Sanitation (and research) dynamics

A research agenda on sanitation and primary data collection

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Institute for Fiscal Studies

Why sanitation?

- Seen as extremely important:
  - At any given time, >50% of the developing world's population suffering from one or more of main diseases associated with unsafe water and poor sanitation.
  - Every day, 6,000 children die of water- and sanitation-related diseases (UNICEF).
  - India said to lose 6.4 % of GDP due to water and sanitation related health costs (WSP)
  - Ghandi: Sanitation more important than Independence

Why sanitation?

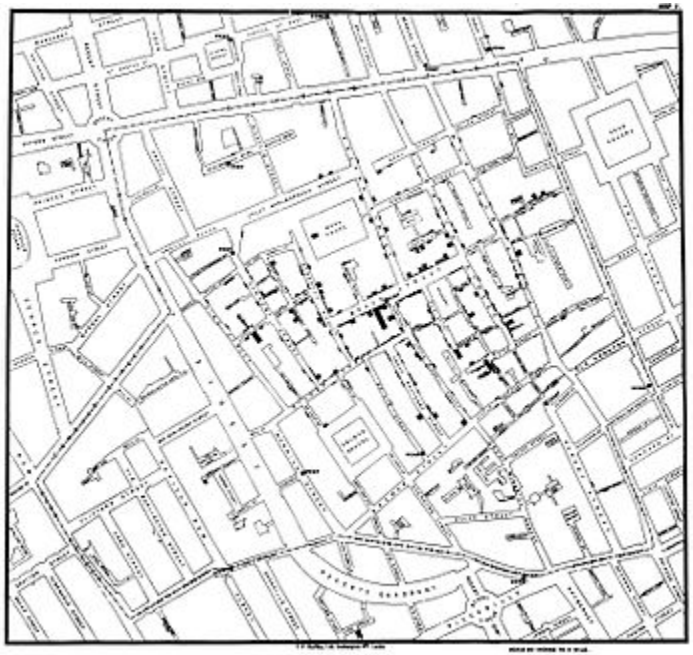
- Tremendous task ahead:
  - 2.5 billion people (2/5 of world's population) live without access to improved sanitation (no adequate means of disposing of human waste)
  - 75 percent live in rural communities (WB Water and Sanitation Program (WSP))
  - Sanitation => "orphan development goal"

Why sanitation?

- And we just don't know yet how to effectively tackle the challenge:
  - DFID (2013): Review on WASH – 1st Key knowledge gaps identified: "Relative effectiveness and efficacy of sanitation interventions on health"
- Challenges faced are manyfold:
  - Technological
  - Financial
  - Behavioural
  - Cultural

What is the evidence?

- It all started with John Snow's investigation into London's cholera epidemic (1854)



➔ Outbreak caused by waterpump, which was polluted by sewage from a nearby cesspit where a baby's nappy contaminated with cholera had been dumped.

What is the evidence?

- Low-cost sanitation in developing countries:

Pattanayak et al (2009)	RCT, India, Shaming and subsidies	Latrine ownership (↑), no effect on diarrhea, improvement in nutritional status of children
Dickinson & Pattanayak (2011)		Evidence of social reinforcing for uptake
Spears (2013)	RCT, India, TSC + "CLTS"	Increase in child height
Cameron et al. (2013)	RCT Indonesia, CLTS, Social Marketing	Toilet construction (↑ 3%), small reduction in diarrhoea
Clase et al (2014), Lancet	**TSC**	**High uptake, No impacts**
Spears, 2012; Spears & Lamda, 2012	Non-experimental, India	indication on ↓ in infant mortality, ↑ in child's height, literacy of children

Ongoing studies

We are conducting a number of studies...

- ... in **India**:
  - 2/3 of pop no access to sanitation
  - >50% of worldwide OD'ers in India
  - Death of 1000 children per day
- ... in **Nigeria**:
  - 3/5 of pop OD or "unimproved"
  - Diarrhoea prevalence 19% (SSA: 16%)
  - Death of ~150,000 per year
- Common: Where possible apply RCT, use estimated parameters in structural models (longer-term research agenda)

FINISH Evaluation

- (Individual HH) Sanitation intervention which:
  1. ...creates awareness about the importance of sanitation,
  2. ...increases technological know-how for the construction of sanitation and
  3. ...alleviates financial constraints to uptake.

