

Technological change, postponement, and over-30 fertility

Francesco C. Billari
Bocconi University

Structure

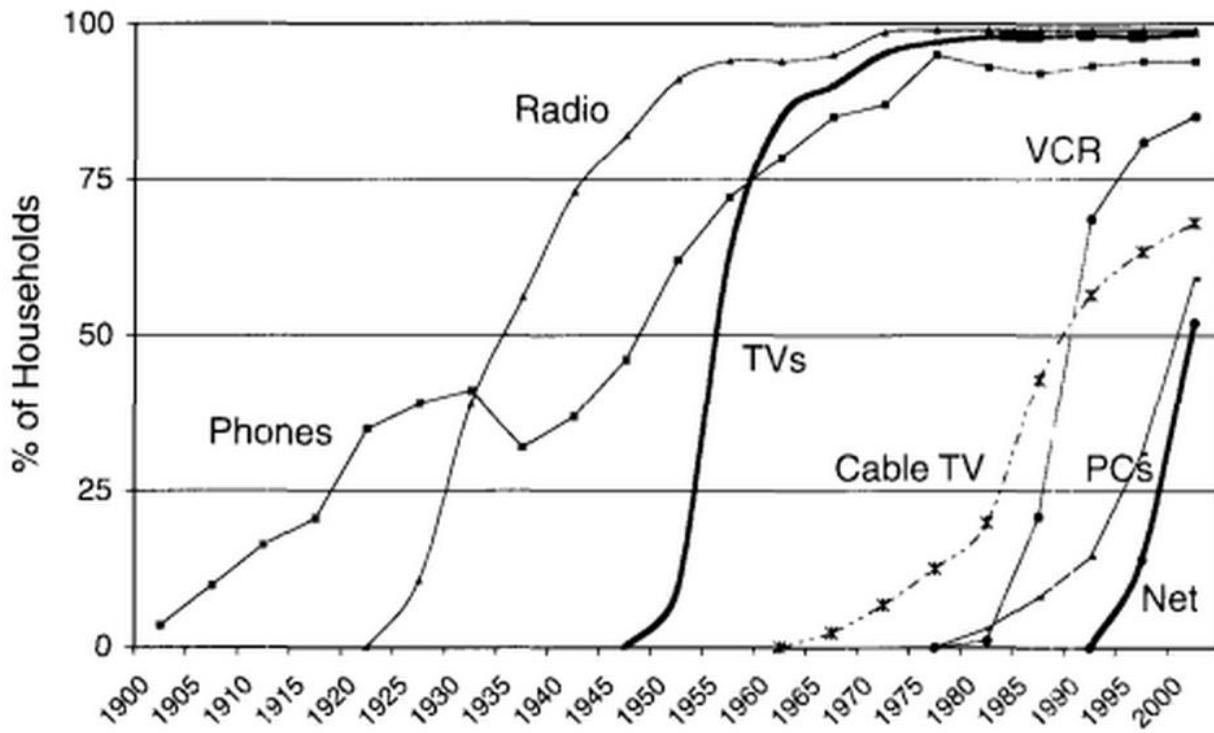
1. Technological change and fertility
2. The Googlization of fertility and fertility postponement
3. Empirical evidence (1) : Germany
4. Empirical evidence (2) : global South
5. Discussion

1. Technological change and fertility

- Technological change has been linked to family and fertility change (and women's labor force participation)
 - The pill
 - Precondition to the Second Demographic Transition (Lesthaeghe & van de Kaa)
 - Power of the pill (Goldin)
 - Other medical advances
 - Assisted Reproduction
 - Infant formula (Albanesi & Olivetti)
 - The media
 - TV, family planning, soap operas (La Ferrara)
 - Household appliances
 - Engines of liberation (Greenwood et al)



Technological change and fertility



Source: Norris (2001)

Figure 2.3. Twentieth-Century American Technology.

Sources: U.S. Census Bureau: *Statistical Abstract of the U.S.*, 1999; *Historical Statistics of the U.S.*

Internet and fertility: possible mechanisms

1. Sexual behavior

- Ambiguous effects on sex (and contraception)
- Access to new ways to meet partners
- Access to infos on risky sex
- No clear evidence on abortion rates, but negative effects on STI in US counties (Guldi & Herbst, 2017)



2. Partnership formation—the Internet as the new social intermediary (Rosenfeld & Thomas, 2012)

- Ambiguous effects on the timing of marriage (wider pool, space for more fine-grained preferences)
- Potential effects on homogamy → inequality

Internet and fertility: possible mechanisms

3. Information and social interaction on family and fertility
 - Access to information on sexual and reproductive health
 - Access to information on the consequences of earlier or later births
 - Boost of cultural change (gender revolution)
 - Search.. (with digital divide: Hargittai, 2010)
 - Social interaction

Internet and fertility: possible mechanisms

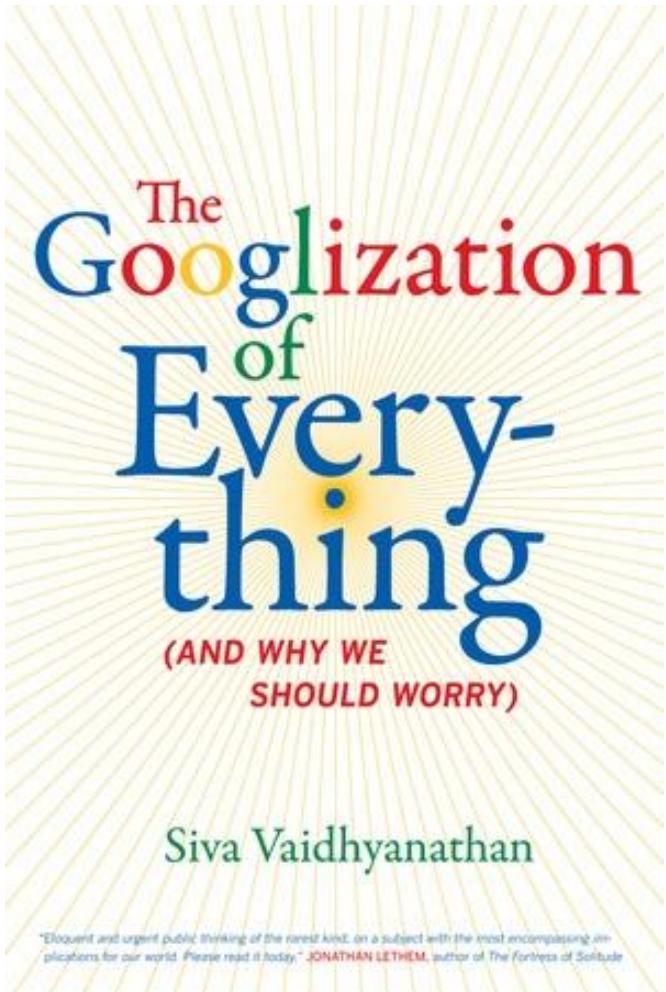
4. Contacts within the nuclear and enlarged family

- Digital contacts (Gubernskaya & Treas, 2016)

5. Health and social integration

- Health Information
- Individual social integration and loneliness (optimistic vs. pessimistic view)
- Behavior (e.g. sleep)

2. The Googlization of fertility



A screenshot of a Google search results page. The search bar at the top contains the word 'kinder'. Below the search bar, the word 'Austria' is selected as the location. To the right of the search bar are two buttons: 'Google Search' and 'I'm Feeling Lucky'. A list of search suggestions is displayed below the location field, including 'kinderbetreuungsgeld', 'kindergarten', 'kindergarten wien', 'kinderarzt', 'kinderwagen', 'kinderbeihilfe', 'kindergeld österreich', 'kindermuseum wien', 'kinder', and 'kinderlieder'. At the bottom right of the suggestions list is a link 'Report inappropriate predictions'.

