Liquidity Constraints and Investment in International Migration:

Theory and Evidence from Indonesia

Samuel Bazzi

UC San Diego

March 15, 2012

Financial Barriers to Migration

- Immense economic benefits of increased migration, yet persistent barriers to international labor mobility (e.g., Clemens, 2011)

- One potentially important barrier, liquidity (or credit) constraints, has received little attention

- Remittances facilitate capital investment in credit-constrained households (e.g., Mendola, 2008; Yang, 2008b)
  - *but* is migration an investment subject to liquidity constraints?

- Standard models presume ready financing from past savings or borrowing (Borjas, 1987; Sjaastad, 1962)

- **Research Question:** *Could liquidity constraints explain some of the gap between migration flows observed in* **aggregate** *data and those predicted in these standard models?*

How to Identify Liquidity Constraints

- Ideal experiment would randomly relax income constraints
  - Not possible yet
- It is possible to use other exogenous income shocks to test for the presence and magnitude of liquidity constraints
- But, a novel theoretical framework is needed because
  - positive income shocks reduce liquidity constraints but may disincentivize migration

Theory: Migration Flows from Rural Villages

- Aggregate village migration rates derived without relying on unobservable skill or preference parameters
  - exploiting observable land-holdings heterogeneity and insights from trade theory (Melitz, 2003)

- Liquidity constraints identified without modeling endogenous financial institutions or social networks
  - distinguishing permanent vs. transitory income shocks

- Land-holdings distribution determines extent to which liquidity constraints bind in population

- Zero migration flows are a possible equilibrium outcome

  $\Longrightarrow$ separate estimating equations for extensive and intensive margin

Testing: Indonesia

- International migration is predominantly rural phenomenon with large fixed, upfront costs details

- Administrative panel data on temporary international emigrants for universe ($> 65,000$) of Indonesian villages in 2005 and 2008
  - nearly half of villages have zero migration stats

- Spatiotemporal variation in agricultural income
  - transitory rainfall shocks
  - huge, permanent increase in rice prices caused by ban on imports

- Estimates of land-holdings distribution parameters using universal Agricultural Census 2003 data for 40 million households

Preview of Findings

- Strong evidence of liquidity constraints consistent with theory
  - rainfall and price shocks increase flow migration rates
  - and with relatively larger increases in villages with low mean and inequality in land-holdings
- Other factors favor liquidity constraints interpretation
  - effects of *rice* price shocks largest, most precisely estimated for land-holdings distributions specific to rice production
  - rainfall shocks have smaller effects in villages with bank presence, higher mean household expenditures, better irrigation
- Along extensive margin, $Pr(migrants > 0) \uparrow$ in (i) mean and inequality in land-holdings, and (ii) attractiveness to recruiters

Theory: Assumptions and Implications

Key assumptions

- Income is Cobb-Douglas in public capital, own skill, own land
  - local farmgate price: $ARMA(1, q)$
  - local rainfall: mean-reverting
- Land-holdings drawn from village-specific Pareto distribution $\lambda_v \underline{R}^{\lambda_v} R_{iv}^{-\lambda_v - 1}$ where mean and inequality $\downarrow$ in λ_v
- Fraction of migration costs must be paid upfront

$\Longrightarrow$ cross-sectional inverted U between migration and land-holdings

These testable assumptions are consistent with Indonesian data.

Theory: Assumptions and Implications

Key Implications

▸ objective ▸ equations

If liquidity constraints are **not binding**, *then flow migration rate is*

- *uncorrelated* with rainfall shocks
- *decreasing* in price levels, with larger declines in villages with higher mean and inequality in land-holdings (lower λ_v)

If liquidity constraints are **binding**, *then flow migration rate is*

- *increasing* in price shocks, and *increasing* in rainfall shocks
  - with larger increases in villages with lower mean and inequality in land-holdings (higher λ_v)

Zero migration from village v if the wealthiest household $\widetilde{R}_v \equiv \max_k R_{kv}$ cannot afford to migrate (liquidity threshold) or the poorest household $\underset{\sim}{R}_v \equiv \min_l R_{lv}$ deems migration unprofitable (incentive threshold)