FINISH Evaluation

- Evaluation design: RCT in 3 Indian states
- Basic idea:
  1. Collect baseline data
  2. Randomize communities into T and C
  3. Offer intervention in T areas only
  4. Collect follow-up data
  5. Run simple regressions
  6. Find interesting impacts
  7. Possibly have a second follow-up and find long(er)-term impacts

FINISH Evaluation

Things that went wrong:

- MF crisis: - Delay (uncertainty in treatment)
  - Loss of partner 1
  - Loss of identification strategy, partner 2
  - Loss of sample size & re-randomization, p 3

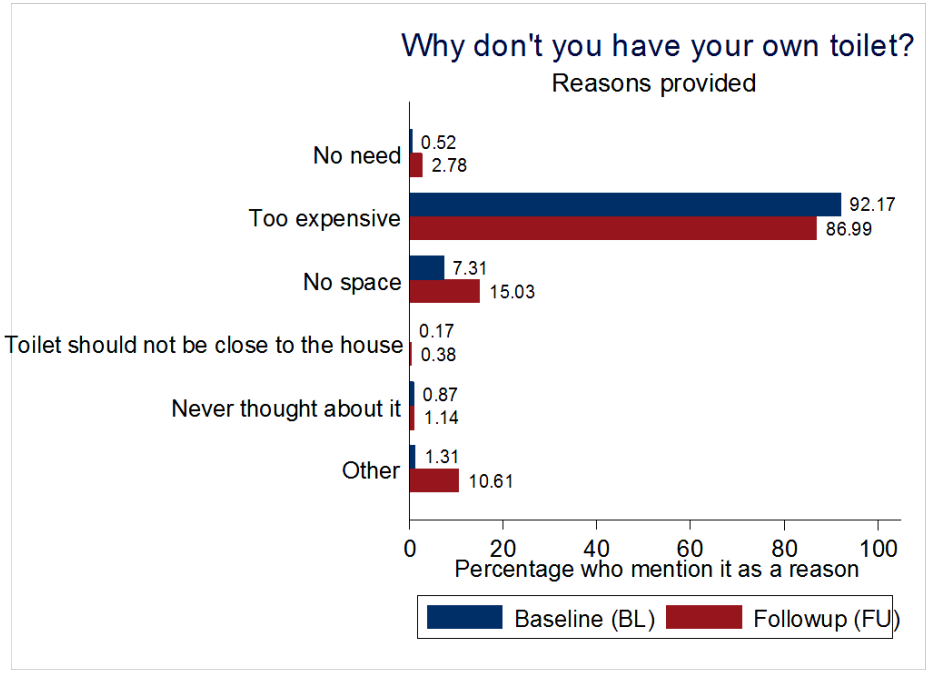
(1) Assess determinants of toilet ownership &acquisition
(2) Understanding the benefits of toilet ownership on a number of outcomes → try to tease out causality attached to observed correlates.

(1) Comparison of means
(2) Possibly not powered to detect unexpected impacts

FINISH Evaluation

Key findings: Urban slums, MP

- Cost of toilet major (reported) hurdle for uptake:

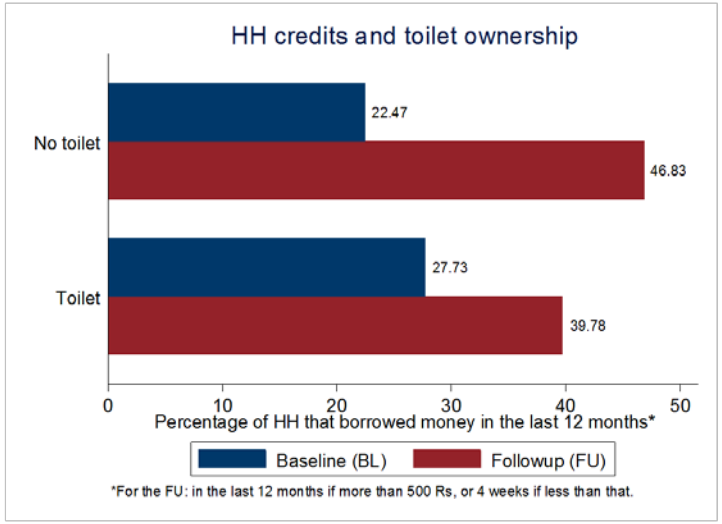


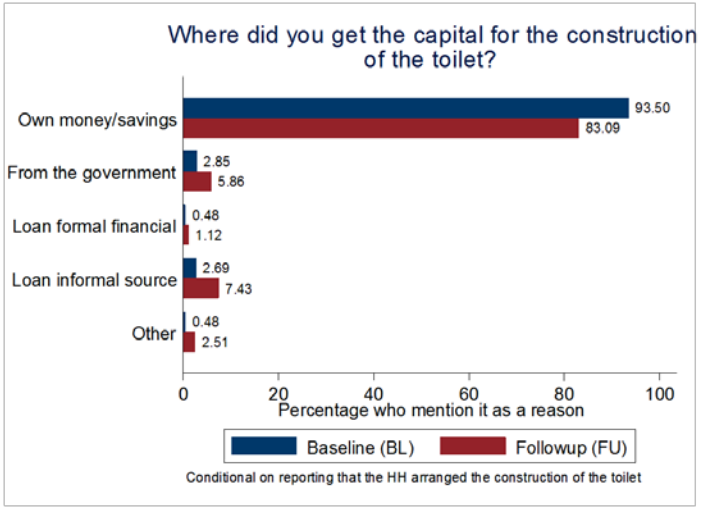
Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

FINISH Evaluation

Key findings: Urban slums, MP

- Since intervention start, credit utilization (for sanitation uptake?) has dramatically increased:



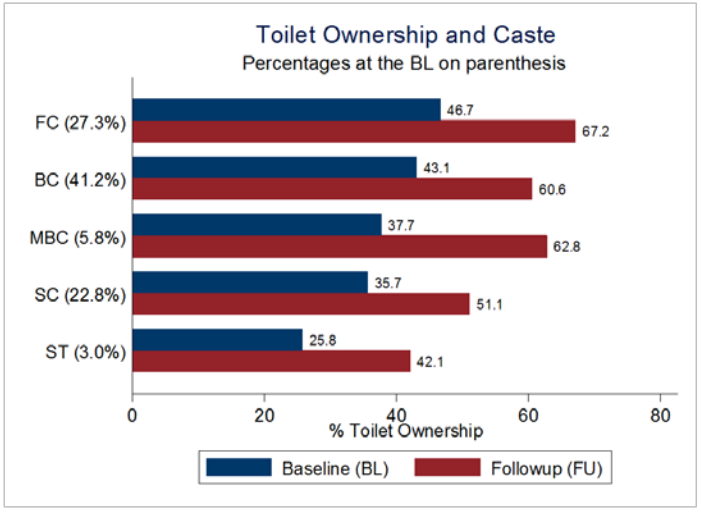


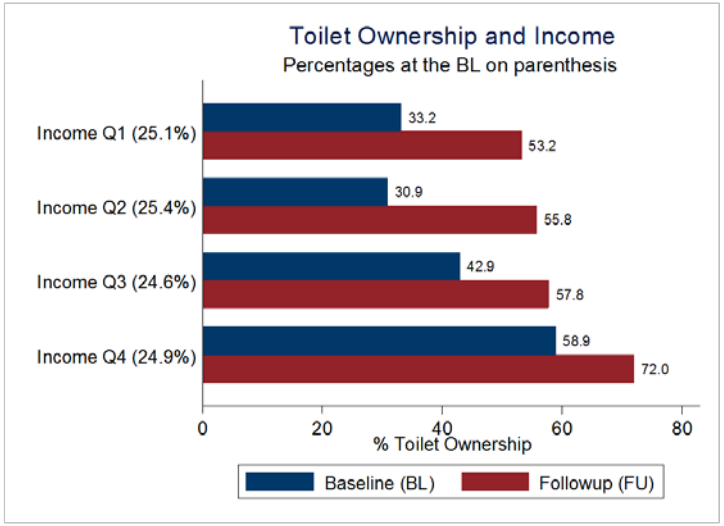
Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

FINISH Evaluation

Key findings: Urban slums, MP

- Less steep gradient in terms of income and social status for those owning a toilet:





Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

FINISH Evaluation

Key findings: Urban slums, MP

- No health impacts (self-reported expenditures, diarrhoea, stool samples, anthropometrics etc)
- Believe they are healthier than others (but don't rate themselves healthier than others do)
- Indication that toilets are acquired for status reasons rather than health reasons:
  - Dwelling increases significantly
  - Main women less likely to work
  - Increased perceived status in the village/slum

Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

FINISH Evaluation
Methodology

- Several specifications used:
  - Cross-sectional: $Y_{i,j,t=\tau} = \delta T_{i,j,t=\tau} + X'_{i,j,t=\tau}\omega_1 + \eta_j + u_{i,j,t=\tau}$
  - Panel: $Y_{i,j,t} = \delta T_{i,j,t} + X'_{i,j,t}\omega_2 + \alpha_i + \gamma_t + u_{i,j,t}$
  - Outcomes only at t=2:

$$Y_{i,j,t=2} = \delta T_{i,j,t=2} + X'_{i,j,t}\omega_3 + \eta_j + u_{i,j,t=2} \quad | \quad T_{i,j,t=1} = 0$$

- SEs clustered at slum level

Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

FINISH Evaluation

Key findings: rural villages, TN

- 'Successful' RCT, unsuccessful intervention:
  - Sanitation uptake over 3yrs: ~18%
  - Average coverage: 45% (power analysis based on >50%)
  - Impact on sanitation uptake: **Zero**!

Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

FINISH Evaluation

Key findings: rural villages, TN

- But, treatment villages less likely to put their own resources

  => Likely that this frees-up own resources for other investments

  – Currently analysing this, but possible that study is not powered to detect these investments
- Thinking of model where intervention had a general equilibrium effect on terms of beliefs on the value of sanitation, which triggers uptake (note that some loans were also provided in control)

Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

Some “take-aways” from research so far

- Health impacts of low-cost sanitation not clear
  - Very little shaky evidence
  - Low uptake!
  - Safety of toilets? Usage?
- Motivation to construct sanitation does not seem to be health concerns
  - Status (marriage)
  - Investment (increased value of dwelling)
- Cost major deterrent
  - This does not equate to credit being the solution

Joint work with: Paul Andrés Rodríguez Lesmes (UCL)

Financial or informational constraints?

Other study ongoing (Karnataka), with 3 arms:

1) Control
2) Credit for sanitation
3) Credit for sanitation + Awareness creation

- **Purpose 1**: Disentangle informational versus credit constraints in sanitation uptake and usage

Financial or informational constraints?

- **Purpose 2**: Analyse whether improved sanitation reduces health insurance claims

  => Overlay all groups with (primary) health insurance and study claims
  - Can one under-write insurance based on sanitation ownership?
  - Attract healthier clients?
  - Attach monetary value to sanitation?

Other constraints: Supply side?