The Googlization of fertility

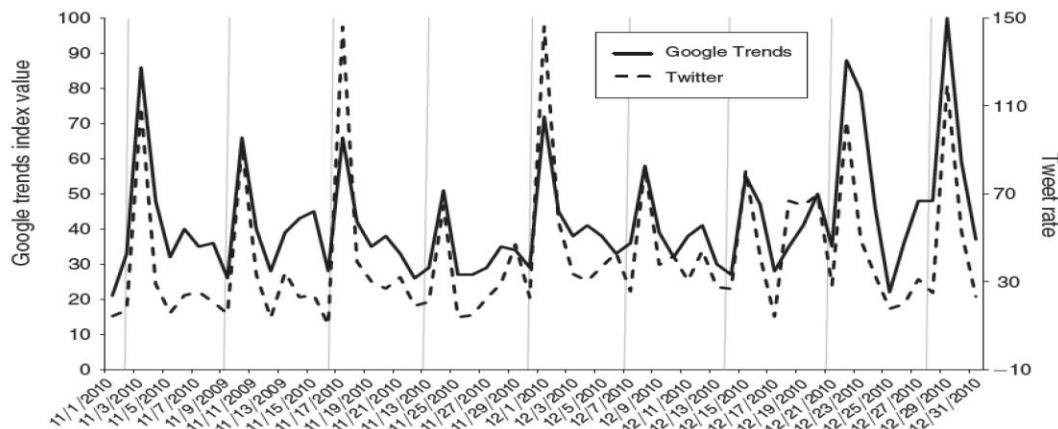
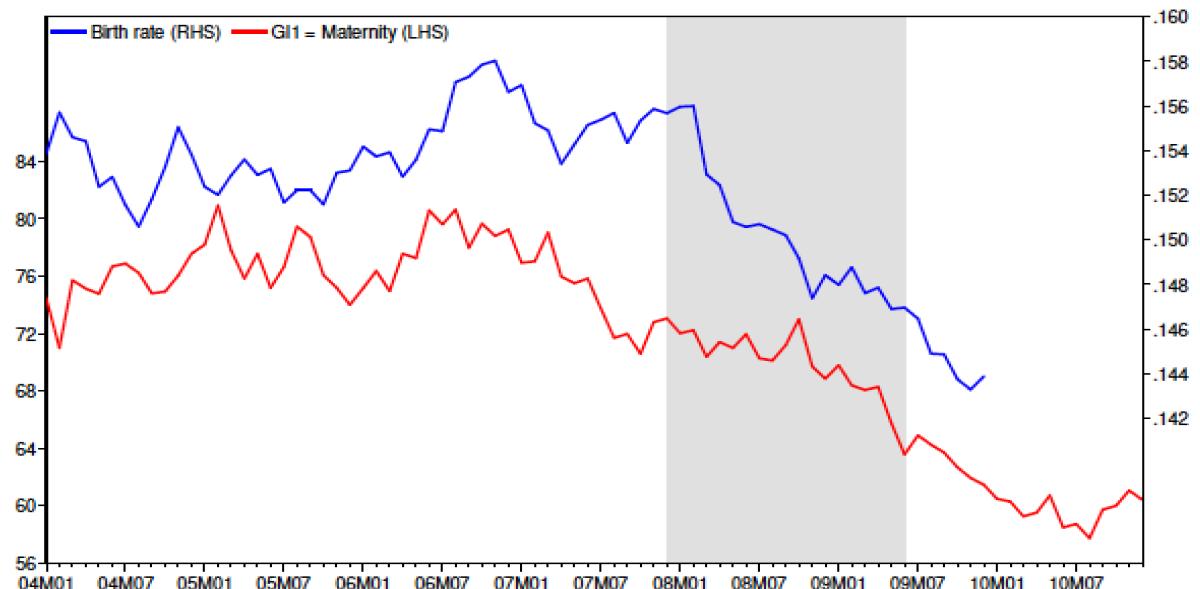


FIGURE 8. DAILY GOOGLE SEARCHES AND TWEETS ABOUT *16 AND PREGNANT*

Note: Vertical lines reflect days that new episodes of *16 and Pregnant* were broadcast.

Sources: Search index values are available directly from Google Trends. Tweet rates are computed based on the frequency of tweets obtained from Topsy Lab.



Source: Kearney & Levine (2015)

Source: Billari, D'Amuri, Marcucci (2013)

Google search and (unequal) fertility

Google Correlate General_Fertility_2015 [X](#) Search correlations [Edit this data](#)

Compare US states	Correlated with General_Fertility_2015
Compare weekly time series	0.8801 pregnancy workout
Compare monthly time series	0.8799 pregnancy workouts
	0.8699 baby tummy
Documentation	0.8669 best projector
Comic Book	0.8587 baby constipation
FAQ	0.8543 increase breast milk
Tutorial	0.8499 baby trend
Whitepaper	0.8484 company christmas party
Correlate Algorithm	0.8477 baby announcement ideas
	0.8433 baby announcements
Correlate Labs	
Search by Drawing	

Show more Export data as CSV | Share:    

Fertility rates	Abbrv.	Av.	Med.	Std.
General, age 15-50	Gen.	54	54	6.5
Marital: unmarried	MSnot	19	19	3.3
Marital: married	MSyes	35	34	6.5
Young, age 15-19	Teen	2.6	2.5	0.8
Old, age 35-50	Old	10	10	2.0
Education: univ.	Ehigh	17	16	3.6
Education: other	Elow	37	37	6.6
Poverty: up to 100	Poor	14	14	3.2
Poverty: from 200	Rich	28	27	5.0

Source: Ojala, Zagheni, Billari & Weber (2017)

Google search and (unequal) fertility

Gen	MSnot	MSyes	Teen	Elow	Ehigh	Rich
pregnancy workout (.88)	chlamydia and gonorrhea (.81)	nursing cover (.84)	names from the bible (.84)	how to potty (0.90)	crib reviews (.81)	post pregnancy (.75)
baby tummy (.87)	biblical names (.77)	jogging stroller reviews (.83)	baby in the womb (.81)	how to potty train (0.90)	week 37 (.74)	chicco key (.73)
baby constipation (.86)	treatment for chlamydia (.77)	double jogging stroller (.82)	None	potty train (0.88)	None	baby stuffy nose (.73)
increase breast milk (.85)	paternity test (.76)	nursing pads (.82)	None	uddercovers.com (0.86)	None	flying while pregnant (.72)
baby trend (.85)	transmitted disease (.76)	jogging stroller (.81)	None	None	None	baby card (.71)

Table 2: (Up to) Top five terms selected from the top 50 correlated terms on Google Correlate for the seven different fertility measures with at least one baby/birth-related search term. The correlation with the 2015 fertility rates is shown in parentheses.

Source: Ojala, Zagheni, Billari & Weber (2017)

Age deadlines



when is too late

- when is too late **to have a baby**
- when is too late **to apply to medical school**
- when is too late **to plant tomatoes**
- when is too late **to drink coffee**
- when is too late **to submit secondaries**
- when is too late **for coffee**
- when is too late **to plant sunflowers**
- when is too late **to abort**

is 30 too old

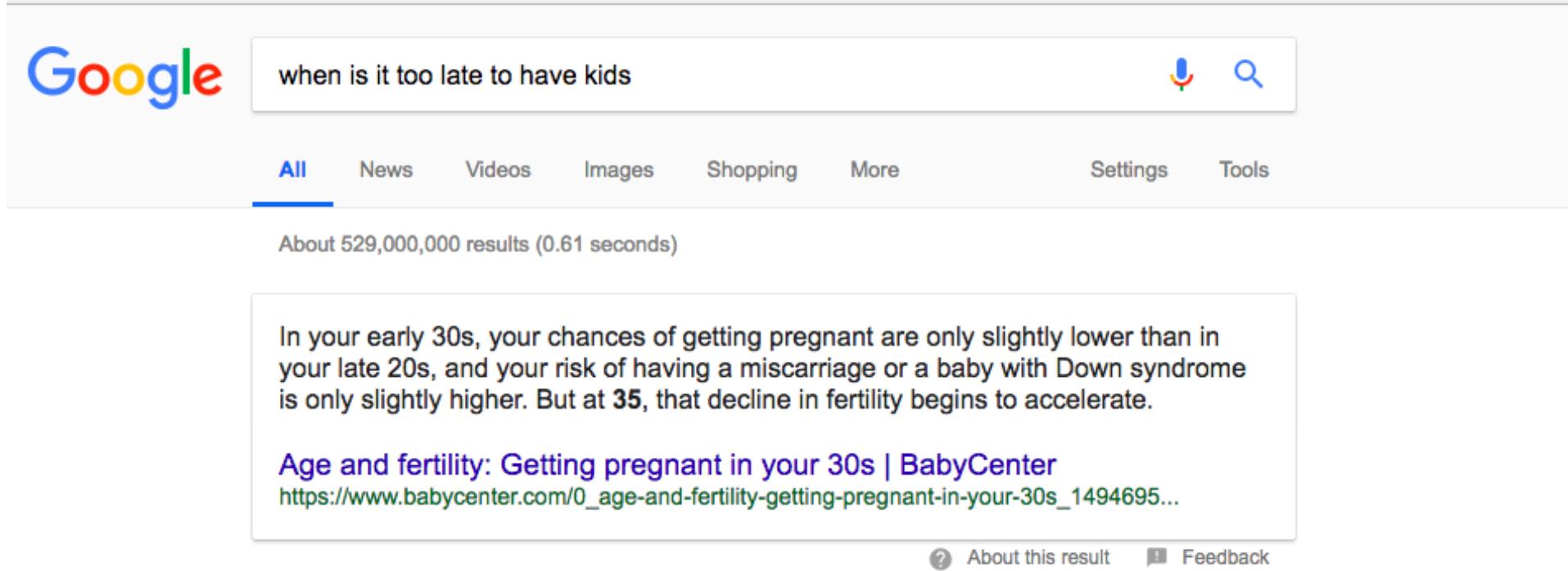
- is 30 too old
- is 30 too old **for mba**
- is 30 too old **for medical school**
- is 30 too old **to become a pilot**
- is 30 too old **to get married**
- is 30 too old **to learn programming**
- is 30 too old **to be single**
- is 30 too old **to learn guitar**
- is 30 too old **to start a new career**
- is 30 too old **to find love**