Empirical Strategy

- Testing theory requires distinguishing between extensive & intensive margin
- Theory suggests two-period latent variable framework

$$\begin{aligned} m^*_{vt} &= \eta'_t \mathbf{Z}_{v,t-1} + u_{vt} \\ m^*_{v,t+1} &= \eta'_{t+1} \mathbf{Z}_{vt} + u_{v,t+1} \\ \Delta \ln(M_{v,t+1}/N_{v,t+1}) &= \Theta' \Delta \mathbf{X}_{vt} + \Delta\varepsilon_{v,t+1} \quad \text{iff} \quad m^*_{v,t+1} > 0, \; m^*_{vt} > 0, \end{aligned}$$

- Estimable using *parametric* (Poirier, 1980) and *nonparametric* (Das et al, 2003) corrections
- Candidate exclusion restrictions
  - actual max- and min- land-holding sizes
  - village population size
  - attractiveness of own and neighboring villages to recruiters
- Estimates of λ_v for every village in Indonesia in 2003 figure

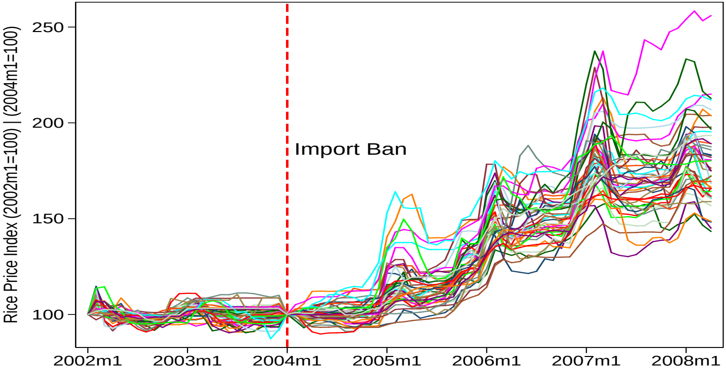
Rice Price Shock: Temporal *and* Spatial Variation

- Gov't banned import of rice in early 2004: went from world's top 3 importers to essentially zero imports through late 2007
- Absence of imports $\Longrightarrow$ massive increase in domestic rice prices at a time when world prices flat or even declining

Rice Price Shock: Temporal *and* Spatial Variation

- Gov't banned import of rice in early 2004: went from world's top 3 importers to essentially zero imports through late 2007
- Absence of imports $\Longrightarrow$ massive increase in domestic rice prices at a time when world prices flat or even declining

Evolution of Rice Prices across Indonesian Cities: 2002-2008



Notes: Each line represents average of prices in major markets located in one of 45 cities throughout Indonesia. The index is initially normalized to equal 100 in January 2002. For comparison purposes, I re-initialize and renormalize the index to equal 100 at the time of the import ban in January 2004.

Reduced Form

$$M_{v,t+1}/N_{v,t+1} = \theta_a rainfall\ shock_{vt} + \theta_{\lambda a}(\hat{\lambda}_v \times rainfall\ shock_{vt}) + \theta_p price\ shock_{vt} + \theta_{\lambda p}(\hat{\lambda}_v \times price\ shock_{vt}) + \xi_t + \xi_v + \varepsilon_{v,t+1}$$

	OLS		Semiparametric Tobit	
	(1)	(2)	(3)	(4)
rainfall shock	0.0011 (0.0002)*** [0.0011]	0.0014 (0.0006)** [0.0012]	0.0083 (0.0011)*** [0.0047]*	0.0033 (0.0047) [0.0051]
rice price shock	0.0086 (0.0014)*** [0.0058]	0.0023 (0.0023) [0.0064]	0.0254 (0.0046)*** [0.0172]	-0.0185 (0.0135) [0.0176]
$\hat{\lambda}_v \times$ rainfall shock		-0.0002 (0.0004) [0.0006]		0.0032 (0.0032) [0.0033]
$\hat{\lambda}_v \times$ price shock		0.0040 (0.0013)*** [0.0026]		0.0293 (0.0093)*** [0.0125]**
Village Fixed Effects	Yes	Yes	Yes	Yes
Number of Observations	103,196	103,196	103,196	103,196
Number of Villages	51,598	51,598	51,598	51,598
R^2	0.005	0.005	—	—

