EE562 Selected Topics in Development Economics 2

(Topic: A Global Perspective and Empirical Evidence in Thailand)

Faculty of Economics

Thammasat University

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Time: Wednesdays and Fridays, 9AM – noon

Savings, Credit and Microfinance

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Office of the National Economic and Social Development Board (NESDB)

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Section I

Concept of Microfinance

https://www.youtube.com/watch?v=XAmfM-z28Nk

Microfinance

- Microfinance is one of the most prominent development tools
- Traditionally, **offering banking services to the poor** was not considered profitable
  - Savings/credits **too small to cover fixed costs**
- Microfinance introduced key innovations which *drove down these costs*

Overall motivation for microfinance

- **Lack of access to financial instruments** (savings, credit) is a key obstacle to poor families seeking *to improve their own lives*
- Many investments that are good for households' long-run prospects require **large up-front costs**
  - e.g., tuition for education, capitalization of small enterprises
- But it is often **difficult to pay such up-front costs**
  - *Savings* mechanisms are inefficient or nonexistent
  - *Credit mechanisms* poor
- Microfinance institutions seek to fill this gap, by *bringing financial services to the poor* and previously **unserved**

Microfinance: common elements

- Focus on providing financial services to those **excluded** *from the formal banking sector*
  - Most common: **credit**
  - More recently: **savings**
  - New frontier: **insurance**
- Credit mostly intended to *finance self-employment activities*
- Provide **small loans** (as small as $75), to be **repaid** *over several months to a year*
- Many dispense with collateral requirements
  - Key for poor households with **few assets**
  - How are microfinance lenders able to do this?

Key innovations of microfinance

Key innovations of microfinance, to *drive down cost* of lending to Poor: **minimizing loan default**

- Lend only to **women**
  - More '*honest*' and '*risk-averse*' lenders?
  - More *embedded in local community* (also due to children)
  - *Less* likely to *run away*
- Give out only *small loans*, and *reward repayment* with *larger subsequent loan*
- Lend to **groups**
  - Each *group member* liable for *loans of other group members*. If default by one, no later loans for anyone
  - *Reduces* transactions costs for *loan officers*

Potential Needs for Microfinance

- **Small businesses *need credit* to grow**, to create more jobs and income
  - Original justification for microfinance on large scale
  - M. Younous: Every *poor* is a *hidden enterpreneur*
- Poor people ***need credit*** to **smooth over income shocks**
  - More popular justification recently
- Poor people ***cannot save*** because of **lack of secure saving possibilities**
- The *poorer people* are, the more *existential income risks* they usually face

The Barriers to Credit

- **Informational asymmetries**
  - Moral hazard
  - Adverse selection
- Lending to the poor is **costly**.
  - Their *rates of return* are too *low*.

Moral Hazard and Adverse Selection

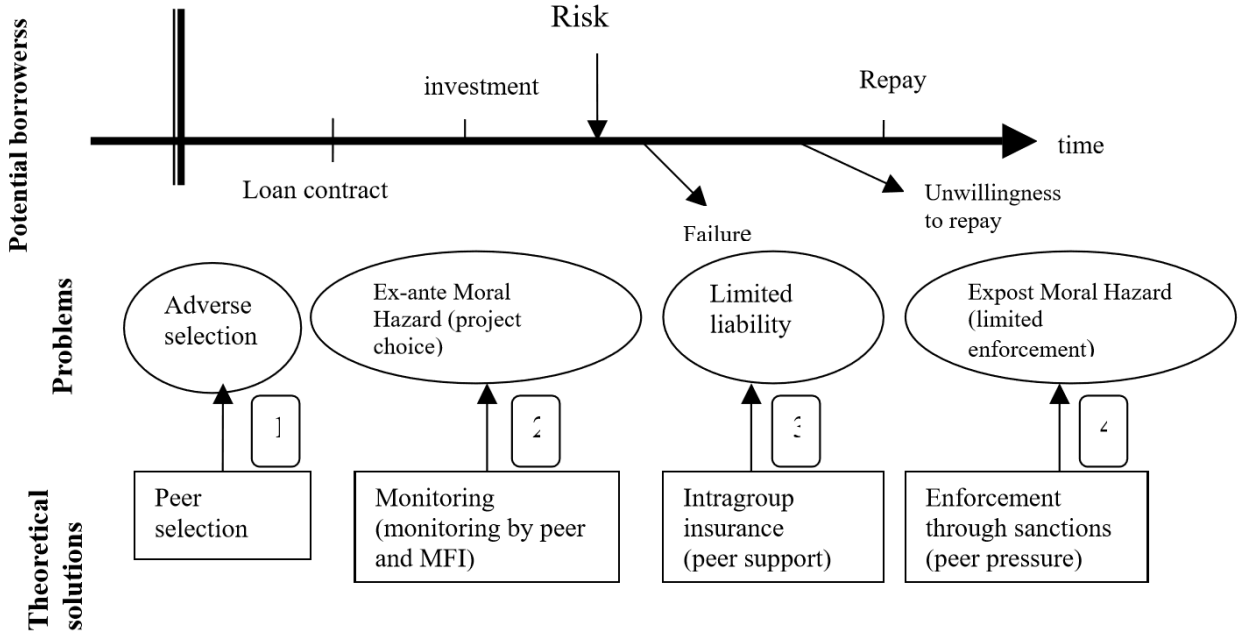


Figure 1: A dynamic presentation of problems and solutions in a multistage joint liability loan

- **Moral Hazard:** Individuals engage in *risk sharing* under conditions that *joint liability* is *social collateral* against the risk and the other party will incur the cost, *repayment burden*.
- **Adverse selection:** Those who *agree to borrow at high rates* are those who were *not planning to repay* anyway.

