

Implications of Mobile Money for Savings and Consumption Smoothing in Developing Countries

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Motivation

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 - ▶ Significant barriers to transactions over time and space
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- The microeconomic effects of mobile money are quite well documented
- However, the role of mobile money in aggregate macro dynamics is very little studied
- This paper: use heterogeneous agent model to analyze
 1. the role of financial innovation for savings and consumption smoothing
 2. General equilibrium effect of mobile money introduction (POTENTIALLY!)

Mobile Money: Background

- Mobile Money service allows users to save and send money to any cell phone owner via SMS messages
- Cash can be transferred into MM deposits and vice versa via specialized agents
- Opening a MM account carries a fixed cost of registration as well as using an electronic technology
- Sending or withdrawal money via SMS involves a variable cost, and this cost increases if the receiver is not a registered user
- Recently service extended from P2P transfer to B2P and P2B, calculating credit score, remittances

Mobile Money: Trends

- The first service became active in 2001, but the rapid growth started in 2007 with Kenya's M-Pesa system
- By December, 2015, there was 271 mln MM services in 93 countries with more than 134 mln active accounts
- Within-country growth can be illustrated by Kenyan example:
 - ▶ The amount of registered M-Pesa customers grew on average by 8%
 - ▶ In June 2015, the monthly value of transactions accounted for about half of average monthly GDP
 - ▶ FinAccess (2013) survey revealed that the proportion of adults using formal financial services rose to 67% in 2013 to 41% in 2009, driven by MM

Micro-empirical studies

- **Adoption:** Manyegera and Matsumoto (2016), Weil et al.(2012)
- **Risk-sharing:** Batista and Vicente (2016), Blumenstock, Eagle, and Fafchamps (2016), Riley (2016), Jack and Suri (2014)
- **Welfare:** Jack and Suri (2016), Murendo and Wolhi (2016), Manyegera and Matsumoto (2016), Sekabira and Qaim (2016), Kikulwe et al. (2014), Kirui et al. (2013)
- **Saving:** Manyegera and Matsumoto (2016), Mbiti and Weil (2016), Batista and Vicente (2016)

Macro literature

- Few papers using macro-data, which mainly concentrate on the effect of mobile money on inflation
- **Adam and Walker (2015)**: adapt DSGE model (Anand and Prasad(2010)), by introducing remittances between urban producer and rural households.
- **Beck et al. (2016)**: develop and solve a DSGE model with heterogeneous entrepreneurs in small and medium enterprises, which has imperfect credit markets and theft. Access to trade credit generates demand to use M-pesa as a payment

Model Framework

Organizing framework

- A two sector model in a developing economy
- Unitary household is spread across more developed (urban) sector and less developed (rural) sector
- Household generated income and consume separately in each sector of the economy
- Urban part of the household is motivated to make transfers to the rural part

Organizing framework

- Heterogeneous agent model (both in wealth and income)
- Infinite horizon and discrete time
- Unit mass of households
- Idiosyncratic shocks: **known** stochastic process
- By now endowment economy
- By now only Partial Equilibrium

Household: Utility

Each household experiences a flow utility each period:

$$u(c_{it}^u, c_{it}^r) = \frac{(c_{it}^u)^{1-\sigma_u}}{1-\sigma_u} + \theta \frac{(c_{it}^r)^{1-\sigma_r}}{1-\sigma_r}$$

where

- c_{it}^u is the consumption of the urban sector of HH
- c_{it}^r is the consumption of the rural sector of HH
- $\frac{1}{\sigma}$ is an intertemporal elasticity of substitution of respective sector
- θ parameterizes the degree to which the household weighted rural utility

Household: Urban sector

The urban budget constraint is:

$$c_{it}^u + \frac{\tau_{it}}{1 - \phi} + b_{i,t+1} = \bar{y}^u + (1 + r_t)b_{it}$$

