

# BGSE Development Economics Summer School

## **Day 5:**

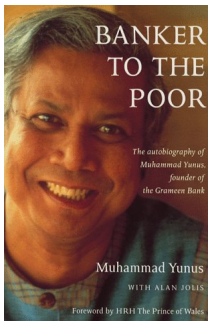
### **What Have We Learned from RCTs?**

#### **Part I: Estimating the Impacts of Microfinance**

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# What is Microfinance?

**Microfinance** is the provision of small, typically uncollateralized loans to poor borrowers — often via various forms of **group lending**



- UN declared 2005 the Year of Microcredit
- Over 3,500 MFIs reached more than 150 million borrowers by 2007

# What is Microfinance?

Poor borrowers may be **credit-constrained** because of **limited liability**

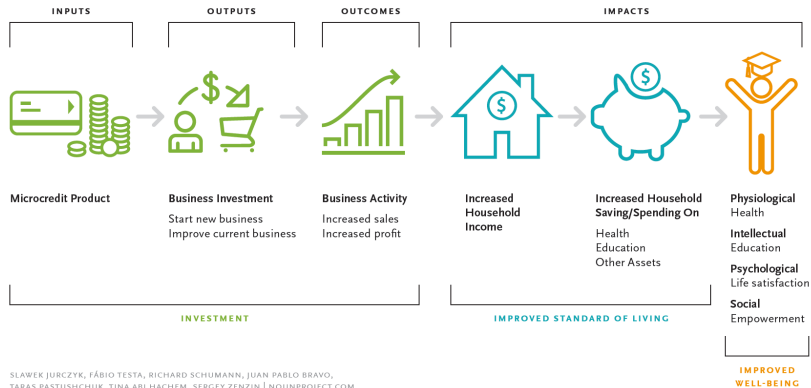
- In many developed country contexts, credit ratings discourage borrowers from defaulting on small loans (e.g. credit card balances)
  - ▶ Credit bureaus are absent in many LMIC contexts
  - ▶ Debt collectors can also take loan defaulters to court, but only when the judicial system is reasonably effective at enforcing contracts
- Lenders could offer borrowers w/o collateral higher interest rates
  - ▶ Creates a credit market for lemons
  - ▶ Interest is a tax on repayment: those willing to accept high-interest contracts likely to have higher default probabilities than population

# What is Microfinance?

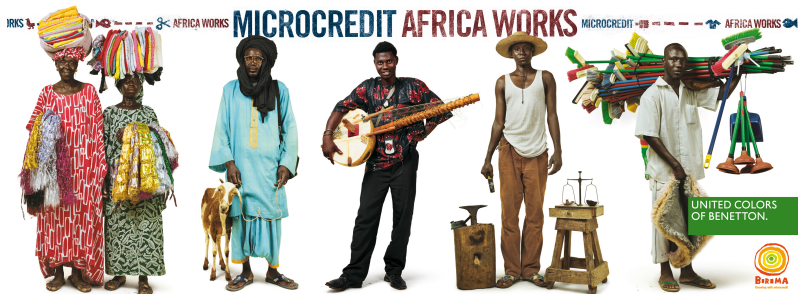
## Components of the traditional microfinance package:

- Small, uncollateralized loans
- **Dynamic incentives:** loans start small, get progressively larger
  - ▶ Creates a private incentive for borrowers to choose low-risk investment opportunities/projects, repay whenever possible
- **Joint liability:** borrowers responsible for others' loans, too
  - ▶ Shifts burden of screening creditworthiness, monitoring effort from lender (w/ limited information) to co-borrowers (absent collusion)
- Dynamic incentives, limited liability can overcome twin problems of **adverse selection** and **moral hazard** (Ghatak & Guinnane 1999)
- Focus on female borrowers (who are seen as more credit-constrained)

# What is Microfinance? Theory of Change



# Does Microfinance Work? Theory of Change



*Microcredit is the way to go to really help developing countries... not the IMF or World Bank... Benetton partnered with [Youssou N'Dour]... to showcase Senegalese workers who have used micro loans to start small, productive businesses — whether textile traders, domestic appliance salesman, mobile toy stores, livestock merchants or others.*