How Microfinance Solves the Moral Hazard

- Lends almost only to **women**.
- **Weekly repayment** schedule.
- Group lending with **joint liability**.
- **Regular meetings**, where members forge bonds and other things can be discussed (business advice, home advice).
- Very *small loans initially*, which *become larger* over time.
- **Extensive monitoring** by credit officers who are *not very well paid* and work very hard, with incentives based on *number of clients*, and *repayment rates*.
- **High interest rates**

Lending to the Poor

- In the 1970s and early 1980s, many had *given up hope on giving credit to the poor* and *being repaid*.
  - Some governments were continuing *subsidized credit programs* to the poor, which functioned almost like free transfers programs.
  - For example, in India: Mandated bank branch expansion in rural areas helped reduce poverty but the *default rate is 42%*, and it *cost $2.72 to increase income by $1*.
  - Loans are used for *political purpose*: agricultural credit increases by 5%-10% in election years, especially in districts where elections are close. These *extra loans are not productive*.
- Yet, **informal credit institutions** have **always existed**: *village money lenders*; and Rotating Savings and Credit Associations (ROSCA)

Credit markets: some facts

- **Sizeable gap** between *lending rates and deposit rates* within the same sub-economy
- **Extreme variability in the interest rate** within the same sub-economy:
- **Low levels of default**:
- There seems to be *ex ante competition* in the markets (*lost of money lenders*)
- The poor get **smaller loans**, and **pay higher interest rates**
- Production and trade finance are the **main reasons given for borrowing**, even in cases where the rate of interest is relatively high

Facts about credit markets

- In developing countries, most of the poor do **not** have **access** to any form of **formal credit** (excluding microcredit, which reaches about 200 million people worldwide)
- **Formal lending** programs have typically been ***failures***, with ***high default rate***, and have some times *become political giveaway*

Facts about credit markets

- **Credit** of *rural household* living *on less than a dollar a day*

	Percent with a loan	Fraction of loan from a bank
Cote d'ivoire	30.5	5.7
India (udaipur)	6	6
Indonesia	11.6	25.3
Mexico	18.5	17.4
Pakistan	93	1.5
Panama	2.8	--
Peru	12.3	0
Timor Leste	10.9	0

Facts about credit markets

- In the **informal market**, lending rates are *much higher than deposit rates*
  - Yearly interest rate are in the 40%-200% range
  - Or some times much more: Fruit vendor in Chennai pay 5% per day!
  - Study of money lenders in Pakistan found that average interest rate was 78.5% annually, and the average cost of capital was 32.5%
- *Extreme variability of interest rates* even within the same economy (village or town)
  - Same study on money lender in Pakistan finds that the standard deviation of interest rate was 38.3%: that means that interest rates of 2% and 150% are in the 95% confidence interval!

Facts about credit markets

- The **rich** have *larger loans*, and *pay lower rates*
  - Summary report of informal credit in India shows that in the rural sample, the landless pay interest rates varying between 28% and 125%, and the cultivators pay between 21% and 40%
  - **Credit limit** is often explicitly set to be *proportional to the borrower net worth*.
  - In Rajasthan, India : The average interest rate from an *informal source drops by 0.40 percent per month* for *each additional hectare of land owned* by the person taking out the loan.
- Those who **borrow more** typically **pay lower interest rates**
- The **rates of default are quite low**. People often **borrow for investment,** not because they are desperate

Why are money lenders thriving

- **Money lenders** are *close to the people* (in the same village)
  - They may also be able to **impose large penalty** if the person *tries to flee* with the money: paradoxically this will *lower the interest rates*
  - They can lend to the poor
  - But their *cost of fund will be high*
  - So the *interest rates they charge will be high*

Asymmetric information problems

- **Adverse selection**: individuals who know they are *likely to default* select into borrowing pool, *raising default rates* and interest rates for everyone
  - "Hidden information"

- **Moral hazard**
  - Individuals exert *less effort than the lender would desire*, raising default rates and interest rates for all
  - **Ex-ante**: *less effort* is exerted *to make the "project" succeed*
  - **Ex-post**: even if project succeeds, may *voluntarily default*
  - "Hidden action"

Section II

Micro-saving

Micro-saving: Realistic?

Do the poor have anything to save?

- Banerjee & Duflo (2007):
  - Even those who *live on 1$ per day* **spend only 2/3 of income on food.**
  - And *what they spend on food*, they spend it not just to maximize calories and nutriants, but *also on 'taste' and 'treats'*
  - 10% often spend on *sugar, alcohol and tobacco*
  - Another 10% on festivals and parties
  - People that report going hungry every now and then still own a (old) TV
  - Rural Indians today, despite higher income, *eat less calories* today than 20 years ago.
- Even the very poor have disposable income from which they could save
  - *Problem*: Many *don't have access to good saving devices* (e.g. saving accounts)

Micro-saving: Obstacles

Poor face obstacles to effective saving

- **Regular saving accounts** at banks **too expensive**
  - Sums involved are too small to warrant opening costs at regular banks
  - Storing money at home is risky
- Rural poor **live remote, far away from many banks**
  - Only 22% or world population have access to formal saving account
- **Lack of Trust**
  - Poor Institutional Environment and Regulation of banks
- **Regulation** itself problematic
  - Anti-terrorism and anti-money laundering regulation *often requires official IDs and documents to open accounts*
  - Poor don't have it

Traditional Microsaving

- RoSCAs (Rotating Saving and Credit Associations)
  - **Group of people (mostly women)** meets regularly
  - Each meeting each member **gives a fixed amount of money to one member**.
  - Member who receives money **rotates from meeting to meeting**
  - For giving a small amount every week or so, **one receives a large amount at regular times**
  - Helps against **presence bias** and demands from others (especially husbands, apparently)

