Does Broadband Internet Affect Fertility?

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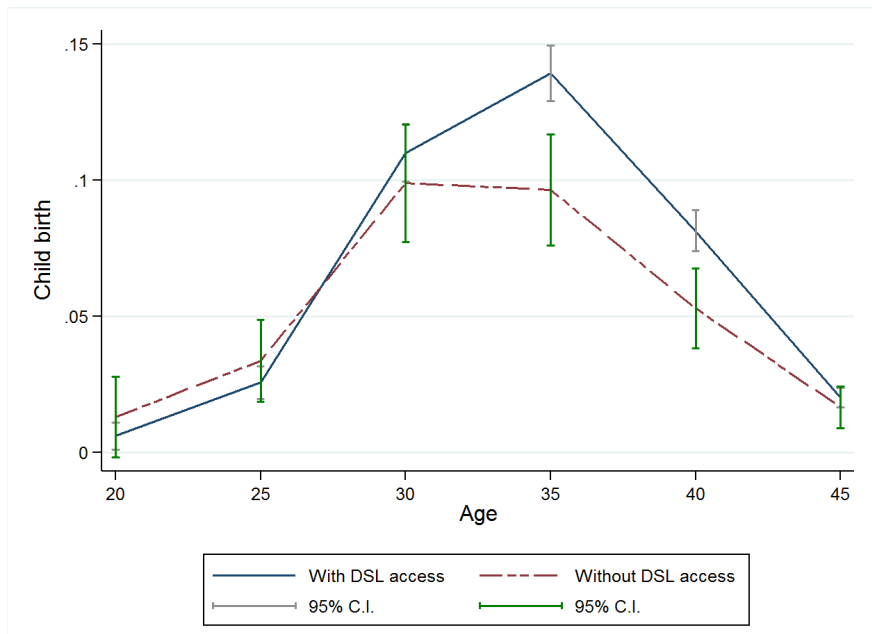[1]Bocconi University

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Figure 1: Child birth by DSL access - High-Educated Individuals

Legend:
- With DSL access
- Without DSL access
- 95% C.I.
- 95% C.I.

Notes: Data are drawn from the SOEP (v32).

Motivation

- Several papers show that broadband Internet affects many outcomes:
    - Falck et al. (AER 2014): voting behavior.
    - Falck (IZA WoL 2017): economic growth.
    - Akerman et al. (QJE 2015): labor productivity & wages.
    - Dettling (ILRR 2017): women's labor force participation.
    - Bellou (JPopEc 2015): marriage rates.
    - Guldi & Herbst (JPopEc 2017): teenage fertility.

- Yet, little is known about its effects on adult fertility.

Research Questions

- ► Does high-speed Internet affect individuals' fertility decisions?

- ► If so, by how much?

- ► Mechanism?

Does Internet Matter for Fertility?

Broadband Internet can affect fertility through different channels:

1. Internet may affect the provision of information:
   - ▶ Guldi & Herbst (JPopEc 2017): Broadband ↓ teen birth rates.

2. Internet may affect partnership formation:
   - ▶ Bellou (JPopEc 2015): Broadband ↑ marriage rates.

3. Internet may affect labor force participation and work-family balance:
   - ▶ Dettling (ILRR 2017): Broadband ↑ labor force participation, especially for high-educated and married women.

Our Contribution

The intended contribution of the paper:

1. First paper to comprehensively assess the impact of broadband Internet on women and men of all ages.

2. Use a novel IV strategy to investigate the causal effects of broadband Internet on fertility.

3. While other studies focus on US, we study a different context: Germany.

Data

- ► German Socio-Economic Panel (SOEP):

  - ► Annual panel study of households initiated in 1984.
  - ► Representative sample of the entire population in Germany. .

- ► In particular, 2008 wave for the first time provides data on DSL access:

  - ► Key explanatory variable: DSL connection in household.

- ► Contains retrospective information on fertility histories:

  - ► Our outcome is the probability of child birth in a given year.

- ► Includes data on work from home, labor market behavior, marital histories, childcare and life satisfaction.

Data (2)

- ▶ Our working sample is constructed as follows:

  - ▶ Focus on individuals aged 17 to 45.

  - ▶ Consider the survey years 2008-2012.

  - ▶ Observations with missing data for fertility, DSL access and all observables are dropped.

- ▶ Final longitudinal sample:

  - ▶ 34,495 person-year observations (17,467 individuals). Table A.1

Model

We estimate the following linear probability model:

$$Y_{ist} = \alpha + \beta DSL_{ist} + \gamma X_{ist} + \mu_t + \eta_s + \lambda_s^1 t + \varepsilon_{ist} \tag{1}$$

where:

- ist : individual i residing in state s at the year of interview t.