- urban income flow \bar{y}^u is constant for all t
- can hold bonds, b_t , which pay off $(1 + r_t)$ urban consumption next period
- urban resources can be transferred to rural sector for a price of $(1 - \phi)$

Household: Rural sector

The rural portion of the household is hand-to-mouth:

$$c_{it}^r = y_{it}^r + \tau_{it}$$

where

- y_{it}^r is stochastic income given by

$$\ln(y_{it}^r) = \rho \ln(y_{i,t-1}^r) + \epsilon_{it}$$

where

- ▶ ϵ_{it} is iid normal shock

Additional constraints

- No borrowing constraint

$$b_{it} \geq 0$$

- One way transfers

$$\tau_{it} \geq 0$$

Model Solution

Yields the following intertemporal and intratemporal conditions:

$$(c_{it}^u)^{-\sigma_u} \geq \beta(1 + r_{t+1})\mathbb{E}_t(c_{i,t+1}^u)^{-\sigma_u}$$

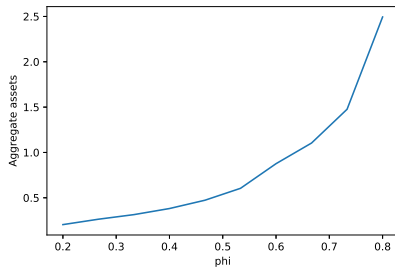
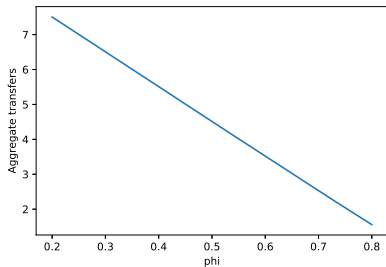
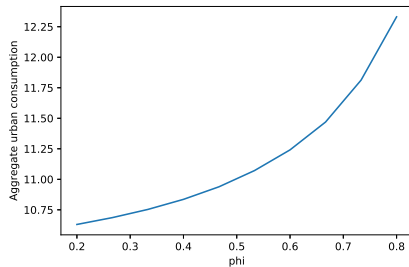
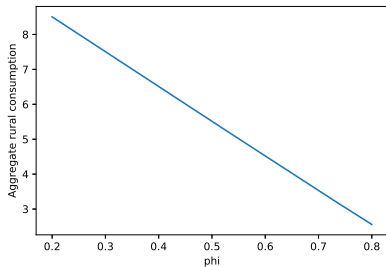
$$(c_{it}^u)^{-\sigma_u} \geq \theta(1 - \phi)(c_{it}^r)^{-\sigma_r}$$

Calibration

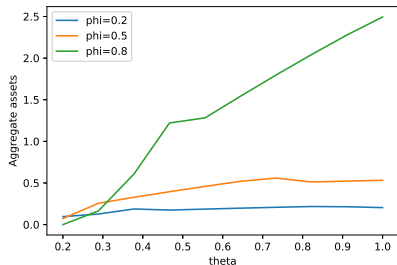
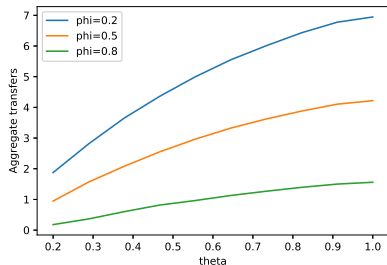
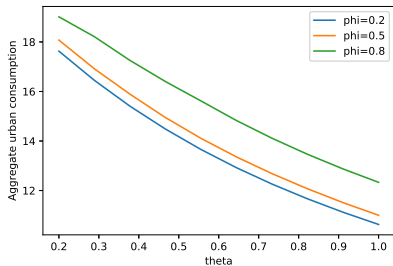
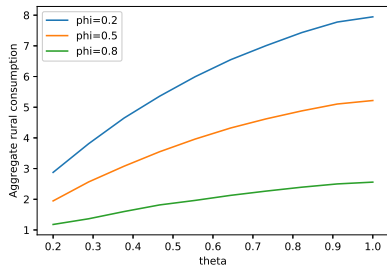
Table: Parameters used