- Some random blogger who doesn't understand selection bias

# Does Microfinance Work? Theory of Change

*Many studies show that clients who join and stay in programs have better economic conditions than non-clients, suggesting that programs contribute to these improvements. A few studies have also shown that over a long period of time many clients do actually graduate out of poverty... By reducing vulnerability and increasing earnings and savings, financial services allow poor households to make the transformation from “every-day survival” to “planning for the future.” Households are able to send more children to school for longer periods and to make greater investments in their children’s education. Increased earnings from financial services lead to better nutrition and better living conditions, which translates into a lower incidence of illness.*

- kiva.org (“loans that change lives”)

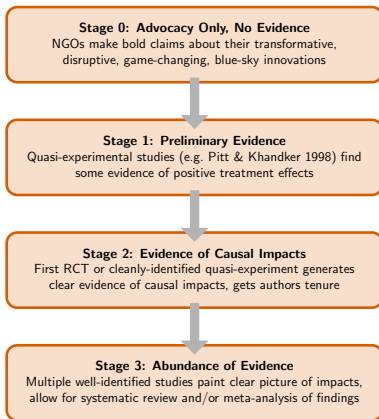
# Does Microfinance Work? Measuring Success

## **How should we measure the success/impact of microfinance?**

- Evidence: many successful MFIs have very low default rates
  - ▶ Does demand for loans imply impact?
- As seen above, many NGOs make explicit or implicit causal claims
  - ▶ Does (access to microfinance) increase self-employment? Income?
  - ▶ Does this translate into higher consumption, empowerment, etc.?



# Evidence-Based Policy: The Process

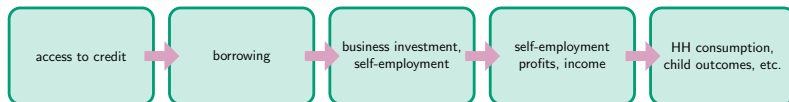


# RCTs Estimating the Impact of Microfinance

Country	Bosnia and Herzegovina	Ethiopia	India	Mexico	Mongolia	Morocco	The Philippines
Study citation	Augsburg et al. (2015)	Tarozzi, Desai, and Johnson (2015)	Banerjee, Duflo, Glenneister, and Kinnan (2015)	Angelucci, Karlan, and Zinman (2015)	Attanasio et al. (2015)	Crépon et al. (2015)	Karlan and Zinman (2011)
Treatment	Lend to marginally rejected borrowers	Open branches	Open branches	Open branches, promote loans	Open branches, target likely borrowers	Open branches	Lend to marginal applicants
Randomization level	Individual	Community	Community	Community	Community	Community	Individual
Urban or rural?	Both	Rural	Urban	Both	Rural	Rural	Urban
Target women?	No	No	Yes	Yes	Yes	No	No
MFI already operates locally?	Yes	No	No	No	No	No	Yes
Microloan liability type	Individual	Group	Group	Group	Both	Group	Individual
Collateralized?	Yes	Yes	No	No	Yes	No	No
Any other MFIs competing?	Yes	No	Yes	Yes	Yes	No	Yes
Household panel?	Yes	No	No	Partial	Yes	Yes	No
Interest rate (intended on average)	22% APR	12% APR	24% APR	100% APR	24% APR	13.5% APR	63% APR
Sampling frame	Marginal applicants	Random sample	Households with at least 1 woman age 18–55 of stable residence	Women ages 18–60 who own businesses or wish to start them	Women who registered interest in loans and met eligibility criteria	Random sample plus likely borrowers	Marginal applicants
Study duration	14 months	36 months	40 months	16 months	19 months	24 months	36 months

*Notes:* The construction of the interest rates here is different to the construction of Banerjee et al. (2015); they have taken the maximal interest rate, whereas I have taken the average of the intended range specified by the MFI. In practice, the differences in these constructions are numerically small.

