# Early Child Care and Child Development: For Whom it Works and Why

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How does early child care affect child development?

• Understanding this issue is important ...

- Child care essential to combine market work and family life
- Care provided by the mother considered superior ("Raven" mother)
- Key early intervention (that might have large payoffs, Heckman and Masterov 2007)
- ... but its empirical assessment is problematic

## What we do and why

- Study the role of child care in Germany
- Tremendous regional variation in child care offer rates
  - Former East: universal child care since late 1970s
  - Former West: very little child care
  - Now: Strong intra regional variation in care
- Comprehensive data
  - Detailed information on who provides care
  - Several dimensions of child development
  - Child rearing activities
- Substitution
  - Care provided by mother to care provided by center

# Main results

- Estimate marginal treatment effects
- Main results
  - Heterogeneity
  - Effects tend to be stronger for
    - Children with lower chances to be in child-care
    - Children with low birthweight, worse socio-economic background
- Policy simulations
  - Expansion from zero to actual level: no or negative effects
  - Expansion from actual to full level: mostly positive effects
- Alternative estimators
  - IV as an interesting summary of effects on children who will enter child-care

# Existing literature

- Maternal employment (Ruhm 2004, etc.)
  - Negative effects, especially if mother highly educated
- Parental leave
  - Short-run: Baker and Milligan (2010): zero
  - Long-run: Carneiro et al. (2010): positive
- Extensions of child care
  - Short-run: Baker et al. (2008): negative; Hidalgo and Urzua (2012): positive
  - Long-run: Havnes and Mogstad (forthcoming): positive

Conflicting evidence

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Conflicting evidence

# Outline

## Background

### Data

- Measuring Child Development
- Descriptive Analysis

### Conceptual Framework

### Pesults

- Propensity Score
- Marginal Treatment Effects
- How to aggregate?

### Conclusions

#### Background

# Family leave

- Maternity leave
  - 14 weeks (6 pre / 8 post birth)
  - full pay
- Parental leave
  - job protection 36 months
  - flat rate benefit for 12 or 24 months, means tested, not taxed, no reduction in social assistance
- Both schemes are identical in East and West

# Early Care in Former West Germany

- Quality
  - ullet Highly regulated by state government o within-state analysis
  - high quality care (trained staff, low child / staff ratio)
- Price
  - Subsidized
  - Parents pay fees that vary by income and municipality
- Expansion
  - Local decision
  - Non-profit organizations

#### Background

# Quality

	Fulltime	Child-Staff	Pedagogical
	slots	Ratio*	Degree
Baden Wuerttemberg	26.8	3.63	86.9
Bavaria	21.4	3.93	89.6
Bremen	35.7	3.17	79.8
Hamburg	29.4	5.09	93.4
Hesse	42.3	4.23	86.7
Lower Saxony	79.0	3.81	95.2
North- Rhine Westphalia	-	2.76	92.9
Rhineland-Palatinate	57.1	3.32	91.6
Saarland	48.3	3.24	94.9
Schleswig Holstein	46.9	3.90	94.0

\* Child- Staff ratio is currently only available for 2010.

Source: Zahlenspiegel (2005), except for Child-Staff ratio.

# Child Care Offer Rate, 2002



This map shows German counties shaded according to the number of slots available to children aged 0 to 3 years in

2002.

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# Data Source

### • German Socio Economic Panel – Mother Child Questionnaire

- children aged 26-47 months
- information on childcare and child development measures
- link to SOEP provides information on family background

# Child development measures

- Vineland Adaptive Behaviors Scale (VABS, Sparrow et al. 1980)
- Four key skill dimensions
  - Language: Child understands brief instructions, etc.
  - Social: Child calls familiar people by name, etc.
  - Daily: Child eats with spoon without making a mess, etc.
  - Motor: Child walks forwards down the stairs, etc.
- Mother self-reports
  - informed, natural environment
  - biases, but these measures are quite objective

# Child Development Measures (1)

	All	Center	No	Diff	z-Val
A. Language Skills					
Understands	.972	.980	.968	.011	(.979)
ShortPhrase	.934	.940	.932	.008	(.458)
ShortMsg	.890	.933	.867	.066	(2.972)
LongPhrase	.724	.803	.683	.120	(3.777)
ListenStory	.680	.756	.641	.115	(3.471)
B. Social Skills					
UsesNames	.985	.98	.988	008	(901)
PlaysKids	.877	.926	.851	.075	(3.227)
TalksEmotions	.771	.833	.739	.094	(3.14)
HasFriends	.731	.819	.685	.135	(4.293)
RolePlay	.683	.773	.636	.137	(4 155)
Children	870	299	571		