when is it too late

- when is it too late **for an abortion**
- when is it too late **to have kids**
- when is it too late **to spay a dog**
- when is it too late **to apply to medical school**
- when is it too late **to eat**

Age deadlines



A screenshot of a Google search results page. The search query "when is it too late to have kids" is entered in the search bar. The "All" tab is selected, showing approximately 529,000,000 results found in 0.61 seconds. A snippet of text from a BabyCenter article discusses fertility decline starting around age 35. Below the snippet is a link to the article and its URL.

when is it too late to have kids

All News Videos Images Shopping More Settings Tools

About 529,000,000 results (0.61 seconds)

In your early 30s, your chances of getting pregnant are only slightly lower than in your late 20s, and your risk of having a miscarriage or a baby with Down syndrome is only slightly higher. But at 35, that decline in fertility begins to accelerate.

[Age and fertility: Getting pregnant in your 30s | BabyCenter](https://www.babycenter.com/0_age-and-fertility-getting-pregnant-in-your-30s_1494695...)
https://www.babycenter.com/0_age-and-fertility-getting-pregnant-in-your-30s_1494695...

About this result Feedback

Age deadlines

- European Social Survey 2006-7. ‘Timing of Life’ module
- ‘After what age would you say a woman [or man] is generally too old to consider having any more children?’
 - Age (integer)
 - ‘Never too old’ (not mentioned)
 - ‘Don’t know’

Human Reproduction, Vol.26, No.3 pp. 616–622, 2011

Advanced Access publication on December 15, 2010 doi:10.1093/humrep/deq360

human
reproduction

ORIGINAL ARTICLE *Psychology and counselling*

Social age deadlines for the childbearing of women and men

F.C. Billari^{1,*}, A. Goisis^{1,2}, A.C. Liefbroer^{3,4}, R.A. Settersten⁵,
A. Aassve¹, G. Hagestad⁶, and Z. Spéder⁷

Age deadlines

Table I Social age deadlines for the childbearing of women and men, by country.

Country	Women				Men					
	No. observed	% acknowledging the existence of a limit	% perceiving a deadline ≤ 40	Mean	SD	No. observed	% acknowledging the existence of a limit	% perceiving a deadline ≤ 45	Mean	SD
Austria	1147	96.8	37.1	43.8	5.2	987	91.0	25.1	51.1	7.8
Belgium	859	99.2	67.5	40.7	4.9	920	97.3	60.2	45.4	7.2
Bulgaria	555	89.6	57.6	41.2	4.7	582	79.0	48.2	45.4	6.3
Cyprus	475	97.7	52.7	42.7	5.3	458	93.9	38.8	48.2	7.3
Denmark	703	98.4	68.6	40.5	4.1	743	97.7	60.2	45.3	6.0
Estonia	736	93.3	43.5	43.4	5.2	672	85.7	25.9	51.2	7.9
Finland	938	95.3	49.7	42.6	4.7	887	92.3	31.2	50.5	8.1
France	979	100.0	54.5	42.1	4.5	949	100.0	50.3	47.7	7.3
Germany	1383	97.5	57.2	41.6	4.6	1362	93.1	45.2	47.4	7.2
Hungary	708	97.3	77.3	39.3	4.7	721	89.2	49.9	46.0	7.4
Ireland	754	95.0	51.3	42.2	4.9	768	86.1	44.4	47.0	7.1
Netherlands	900	98.6	66.9	40.8	4.3	930	96.1	58.9	45.7	6.9
Norway	847	98.6	56.7	41.7	4.3	856	96.8	47.4	47.3	6.7
Poland	775	97.1	66.7	40.8	5.1	776	90.9	46.6	46.7	7.6
Portugal	1056	97.3	48.4	42.8	5.2	951	87.0	35.4	48.3	8.2
Russia	1034	93.8	60.6	41.1	5.7	972	80.6	39.8	47.7	8.3

Source: Billari, Goisis, et al., 2011

Age deadlines

Table I Social age deadlines for the childbearing of women and men, by country.

Country	Women				Men					
	No. observed	% acknowledging the existence of a limit	% perceiving a deadline ≤ 40	Mean	SD	No. observed	% acknowledging the existence of a limit	% perceiving a deadline ≤ 45	Mean	SD
Slovakia	811	95.1	62.5	40.9	5.7	812	87.8	41.7	46.8	7.7
Slovenia	653	94.6	53.0	42.4	5.0	684	86.7	34.5	48.7	7.6
Spain	910	96.7	49.9	42.9	5.4	843	91.8	57.4	46.0	7.1
Sweden	899	95.7	48.5	42.6	5.1	926	96.0	44.7	47.8	6.9
Switzerland	894	97.4	56.1	41.7	4.5	819	96.3	50.6	47.2	6.6
UK	1139	96.9	49.6	42.6	5.3	1126	91.7	43.2	48.1	7.7
Ukraine	960	95.4	58.1	42.1	5.2	775	88.0	50.1	46.4	7.5
Latvia ^a	818	77.5	31.7	44.5	6.8	812	68.2	23.2	49.9	8.4
Romania ^a	976	94.1	49.4	42.8	6.7	908	88.2	42.1	47.4	8.6
Countries average ^a	21 909	96.4	57.2	41.7	5.2	21 239	90.2	46.2	47.3	7.6

Authors' computations, ESS, 2006–2007. Values below 26 and above 80 were dropped from analyses. In order to obtain accurate estimates, data were weighted by design weights. See text and ESS website (<http://www.europeansocialsurvey.org/>) for additional information.

^aLatvia and Romania were not included in average country values because the appropriate design weights are not available.

Age deadlines

- Information channel: Internet
- ESS: Do respondents use Internet everyday?
- Too young, too old, ideal age
- (work in progress with Alice Goisis)

Age deadlines

- Effect of using Internet everyday on (women)
- Age too young +.33 ($p<0.001$)
- Age too old: +.217 ($p<0.01$)
- Ideal age: +.493 ($p<0.001$)
- *Controls: age, age squared, years of education, having ever been a parent, married, gender of respondent, coping with income, country fixed effects*

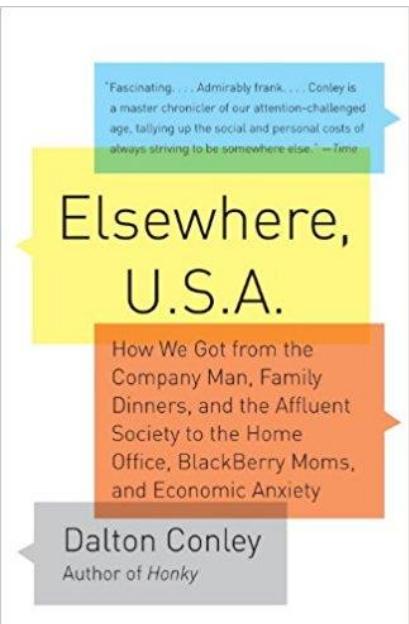
Age deadlines

- Effect of using Internet everyday on (men)
- Age too young +.365 ($p<0.001$)
- Age too old: +.373 ($p<0.01$)
- Ideal age: +.508 ($p<0.001$)
- *Controls: age, age squared, years of education, having ever been a parent, married, gender of respondent, coping with income, country fixed effects*