# Research Questions: Potential Causal Pathways

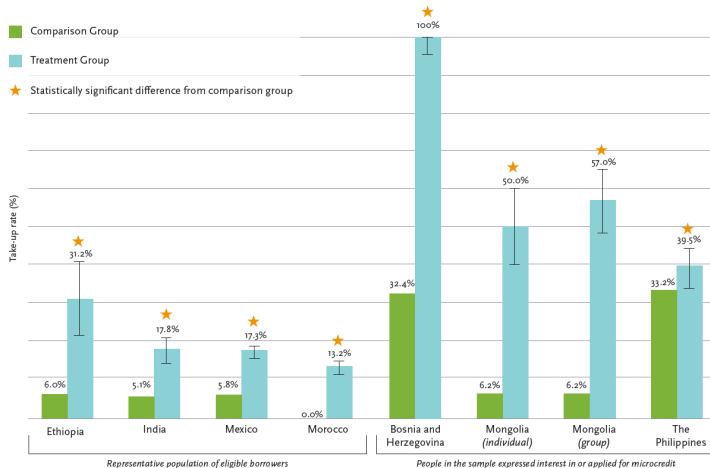


## Outcome variables:

- Borrowing (from program MFI, from all MFIs, total)
- Self-employment, business investment, revenues
- HH income, consumption
- Empowerment, HH bargaining, child outcomes, etc.

Statistical power to detect presence or absence of downstream impacts depends on magnitude, precision of effects at earlier links in causal chain

# The Demand for Microfinance



Note: Statistical significance is noted at the 90 percent confidence level or higher and error bars represent 90 percent confidence intervals; In Ethiopia, India, Mexico, Mongolia, and Morocco, take-up is measured as having any loans from the partner MFI at the time of the endline survey; In India, the results displayed are from the first endline survey (1.5 years), and there is also a statistically significant difference after 3.5 years; In Bosnia and Herzegovina, comparison group take-up is measured as having any outstanding loan from any MFI and treatment group take-up is a direct measurement of those who took up the partner MFI's microcredit offer (76.3 percent of borrowers in the treatment group reported having any loans from any MFI at the time of the endline survey); In the Philippines, take-up is measured as having any loan from any financial institution in the month preceding the endline survey.

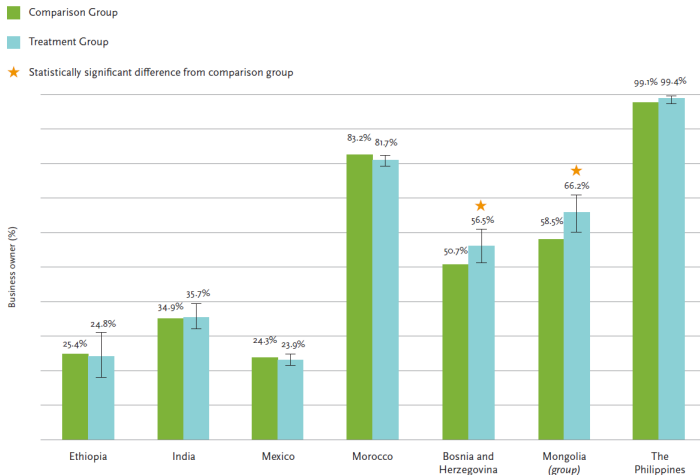
# Impacts of Microfinance on Self-Employment

Country	Effect	S.E.	95% CI
Bosnia	0.0602	0.0293	[0.0028,0.1176]
Ethiopia	-0.006	0.043	[-0.0903,0.0783]
India	0.0083	0.0215	[-0.0338,0.0504]
Mexico	-0.004	0.009	[-0.0216,0.0136]
Mongolia	0.077**	0.033	[0.0123,0.1417]
Morocco	-0.015	0.01	[-0.0346,0.0046]

## Average treatment effects on self-employment are modest

The two countries where the CI excludes zero are the two countries where randomization occurred at the borrower level and not the location level

# Impacts of Microfinance on Self-Employment



Note: Statistical significance is noted at the 90 percent confidence level or higher and error bars represent 90 percent confidence intervals; In Ethiopia, ownership is measured for non-farm businesses; In India, displayed results are from the first endline survey (1.5 years), and there is also no statistically significant difference after 3.5 years; In Bosnia and Herzegovina, differences in business ownership are not significant for multiple hypotheses testing; In Mongolia, displayed results are for household businesses. There was also a positive statistically significant difference for respondent businesses.