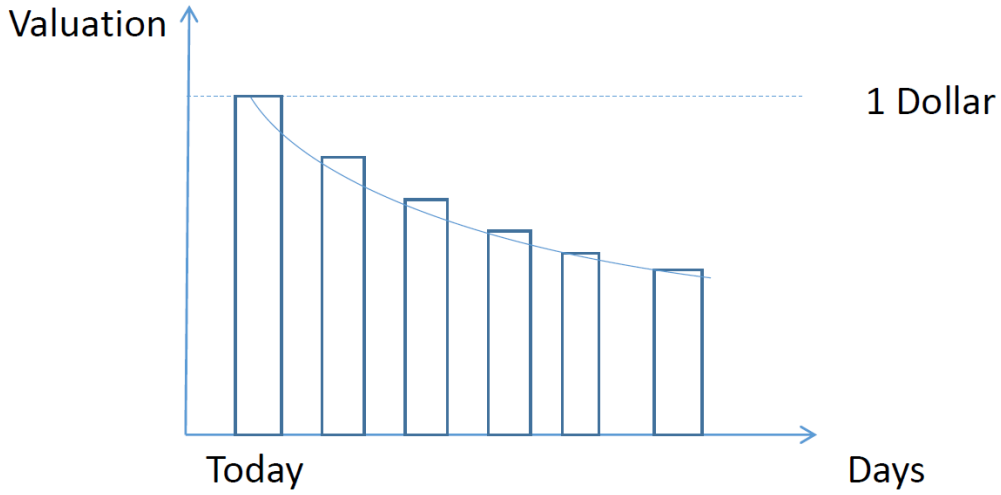
Traditional Microsaving

- Taking Credit against Savings
  - Even though people have savings available at larger credit and saving associations, they **still take credit from a lender**
  - Credit signals '*lack of any money to share*' to others
  - But comes at a big cost, **paid interest rates** instead of earned ones
  - Many poor will ***accept* negative nominal interest rates** for a *safe* (and anonymous) *place to save money*

Effects of Microsaving

- Formal Microfinance has *recently expanded into micro-saving*
- Especially as evidence mounted that *micro-credit not as effective* as hoped
  - Plus reports on *micro-borrowers* driven *into indebtedness*
- Many MFIs now demand that a micro-loan borrowers **open a micro-saving account** and pay some money in on top of each repay installment

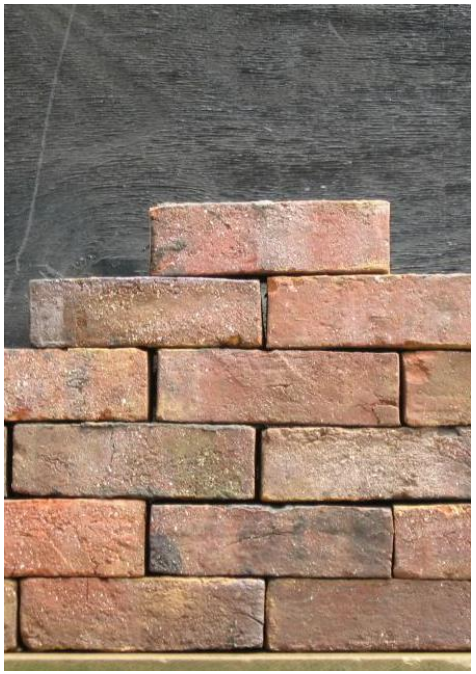
Time inconsistent preferences



- Theory: Time-consistent preferences: **Humans <u>discount</u> the utility of *receiving a good in the next day/month/year by a factor* $\delta < 1$**
- Now consider **<u>time-inconsistent preferences</u>**: '***sophisticated present-biased***' people
  - Are aware of this problem, but find it *<u>hard to resist temptations today</u>*
  - Would be happy if they could get a commitment device… something that binds their hands against spending money on temptations today

How do the poor save

- **Brick by brick**
- **Financial savings**
  - Savings collectors
  - Self-help groups
- **Constraints on savings**
  - Efficient not to save
  - Lack of income
  - Lack of access to savings accounts
  - Challenges of saving at home
    - Self-control issues
    - "Spouse-control" issues



The role of savings

- **Transform** a series of ***small payments*** into a usably ***large lump sum***
- For **investment**
- As **buffer stock** (self-insurance)
- **Less costly** than credit: **no need to pay for lender's risk**

Barriers to savings

- Problems with self-discipline
  - While understanding the need to save for the future, individuals **can't resist the temptation** to spend now
- Strong social pressures to share accumulated assets with others who have immediate needs
  - Reflective of *informal insurance/risk-sharing arrangements*
- High transactional or informational costs
  - *Distance* to branches, *unfamiliarity* with formal financial institutions, *difficulty filling out forms*, etc.
  - A barrier to *formal* savings

Informal savings

In the absence of formal savings mechanisms, households in poor countries have developed a variety of **informal means to save**

- **Cash savings at home**
  - But *vulnerable* to *temptation, theft, and pressure to share* with others
- **Asset accumulation and decumulation**
  - But this comes at an *efficiency cost* when they *try to liquidate*
- ROSCAs
- … but some innovative MFIs are starting to offer formal savings

Savings commitment devices

- Helping overcome transactional cost barriers to savings

- New program in Dhaka, Bangladesh
- **Deposit collectors visit people** in their homes
- Clients may deposit as little as one taka ($0.015) when the collector calls at their house each day
- Accounts with balances above 1,000 taka ($15) earn 6% interest.
- Clients may withdraw up to 500 taka per day ($7.50) at their doorstep, or up to 5,000 taka per day ($75) at the branch office
- 22,000 clients, with average savings balance of $22

Savings commitment devices

- Effects may be due to helping **overcome**:
  - *Self-discipline problems*
  - But also: helps *resist pressure to share* with others

- *More research needed* on whether this is substitution from other forms of saving (other banks, or physical asset holdings)

- A follow-up paper indicates that *savings do not seem to be sustained* in longer term

Savings commitment devices

- Maybe people don't save more because they are **tempted to spend *now*,** or they **protect money from other household members**
- Commitment savings devices could be beneficial
- Philippines: SEED (Save, Earn, Enjoy Deposits) helps clients save by locking away their money until they reached a self-specified savings goal (date or amount)

Why don't people save more?