Internet, family and fertility: possible mechanisms

6. Time allocation and work-family balance

- Worse balance (Conley's 'elsewhere USA') → negative spillover from work → negative family outcomes
- Better ability to combine work and family through Internet
- Telework
- Time use, e.g. childcare
- Digital divide by education/occupation



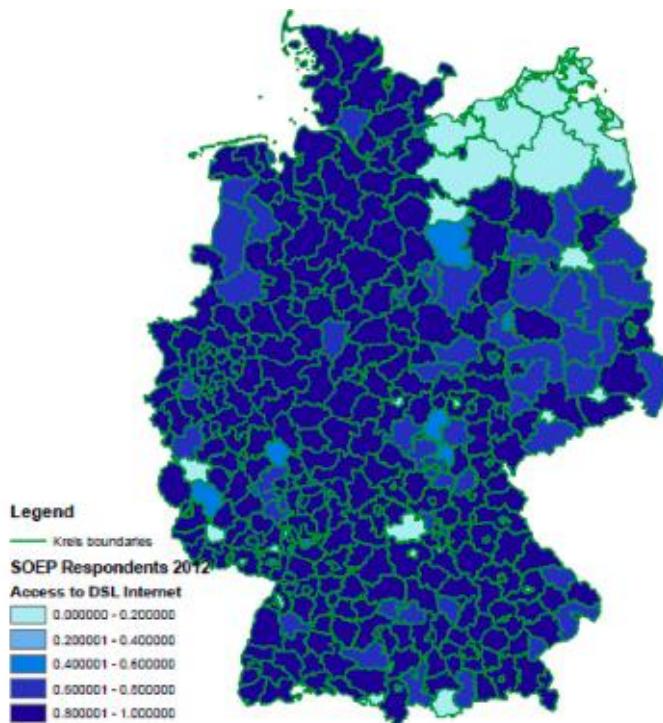
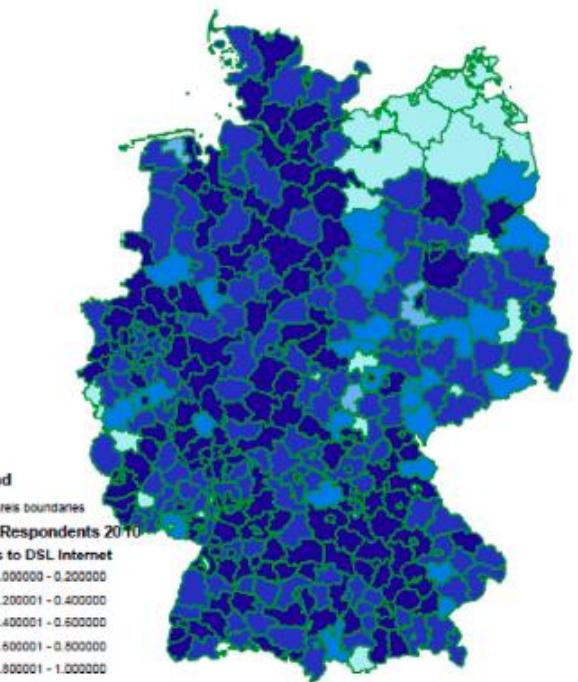
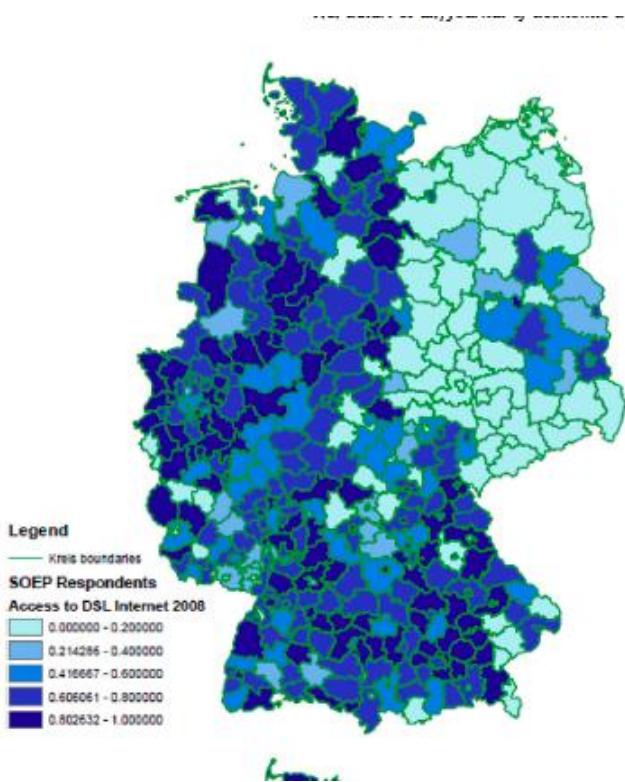
Internet, family and fertility: possible mechanisms

7. (It's the economy, stupid!) Internet affects the economy and therefore impacts family and fertility in a pro-cyclical way (no “direct” effect but “total” effect)

3. Some empirical evidence (1)

- Germany (mostly data from the Socio-Economic Panel). With Osea Giuntella (Pitt) and Luca Stella (Bocconi)
- Effects of broadband access
- Causal estimates by using an instrumental variable approach based on Falck, Gold and Hebligh (2014)
 1. Fertility
 2. Marriage

Some empirical evidence (1)



DISCUSSION PAPER SERIES

IZA DP No. 10935

Does Broadband Internet Affect Fertility?

Francesco C. Billari
Osea Giuntella
Luca Stella

AUGUST 2017

Figure 1: Annual Probability of Child Birth by DSL Access - High-educated Individuals