# Impacts of Microfinance on Business Profits

Country	Effect	S.E.	95% CI	Rescaled CI
Bosnia	671.9	541.3	[-389.05, 1732.85]	[-0.72,3.20]
Ethiopia	526	403	[-263.88, 1315.88 ]	[-0.66,3.27]
India	354	314	[-261.44, 969.44 ]	[-0.83,3.09]
Mexico	0	39	[-76.44, 76.44]	[-1.96,1.96]
Mongolia	-4789	5302	[-15180.92, 5602.92]	[-2.86,1.06]
Morocco	2005*	1210	[-366.6, 4376.6]	[-0.30,3.62]

Rescaled CI normalizes upper and lower limits of the confidence interval by the standard error of the estimated coefficient.

In four of six countries, we can't rule out large positive impacts on profits

# Impacts of Microfinance on Consumption

Country	Effect	S.E.	95% CI	Rescaled CI
Bosnia	-647.9	327.6	[-1290.0, -5.8]	[-3.94,-0.02]
India	10.24	37.22	[-62.71,83.19]	[-1.68,2.24]
Mongolia	0.109*	0.061	[-0.01,0.23]	[-0.17,3.75]
Morocco	-46	47	[-138.1,46.1]	[-2.94,0.98]

Rescaled CI normalizes upper and lower limits of the confidence interval by the standard error of the estimated coefficient. Impacts on consumption are not reported in the Ethiopia and Mexico studies.

Impacts on consumption are imprecise but clearly heterogeneous

- Evaluation periods, baseline levels differ across study sites
- Theoretical predictions (over medium-term) are ambiguous



# Impacts of Microfinance on Other Outcomes

Outcome	Bosnia and Herzegovina	Ethiopia	India	Mexico	Mongolia	Morocco	Philippines
Business ownership	↑	—	—	—	↑	—	—
Business revenue	—	—	—	↑	—	↑	—
Business inventory/assets	↑	<i>no data</i>	↑	<i>no data</i>	↑	↑	—
Business investment/costs	—	—	↑	↑	<i>no data</i>	↑	↓
Business profit	—	—	—	—	—	↑	—
Household income	—	—	—	—	—	—	—
Household spending/consumption	—	↓	—	↓	↑	—	—
Social well-being	—	—	—	↑	—	—	↓

Note: Green (red) arrows represent statistically significant positive (negative) differences in outcomes between the treatment and comparison groups at the 90 percent confidence level or higher, dashes represent no statistically significant difference; Ethiopia: While none of the individual business outcomes showed a positive impact, a combined business outcomes index did; a decline in household spending/consumption is measured as an increase in food insecurity; India: The increase in assets occurred only after 3.5 years, while the increase in inventories occurred only after 1.5 years; Mexico: Household spending is measured as the value of assets purchased in the past two years; social well-being is measured as a combination of women's empowerment outcomes and trust in people; Mongolia (group): Business assets measured as an index of listed assets increased, while assets measured as monetary stock did not; Morocco: There was an increase in combined business sales and home consumption, an increase in business costs, and no change in investment; The Philippines: There was a decrease in the number of businesses and number of paid employees; household spending/consumption was measured as changes in food costs and quality; a combined social well-being index showed a negative effect.