- Y_{ist} : probability of a child birth of individual i.

- DSL_{ist} : dummy equal to 1 if the individual has a DSL subscription.

- X_{ist} : secondary school track effects, marital & occupational status, migration background, homeowner, and log of household income.

- μ_t : survey year dummies.

- η_s : federal state fixed-effects.

- $(\lambda_s^1 t)$: linear state-specific time trends.

Identification

▶ Follow Falck et al. (AER 2014) to address endogeneity in DSL access.

▶ Exploit historical variation in pre-existing telephone infrastructure which significantly affected the cost of DSL adoption across Germany.

▶ DSL connections depend crucially on the distance between the household and the main distribution frame (MDF).

▶ When the distance is $> 4{,}200$ meters, DSL becomes more costly unless households can be connected to an alternative MDF in the close vicinity.

Figure 2: Graphical Illustration of the Distance Instruments
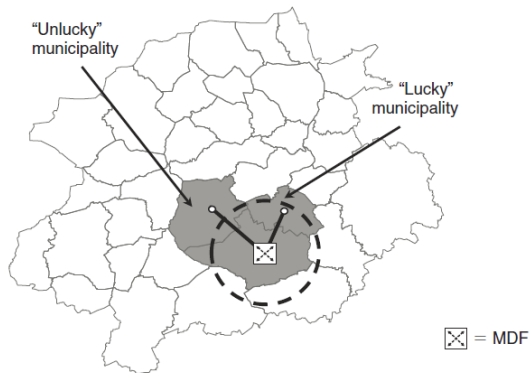
Notes: Figure is drawn from Falck et al. (AER 2014).

Identification (2)

Construct 3 household-level binary instruments:

1. Dummy equal to 1 for households with distances $> 4{,}200$ meters.

2. Dummy equal to 1 for households above the threshold which could not be connected to another MDF at a distance $< 4{,}200$ meters.

3. Dummy equal to 1 for areas in East Germany that adopted the optical access line (OPAL) technology.

Instrumental Variables Approach

Equation (1) is estimated by 2SLS:

$$DSL_{ist} = \eta + \delta\, Threshold_{ist} + \theta (No\ Closer MDF)_{ist} + \sigma\, OPAL_{ist} + $$
$$+ \rho X_{ist} + \mu_t + \eta_s + \lambda_s^1 t + v_{ist}$$

▶ *Threshold*, (*No Closer MDF*), *OPAL* are used as instruments for *DSL*.

▶ Cluster s.e. by household, the level of variation of our instruments.

Table A.2

Table 2: Effects of High-Speed Internet on Fertility by Age Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age group:		17-45			17-24			25-45	
	All	Women	Men	All	Women	Men	All	Women	Men
Dep. var.: Child birth									
DSL access	0.047	0.080*	0.021	0.013	-0.012	0.045	0.057	0.093*	0.020
	(0.046)	(0.048)	(0.051)	(0.052)	(0.086)	(0.039)	(0.055)	(0.054)	(0.065)
Mean	0.065	0.065	0.066	0.028	0.041	0.015	0.073	0.069	0.078
Std. dev.	0.247	0.246	0.248	0.165	0.198	0.121	0.260	0.254	0.268
F-test	24.03	19.04	17.04	6.91	3.64	4.81	21.28	19.10	13.66
Overidentification test	0.773	0.764	0.498	1.244	1.535	0.633	1.173	1	0.724
$\aleph^2$ p-value	0.680	0.682	0.780	0.537	0.464	0.729	0.556	0.607	0.696
Observations	34,495	19,069	15,426	5,988	3,036	2,952	28,507	16,033	12,474

Notes: Standard errors are reported in parentheses and are clustered at the household level.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.3

Table 3: Effects of High-Speed Internet on Fertility by Skill Group - People aged 25-45

	(1)	(2)	(3)	(4)	(5)	(6)
Skill group:	All high-skilled	All low-skilled	Women high-skilled	Women low-skilled	Men high-skilled	Men low-skilled
Dep. var.: Child birth						
DSL access	0.096*	-0.068	0.120**	-0.100	0.054	0.016
	(0.057)	(0.117)	(0.061)	(0.126)	(0.064)	(0.155)
Mean	0.075	0.070	0.072	0.063	0.079	0.076
Std. dev.	0.263	0.255	0.258	0.244	0.269	0.265
F-test	18.97	4.93	15.61	4.81	12.17	2.66
Observations	19,818	8,689	11,710	4,323	8,108	4,366