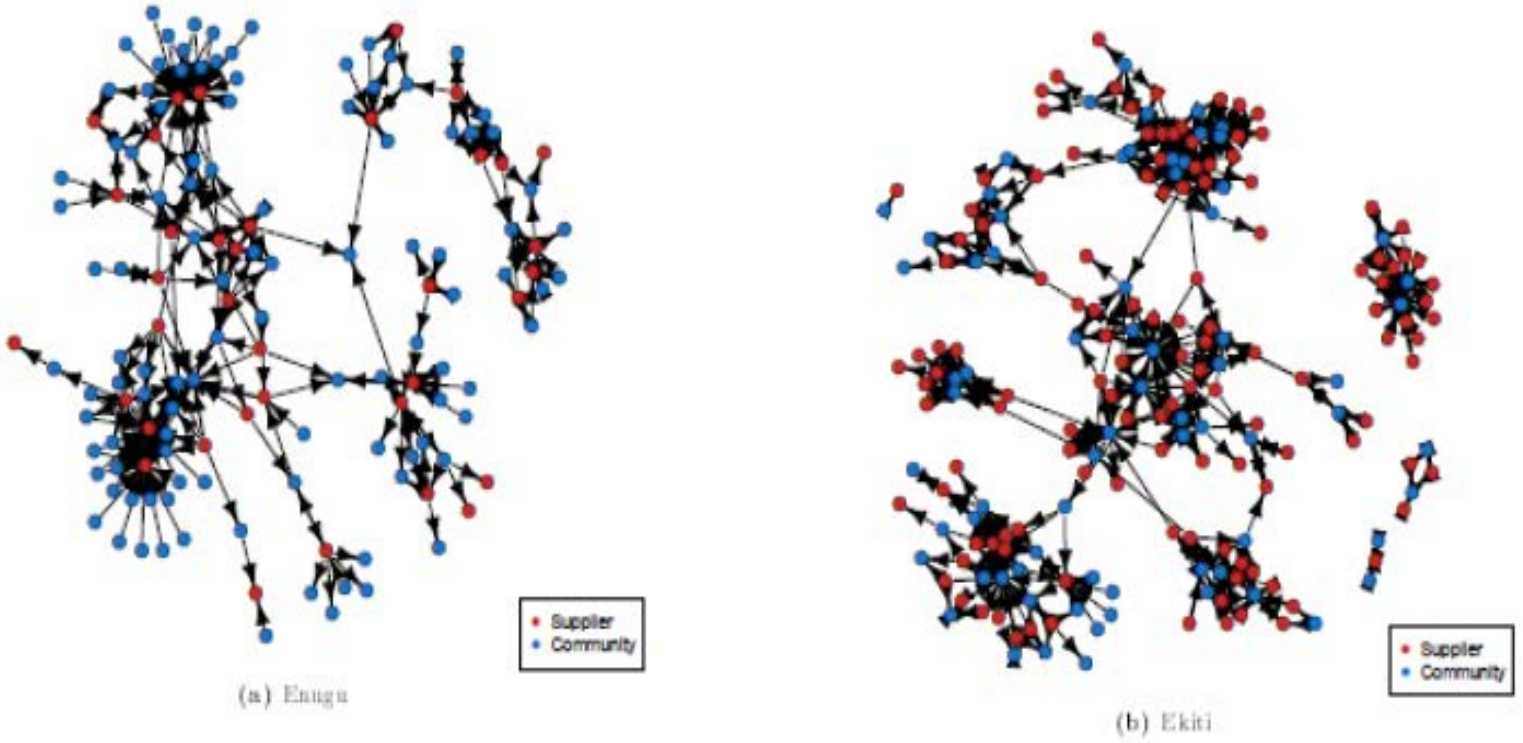
- Project Nigeria, two interventions (simplified):
  1. Demand creation (CLTS)
  2. Supply side intervention (SanMark): design desired product and get/support suppliers to sell it
- Evaluation strategy:
  1. RCT at level of `community'
  2. RCT at supplier level?? → Only if suppliers work in independent (small) local markets!!!!

Other constraints: Supply side?

- Mapping exercise:
  - Where do suppliers deliver to?
  - Where do households buy?
- Basic result:
  - Communities and suppliers are part of a dense web of business interactions
  - Suppliers are located very near each other and each serve overlapping sets of communities

Other constraints: Supply side?

Figure 1: Transaction networks for concrete blocks



Joint work with: Laura Abramovsky, Richard Audoley

THANK YOU

SOME TABLES

Table 6: Toilet ownership and Outcomes - Health

Eq4. Cross-section τ : $Y_{i,j,t=\tau} = \delta Toilet_{i,j,t=\tau} + \beta X_{i,j,t=\tau} + \eta_j + u_{i,j,t=\tau}$, **Eq5. Panel:** $Y_{i,t} = \delta Toilet_{i,t} + \beta X_{i,t} + \alpha_i + \gamma_t + u_{i,t}$