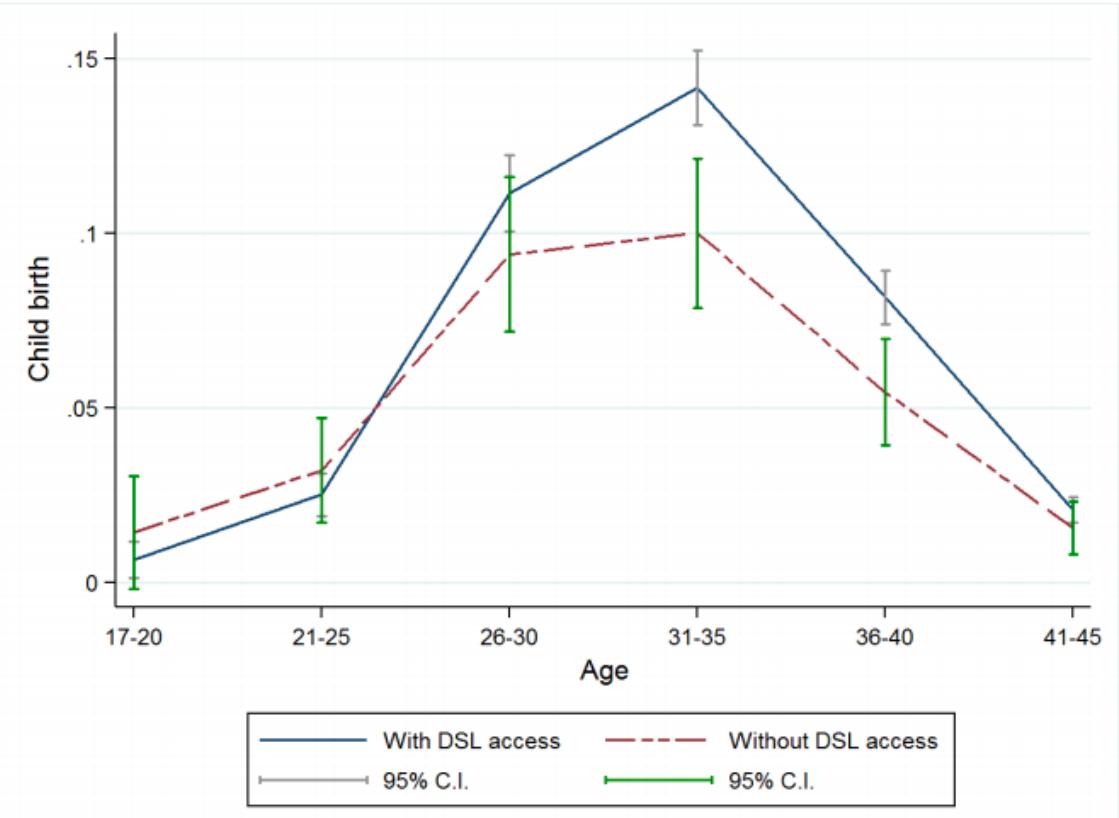
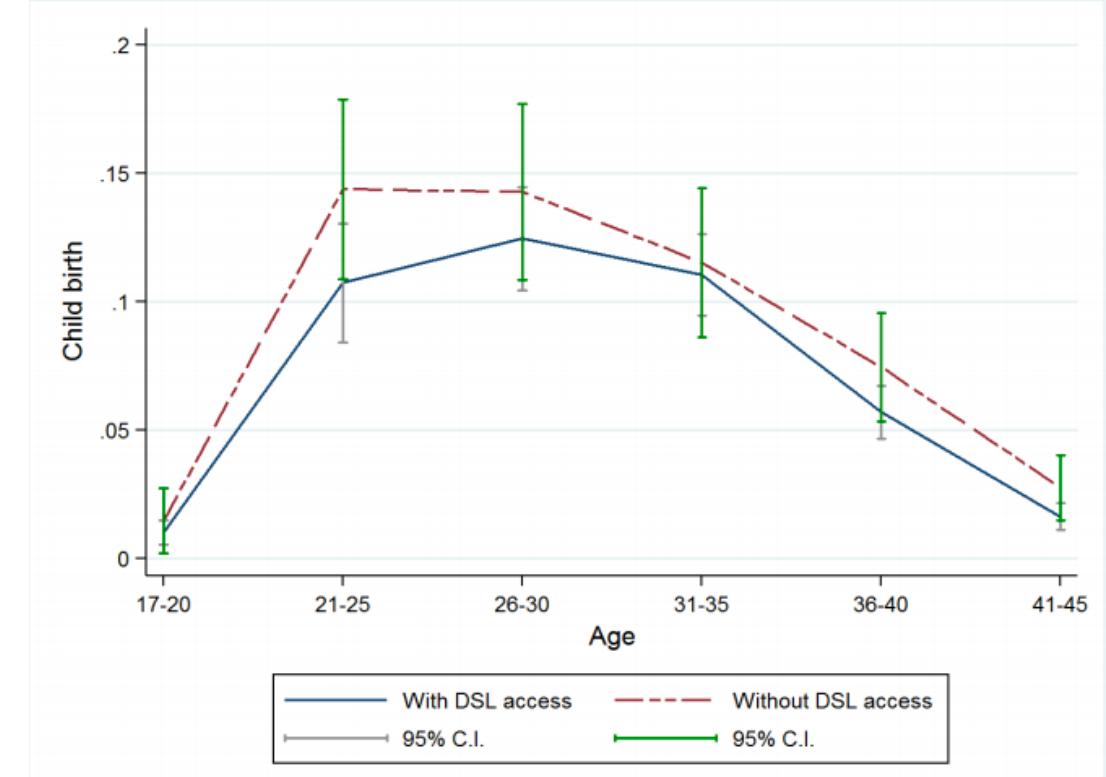


Figure 2: Annual Probability of Child Birth by DSL Access - Less-educated Individuals



Source: Billari, Giuntella, Stella (2018)

Table 3: Effects of Broadband Internet on Fertility by Education - Individuals aged 25-45

Education group:	(1)	(2)	(3)	(4)	(5)	(6)
	All high-educated	All less-educated	Women high-educated	Women less-educated	Men high-educated	Men less-educated
<i>Dep. var.: Child birth</i>						
DSL subscription	0.108* (0.059)	-0.032 (0.112)	0.133** (0.062)	-0.074 (0.124)	0.070 (0.065)	0.034 (0.147)
Mean of dep. var.	0.075	0.070	0.072	0.063	0.079	0.076
Std. dev. of dep. var.	0.263	0.255	0.258	0.244	0.269	0.265
<i>First stage</i>						
Threshold	-0.132*** (0.021)	-0.105*** (0.033)	-0.124*** (0.022)	-0.115** (0.047)	-0.147*** (0.030)	-0.092** (0.037)
"No closer MDF"	-0.061** (0.028)	-0.037 (0.045)	-0.044 (0.029)	-0.047 (0.057)	-0.090** (0.037)	-0.023 (0.055)
OPAL	-0.094** (0.047)	-0.105 (0.103)	-0.036 (0.051)	-0.344** (0.150)	-0.159** (0.065)	0.016 (0.135)
F-test of excluded instruments	18.52	5.049	15.52	4.948	12.08	2.826
Overidentification test	0.497	3.530	0.677	2.173	0.111	2.141
χ^2 p-value	0.780	0.171	0.713	0.337	0.946	0.343
Observations	19,818	8,689	11,710	4,323	8,108	4,366

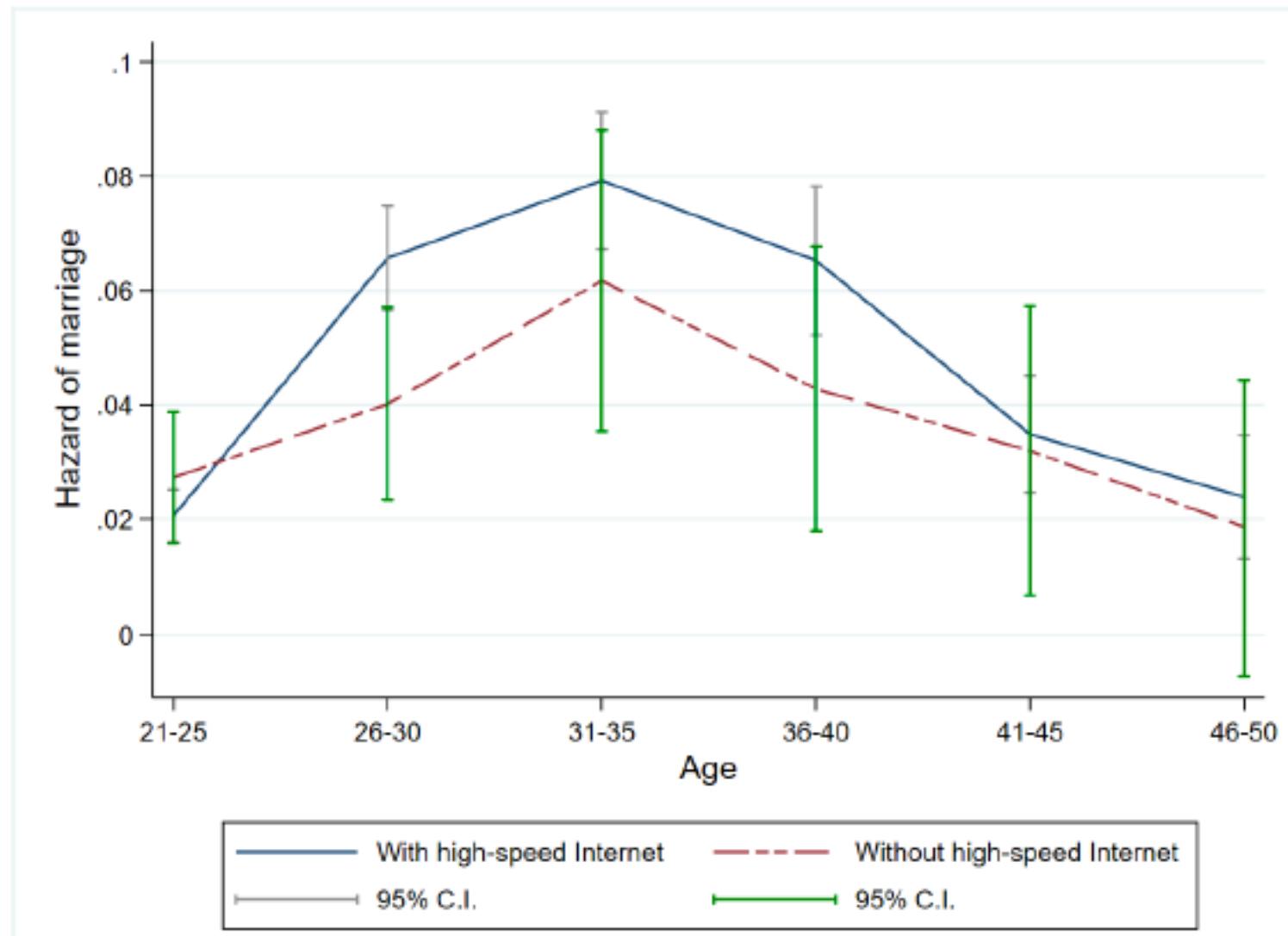
Notes - Standard errors are reported in parentheses and are clustered at the household level. All models include controls for education, age and its quadratic term, gender, an indicator for rural area, marital status, occupational status, migration background, and log of net household income. All regressions further include state and survey years fixed effects, as well as state-specific time trends. The *F*-test for excluded instruments refers to the Kleibergen-Paap *F*-statistic. The overidentification test is based on the Huber-White robust variance-covariance matrix without clustering. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Potential Mechanisms - High-educated Women aged 25-45