- Poor households ***have disposable income*** that they **could save**
- However, they **don't save as much as they could**, or want
- Sometimes, they *borrow at very high interest rates* for businesses that *don't grow* – although they could **get out of debt by saving more**
- Why don't they save more?
- Could be several reasons
  - no safe avenues for savings; want to save but tempted; other household members take the money; don't understand returns to savings.
- If tempted to consume → need **products that will help people save**
- If don't understand → may need **financial literacy** training

Savings commitment devices

- **Strong effect on savings**
  - after a year: 80% increase, 337 % for those who opened the account
  - after 2.5 years, differences smaller but still there
- After 2.5 years, impact on:
  - Self-reported decision making processes within the household
  - Purchase of female-oriented durable goods
- Impact biggest for **women with below median decision-making power** in the baseline
- Bottom line: this specialized account **helped women with less power gain control over household assets**

⇒ **Savings commitment devices were very effective for women who find it difficult to save, and had a positive impact on empowerment**

Reminders

- **Savings** is "salience challenged" relative to debt
- Banks (and lenders) remind us to pay our debts
- Banks do ***not* remind us to save**
- Maybe attention is an issue
- In Peru, Philippines and Bolivia, we tested *sending reminders*
- We find significant increases in reaching one's savings goals

Section III

Micro-credit

Why Do Poor Households Borrow Money?

- Poor households have to finance their business activities
  - Agriculture involves **long delays** between *investment and return*
  - Many *poor entrepreneurs* **take daily loans to cover working capital**
- Other reasons the poor often need to borrow money:
  - **Health shocks**: very few poor households have insurance
  - **Long-run investments** (children's education, weddings, etc.)
- The *poor need to (and do) take out loans*, but the *formal lenders (i.e. banks) are unwilling to provide loans to them*

Why Lending to the Poor is Difficult

- **Non-poor borrowers** have some savings, valuable assets
  - Can raise cost of default by ***offering lender collateral***
  - Will typically **invest** *own savings + (costly) borrowed funds*

- In contrast, almost by definition, the **poor** *lack collateral* (assets, savings)
  - *Limited liability*:
  - Lender is *forced to bear* poor borrowers' *downside risk*
    - Changes a poor borrower's **incentives**, *making default more likely*
    - Makes **high interest rates** attractive to unattractive borrowers

Fact of Lending to the Poor

- Fact 1: the **poor do not borrow from formal sources** (banks)
  - *Moneylender* has better information about borrowers than banks
- Fact 2: the **poor pay (moneylenders) very high interest rates**
  - Market interest rate + *costs of screening, monitoring*
  - Moneylenders may also *have market power*
- Fact 3: **richer people borrow more, pay lower interest rates**
  - Screening, monitoring involve *fixed costs*
- Fact 4: among the **poor, default rates are extremely low**
  - Moneylenders exert *considerable effort in monitoring behavior*

Typical Features of Microcredit

- Could the low effects of microcredit, especially on business creation, be caused by its typical design?
  - Group lending
  - Joint liability
  - Immediate start of repayment (from first week on)
  - Frequent payments (usually weekly)
  - Zero-tolerance policy to late payment

Theory of Microcredit

Every Lender/Bank in the world is faced with three basic problems

- Adverse Selection
  - How do I **screen out bad "types" of borrowers**
- Ex-Ante Moral Hazard
  - How do I **screen out borrower with risky/bad investment** ideas
- Ex-Post Moral Hazard
  - How do I make sure **borrower puts effort into his project**, so that it succeeds, and he does not default and walk away
- Problems of 'Asymmetric Information'
- Cost of recovering loan in case of default is so high, especially in developing countries, that lender want to prevent default from the beginning

Theory of Microcredit

- If lender has 'asymmetric information', **exploit information from people that know borrower better**, e.g. people from his village
- Make them **guarantee each other's loan**. A microfinance group will only form if all member are convinced that risk of default by other group members is low
- Addresses all three sources of asymmetric information
- **Joint liability** could *have some perverse effects*

Self Control

- **Small weekly repayment instalments** are easier to repayment.
- **Setting Expectations and Norms**
- **Strict enforcement** and **immediate start or repayment** from week one communicates that repayment of loan must have highest priority
- **No delay in starting project** for which money was borrowed

Group Lending & Joint Liability

- **Group Lending** is core characteristic of microcredit

Significantly reduces lending costs

Strains communities and lets borrowers invest loans too conservatively

Group Lending & Joint Liability

- Possible Effects of **Group Lending** on ***preventing default***

	Group Lending with Joint Liability	Group Lending without Joint liability
Pre-Loan disbursement	Selection of good borrowers/projets	Concerns of 'loosing' face in front of group if one does not repay. Make one less trustworthy in community for future cooperation
Post-Loan disbursement	Ensure effort in implementation and non-default	

Group liability lending

- Widely-publicized mechanism of **Grameen Bank** for providing with collateral requirements
  - a.k.a. joint liability

- Idea: make everyone in a group of ~5 borrowers **jointly liable for repaying each of the loans to group members**

- If group doesn't repay each loan, **no-one in group gets subsequent loans**

- Not the same as "group lending"