Notes: Significance levels: $*$ 10% $**$ 5% $***$ 1%. Standard errors are clustered by village in parentheses and district in brackets. Semiparametric Tobit is the trimmed LAD estimator of Honore (1992). *rainfall shock* is the cumulative log deviation from long-run mean rainfall in the growing seasons ending in 2006-2008 or 2002-2005. *rice price shock* is the annualized log growth rate in the nearest rice price index between 2005m4-2008m3 or 2002m1-2005m3. The estimated Pareto exponent $\hat{\lambda}_v$ is for total agricultural land-holdings.

Two-Step Estimates

$$\Delta \ln\left(M_{v,t+1}/N_{v,t+1}\right) = \theta_a \Delta \mathit{rainfall\ shock}_{vt} + \theta_p \Delta \mathit{price\ shock}_{vt} + \alpha \hat{\lambda}_v + \zeta' \Delta \mathbf{X}_{vt} + f(\hat{\mathbb{P}}_{vt}, \hat{\mathbb{P}}_{v,t-1}) + \Delta \varepsilon_{v,t+1}$$

Correction Procedure	—	DNV-Polynomial		Poirier
1st Stage Estimator	—	SU-LPM	SNP-ML	BiProbit
Landholdings specification	**Total Agricultural Land-holdings**			
	(1)	(2)	(3)	(4)
Pareto exponent $\hat{\lambda}_v$	-0.002 (0.018)	0.039 (0.017)**	0.039 (0.018)**	0.038 (0.018)**
Δ price shock	**-0.092 (0.438)**	**0.409 (0.448)**	**3.504 (0.850)*** **	**0.283 (0.426)**
Δ rainfall shock	**0.098 (0.127)**	**0.415 (0.133)*** **	**0.572 (0.156)*** **	**0.296 (0.128)** **
Number of Villages	26,529	26,527	26,527	26,527
R^2	0.021	0.036	0.032	0.032

Notes: Significance levels: $*$ 10% $**$ 5% $***$ 1%. Standard errors are clustered at the district level. SU-LPM is seemingly unrelated linear probability model (Zellner, 1965); SNP-ML is semi-nonparametric maximum likelihood (Gallant & Nychka, 1987). DNV-Polynomial refers to Das, Newey, and Vella (2003) and includes a 3rd degree polynomial in the propensity scores for 2005/8. Poirier includes bivariate Mills rato terms. See paper for additional covariates and exclusion restrictions.

Heterogeneity in Land-holdings Dispersion λ_v and Type

$$\Delta \ln(M_{v,t+1}/N_{v,t+1}) = \alpha\hat{\lambda}_v + \theta_a \Delta \textit{rainfall shock}_{vt} + + \theta_{a\lambda}(\hat{\lambda}_v \times \Delta \textit{rainfall shock}_{vt}) + \theta_p \Delta \textit{price shock}_{vt} + \zeta' \Delta \mathbf{X}_{vt} + f(\hat{\mathbb{P}}_{vt}, \hat{\mathbb{P}}_{v,t-1}) + \Delta\varepsilon_{v,t+1}$$

Correction Procedure	DNV-P	Poirier	DNV-P	Poirier	DNV-P	Poirier
1st Stage Estimator	SU-LPM	BiProbit	SU-LPM	BiProbit	SU-LPM	BiProbit
Landholdings type	**Agricultural**		**Wetland**		**Paddy Planted**	
	(1)	(2)	(3)	(4)	(5)	(6)
Pareto exponent $\hat{\lambda}_v$	0.017	0.036	0.073	0.052	0.027	0.044
	(0.018)	(0.018)**	(0.018)***	(0.017)***	(0.017)	(0.017)**
Δ rainfall shock	0.184	0.132	0.162	0.069	0.113	0.045
	(0.167)	(0.158)	(0.167)	(0.166)	(0.171)	(0.170)
$\hat{\lambda}_v \times \Delta$ rainfall shock	**0.147**	**0.108**	**0.082**	**0.085**	**0.165**	**0.126**
	(0.072)**	**(0.067)**	**(0.049)***	**(0.058)**	**(0.059)*****	**(0.057)****
Number of villages	26,527	26,527	24,537	24,537	24,855	24,855

Notes: Significance levels: * 10% ** 5% *** 1%. Standard errors are clustered by district. See paper for additional covariates and exclusion restrictions.

