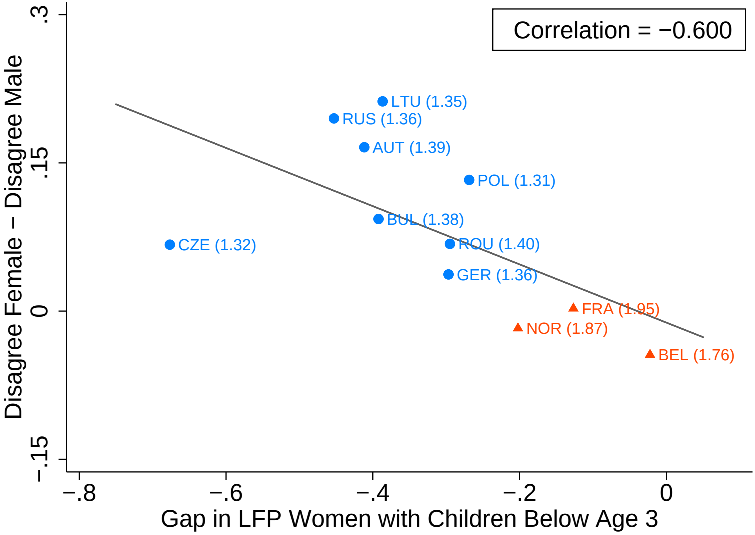
Fact 3:

The extent of disagreement is related to the distribution of child care

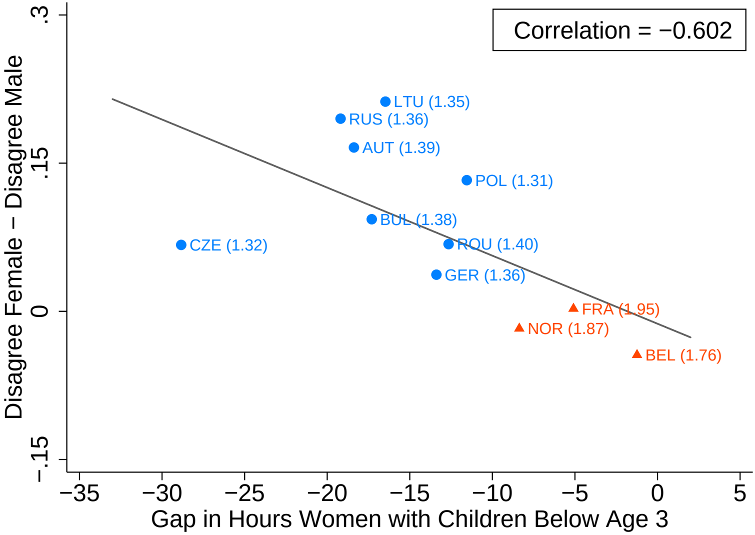
GGP Data on Fertility Intentions and Childcare



GGP Data on Fertility Intentions and Labor Supply



GGP Data on Fertility Intentions and Hours



A Bargaining Model of Fertility Choice

Family Setup

- Couple consists of wife f and husband m
- Both spouses earn wages w_f and w_m
- Decide about
  - consumption allocation c_f and c_m and
  - whether to have a child, $b \in \{0,1\}$
- Child creates costs ϕ

Family Setup

- Preferences of spouse $g \in \{f, m\}$ are:

$$u_g(c_g, b) = c_g + b \cdot v_g,$$

- Cooperative family budget constraint:

$$c_f + c_m = (1 + \alpha) \cdot \left(w_f + w_m - b \cdot \phi\right)$$

- Nash bargaining with equal weights

Optimization Problem

Mechanics of Nash-Bargaining with Equal Weights

- Total amount of available utility:

$$U = u_f(c_f, b) + u_m(c_m, b)$$

Mechanics of Nash-Bargaining with Equal Weights

- Total amount of available utility:

$$
\begin{aligned}
U &= u_f(c_f, b) + u_m(c_m, b) \\
&= (1+\alpha) \cdot \left(w_f + w_m - b \cdot \phi\right) + b \cdot \left(v_f + v_m\right)
\end{aligned}
$$