	Cross-section analysis									Panel	
	Round 1 (2010)			Round 2 (2013)			Restricted Round 2†			DID on R.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome Variables Y	N	$\bar{Y}_{t=1}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	Eq5
Rating own health (1-10; 1=very poor)	1847	*7.0*	0.10	1592	*8.6*	0.04	951	*8.6*	0.08	1042	0.12
			(0.07)			(0.09)			(0.12)		(0.11)
Perceive himself as healthier than others	1838	*32.2%*	4.53	1559	*29.1%*	−0.85	929	*29.7%*	0.28	1019	9.72**
			(3.20)			(2.37)			(2.64)		(4.22)
Rating family's health (1-10;1=very poor)	1841	*6.9*	0.06	1589	*8.8*	0.15*	949	*8.7*	0.19	1040	0.11
			(0.07)			(0.09)			(0.12)		(0.11)
Perceive family as healthier than others	1836	*29.8%*	2.37	1552	*28.0%*	0.73	925	*27.5%*	4.03	1015	8.87**
			(2.82)			(3.04)			(3.99)		(4.19)
Did any children have diarrhoea last week?	1858	*11.6%*	−0.43	1592	*6.3%*	1.40	951	*6.2%*	2.44	960	0.65
			(2.06)			(1.36)			(2.16)		(2.67)
Health provider visited, last 4 weeks	1841	*25.4%*	1.78	1592	*44.0%*	2.82	951	*44.6%*	−1.30	1042	−8.66**
			(2.29)			(2.64)			(3.82)		(3.96)
Average medical costs over all visits, Rs††	1769	*132.9*	27.24	1474	*311.1*	7.21	882	*320.5*	9.00	969	67.44
			(38.32)			(59.08)			(83.44)		(73.54)
Hospitalization, last 12 months	1867	*8.9%*	−0.80	1592	*14.4%*	2.40	951	*13.0%*	−0.96	1042	−3.95
			(2.19)			(2.39)			(2.97)		(2.63)
Presents mucus in the stool				317	*46.4%*	15.06**	197	*47.2%*	10.00		
						(7.23)			(9.67)		
Presents stool acid reaction				317	*67.2%*	−4.72	197	*72.1%*	−7.04		
						(3.89)			(6.94)		
Presents OVA in the stool				317	*23.0%*	1.45	197	*20.8%*	−11.69		
						(5.68)			(7.77)		
Presents Cyst in the stool				317	*4.1%*	0.40	197	*5.1%*	−0.60		
						(3.20)			(3.51)		
Presents fat in the stool				317	*49.2%*	13.57	197	*53.3%*	13.36*		
						(8.70)			(7.88)		
Water Sample: chlorine present				1592	*47.9%*	0.43	951	*54.6%*	0.96		
						(2.73)			(3.30)		
Water Sample: Colony count (1000s)				578	*104.3*	0.29	341	*102.8*	−2.01		
						(2.60)			(3.06)		

† Restricted sample to HHs that reported NOT having a toilet at survey round 1.; †† Round 1 Rs values adjusted for national inflation (factor 1.32).
Notes: Data source: Round 1 and 2 data. Variables defined at the HH level except for stool samples which are at the individual level. X_i includes socio-demographic controls of the main woman, HH head, HH demographics and socio-economic status. Robust SE in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Table 7: Toilet ownership and Outcomes - Productivity and time use

Eq4. Cross-section τ : $Y_{i,j,t=\tau} = \delta Toilet_{i,j,t=\tau} + \beta X_{i,j,t=\tau} + \eta_j + u_{i,j,t=\tau}$, **Eq5. Panel:** $Y_{i,t} = \delta Toilet_{i,t} + \beta X_{i,t} + \alpha_i + \gamma_t + u_{i,t}$

	Cross-section analysis									Panel	
	Round 1 (2010)			Round 2 (2013)			Restricted Round 2†			DID on R.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome Variables Y	N	$\bar{Y}_{t=1}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	Eq5
Labour martket											
HH: N Males 25-65 who work (a32)	1867	*0.9*	0.01	1592	*0.8*	−0.01	951	*0.8*	−0.04	1042	−0.00
			(0.04)			(0.04)			(0.05)		(0.04)
HH: N Females 25-65 who work (a32)	1867	*0.2*	−0.03	1592	*0.2*	−0.06	951	*0.2*	−0.05	1042	−0.07**
			(0.03)			(0.04)			(0.05)		(0.04)
Total male paid working hours of the household	1867	*74.6*	−4.36	1592	*64.7*	−2.51	951	*63.3*	0.87	1042	−0.44
			(3.14)			(2.78)			(3.50)		(3.48)
Total female paid working hours of the household	1867	*12.8*	−2.69	1592	*14.9*	−4.10**	951	*15.0*	−3.53	1042	−6.02***
			(1.69)			(1.95)			(2.48)		(2.32)
Children Time Utilization											
Children 3-15: avg. hours doing domestic housework	1491	*0.3*	−0.11***	1146	*0.5*	−0.12*	708	*0.5*	−0.17*	784	−0.13*
			(0.03)			(0.07)			(0.09)		(0.08)
Children 3-15: avg. hours carrying water	1491	*0.3*	−0.08	1139	*0.4*	−0.13**	704	*0.5*	−0.13	780	−0.22***
			(0.05)			(0.06)			(0.09)		(0.08)
Children 3-15: avg. hours working HH business	1491	*0.0*	−0.03	1138	*0.2*	0.05	703	*0.3*	0.06	779	−0.04
			(0.02)			(0.05)			(0.06)		(0.07)
Children 3-15: avg. hours extra education	1491	*0.2*	0.17***	1146	*0.5*	0.11	708	*0.4*	0.03	784	−0.02
			(0.05)			(0.10)			(0.11)		(0.10)
Attend to school (indiv. level)	8525	*25.7%*	2.99**	9048	*25.7%*	2.66**	5412	*26.3%*	1.75	4170	0.42
			(1.30)			(1.30)			(1.59)		(1.36)
HH: No Girls 6-12yrs attending school	1867	*0.3*	−0.01	1592	*0.3*	−0.00	951	*0.3*	0.01	1042	−0.01
			(0.04)			(0.03)			(0.04)		(0.03)