Notes: Standard errors are reported in parentheses and are clustered at the household level.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Robustness Checks

We verify whether our results are robust to: Table A.5

1. Exclusion of county (or residential) movers.

2. Placebo test using low-speed Internet for the period 2000-2004.

3. Inclusion of number of children.

4. Inclusion of regional policy regions (ROR) fixed effects & ROR-specific time trends.

5. Aggregating the analysis at the municipality-year level.

6. Clustering s.e. at municipality (or county) level.

Potential Mechanisms

▶ We test the three main mechanisms:

1. Information
2. Marriage
3. Work-family balance

▶ To test the relative role of information, we analyze the OLS relation between low-speed Internet and fertility. Table A.6

▶ To test marriage and work-family balance, we estimate model (1), with many alternative outcomes:

  ▶ Marriage (dummy = 1 if the individual got married in a given year)
  ▶ Work from home
  ▶ Labor market (part-time/full-time/not working & hours of work)
  ▶ Time spent on childcare
  ▶ High life satisfaction (> median)

Table A.7

Table 4: Potential Mechanisms - High-Skilled Women aged 25-45

Dep. Var.:	(1) Got married	(2) Work from home	(3) Part-time work	(4) Full-time work	(5) Working hours (weekly)	(6) Not working	(7) Childcare (weekday)	(8) High life satisfaction
DSL access	0.031	0.296*	0.371**	-0.318*	-14.687**	-0.053	3.377*	0.282**
	(0.040)	(0.179)	(0.173)	(0.168)	(5.842)	(0.141)	(1.918)	(0.133)
Mean	0.026	0.243	0.474	0.320	28.21	0.207	5.353	0.219
Std. dev.	0.154	0.429	0.499	0.466	14.097	0.405	5.982	0.414
F-test	14.48	10.06	15.33	15.33	11.90	15.33	15.32	15.80
Observations	11,710	4,067	11,710	11,710	9,164	11,710	11,393	11,615

Notes: Standard errors are reported in parentheses and are clustered at the household level.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Conclusion

▶ Explore the effects of high-speed Internet on fertility, using data from Germany.

▶ Main finding:
  ▶ DSL access causally ↑ fertility for high-skilled women aged 25-45.

▶ Potential mechanisms:
  ▶ DSL access ↑ work from home, part-time, childcare and life satisfaction.
  ▶ Results are consistent with the hypothesis that DSL access allows high-educated women to better conciliate work and motherhood.

▶ Policy recommendation:
  ▶ Smart working policies can enhance fertility, but with a "digital divide".

THANK YOU FOR YOUR ATTENTION !

Table A.1: Descriptives on Selected Variables - Observations: 34,495

Variable	Mean	Std. Dev.	Min.	Max.
Child birth in current year	0.07	0.25	0	1
DSL subscription in household	0.82	0.39	0	1
Work from home	0.21	0.41	0	1
Full-time work	0.43	0.50	0	1
Part-time work	0.31	0.46	0	1
Not working	0.26	0.44	0	1
Hours spent on childcare (weekdays)	3.28	4.99	0	24
Life satisfaction	7.30	1.65	0	10
High life satisfaction	0.21	0.41	0	1
Got married in current year	0.024	0.154	0	1
Female	0.55	0.50	0	1
Age	33.76	8.03	17	45
Lower secondary education	0.20	0.40	0	1
Medium secondary education	0.34	0.48	0	1
Higher secondary education	0.33	0.47	0	1

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Table A.2: First Stage by Age Group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age group:		17-45			17-24			25-45	
	All	Women	Men	All	Women	Men	All	Women	Men
Threshold	-0.132***	-0.124***	-0.141***	-0.161***	-0.137***	-0.186***	-0.126***	-0.122***	-0.128***
	(0.018)	(0.020)	(0.023)	(0.040)	(0.049)	(0.054)	(0.019)	(0.020)	(0.024)
"No closer MDF"	-0.062**	-0.052**	-0.073**	-0.096*	-0.084	-0.100	-0.056**	-0.045*	-0.066**
	(0.024)	(0.026)	(0.030)	(0.050)	(0.060)	(0.070)	(0.025)	(0.026)	(0.031)
OPAL	-0.089**	-0.067	-0.114*	-0.076	-0.102	-0.050	-0.089**	-0.058	-0.123**
	(0.043)	(0.047)	(0.060)	(0.085)	(0.097)	(0.135)	(0.044)	(0.049)	(0.059)
F-test	24.03	19.04	17.04	6.91	3.64	4.81	21.28	19.10	13.66
Observations	34,495	19,069	15,426	5,988	3,036	2,952	28,507	16,033	12,474

Notes: Standard errors are reported in parentheses and are clustered at the household level.