Mechanics of Nash-Bargaining with Equal Weights

- Total amount of available utility:

$$U = u_f(c_f, b) + u_m(c_m, b)$$

$$= (1+\alpha) \cdot \left(w_f + w_m - b \cdot \phi\right) + b \cdot \left(v_f + v_m\right)$$

- Outside Options: $\bar{u}_f$ and $\bar{u}_m$

  $\rightarrow$ non-cooperation (Lundberg/Pollak 1993)

- Bargaining outcome:

$$U_g = \bar{u}_g + \frac{1}{2} \cdot \left[U - \bar{u}_f - \bar{u}_m\right]$$

Case 1: Commitment

- General time line: first the kid, then consumption
- Simultaneous decision about fertility and consumption
- Can fully commit to consumption plan after kid was born
- Outside options: Work and have no kid

$$\bar{u}_f = w_f \quad \text{and} \quad \bar{u}_m = w_m$$

Outcome Under Commitment

- The bargaining solution is:

$$\begin{aligned} U_f &= w_f &+ \frac{\alpha}{2}\left(w_f + w_m - \phi b\right) &+ \frac{b}{2}\left(v_f + v_m - \phi\right) \\ U_m &= w_m &+ \underbrace{\frac{\alpha}{2}\left(w_f + w_m - \phi b\right)}_{\text{Surplus from Consumption}} &+ \underbrace{\frac{b}{2}\left(v_f + v_m - \phi\right)}_{\text{Surplus from Fertility}} \end{aligned}$$

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- Couple will have a child if:

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

- Couple agrees on fertility and choice is efficient

Case 2: No Commitment

- Two-stage decision without commitment:
  1. Decide on fertility
  2. Ex-post bargaining over consumption given fertility choice
- Solve backwards
- Outside options in second stage (as function of b):

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

with fixed cost shares $\chi_f + \chi_m = 1$

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:

$$U_f(1) = w_f + v_f - \chi_f \phi + \frac{\alpha}{2}(w_f + w_m - \phi),$$
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- Spouses still share consumption surplus equally, but partners are not compensated for reduction in outside option

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- 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:

$$b = \begin{cases} 1 & \text{if } U_f(1) \geq U_f(0) \text{ and } U_m(1) \geq U_m(0) \\ 0 & \text{otherwise} \end{cases}$$

- Wife agrees to birth if:

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

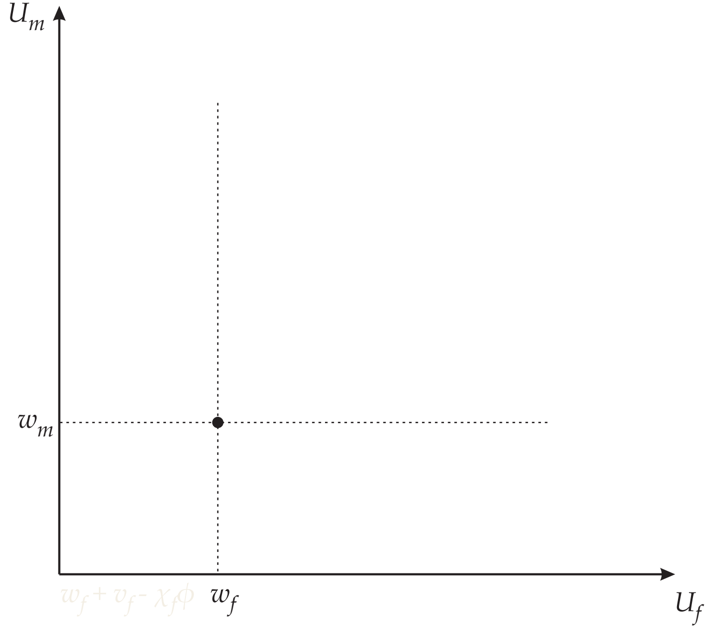
- Husband agrees to birth if:

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

- Disagreement is possible and outcome may be inefficient

Graphical Representation

Child Bearing Decisions With and Without Commitment



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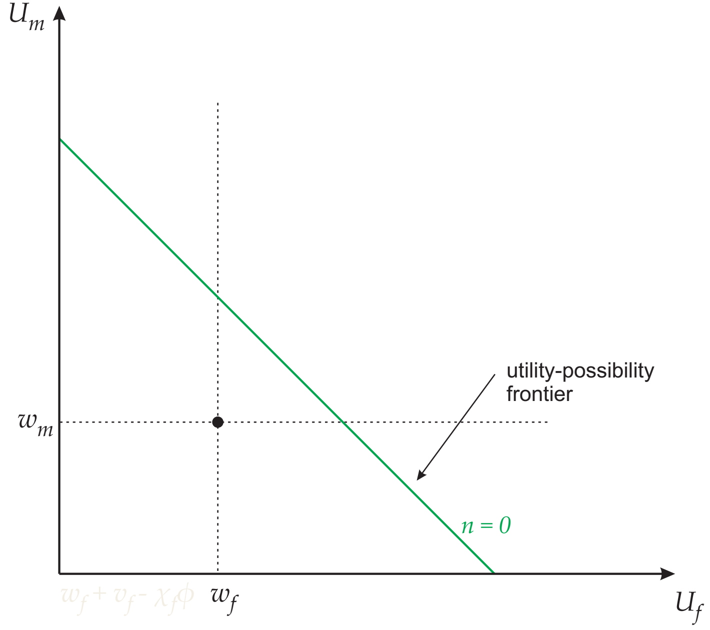

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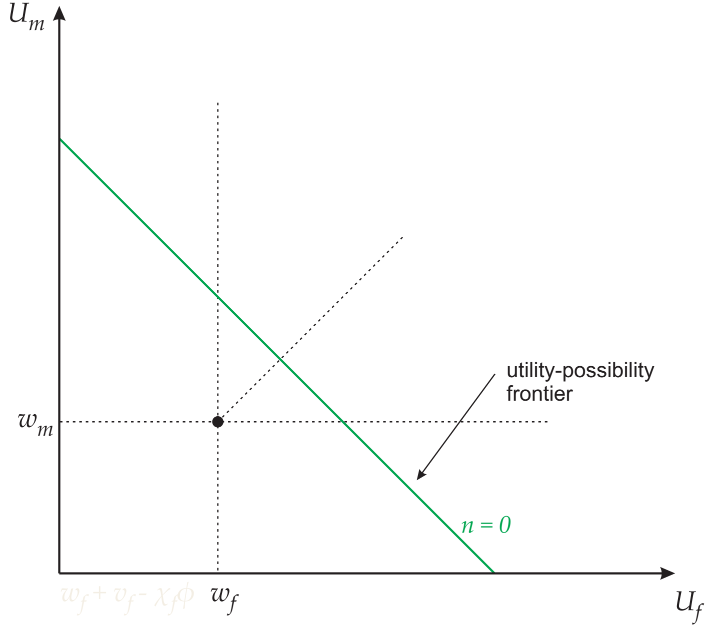

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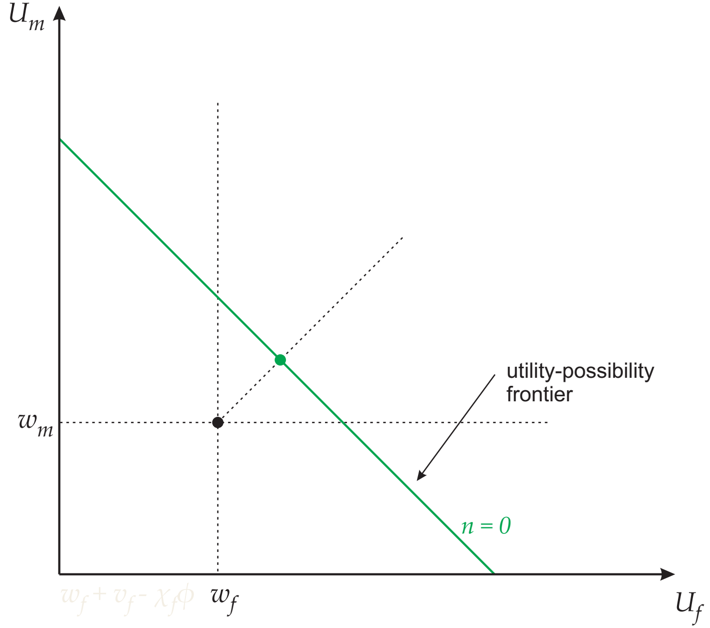