† Restricted sample to HHs that reported NOT having a toilet at survey round 1.

Notes: Data source: Round 1 and 2 data. Variables defined at the HH level, except where indicated. X_i includes socio-demographic controls of the main woman, HH head, HH demographics and socio-economic status. Robust SE in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Table 8: Toilet ownership and Outcomes - Wealth and finances

Eq4. Cross-section τ : $Y_{i,j,t=\tau} = \delta Toilet_{i,j,t=\tau} + \beta X_{i,j,t=\tau} + \eta_j + u_{i,j,t=\tau}$, **Eq5. Panel:** $Y_{i,t} = \delta Toilet_{i,t} + \beta X_{i,t} + \alpha_i + \gamma_t + u_{i,t}$

	Cross-section analysis									Panel	
	Round 1 (2010)			Round 2 (2013)			Restricted Round 2†			DID on R.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome Variables Y	N	$\bar{Y}_{t=1}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	Eq5
Dwelling and other assets											
Value of the Dwelling	1397	*158.9*	74.01***	1484	*169.4*	50.08***	909	*150.0*	46.14***	997	42.69***
			(10.82)			(10.47)			(11.98)		(14.34)
Assets: Transport (1000 Rs††)	1867	*6.6*	4.55**	1592	*22.7*	1.57	951	*8.9*	2.79	1042	3.45*
			(1.82)			(5.54)			(2.13)		(1.78)
Assets: House elements (1000 Rs††)	1867	*69.7*	15.84***	1592	*181.6*	53.32*	951	*146.4*	25.00	1042	62.93**
			(2.99)			(27.01)			(29.21)		(27.99)
Assets: Farm (1000 Rs††)	1867	*21.3*	−7.38	1592	*47.9*	0.30	951	*54.0*	−31.26	1042	−32.67
			(4.77)			(16.32)			(19.12)		(21.36)
Income											
Income from wages	1867	*94.1%*	−1.48	1591	*85.4%*	−2.60	950	*86.3%*	1.33	1041	5.18**
			(1.27)			(1.76)			(1.97)		(2.38)
Income earned from wages (1000s ††)	1867	*55.4*	1.24	1592	*55.4*	−6.34**	951	*50.2*	−4.70	1042	−0.19
			(1.35)			(3.05)			(3.04)		(2.49)
Income from ANY business	1867	*12.9%*	−2.60	1591	*29.0%*	1.45	950	*30.7%*	−0.10	1041	−8.88***
			(2.30)			(2.12)			(2.44)		(3.12)
Income earned from ANY business (1000s††)	1867	*4.8*	−1.32	1591	*12.3*	3.25**	950	*11.8*	1.22	1041	−3.11*
			(1.40)			(1.29)			(1.41)		(1.75)
Savings and loans											
HH borred> Rs 500, last 12 months	1717	*24.5%*	−3.40	1146	*44.9%*	0.08	702	*47.7%*	5.86	761	−1.56
			(3.27)			(4.29)			(4.47)		(5.02)
Amount borred, last 12 months (1000s††)	1717	*11.2*	1.25	1148	*14.3*	6.69**	703	*14.1*	6.80**	762	−4.86
			(4.25)			(3.13)			(3.11)		(5.57)
Loans as a proportion of Income	1674	*17.5%*	4.57	1145	*27.6%*	12.97**	701	*27.0%*	11.55*	760	−11.48
			(8.26)			(6.07)			(5.76)		(10.48)
HH: any savings?	1867	*27.1%*	4.24*	1588	*29.4%*	1.58	948	*29.1%*	−1.53	1038	−0.96
			(2.27)			(2.92)			(3.07)		(3.95)
Amount saved, 1000s of Rs†	1867	*4.6*	0.42	1588	*5.0*	1.21	948	*4.8*	1.56	1038	2.18
			(1.47)			(1.75)			(1.42)		(1.79)
Savings as a proportion of income	1815	*5.0%*	1.24	1585	*5.5%*	2.37*	946	*6.3%*	3.72**	1036	4.93*
			(0.88)			(1.33)			(1.52)		(2.61)