Dep. Var.:	(1) Got married	(2) Work from home	(3) Part-time work	(4) Full-time work	(5) Working hours	(6) Not working	(7) Childcare (weekday)	(8) High life satisfaction
DSL subscription	0.052 (0.041)	0.294* (0.178)	0.350** (0.174)	-0.240 (0.167)	-13.377** (5.836)	-0.110 (0.142)	3.693* (1.928)	0.270** (0.133)
Mean of dep. var.	0.026	0.243	0.474	0.320	28.21	0.207	5.353	0.219
Std. dev. of dep. var.	0.16	0.429	0.499	0.466	14.10	0.405	5.982	0.414
<i>First stage</i>								
Threshold	-0.121*** (0.022)	-0.127*** (0.029)	-0.124*** (0.022)	-0.124*** (0.022)	-0.114*** (0.024)	-0.124*** (0.022)	-0.124*** (0.022)	-0.126*** (0.022)
"No closer MDF"	-0.044 (0.030)	-0.024 (0.040)	-0.044 (0.030)	-0.044 (0.030)	-0.025 (0.033)	-0.044 (0.030)	-0.047 (0.029)	-0.045 (0.030)
OPAL	-0.037 (0.051)	0.010 (0.064)	-0.034 (0.051)	-0.034 (0.051)	-0.009 (0.051)	-0.034 (0.051)	-0.035 (0.051)	-0.026 (0.051)
F-test of excluded instruments	14.33	9.849	15.13	15.13	11.62	15.13	15.35	15.74
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. All models include controls for education, age and its quadratic term, gender, an indicator for rural area, marital status, occupational status, migration background, and log of net household income. All regressions further include state and survey years fixed effects, as well as state-specific time trends. The F-test for excluded instruments refers to the Kleibergen-Paap F-statistic.* Significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1: Marriage rates by high-speed Internet access - Full sample



Source: Billari, Giuntella, Stella (2019)

Table 2: Effects of Internet on Marriage and Divorce by Education Group, OLS Estimates

Education group:	(1) All	(2) High-educated	(3) Low-educated
Panel A: Dep. var.: Hazard of marriage			
High-speed Internet subscription	0.027*** (0.007)	0.024*** (0.008)	0.031*** (0.011)
Observations	7,480	5,669	1,811
Mean of dep. var.	0.059	0.059	0.057
Std. dev. of dep. var.	0.235	0.236	0.232
Panel B: Dep. var.: Hazard of divorce			
High-speed Internet subscription	-0.002 (0.003)	-0.005 (0.005)	0.002 (0.005)
Observations	15,909	10,606	5,303
Mean of dep. var.	0.015	0.016	0.014
Std. dev. of dep. var.	0.122	0.123	0.119

Notes - Standard errors are reported in parentheses and are clustered at the household level. All models include controls for education, age and its quadratic term, gender, occupational status, migration background, rural area, and log of net household income. All regressions further include state and survey years fixed effects. Regressions in Panel B also include controls for marriage duration. * Significant at 10%; ** significant at 5%; *** significant at 1%.

Table 5: Educational Assortative Mating, OLS and 2SLS Estimates

Dep. var.:	(1) Homogamy	(2) Distance (absolute value)
Panel A: OLS Estimates		
High-speed Internet subscription	0.020 (0.016)	-0.099*** (0.033)
Observations	19,498	19,498
Mean of dep. var.	0.523	0.680
Std. dev. of dep. var.	0.499	0.884
Panel B: 2SLS Estimates		
High-speed Internet subscription	0.494** (0.223)	-0.588* (0.331)
Observations	19,498	19,498
Mean of dep. var.	0.523	0.680
Std. dev. of dep. var.	0.499	0.884
<i>F</i> -test of excluded instruments	16.91	16.91

Notes - Standard errors are reported in parentheses and are clustered at the household level. All models include controls for age and its quadratic term, gender, marital status, occupational status, migration background, rural area, and log of net household income. All regressions further include state and survey years fixed effects. The *F*-test for excluded instruments refers to the Kleibergen-Paap *F*-statistic. * Significant at 10%; ** significant at 5%; *** significant at 1%.

4. Some empirical evidence (2)



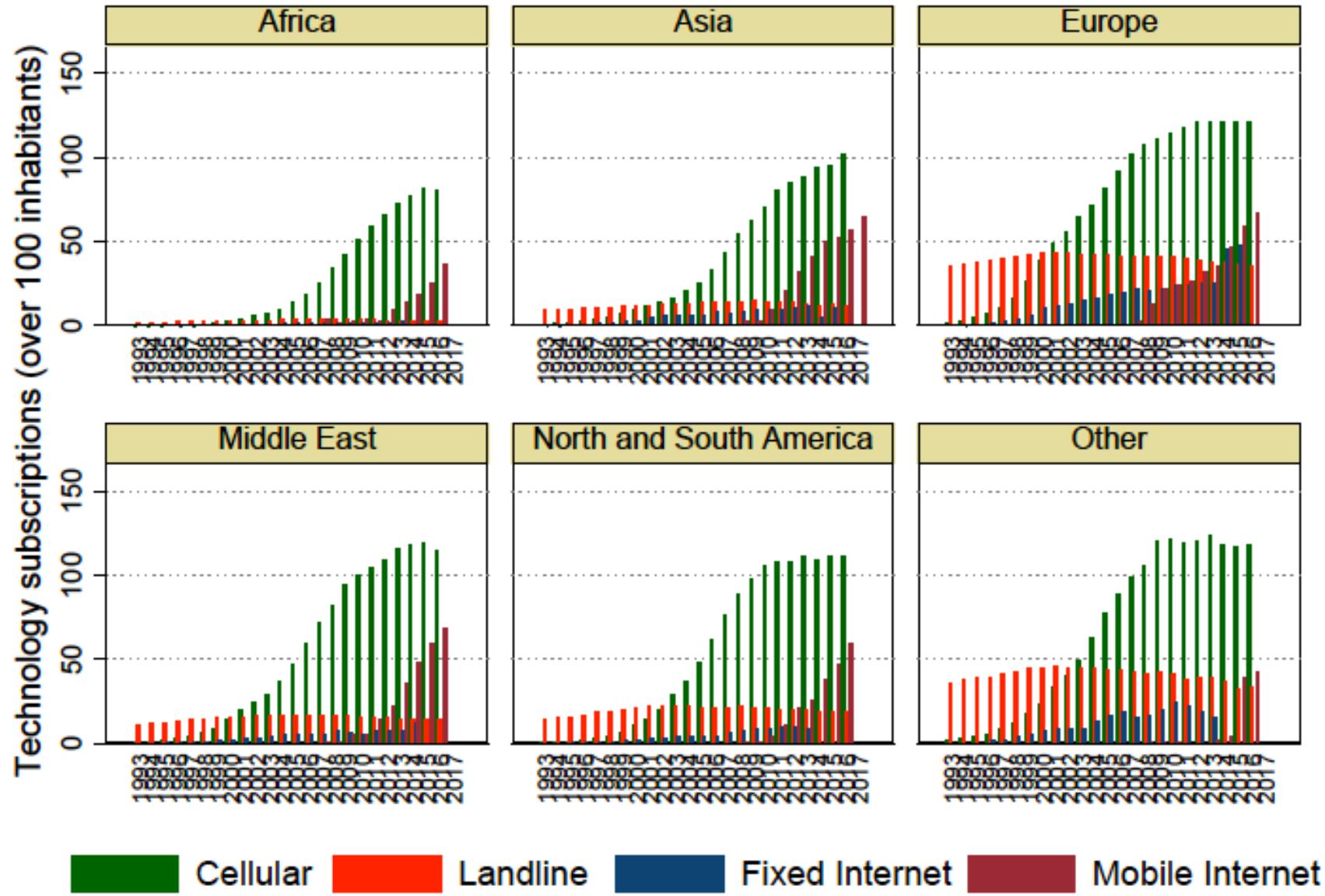
Mobile Phones, Women Empowerment, and Sustainable Development Goals