Group liability in theory

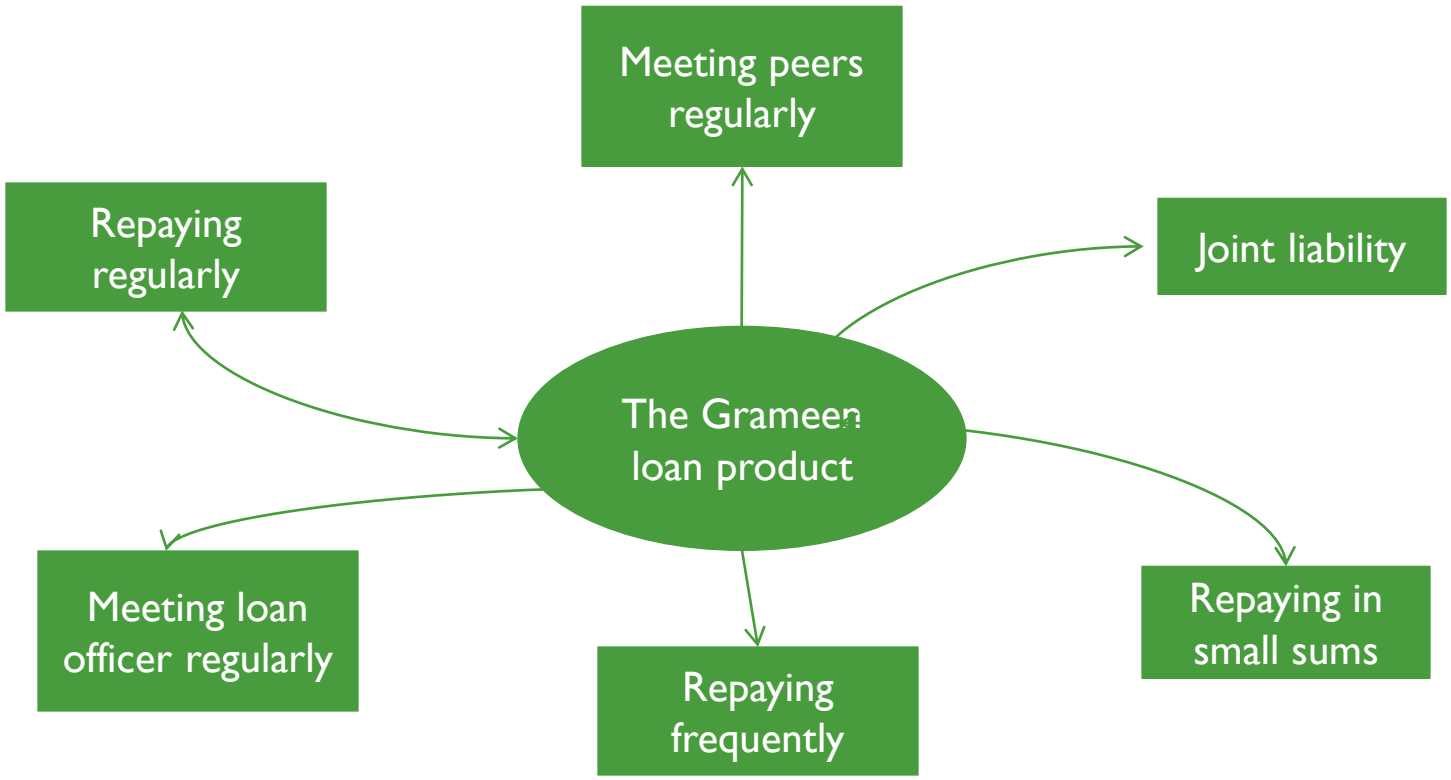
- Helps **solve asymmetric information** problem that usually exists between lenders and borrowers (and that is costly for conventional lenders to deal with)
  - Adverse selection
  - Moral hazard
- **Reduces adverse selection**
  - groups will only form if all have confidence in individuals' repayment
  - people generally know each other beforehand, members will be "selected" for their reliability as borrowers
- **Reduces moral hazard**
  - creates incentives for within-group monitoring and enforcement
- In the end, key is to reduce transaction costs for lenders, allowing them to **serve borrowers with very small loans**

Group liability drawbacks

What **drawbacks** might group liability have?

- **Increases tension among members**
  - Leads to *voluntary dropouts*
  - Can harm *social capital* among members
- More **costly** for clients **who are good risks**, because they are **more likely to pay off loans of their peers**
  - Bad clients can "*free ride*" off good ones
  - Makes it more *difficult to attract and retain good clients*
- As groups mature, **loan sizes typically diverge**
  - ***Smaller clients*** may not want to guarantee larger loans of other group members
- Overall: group liability's beneficial effect on repayment may ***reduce client base*** (and poor's overall access to finance)
  - Also: bank profitability may be lower

The Grameen "myth"



Individual and joint liability

- No change in repayment rate for pre-existing borrowers
- Higher growth in center size (keeping more pre-existing borrowers + attracting new ones)
- Even new members (selected under IL) did not have worse repayment rates
- Limits to immediate policy prescription: would groups be sustainable if begun under individual liability?
- Experiment #2 in new areas: Still same high repayment. Smaller groups because of fear of bank employees

⇨ **Joint liability may not be so essential to MFIs performance, and may even keep some borrowers away**

Section IV

Risk and Micro-Insurance

Micro-insurance

Poor people are exposed to a **high degree of uncertainty**

- Many insurances we take for granted do ***not* exist for them**
- *Little to even no* **health insurance**
- Most **self-employed** or working as ***day-labourer***
- **Income uncertain**

Micro-insurance

Poor people are exposed to a **high degree of uncertainty**

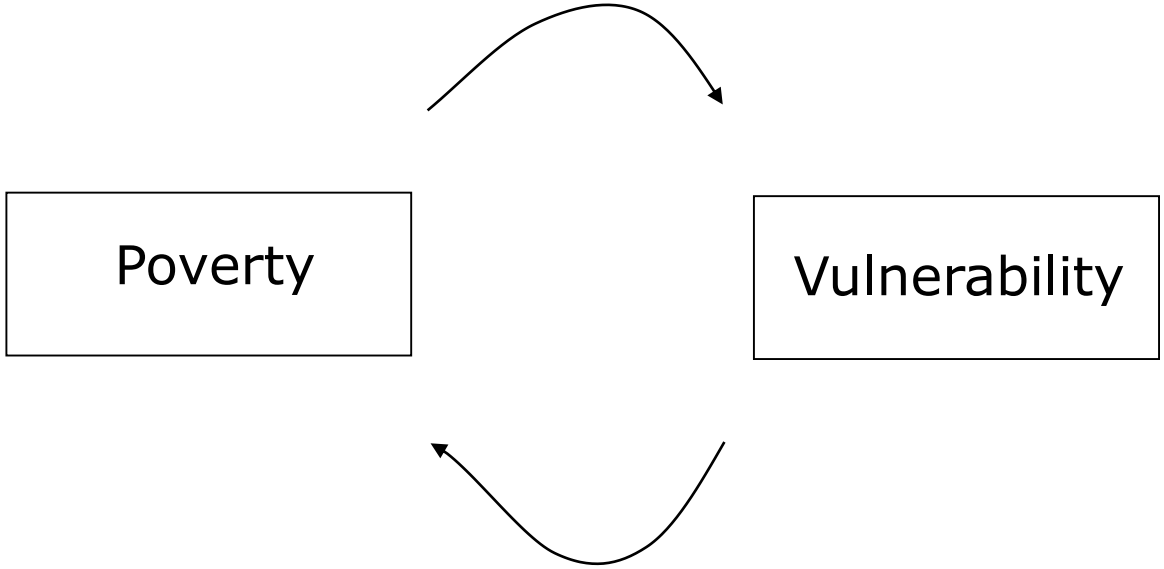
- ***Public services bad***… e.g. bad housing
- People report high levels of ***depression and anxieties***
- ***Lack of focus in income generation*** => Lower income
- Implicit ***obligations to help each other*** => Lower capital accumulation
- Adoption of ***riskless –but low yield*** – *self-sufficient agricultural production*