† Restricted sample to HHs that reported NOT having a toilet at survey round 1.; †† Round 1 Rs values adjusted for national inflation (factor 1.32).
Notes: Data source: Round 1 and 2 data. Variables defined at the HH level. X_i includes socio-demographic controls of the main woman, HH head, HH demographics and socio-economic status. Robust SE in parenthesis. Significance: * 10%, ** 5%, *** 1%.

Table 9: Toilet ownership and Outcomes - Main woman

Eq4. Cross-section τ : $Y_{i,j,t=\tau} = \delta Toilet_{i,j,t=\tau} + \beta X_{i,j,t=\tau} + \eta_j + u_{i,j,t=\tau}$, **Eq5. Panel:** $Y_{i,t} = \delta Toilet_{i,t} + \beta X_{i,t} + \alpha_i + \gamma_t + u_{i,t}$

	Cross-section analysis									Panel	
	Round 1 (2010)			Round 2 (2013)			Restricted Round 2†			DID on R.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Outcome Variables Y	N	$\bar{Y}_{t=1}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	$\bar{Y}_{t=2}$	Eq4	N	Eq5
For how many years are/were you married?	1782	*21.0*	−0.06	1537	*22.0*	−0.52	924	*22.2*	−0.61	932	0.11
			(0.35)			(0.39)			(0.54)		(0.95)
How old were you when you got married?	1803	*16.0*	0.25	1538	*16.5*	0.27	923	*16.4*	0.36	931	0.43
			(0.17)			(0.20)			(0.26)		(0.27)
Was it an arranged marriage?	1777	*98.9%*	−0.17	1542	*95.1%*	0.86	927	*95.4%*	0.60	935	−1.59
			(1.03)			(1.15)			(1.30)		(1.71)
When looking for a husband, did it matter whether he could offer sanitation?	1801	*49.1%*	9.72**	1542	*14.7%*	7.58***	926	*10.3%*	2.86	934	−4.93
			(4.05)			(1.95)			(2.12)		(4.20)
Was a dowry paid?	1769	*76.3%*	7.05***	1518	*83.6%*	2.85	907	*83.7%*	2.29	915	5.08
			(2.58)			(2.58)			(2.78)		(3.95)
With whom do you live? You in-laws	1867	*12.4%*	−3.22	1592	*23.9%*	5.90**	951	*21.7%*	5.38	1042	3.33
			(2.21)			(2.77)			(3.72)		(3.23)
Knowledge test: correct answers	1852	*34.8*	0.31	1592	*42.6*	−0.25	951	*42.3*	−0.11	959	0.28
			(0.49)			(0.27)			(0.31)		(0.77)
Knowledge test: INcorrect answers	1851	*12.7*	0.24	1592	*8.7*	0.05	951	*8.7*	−0.19	959	−1.18**
			(0.34)			(0.18)			(0.25)		(0.58)
Disgust: shared soda glass (1-5, 5 ext. disg)				905	*4.0*	−0.61***	502	*4.1*	−0.67***		
						(0.18)			(0.18)		

† Restricted sample to HHs that reported NOT having a toilet at survey round 1.

Notes: Data source: Round 1 and 2 data. Variables defined at the HH level. X_i includes socio-demographic controls of the main woman, HH head, HH demographics and socio-economic status. Robust SE in parenthesis. Significance: * 10%, ** 5%, *** 1%.