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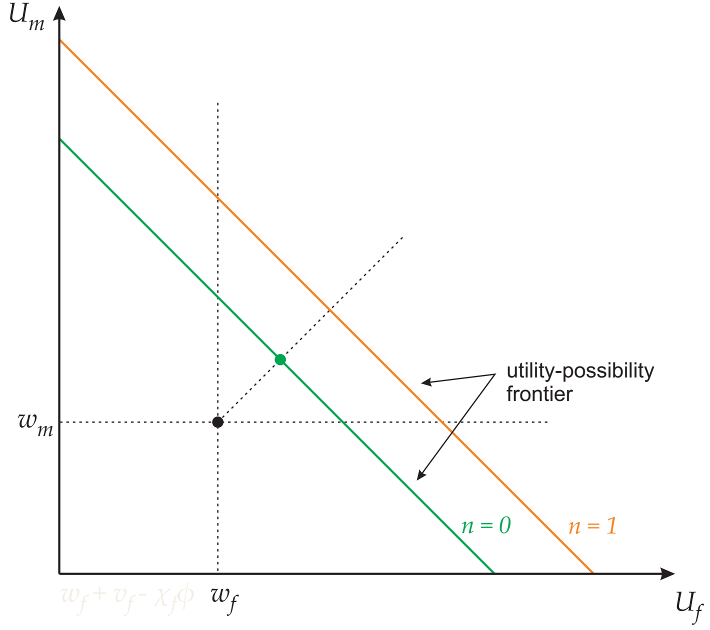

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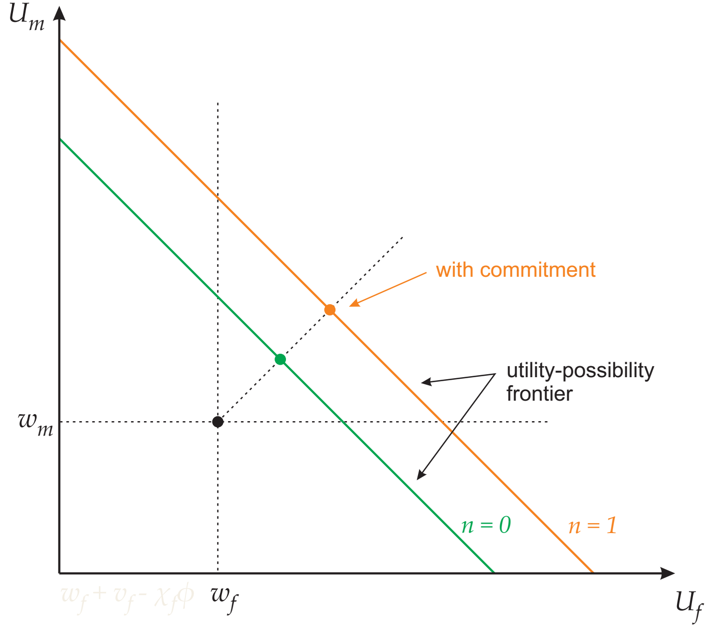

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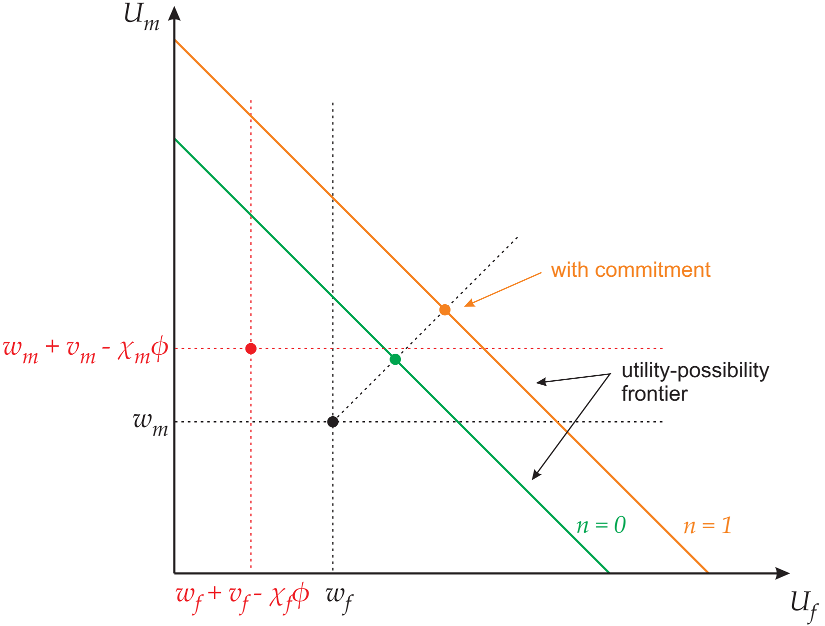