Micro-level responses to risk

How do households cope with risk?

- In rich countries, people have insurance
  - Fire insurance, home insurance, auto insurance, life insurance, medical insurance
  - These ***insulate people*** from the potentially ruinous effects of **catastrophic shocks**
- In poor countries, formal insurance markets tend *not to exist or to be very limited*
  - The poor have to rely on ***informal*** **insurance**
  - A vast literature in development economics illustrates the ingenious ways poor households insure themselves from adverse shocks
- A theme: *idiosyncratic* risk is easier to cope with than *aggregate* risk

Poverty and vulnerability: a vicious circle



Ways to cope with risk

- Ex ante: smooth *income*

- Ex post: smooth *consumption*

Smoothing income

- Choose a **safe production technology**: farm a food crop like cassava ***rather than a cash crop*** like *coffee*
- ***Avoid risky new investments***, transitions to different technologies (Malawi example)
- ***Diversify income sources***
- ***Diversify farming plots*** spatially
- Note all of these are *costly* (reduce average income, even while **making income more stable**)

Smoothing consumption

- Reciprocal transfers (informal insurance)
- Credit (informal credit/loan)
- Asset sales
- Labor supply
- Migration by family members:
- Remittances
- Savings

Micro insurance

- Micro-insurance possibly addressing huge demand
  - But micro-insurance more complex than micro-credit or saving
- How to establish ***loss from a bad harvest***?
- How to separate bad weather shocks is from low effort (insurance fraud)?

Micro insurance

- Significant trust aspects from buying insurance
- **Recency bias**:
  - When farmer ***got a pay-out*** in previous period, likelihood of ***buying insurance increased***
  - When farmer did ***not get a pay-out*** (no anomalies in rain), ***likelihood decreased***
- Likelihood also increased if another farmer in the social network got a pay-out
- Problem:
  - Low-probability, high impact events, where insurance might work best
  - However, demand will be lowest -> **market failures**