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Table A.3: First-Child vs. Second or Higher-Order Child by Skill Group

	(1)	(2)	(3)	(4)
Dep. Var.:	First-child		Second or Higher-order Child	
Skill group:	Women high-skilled	Women low-skilled	Women high-skilled	Women low-skilled
DSL access	0.043	0.071	0.192**	-0.207
	(0.094)	(0.129)	(0.082)	(0.181)
Mean	0.041	0.030	0.083	0.070
Std. dev.	0.199	0.170	0.276	0.256
F-test	6.19	2.76	11.28	3.49
Observations	3,275	738	8,435	3,585

Notes: Standard errors are reported in parentheses and are clustered at the household level.
* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.4: High-Speed Internet on Fertility - High-Skilled People aged 25-45, OLS

	(1)	(2)	(3)	(4)	(5)	(6)
	All	All	Women	Women	Men	Men
Dep. var.: Child birth						
DSL access	0.014**	0.003	0.015**	0.005	0.013*	0.000
	(0.006)	(0.006)	(0.006)	(0.006)	(0.008)	(0.008)
Covariates	No	Yes	No	Yes	No	Yes
Mean	0.074	0.074	0.072	0.072	0.079	0.079
Std. dev.	0.263	0.263	0.258	0.258	0.269	0.269
Observations	19,818	19,818	11,710	11,710	8,108	8,108

Notes: Standard errors are reported in parentheses and are clustered at the household level.

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Table A.5: Robustness Checks - High-Skilled Women aged 25-45

	(1) Exclude county movers	(2) Placebo test	(3) Incl. number of children	(4) ROR F.E.	(5) Child birth at municipality	(6) Cluster at municipality
DSL access	0.129**	—	0.125**	0.127**	0.061	0.120*
	(0.061)		(0.061)	(0.062)	(0.061)	(0.066)
Low-speed Internet		-0.292				
		(0.487)				
Mean	0.049	0.054	0.072	0.072	0.049	0.072
Std. dev.	0.216	0.227	0.258	0.258	0.183	0.258
F-test	10.75	0.333	15.60	15.64	19.19	13.89
Observations	8,940	7,290	11,710	11,710	5,398	11,710

Notes: Standard errors are reported in parentheses and are clustered at the household level.

* Significant at 10%; ** significant at 5%; *** significant at 1%.

Table A.6: Effects of low-speed Internet on Fertility by Age Group, OLS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Age group:		17-45			17-24			25-45	
	All	Women	Men	All	Women	Men	All	Women	Men
Dep. var.: Child birth									
Low-speed Internet	-0.003	-0.003	-0.003	-0.002	-0.001	-0.004	-0.002	-0.002	-0.002
	(0.005)	(0.005)	(0.005)	(0.006)	(0.008)	(0.006)	(0.006)	(0.006)	(0.006)
Mean	0.065	0.065	0.066	0.028	0.041	0.015	0.073	0.069	0.078
Std. dev.	0.247	0.246	0.248	0.165	0.198	0.121	0.260	0.254	0.268
Observations	34,495	19,069	15,426	5,988	3,036	2,952	28,507	16,033	12,474

Notes: Standard errors are reported in parentheses and are clustered at the household level.

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Table A.7: Potential Mechanisms - Low-Skilled Women aged 25-45

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dep. Var.:	Work from home	Part-time work	Full-time work	Working hours (weekly)	Not working	Got married	Childcare (weekday)	High life satisfaction
DSL access	-0.182	0.338	0.149	-1.867	-0.487	-0.001	-4.411	-1.653
	(0.191)	(0.281)	(0.197)	(10.194)	(0.312)	(0.083)	(3.516)	(1.056)
Mean	0.099	0.455	0.156	22.862	0.389	0.0243	6.121	0.193
Std. dev.	0.299	0.498	0.363	13.675	0.487	0.154	6.100	0.395
F-test	4.909	5.142	5.142	2.96	5.142	4.613	4.937	4.868
Observations	1,163	4,323	4,323	2,672	4,323	4,323	4,228	4,281

Notes: Standard errors are reported in parentheses and are clustered at the household level.

* Significant at 10%; ** significant at 5%; *** significant at 1%.