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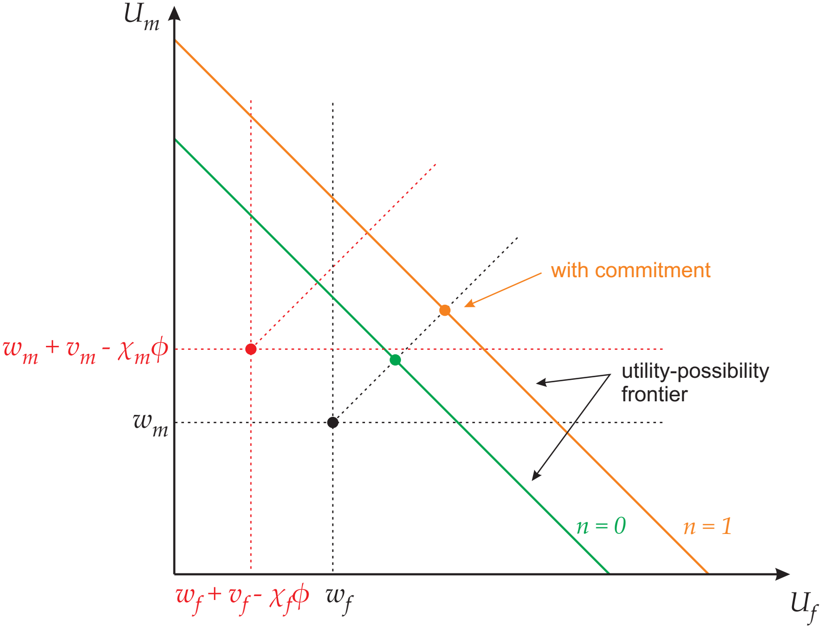

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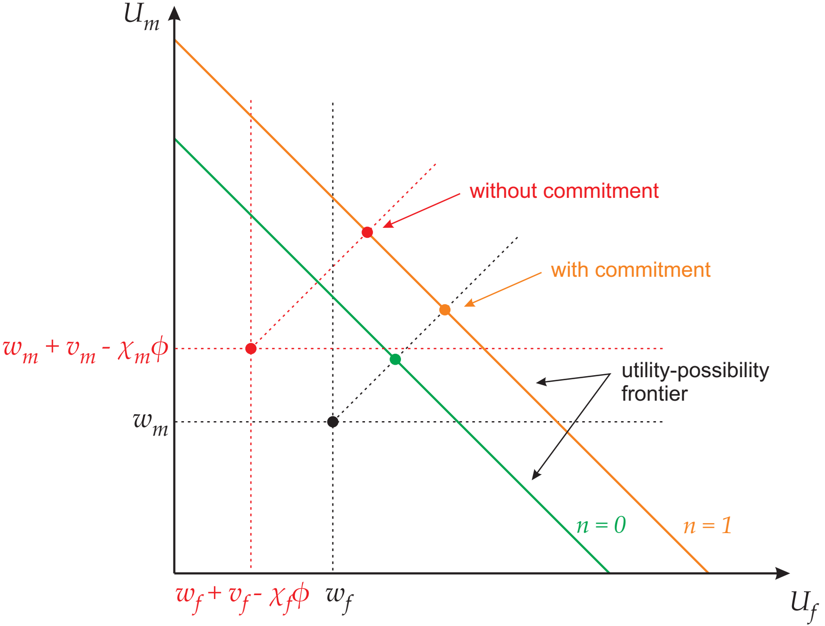

Towards a Quantitative Model

- Consider impact of targeted subsidy on fertility when there are many couples with a distribution of preferences
  - Impact depends on density of preference distribution
  - Impact depends on which partner is pivotal for decision
- Consider impact of child subsidy on timing of births versus total number of births
  - Impact depends on persistence of disagreement
- Additional features of quantitative model
  - Female labor supply decision
  - Partial commitment