# Aggregating the Impacts

Banerjee, Karlan, and Zinman (2015):

*“Five of the studies have measures of business assets and/or investment, and eight of the ten point estimates on these measures are positive, with two of the positive ones (and none of the negatives) reaching statistical significance. This suggests that the average effect, pooling across studies, is likely statistically as well as economically significant.”*

*“Each of the studies measures profits, and here we have seven positive point estimates and one zero, with one statistically significant result. Our eyeballing suggests that pooling across [studies] would yield significant increases in business size and profit.”*

**Presumably we can do better than this!**

# Aggregating the Impacts: Setup

Estimate the impact of microfinance at  $k$  study sites

- Each study generates an estimate of the treatment effect,  $\hat{\tau}_k$
- The true impact at cite  $k$  is  $\tau_k$ 
  - ▶  $\hat{\tau}_k \neq \tau_k$  because of sampling variation (i.e. noise)
- We might like to know:
  - ▶ Did microfinance impact the people at cite  $k$ ?
  - ▶ Did microfinance impact people across the  $k$  study sites?
  - ▶ If a new MFI enters cite  $k + 1$ , how will it impact the people there?

# Aggregating the Impacts: Setup

Rubin (1981) proposes a **hierarchical model** of parallel experiments:

$$\hat{\tau}_k \sim N(\tau_k, \hat{se}_k^2) \quad \forall k$$

$$\tau_k \sim N(\tau, \sigma_k^2) \quad \forall k$$

Benefits of normality assumption (discussed in Meager 2019):

- Regression estimates of impacts yield normally-distributed  $\hat{\beta}_{ols}$
- Traditional (fixed effects) meta-analysis assumes  $\sigma_k^2 = 0$
- More recent “random-effects” meta-analysis allows non-zero  $\sigma_k^2$

# Aggregating the Impacts: Setup

Framework provides an explicit structure for assessing external validity

- **Information pooling:** when estimated  $\sigma_k^2 = 0$ , differences in  $\hat{\tau}_k$  are due to sampling variation,  $\hat{\tau}$  is a better estimate of impact at cite  $k$
- **No pooling:** when estimated  $\sigma_k^2$  is large, information from cite  $k$  tells us nothing about impacts at cite  $k + 1$  — so we should not attempt to generalize findings on whether an intervention “works”
- **Partial pooling:** intermediate  $\sigma_k^2$  indicates some external validity

Conventional **pooling factor** indicates extent of external validity

$$\omega(\tau_k) = \frac{\hat{s}e_k^2}{\tilde{\sigma}_k^2 + \hat{s}e_k^2}$$

When  $\omega(\tau_k) > 0.5$ , sampling variation ( $\hat{s}e_k^2$ ) explains more of variation in estimated treatment effect at cite  $k$  than variance of true  $\tau_k$  parameters

# Aggregating the Impacts: Bells and Whistles

## Estimation in a Bayesian statistical framework

- Frequentist approaches (i.e. “random effects” meta-analysis) may underestimate  $\sigma_k^2$  leading to over-confidence about external validity
- Bayesian approach allows for better optimization algorithm targeting

## Extensions to the estimation approach

- Allow treatment effect to co-vary with control mean

$$y_{ik} \sim N(\mu_k + \tau_k T_{ik}, \sigma_{yk}^2)$$
$$\begin{pmatrix} \mu_k \\ \tau_k \end{pmatrix} \sim N\left(\begin{pmatrix} \mu \\ \tau \end{pmatrix}, \begin{bmatrix} \sigma_\mu^2 & \sigma_{\tau\mu} \\ \sigma_{\tau\mu} & \sigma_\tau^2 \end{bmatrix}\right)$$

- Allow treatment effect to vary across mutually exclusive sub-groups (in terms of population or treatment/intervention characteristics)