Francesco C. Billari Ridhi Kashyap Luca M. Pesando
Valentina Rotondi Simone Spinelli

November 2018

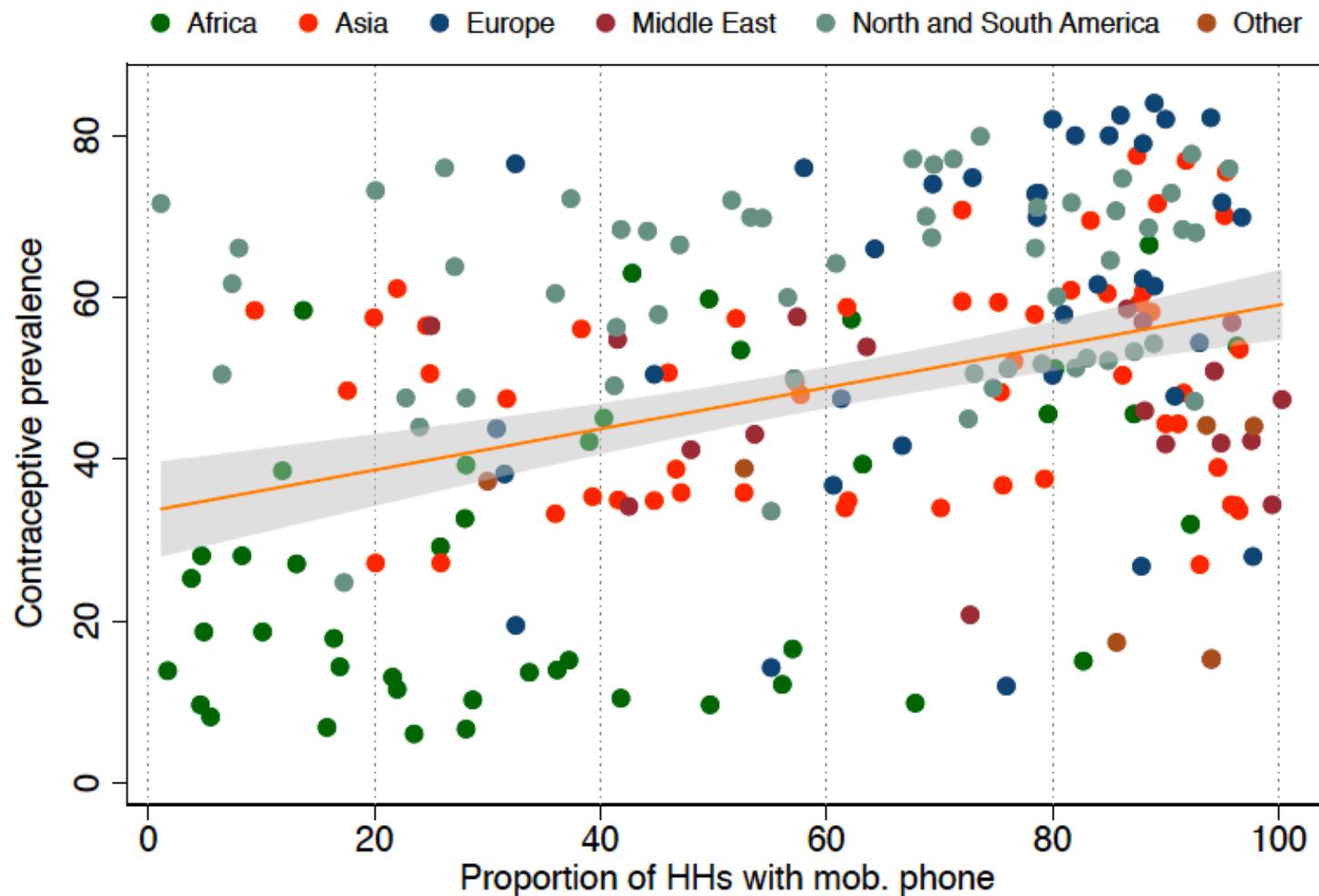
The quickest way to get out of poverty right now is to have one mobile telephone

Muhammad Yunus (2011)

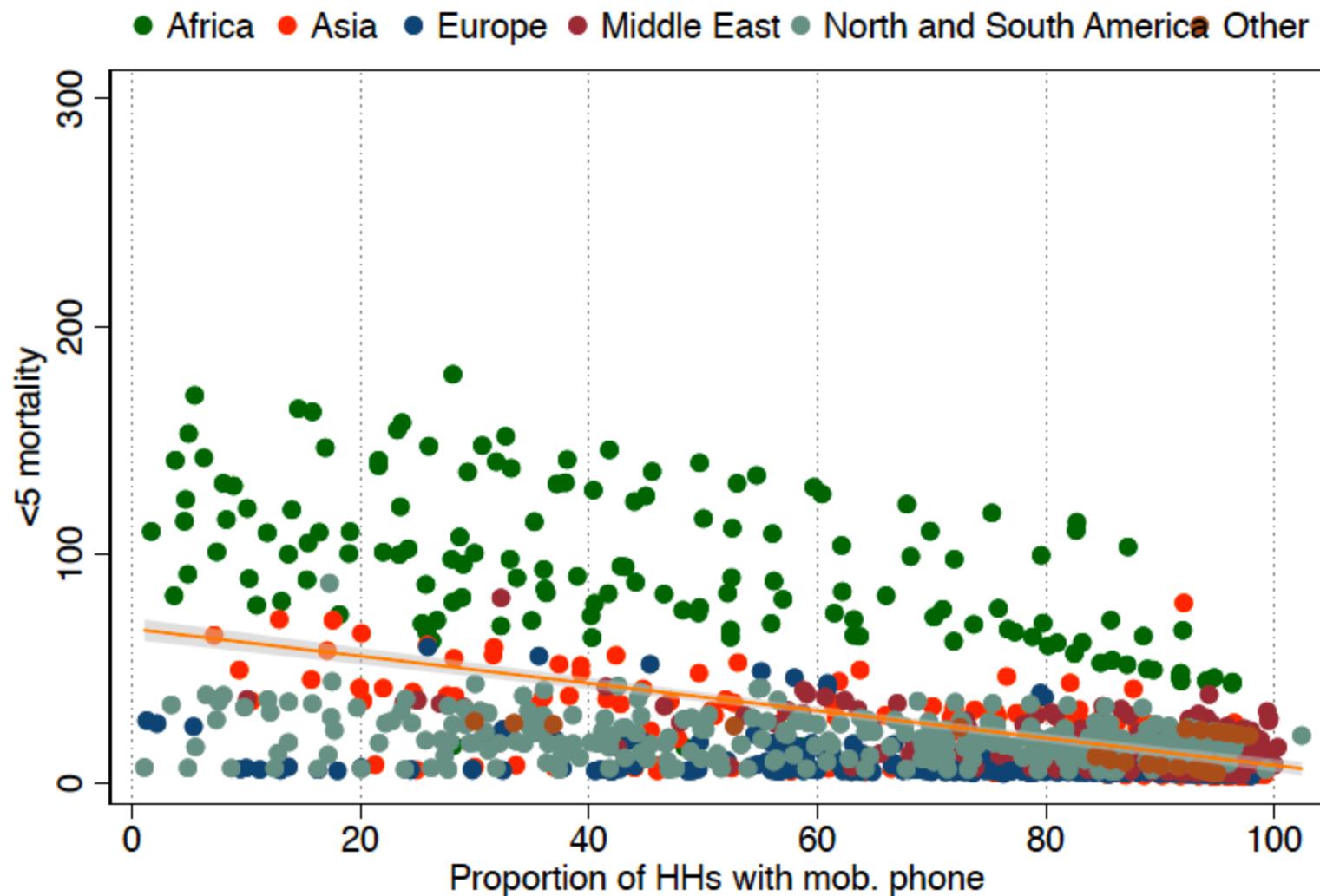


Source: ITU data

Some empirical evidence (2)