A Quantitative Model

The Quantitative Model

- Model period is three years
- Couples fertile until age 43
- Utility from children is stochastic and evolves over time
- Probability of birth conditional on intentions, but exogenous
- Two types of female education $e \in \{hs, co\}$
- Additional wage heterogeneity $w_f \sim \log N(\mu_{w,e}, \sigma_w^2)$

Cost of Having Children

- Cost of children linear in the number of kids n
- Three types of costs:

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  3. Child care cost: $\phi_y \rightarrow$ depends on female labor supply $1-h$
- Child care cost only for children age 3 and below
- Total material cost of having children

$$k(h) = \phi_c + \underbrace{h \cdot w_f + (1-h) \cdot w_y}_{=\phi_y}$$

Preferences

- $n \leq 3$ is total number of existing children
- Raise children for $H = 6$ periods (18 years)
- State vector of a couple:

$$\mathcal{S} = (w_f, w_m, v_f, v_m, a_1, a_2, a_3),$$

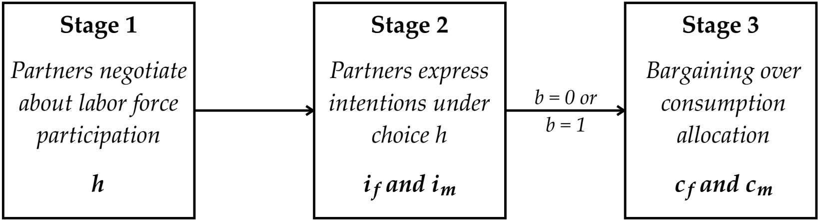
- Utility of spouse g:

$$V_g^t(\mathcal{S}) = E\left[u(c_g, v_g, b) + \beta V_g^{t+1}(\mathcal{S}')\right]$$

with

$$u(c_g, v_g, b) = c_g + b \cdot (v_g - \chi_g \cdot \phi_u)$$

The Within Period Game



Stage 3: Bargaining Game

- Nash bargaining as in static model
- Outside options:

$$\bar{u}_f = (1 - bh)w_f + b \cdot \left[v_f - \chi_f \phi_u - 0.5 \left(\phi_c + (1-h) w_y \right) \right]$$

$$\bar{u}_m = w_m + b \cdot \left[v_m - \chi_m \phi_u - 0.5 \left(\phi_c + (1-h) w_y \right) \right]$$

Stage 2: Fertility Intentions

- Fertility intentions:

$$i_g = I\Big\{E\left[u(c_g, v_g, 1) + \beta V_g^{t+1}(\mathcal{S}')\Big| b = 1\right] - E\left[u(c_g, v_g, 0) + \beta V_g^{t+1}(\mathcal{S}')\Big| b = 0\right] \geq 0\Big\},$$

- Probability of having a child given by function:

$$\kappa_e(i_f, i_m, n)$$

taken directly from GGP data

Stage 1: Female Labor Force Participation

- Efficient choice:

$$h_{\text{eff}} = \begin{cases} 1 & \text{if } w_f < w_y \\ 0 & \text{otherwise} \end{cases}$$

- If under h_{eff} one partner is in favor of child, other not:
  - Partner who is in favor can offer a different $h \in [0, 1]$
  - Make other partner indifferent between having baby or not
  - Not always possible to make such an offer

Dynamic Model Component

- Fertility preferences drawn from uniform distribution
  - gender and education specific means
  - gender specific densities/variances
  - correlation ρ between spouses
- Wages drawn from log-normal distribution with
  - education specific means
  - common variance
- If $b = 0$, retain preferences with probability π
- If $b = 1$, draw new preferences

Parameter Choice

Matching the Model to the Data: Exogenous Parameters

Description	*Parameter*	*Value*	
Time preference rate	β	0.95	
Economies of scale	α	0.40	
Distribution of utility cost	χ_m	0.31	
Monetary cost of children	ϕ_c	€ 5000 p.a.	
Wage of female partner	$\mu_{w,e}$	1.00	1.50
Fraction going to college		0.25	
Birth probabilities	$\kappa_e(i_f, i_m, n)$	from GGP	