# Aggregating the Impacts: Self-Employment

		$\hat{\tau}$	Posterior dist'n quantiles			
			2.5 <sup>th</sup>	25 <sup>th</sup>	75 <sup>th</sup>	97.5 <sup>th</sup>
Profit	BHM-Joint	6.8	-3.0	1.8	10.4	24.5
	BHM-I	7.3	-4.7	1.9	11.2	27.5
	OLS	7.3	-1.8	4.1	10.4	16.3
Revenues	BHM-Joint	14.5	-1.4	6.6	19.9	43.5
	BHM-I	19.9	-6.2	9.0	28.1	60.1
	OLS	22.5	4.6	16.3	28.6	40.4
Expenditures	BHM-Joint	6.7	-2.3	2.6	9.7	22.1
	BHM-I	8.4	-3.9	3.4	12.0	27.6
	OLS	13.0	-2.6	7.7	18.4	28.6

All effects are in USD PPP per fortnight. BHM-Joint allows the treatment effect to vary with the control mean. BHM-I (independent) does not allow for a correlation between the control group mean and the treatment effect. OLS reports the full pooling (fixed effects meta-analysis) model controlling for country fixed effects.

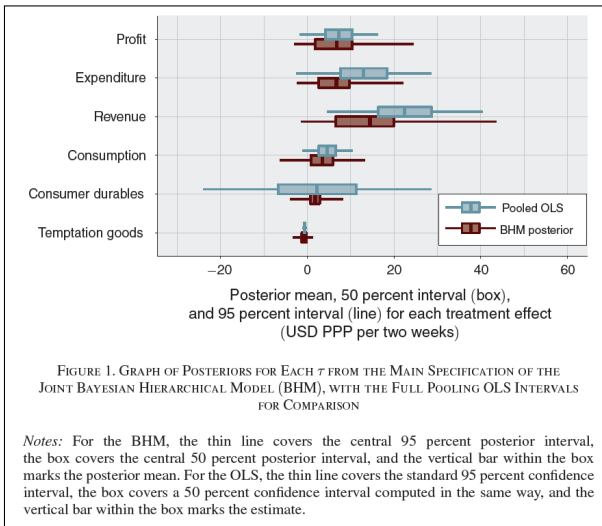
# Aggregating the Impacts: Consumption

		$\hat{\tau}$	Posterior dist'n quantiles			
			2.5 <sup>th</sup>	25 <sup>th</sup>	75 <sup>th</sup>	97.5 <sup>th</sup>
Consumption	BHM-Joint	3.4	-6.3	0.8	5.9	13.2
	BHM-I	3.8	-11.3	0.4	7.	22.2
	OLS	4.6	-1.1	2.6	6.6	10.4
Durables	BHM-Joint	1.8	-3.9	0.7	2.9	8.3
	BHM-I	2.1	-11.3	0.5	3.4	16.2
	OLS	2.3	-23.9	-6.7	11.3	28.5
Temptation goods	BHM-Joint	-0.8	-3.3	-1.3	-0.2	1.3
	BHM-I	-0.8	-3.6	-1.3	-0.2	1.4
	OLS	-0.6	-1.1	-0.8	-0.5	-0.2

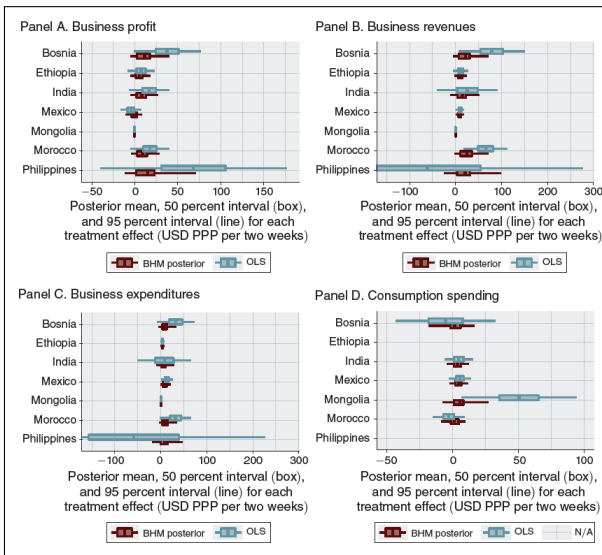
All effects are in USD PPP per fortnight. BHM-J (joint) allows the treatment effect to vary with the control mean. BHM-I (independent) does not allow for a correlation between the control group mean and the treatment effect. OLS reports the full pooling (fixed effects meta-analysis) model controlling for country fixed effects.