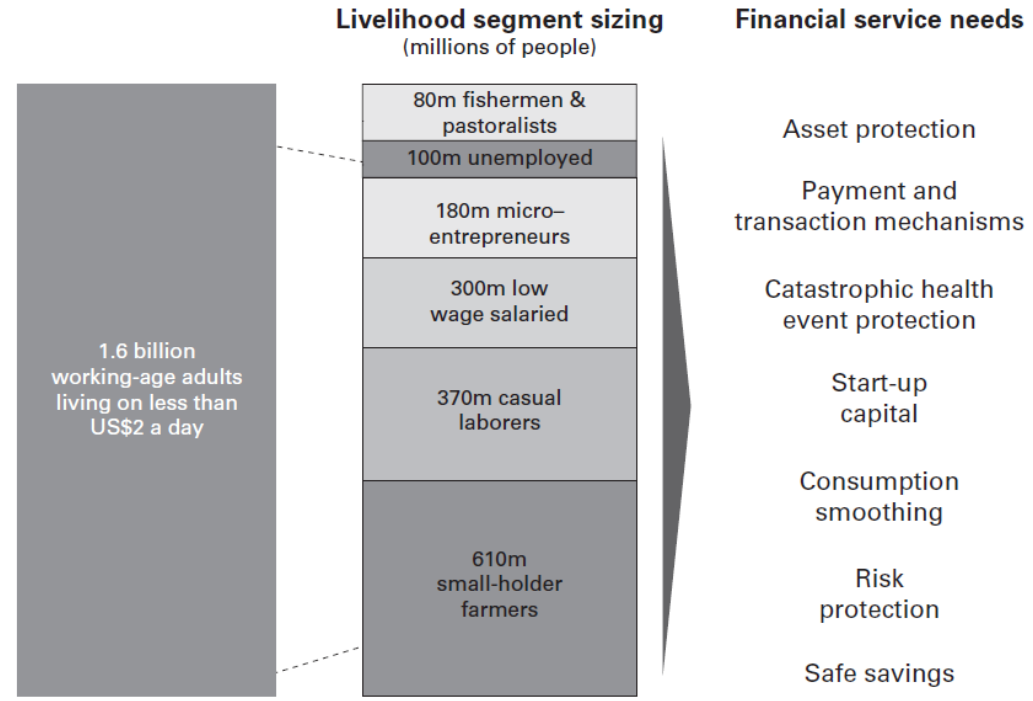
Section V

The Evolving of Financial Landscape

https://www.youtube.com/watch?v=uygbfBWYMiE

Financial service for the Poor

Figure 1.1 Financial Service Needs for Different Livelihood Segments

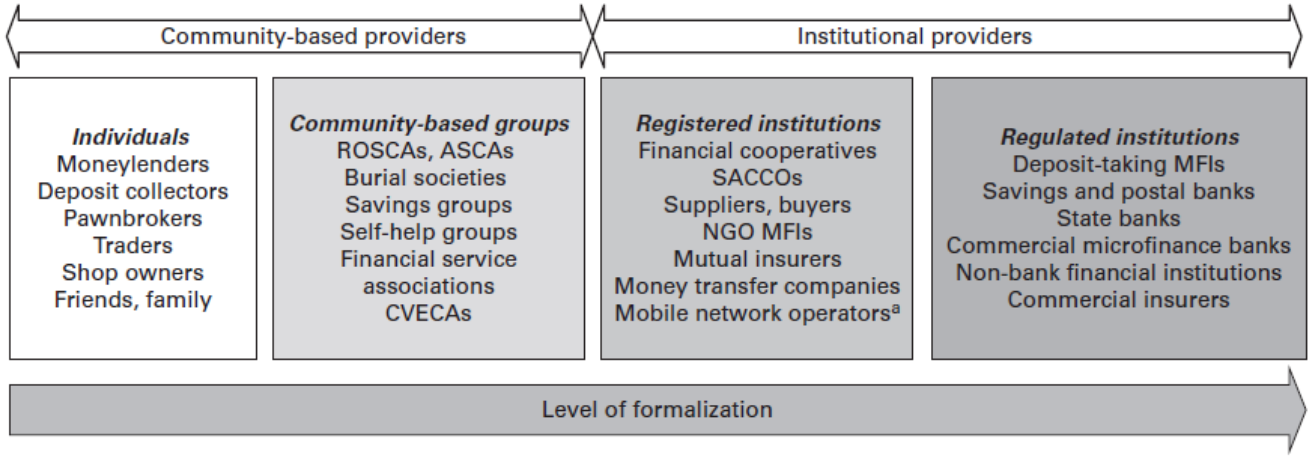


Source: Wyman 2007.

- The financial pressures of managing **inconsistent income** to cover daily expenses, unexpected emergencies, and life-cycle events **weigh heavily on the poor**.
- By focusing on productive credit, microfinance providers *may have missed serving the majority of the potential market.*

Financial service for the Poor

Figure 1.3 The Range of Financial Service Providers



Note: ROSCAs = rotating savings and credit associations; ASCAs = accumulating savings and credit associations; CVECAs = *caisses villageoises d'épargne et de crédit autogérées*; SACCOs = savings and credit cooperatives; NGO = nongovernmental organization; MFIs = microfinance institutions.

a. Mobile network operators are regulated as communication companies; most are not licensed to provide financial services.

- **Community-based providers** include both individuals (such as friends and family, moneylenders, shop owners, traders, and deposit collectors) and groups, including indigenous group sand facilitated groups.

Financial Inclusion

- **Financial inclusion** is measured in three dimensions:
  - (i) **access** to financial services;
  - (ii) **usage** of financial services; and
  - (iii) the **quality of the products** and the service delivery.

Fintech & financial inclusion

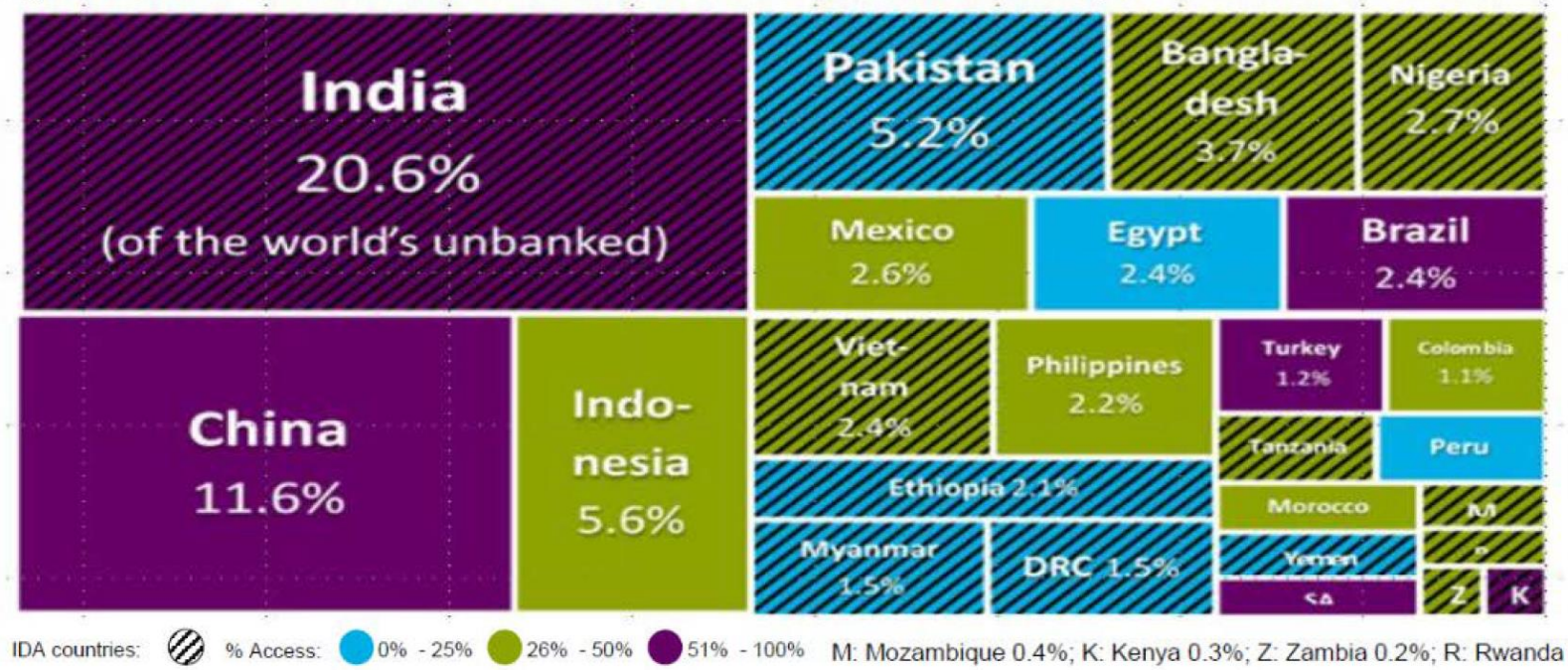
- Role of **e-finance** in enhancing financial inclusion for individuals and small businesses, especially in developing countries –*making financial services available to those who would normally not have access*
- **Fintech** *expands availability of information* on financial services, such as investment advice and online and mobile banking services and products
- Opportunity for them to *seize new previously financially* **underserved** *markets*

Fintech & financial inclusion

- All you need is **access to the internet and a smartphone**
- Spread of mobile technology, **smartphones** and **mobile network coverage**
- More (and cheaper) options for individuals but also small and medium enterprises, for example with ***peer-to-peer lending***, borrowing funds without going through a financial intermediary '***direct finance***'

Fintech & financial inclusion

Figure 1: Some 73 Percent of the World's Unbanked Reside in 25 Countries, Predominantly in Asia. Access is Low in Africa.