Matching the Model to the Data: Endogenous Parameters

1. Means and correlation of fertility preferences + utility cost:
   Match agreement shares by number of existing children
2. Persistence of fertility preferences over time:
   Match repeated observation of intentions for people who don't have a child birth between waves 1 and 2
3. Cost of external child care + variance of wages:
   Labor force participation of women with and without children under age 3

Matching the Model to the Data: Endogenous Parameters

4. Key parameter: Gender-specific densities d_f and d_m
   - Determine how strongly intentions react to χ_g
   - Exploit variation across low-fertility countries
   - Vary χ_m from 0.28 to 0.34; adjust w_y to match predicted LFP of mothers; and match regression of male on female intentions across countries
   - Implies higher density for women

Estimated Parameters

Description	*Parameter*	*Value*	
		High school	*College*
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
Std. dev. 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
Std. dev. men	σ_m	12.72	
Correlation	ρ	0.93	
Persistence	π	0.29	
Child care cost	w_y	0.58	
Participation cost	p_c	0.36	
Std. dev. female wages	$\sigma_{w,e}$	0.89	0.94

Model Fit

1. Fit for Fertility Intentions

		High school					
		$n = 0$		$n = 1$		$n = 2$	
		He no	He yes	He no	He yes	He no	He yes
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					
		$n = 0$		$n = 1$		$n = 2$	
		He no	He yes	He no	He yes	He no	He yes
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

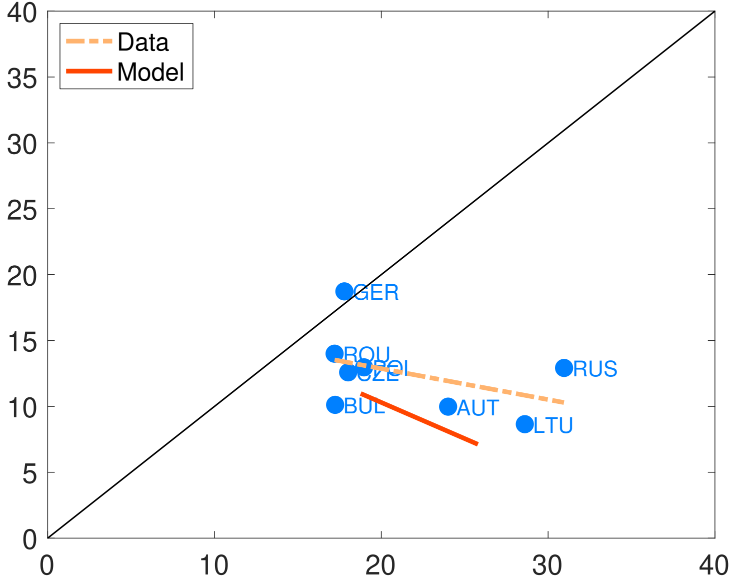
2. Fit for Persistence over Time

	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

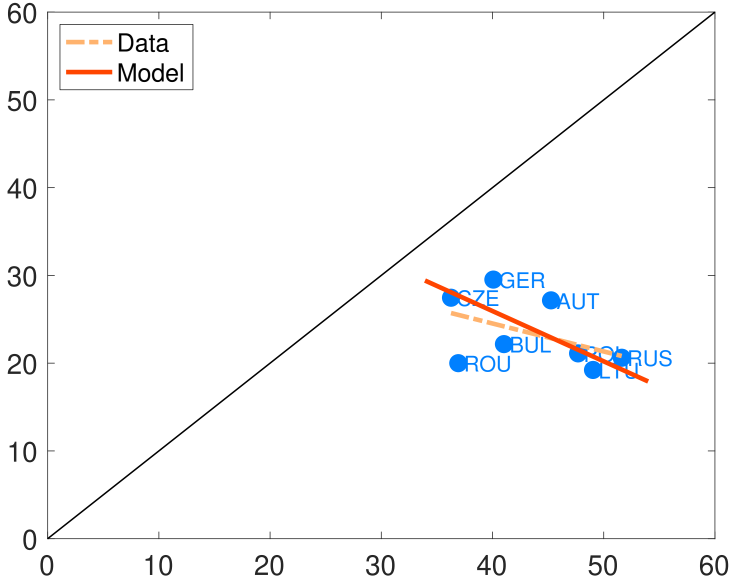
3. Fit for Labor Force Participation

	Data		*Model*	
	Child under 3:		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