# Aggregating the Impacts: BHM vs. OLS



# Aggregating the Impacts: BHM vs. OLS



# External Validity

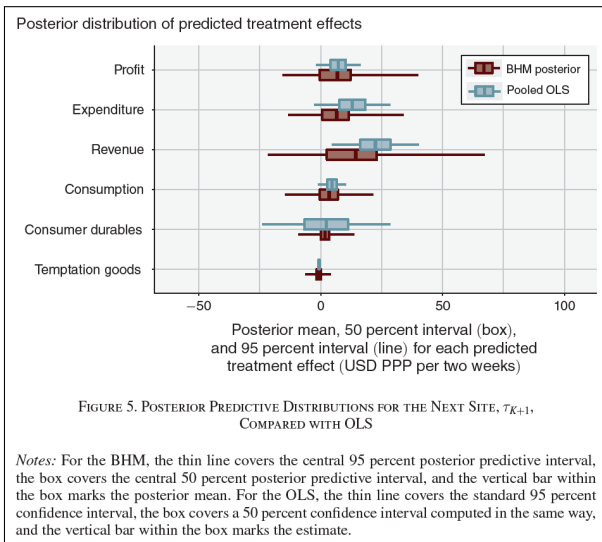
	BHM-J	BHM-I
Self-Employment Revenues	0.5	0.4
Self-Employment Expenditures	0.5	0.5
Self-Employment Profit	0.5	0.4
HH Consumption	0.5	0.4
Consumer Durables	0.3	0.3
Temptation Goods	0.2	0.3

Both columns report estimated  $\omega(\tau)$  parameter.  $\omega(\tau) > 0.5$  indicates that more than half of the variation observed across sites is due to sampling variation.

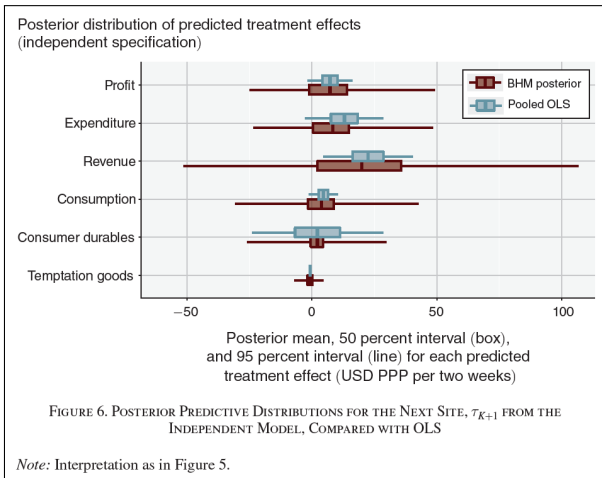
## Estimates suggest modest external validity:

- Variability of estimated treatment effects driven by both sampling variation and heterogeneity in impacts, but latter is more important

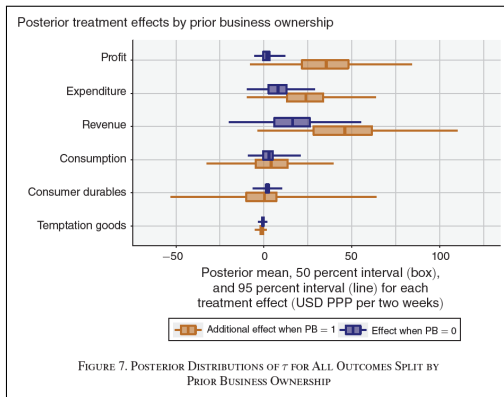
# Predicting Impacts at Site $k + 1$ (BHM-J Model)