Parameter	Value
β	0.92
σ_u	1
σ_r	1
ρ	0.6
σ_ϵ	0.92
θ	1
ϕ	0.5
r	0.05
\bar{y}^U	20

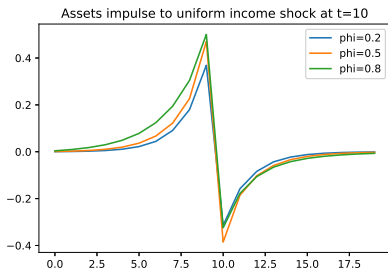
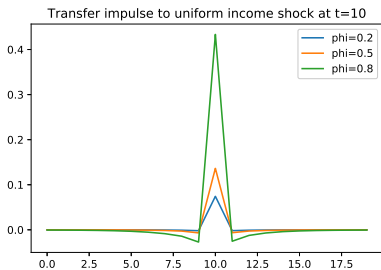
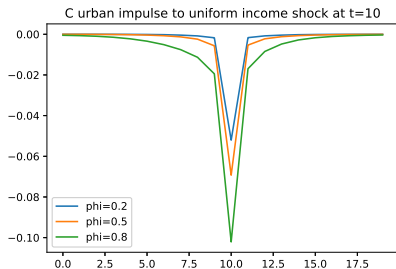
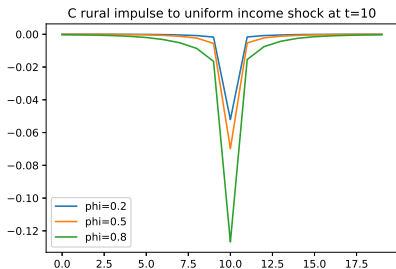
Steady State



Steady State: Comparative Statics



Impulse Response: Uniform income shock



Results comments

- Decrease in the cost of money transfer yields
 - ▶ Higher aggregate transfers, rural and urban consumption
 - ▶ Higher precautionary savings

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- Higher θ yields:
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Results comments

- Decrease in the cost of money transfer yields
 - ▶ Higher aggregate transfers, rural and urban consumption
 - ▶ Higher precautionary savings
- Higher θ yields:
 - ▶ Rural consumption and transfers are increasing
 - ▶ Assets are increasing due to higher risk aversion; but decreasing due intratemporal relationship between urban and rural consumption
- In case of anticipated rural income shock lower cost of transfer leads to:
 - ▶ Better consumption smoothing in rural area
 - ▶ Higher transfers and assets accumulation before the shock

Model Extension

Rural Savings

Allow rural sector of the household to save:

$$c_{it}^r + b_{it}^r \leq y_{it}^r + \tau_{it} + (1 - \phi_2)b_{i,t-1}^r$$

Yields the following intertemporal and intratemporal conditions:

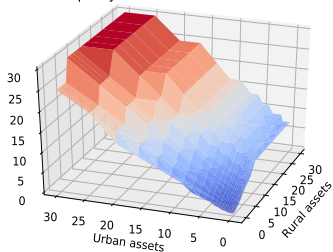
$$(c_{it}^u)^{-\sigma_u} \geq \beta(1 + r_{t+1})\mathbb{E}_t(c_{i,t+1}^u)^{-\sigma_u}$$

$$(c_{it}^r)^{-\sigma_r} \geq \beta(1 - \phi_2)\mathbb{E}_t(c_{i,t+1}^r)^{-\sigma_r}$$

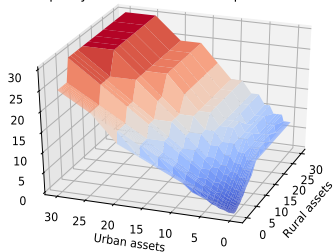
$$(c_{it}^u)^{-\sigma_u} \geq \theta(1 - \phi_1)(c_{it}^r)^{-\sigma_r}$$