# Child Development Measures (2)

	All	Center	No	Diff	z-Val
C. Daily Skills					
EatsSpoon	.611	.662	.585	.077	(2.225)
BrushesTeeth	.437	.421	.445	023	(661)
CleansNose	.424	.438	.417	.021	(.604)
Toilet No2	.391	.468	.35	.118	(3.405)
DressesAlone	.284	.341	.254	.087	(2.717)
D. Motor Skills					
OpensDoor	.960	.977	.951	.026	(1.828)
WalksStairs	.930	.943	.923	.02	(1.108)
Climbs	.779	.819	.758	.061	(2.066)
UsesScissors	.594	.706	.536	.170	(4.905)
Paints	.331	.331	.331	.000	(.003)
Children	870	299	571		

# Child Care, Quality, and Employment

	All	Center	No	Diff	z-Val
A. Child care (hrs per week)					
Center	6.377	18.555	0.000	18.555	(37.882)
Mother	42.750	39.000	44.708	-5.708	(-4.845)
Family	19.218	18.435	19.631	-1.196	(857)
Informal	1.527	.452	2.093	-1.642	(-4.013)
B. Quality of motherly care					. ,
Cognitive activities	.518	.554	.499	.055	(2.385)
Motor activities	.366	.336	.382	046	(-1.911)
Passive activities	.201	.166	.220	054	(-2.515)
C. Labor supply and income					. ,
Work (hrs per week)	9.602	12.511	8.077	4.434	(4.557)
Gross income (EUR/month)	602.818	865.644	466.874	398.771	(4.715)
Net income (EUR/month)	3025.504	3276.758	2896.62	380.138	(3.156)
Children	870	299	571		

#### Data

#### Descriptive Analysis

# Selection Into Care

	All	Center	No	Diff	z-Val
A. Child Characteristics					
Child's age	2.776	2.883	2.720	.163	(7.195)
Low Birth Weight	.074	.060	.081	020	(-1.092)
Воу	.506	.515	.501	.014	(.397)
B. Mom's Characteristics					
Mom's age	30.997	31.819	30.566	1.254	(3.336)
Mom is married	.724	.696	.739	043	(-1.360)
Nr of siblings	.989	.987	.989	003	(039)
High educated mom	.378	.492	.319	.173	(5.062)
High household net income	.569	.659	.522	.137	(3.904)
Children	870	299	571		

## Conceptual Framework

• Potential outcomes  $Y_1^s$  with care,  $Y_0^s$  without care

$$\begin{array}{rcl} Y_1^s &=& X\beta_1^s + U_1^s \\ Y_0^s &=& X\beta_0^s + U_0^s \\ Y^s &=& Y_0^s + D(Y_1^s - Y_0^s) \end{array}$$

Selection into care

$$D = I(X\pi_X + Z\pi_Z - V > 0) = I(F_V(X\pi_X + Z\pi_Z) > F_V(V)) = I(P(W) > U_D)$$
(1)

where Z is child care offer rate, W = (X, Z), P(W) is the propensity score, and  $U_D$  is a uniform random variable.

# Identification

 Marginal treatment effect: just indifferent between attending child care and not attending child care, i.e.

$$E(Y_1^s - Y_0^s | X = x, U_D = P(w)) = x(\beta_1^s - \beta_0^s) + E(U_1^s - U_0^s | X = x, U_D = P(w))$$

• Key assumption to identify this parameter

$$Z|X \perp \!\!\perp U_1, U_0, U_D \tag{2}$$

# Recovering MTE

• Model for observed  $Y^s$ 

$$Y^{s} = X\beta_{0}^{s} + DX[\beta_{1}^{s} - \beta_{0}^{s}] + U_{0}^{s} + D(U_{1}^{s} - U_{0}^{s})$$
(3)

### Reduced form

$$E(Y^{s}|X = x, P(W) = p) = x\beta_{0}^{s} + px[\beta_{1}^{s} - \beta_{0}^{s}] + K_{x}^{s}(p)$$
(4)

• MTE is the partial derivative of (4) with respect to the propensity score.

$$E(Y_1^s - Y_0^s | X = x, U_D = p) = \frac{\partial E(Y^s | X = x, P(Z) = p)}{\partial p}$$
$$= x[\beta_1^s - \beta_0^s] + \frac{\partial K_x^s(p)}{\partial p}$$

## Estimation

- Equation (4) can not be estimated in small samples
- Additional assumption: independence

$$Z, X \perp U_1, U_0, U_D \tag{5}$$

• Key equation simplifies to

$$E(Y^s|X=x, P(W)=p) = x\beta_0^s + px[\beta_1^s - \beta_0^s] + K^s(p) \qquad (6)$$

• Assumption clearly strong, assess it with a sensitivity analysis

### Formal Care Attendance vs Offer Rate



Notes: This graph shows formal attendance vs the county level offer rate both expressed as deviation from state mean. The graph is produced using kernel regression (Epanechnikov kernel, bandwidth of 0.2, 100 grid points).