# Predicting Impacts at Site $k + 1$ (BHM-J Model)



# Predicting Heterogeneity by Business Ownership



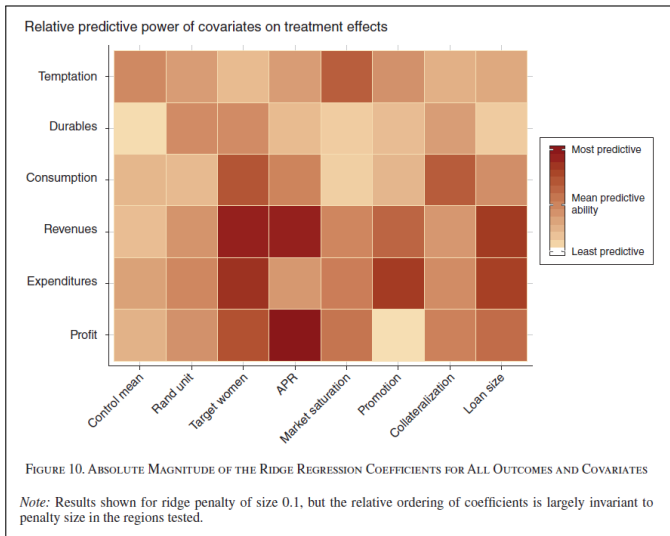
Estimated impacts on non-entrepreneurs are mostly precise(ish) zeros

# Treatment Effect Heterogeneity

Country	Randomization	Women	APR	Saturation	Promotion	Collateral	Loan size
Bosnia	1	0	22.0	2	0	1	9.0
Ethiopia	0	0	12.0	1	0	0	118.0
India	0	1	24.0	3	0	0	22.0
Mexico	0	1	100.0	2	1	0	6.0
Mongolia	0	1	24.0	1	0	1	36.0
Morocco	0	0	13.5	0	1	0	21.0
Philippines	1	0	63.0	1	0	0	24.1

*Note:* Contextual variables: Unit of randomization (1 = individual, 0 = community), Women (1 = MFI targets women, 0 = otherwise), APR (annual interest rate), Saturation metric (3 = highly saturated, 0 = no other microlenders operate), Promotion (1 = MFI advertised itself in area, 0 = no advertising), Collateral (1 = MFI required collateral, 0 = no collateral required), Loan size (percentage of mean national income).

# Aggregating the Impacts: Heterogeneity





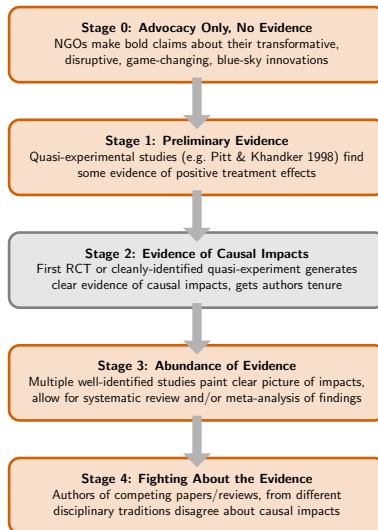
# What Have We Learned About Microfinance?

6 RCTs demonstrate that microfinance is not transformative **on average**

- Modest demand for microfinance loans, varies across sites
- Loans associated with expanded self-employment activities
- Impacts on revenues, profits, HH consumption imprecisely estimated
  - ▶ Cannot rule out substantial average impacts
  - ▶ Impacts concentrated on those with pre-existing businesses

External validity across sites is modest (though not entirely absent), in spite of similarity in patterns of treatment effects across study locations

# What Haven't We Learned About Microfinance?



# What Haven't We Learned About Microfinance?

People are already debating the conclusions of Meager (2019)

- Meager (2019b) finds evidence of positive effects on right tail
- Others (e.g. Vivalt 2019) find even more heterogeneity in treatment effects and, consequently, even less external validity

Randomized evaluations estimate ITT impacts on marginal borrowers

- Not necessarily identical to impacts on average borrowers
- Differences in take-up rates are substantial
- Breza & Kinnan (2019) find substantial negative impacts (declines in HH income and consumption) from 2010 Indian microfinance crisis