Some empirical evidence (2)



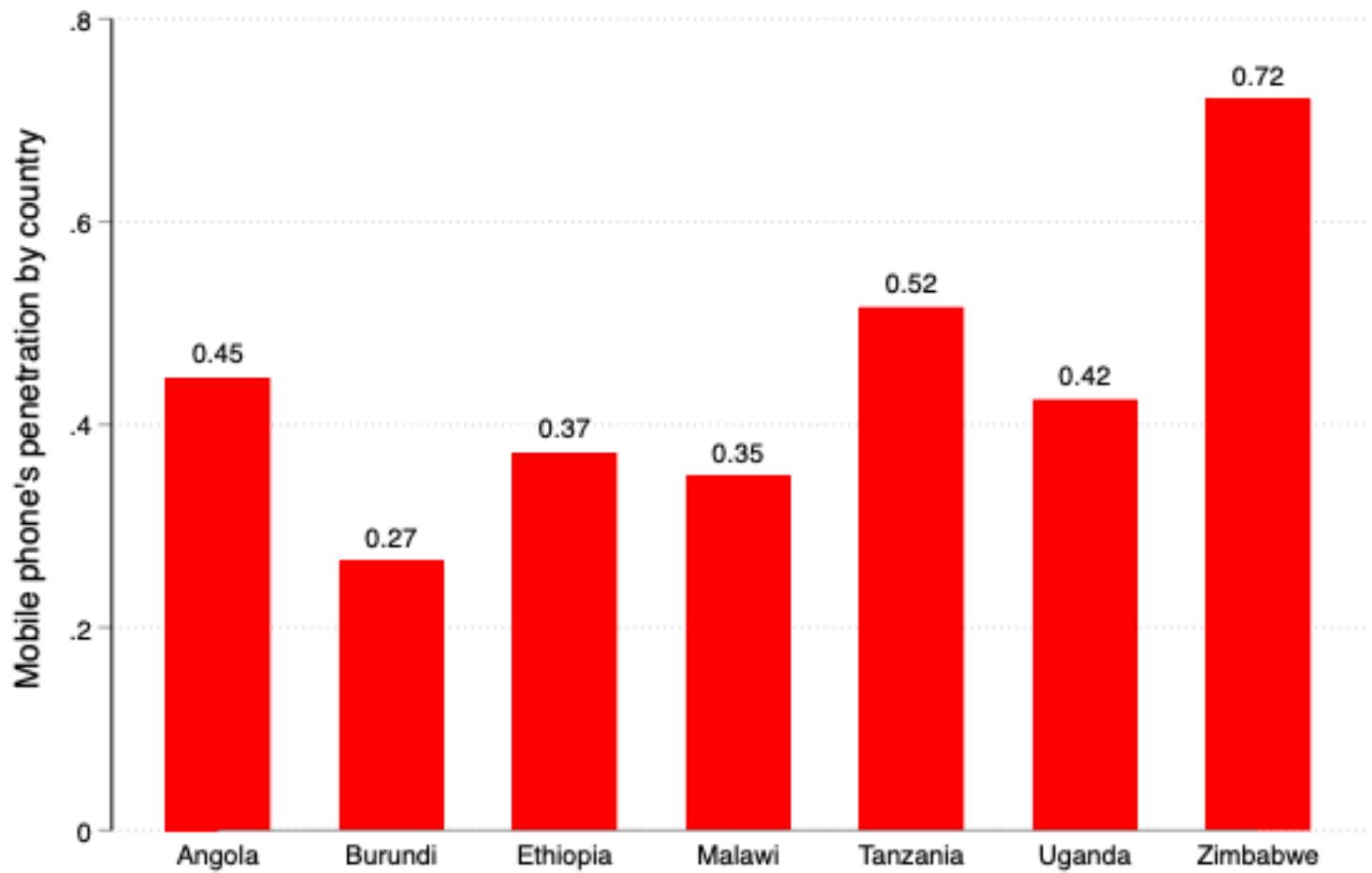


Figure 8: Mobile phones' penetration rates. DHS Africa (2015-2016).

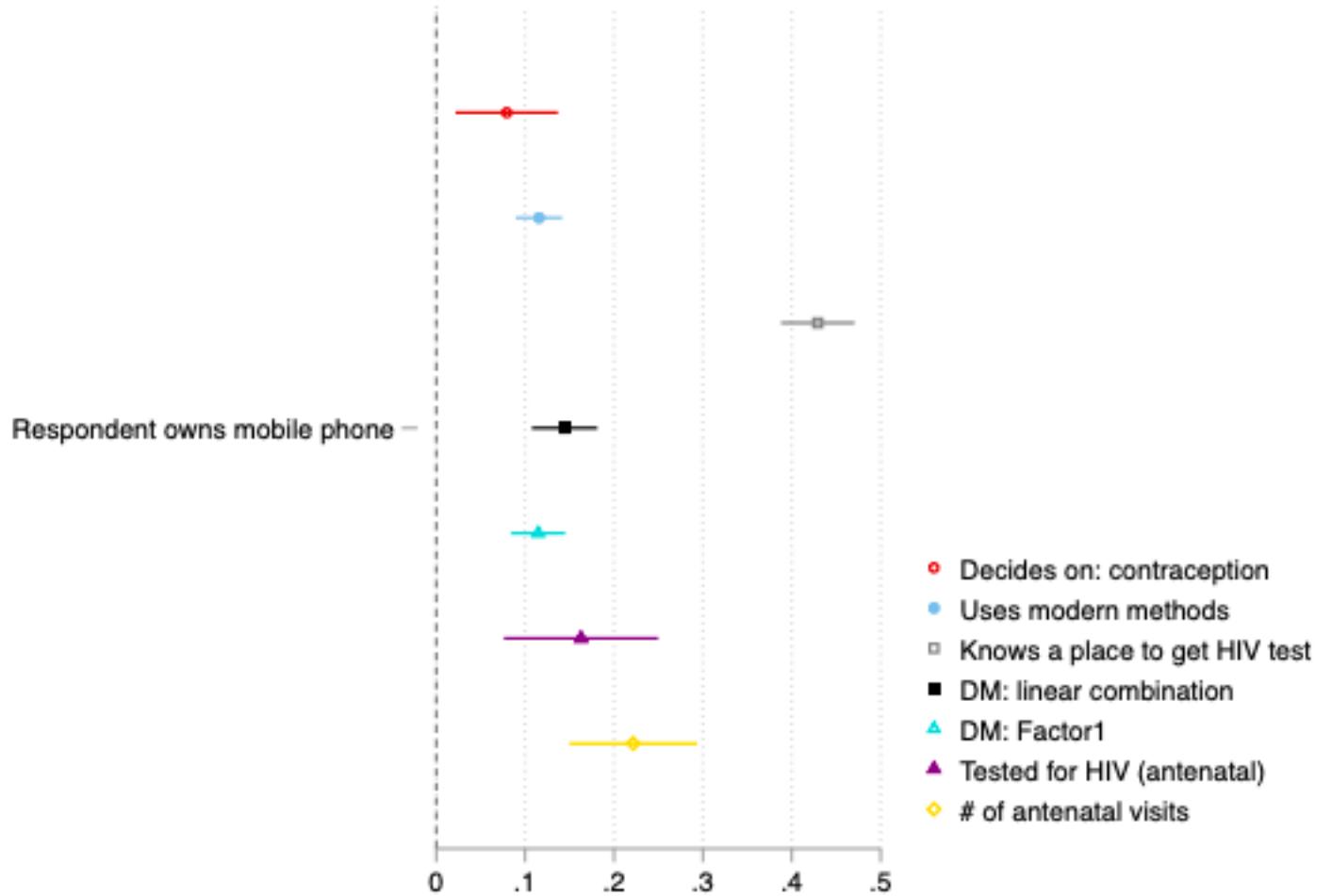


Figure 9: Correlations between mobile phone ownership and women empowerment. Africa. DHS (2015-2016). OLS or Probit (mfx). Wiskers represent 95% confidence intervals.

5. Discussion

- The digital revolution influences fertility, in particular postponement (evidence on the Global South) and over-30 fertility (evidence on Germany)
- Multiple mechanisms
- Several challenges: data, causality, mechanisms



European Research Council

Established by the European Commission

This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement n° 694262), project *DisCont - Discontinuities in Household and Family Formation*

Thank you!