Shaded Countries = IDA International Development Association (poorest countries). Sources: Global Findex 2014, IMF Financial Access Survey 2012.

Fintech & financial inclusion

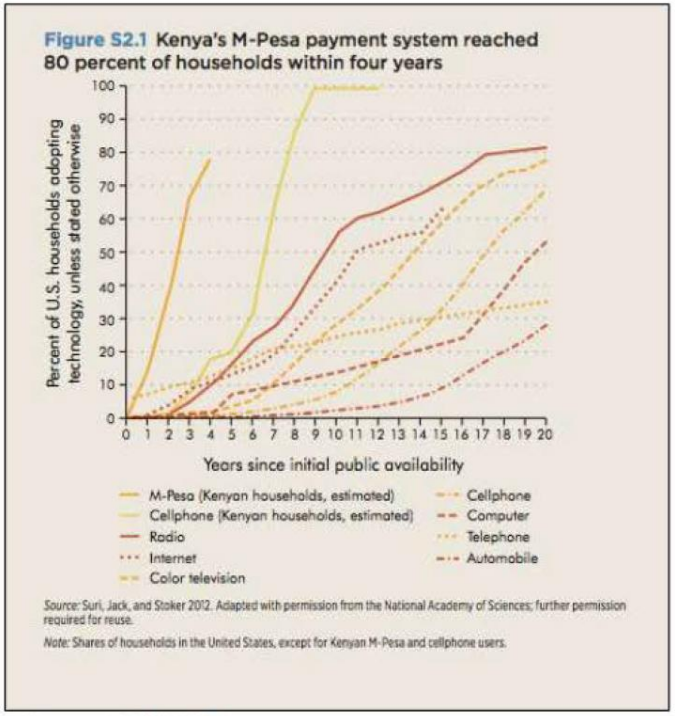
FinTech enabling Financial Inclusion

Digital technologies have spread rapidly in much of the world, yet, there is potential to boost digital dividends.

Global investments in Fintech ventures grew by 75% reaching $22.3bn in 2015 ($12.7bn in 2014)

Source: Accenture

M-Pesa reached 80% of households in Kenya within 4 years



Source: WDR 2016

New Financial Landscape

Mobile Network Operators

- Mobile network operators **provide the ability to use mobile phones for financial services**—either directly to consumers or on behalf of other financial service providers, usually through an agent network.
- The role of MNOs in mobile banking can vary from simply *selling text-messaging services* to *providing a full-fledged parallel banking infrastructure* (although it is still early in the process to fully understand what this involves).

Cryptocurrency

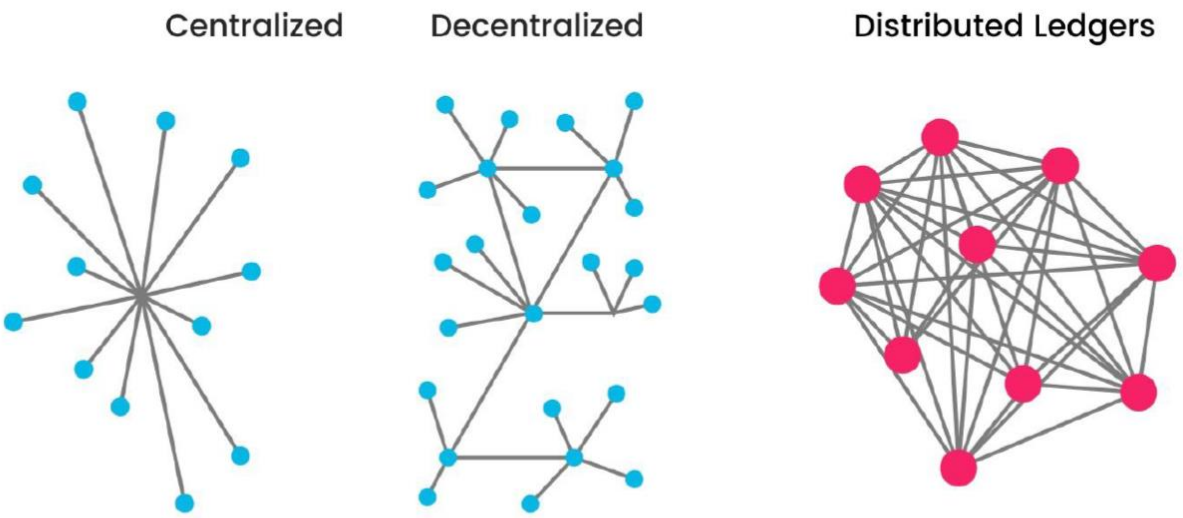
A digital currency that uses encryption techniques to regulate the generation of units of currency and verify the transfer of funds, operating independently of a central bank.

* Decentralized
* Immutable
* Transparent
* Consensus driven
* Cryptographic token (coin)

Cryptocurrency

- **Distributed ledger** (stored in blockchain)
- **Easy to set up and participate** (low entry barrier)
- **Anonymous** (public access)
- **Transparent**, holographic, provenance, audit trail, trust, collaboration
- **Minimizes transaction fees** (very low cost)
- **Fast** (payments arrive in minutes) versus international banking delays
- **Immutable, encrypted**

Distributed ledger



The New Networks

Distributed ledgers can be public or private and vary in their structure and size.

Public blockchains

Require computer processing power to confirm transactions ("mining")

- Users (●) are anonymous

- Each user has a copy of the legder and partipates in confirming transactions independently

End of Lecture