Source: Own calculations, based on SOEP data.

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Results	Propenschild Care Attendance
Slots at Birth	1.712***
	(0.472)
Age of child in years	0.354***
	(0.050)
Child was low birth weight child	-0.057
5	(0.057)
Child is a boy	-0.006
	(0.032)
Age of mom at child birth	0.004
0	(0.003)
Mom is married	-0.041
	(0.038)
Number of kids in the household	-0.016
	(0.016)
High education	0.137***
5	(0.037)
High income	0.092***
8	(0.031)
Urban area	0.027
	(0.033)
Unemployment rate at childbirth	0.004
	(0.005)
Female employment rate at child	birth 0.000
	(0.001)
Fertility rate at childbirth	0.174
	(0.199)
GDP per capita at childbirth	-0.001
	(0.002)
Net migration at childbirth	-0.002
8	(0.005)
F-test Individual variables	0.000
F-test Regional variables	0.797
F-test State dummies	0.000
R-squared	0.150
Children	870

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# Conditional Independence?

	t-statistic
Birth height	-1.026
Birth head circumferences	1.246
Child rearing makes happy	324
Motherhood is satisfying	872
Tenderness is important	662
Often Exhausted	.100
New Tasks Difficult	1.04
Suffer from Limitation	779
Risk aversion	.009
Patience	940

Notes: This table shows estimates of the partial correlation between the supply of child care slots and various measures of child and mother characteristics that do NOT figure in the list of control variables.

Source: Own calculations, based on SOEP data.

	Understands	ShortPhrase	Short Msg	LongPhrase	ListenStory
pZ × age child	-0.534*	0.510	-0.426	-0.768	0.471
	(0.291)	(0.403)	(0.376)	(0.510)	(0.622)
pZ × ∣owBirthWeight	0.255	0.142	0.492*	0.406*	0.071
	(0.164)	(0.242)	(0.268)	(0.238)	(0.341)
рZх Boy	0.048	0.136	0.293**	0.263*	0.072
	(0.072)	(0.108)	(0.113)	(0.148)	(0.170)
pZ × age mother	0.001	-0.022 <b>*</b>	-0.024 <sup>*</sup>	-0.040**	`0.000´
	(0.007)	(0.013)	(0.013)	(0.016)	(0.022)
pZ × married	0.123*	<b>`</b> 0.070 <sup>´</sup>	0.151	0.058	-0.274
	(0.066)	(0.152)	(0.125)	(0.195)	(0.217)
pZ × nrkids	0.030	0.023	-0.042	0.016	0.011
	(0.034)	(0.049)	(0.085)	(0.096)	(0.095)
pZ×high Educ	-`0.272* <sup>*</sup> *	-0.203 <sup>´</sup>	0.012	0.021	0.394
	(0.127)	(0.196)	(0.194)	(0.291)	(0.332)
pZ×high ∣nc	0.095	0.036	-0.251	-0.024	0.480
	(0.098)	(0.156)	(0.210)	(0.308)	(0.365)
Het unobs.	0.109	0.912	0.449	0.810	0.216
Het. Individual	0.543	0.000	0.000	0.076	0.721
Het Regional	0.026	0.175	0.038	0.292	0.112
Het. States	0.109	0.273	0.420	0.004	0.032
R-squared	0.065	0.114	0.080	0.106	0.034
Children	870	870	870	870	870

Notes: This table presents heterogeneity of the treatment effects with respect to observed characteristics for Language Skills.

Source: SOEP, Own Calculations.

Re	sults Marginal	Treatment E	ffects	
	Language	Social	Daily	Motor
A. Child's characteristics	-			
Age child	-	-		
Low birth weight	+	+		
Boy	+	+		
B. Mother's characteristics				
Age mother	-	-		
Married	+			+
Nr siblings		+	+	
High Education	-		-	
High Income			-	
Het. Unobserved	0/5	0/5	1/5	0/5
Het Individual	3/5	2/5	2/5	3/5
Het Regional	2/5	0/5	2/5	0/5
Het. State	2/5	4/5	1/5	1/5

Notes: This table summarizes the results of the reduced form estimates for language, social, daily and motor skills. A negative sign indicates that the respective subgroup (in terms of child, mother or family characteristics) exhibits significantly lower returns in at least one measure in the respective skill dimension, a positive sign works analogue but indicates higher returns in the respective subgroup. The rows referring to heterogeneity with respect to individual features, regional features or states, indicate in how many measures out of the five measures in each skill dimension the hypothesis test of joint significance of the respective interaction terms could not be rejected. Source: SOEP, Own Calculations.

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## MTE and Unobservables: Understands



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# MTE and Unobservables: Language Skills



### MTE and Unobservables: Social Skills



#### Results How to aggregate?

# Linear IV weights



Notes: This graph reports the weights implicit in the average treatment effect on the treated, h\_ATET, and those implicit in linear IV, h\_IV.