4. Fit for Variation in Agreement Shares: One Child



4. Fit for Variation in Agreement Shares: Two Children



Predictions for Demographic Variables

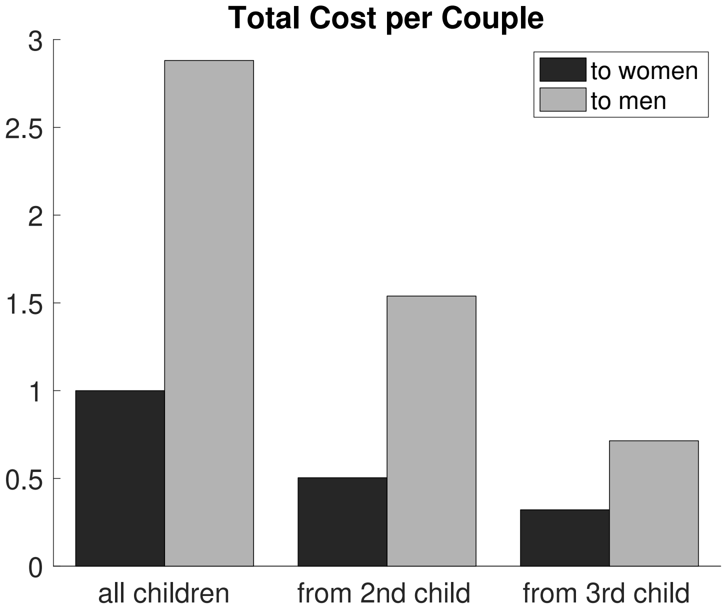
Total fertility rate	1.56
Fraction of couples without children	0.12
Fraction of couples with one child	0.39
Fraction of couples with two children	0.43
Fraction of couples with more than two children	0.06

Policy Experiments

Policy Experiment (Set 1)

- Increase fertility by either:
  - Giving subsidies directly to mothers
  - Giving subsidies directly to fathers
- Consider subsidy for all children or higher-order children
- Compare cost of raising total fertility rate by 0.1

Total Cost of Subsidy



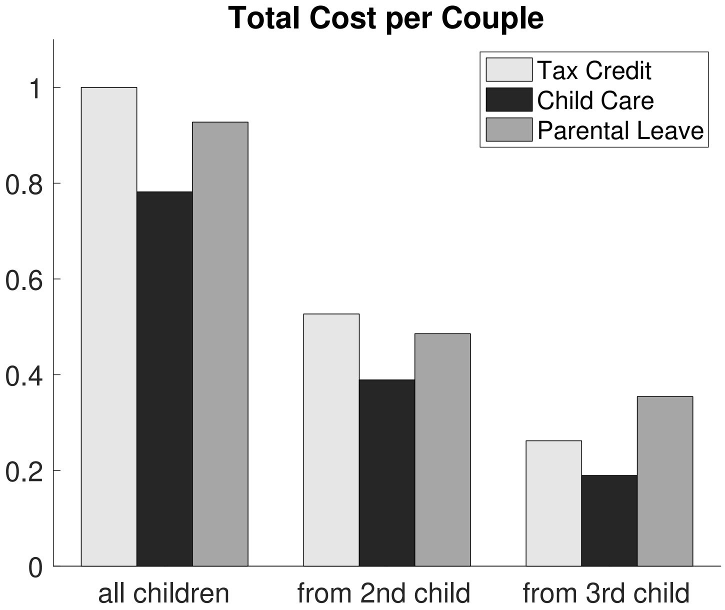
Why Does Targeting Matter?

- Targeting towards higher order children:
  - Only small fraction of population actually childless
  - Targeting higher order children
    $\rightarrow$ 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

Policy Experiment (Set 2)

- Real life policies:
  - Tax credits
  - Child care subsidies
  - Parental leave benefits
- Compare cost of raising total fertility rate by 0.1

Total Cost of Real Life Policies



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

Optimization Problem under Commitment

- The couple solves:

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

subject to:

$$c_f + c_m = (1+\alpha)\left(w_f + w_m - \phi_u b\right)$$

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