Preliminary results: Urban assets policy function

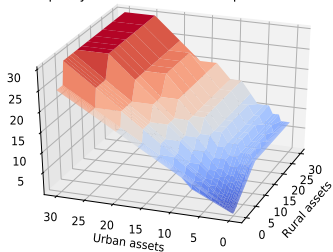
Urban assets policy function for the lowest rural income



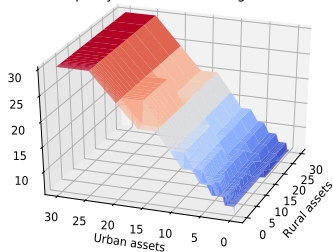
Urban assets policy function for the 25th percentile rural income



Urban assets policy function for the 75th percentile rural income

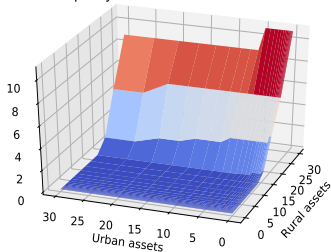


Urban assets policy function for the highest rural income

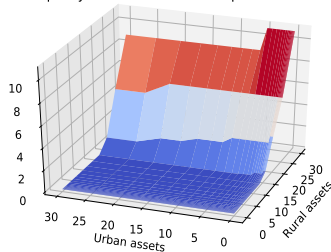


Preliminary results: Rural assets policy function

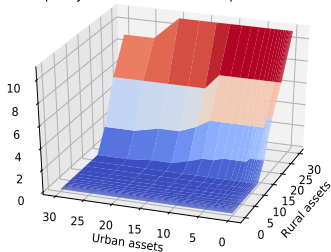
Rural assets policy function for the lowest rural income



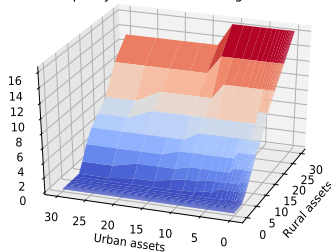
Rural assets policy function for the 25th percentile rural income



Rural assets policy function for the 75th percentile rural income

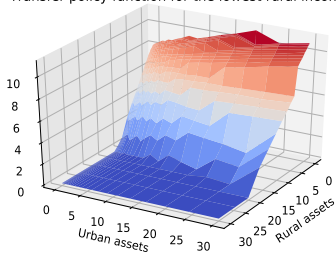


Rural assets policy function for the highest rural income

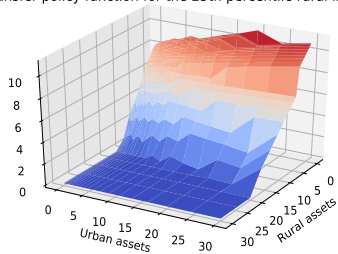


Preliminary results: Transfers policy function

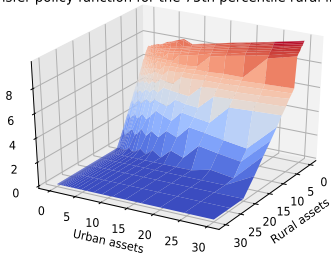
Transfer policy function for the lowest rural income



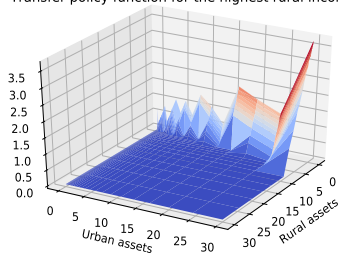
Transfer policy function for the 25th percentile rural income



Transfer policy function for the 75th percentile rural income



Transfer policy function for the highest rural income



Still in progress

- Use micro-data to inform calibration
- Aggregate shocks in the rural area; idiosyncratic shocks to urban income
- Moving from an endowment economy to an economy with production
- Look more closely on inequality

- Move to GE

Impulse Response: Uniform income shock