Source: SOEP, Own calculations

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## **IV** Estimates

A. Language Skills						
	Un derst an ds	ShortPhrase	Sh ort M sg	LongPhrase	List en St or y	
In Child Care	0.002	-0.032*	0.037	0.037	0.076**	
	(0.009)	(0.019)	(0.023)	(0.031)	(0.032)	
Chi2						
Children	870	870	870	870	870	
		B. Soc	ial Skills			
	UsesNames	PlaysKids	TalksEmotions	HasFrien ds	RolePlay	
In Child Care	-0.010	0.058**	0.068**	0.117***	0.075**	
	(0.012)	(0.023)	(0.031)	(0.032)	(0.034)	
Chi2	. ,		. ,	. ,		
Children	870	870	870	870	870	
		C. Dai	ly Skills			
	EatsSpoon	BrushesTeeth	CleansNose	Toil et No2	DressesAlone	
In Child Care	0.019	-0.057	-0.022	0.043	0.044	
	(0.033)	(0.041)	(0.039)	(0.035)	(0.031)	
Chi2						
Children	870	870	870	870	870	
		D. Moi	tor Skills			
	OpensDoor	WalksStairs	Climbs	UsesScissors	Paints	
In Child Care	0.013	-0.002	0.049	0.101***	-0.010	
	(0.015)	(0.018)	(0.031)	(0.038)	(0.035)	
Chi2						
Children	870	870	870	870	870	

Notes: Table reports the average effect of formal care on children with intermediate entry barriers into child care.

Source: SOEP, Own Calculations

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### Why does Child Care Affect Child Development?

	A. Child Care (	(hours per week)		
	Center	Mother	Family	Informal
Child Care	26.455***	-30.000***	5.787	-3.909*
	(4.654)	(10.559)	(11.789)	(2.246)
Chi-Squared	1169.167	132.800	87.054	84.291
Children	870	860	845	867
	B. Things Mom	does with Child		
	CognitiveAct	M ot or Act	PassiveAct	
Child Care	0.344*	0.259	-0.368*	
	(0.195)	(0.211)	(0.209)	
Chi-Squared	156.049	69.318	38.588	
Children	870	870	870	
	C. Work and In	come (Changes)		
	dWork	dMomGrossinc	d Hh Net In c	
Child Care	23.105***	1286.852***	434.268	
	(6.995)	(398.475)	(676.523)	
Chi-Squared	48.020	48.194	49.964	
Children	845	741	870	

Notes: dWork is change in actual weekly hours of work between survey when child is 3 years old and survey when child is two years old. dMomGrossInc is the equivalent change in nominal gross income (Euros per month).

Source: SOEP, own calculations.

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# Policy Simulations

	No to	Actual	Actual to Full	
	(1)	(2)	(3)	(4)
A. Language Skills				
Understands	329	(.205)	.374	(.339)
ShortPhrase	.128	(.357)	.192	(.552)
ShortMsg	050	(.424)	.390	(.584)
LongPhrase	652	(.510)	439	(.773)
ListenStory	.134	(.480)	-1.072	(.763)
B. Social Skills				
UsesNames	.083	(.103)	006	(.173)
PlaysKids	078	(.389)	718	(.629)
TalksEmotions	603	(.55)	.665	(.773)
HasFriends	.059	(.520)	098	(799)
RolePlay	875	( 568)	.250	( 832)

Notes: This Table shows the average effect of going from no child care to actual levels, and the effect of going from actual levels to full. Bootstrap standard errors in parentheses.

Source: SOEP, own calculations.

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# **Policy Simulations**

	No to Actual		Actual to Full	
	(1)	(2)	(3)	(4)
C. Daily Skills				
EatsSpoon	150	(.615)	166	(.949)
BrushesTeeth	441	(.599)	.490	(.893)
CleansNose	- 170	(.526)	.920	(.969)
Toilet No2	818	(.468)	874	(.800)
DressesAlone	707	(.432)	.868	(954)
D. Motor Skills				
OpensDoor	.190	(.211)	.246	(.289)
WalksStairs	080	(.369)	.054	(.422)
Climbs	.106	(.439)	.116	(787)
UsesScissors	11	(.507)	.085	(.827)
Paints	468	(.487)	.313	(818)

Notes: This Table shows the average effect of going from no child care to actual levels, and the effect of going from actual levels to full. Bootstrap standard errors in parentheses.

Source: SOEP, own calculations.

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# Conclusions

- How does child care affect child development?
- Findings
  - Effects differ in terms of observed characteristics
  - Gains for children with high unobserved entry barriers
- Heterogeneity rationalizes diverse estimates of the effects
- Expanding high quality care from
  - Zero to Current: negative effects
  - Current to Full: more positive effects

Strong expansion of child care can level the playing field

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