Heterogeneity in Land-holdings Dispersion λ_v and Type

$$\begin{aligned}\Delta \ln(M_{v,t+1}/N_{v,t+1}) \;=\; & \alpha\hat{\lambda}_v + \theta_a \Delta \textit{rainfall shock}_{vt} + \theta_{a\lambda}(\hat{\lambda}_v \times \Delta \textit{rainfall shock}_{vt}) \\ & + \theta_p \Delta \textit{price shock}_{vt} + \theta_{p\lambda}(\hat{\lambda}_v \times \Delta \textit{price shock}_{vt}) \\ & + \zeta' \Delta \mathbf{X}_{vt} + f(\hat{\mathbb{P}}_{vt}, \hat{\mathbb{P}}_{v,t-1}) + \Delta\varepsilon_{v,t+1}\end{aligned}$$

Correction Procedure	DNV-P	Poirier	DNV-P	Poirier	DNV-P	Poirier
1st Stage Estimator	SU-LPM	BiProbit	SU-LPM	BiProbit	SU-LPM	BiProbit
Landholdings type	**Agricultural**		**Wetland**		**Paddy Planted**	
	(1)	(2)	(3)	(4)	(5)	(6)
Pareto exponent $\hat{\lambda}_v$	-0.007	-0.019	-0.113	-0.070	-0.083	-0.084
	(0.035)	(0.034)	(0.030)***	(0.030)**	(0.046)*	(0.042)**
Δ rainfall shock	0.225	0.188	0.262	0.135	0.167	0.110
	(0.169)	(0.162)	(0.168)	(0.161)	(0.176)	(0.174)
$\hat{\lambda}_v \times \Delta$ **rainfall shock**	**0.119**	**0.073**	**0.028**	**0.048**	**0.140**	**0.087**
	(0.074)	**(0.070)**	**(0.052)**	**(0.051)**	**(0.065)****	**(0.061)**
Δ price shock	-0.016	-0.616	-2.234	-1.503	-1.031	-1.750
	(0.688)	(0.686)	(0.709)***	(0.688)**	(0.822)	(0.776)**
$\hat{\lambda}_v \times \Delta$ **price shock**	**0.267**	**0.586**	**1.913**	**1.155**	**1.116**	**1.314**
	(0.329)	**(0.335)***	**(0.335)*****	**(0.327)*****	**(0.423)*****	**(0.400)*****
Number of villages	26,527	26,527	24,537	24,537	24,855	24,855

Notes: Significance levels: $*$ 10% $**$ 5% $***$ 1%. Standard errors are clustered by district. See paper for additional covariates and exclusion restrictions.

Other Evidence of Liquidity Constraints

$$\Delta \ln\left(M_{v,t+1}/N_{v,t+1}\right) = \theta_z z_{vt} + \theta_a \Delta rain\ shock_{vt} + \theta_{az}(\Delta rain\ shock_{vt} \times z_{vt}) + \zeta' \Delta \mathbf{X}_{vt} + f(\hat{\mathbb{P}}_{vt}, \hat{\mathbb{P}}_{v,t-1}) + \Delta\varepsilon_{v,t+1}$$

Correction Procedure	DNV-P	Poirier	DNV-P	Poirier	DNV-P	Poirier
1st Stage Estimator	SU-LPM	BiProbit	SU-LPM	BiProbit	SU-LPM	BiProbit
	z := bank presence in subdistrict		**z := log mean HH exp./capita**		**z := tech. irrigation in village**	
	(1)	(2)	(3)	(4)	(5)	(6)
Δ rainfall shock	0.572	0.419	10.897	10.037	0.527	0.396
	(0.155)***	(0.147)***	(1.912)***	(1.742)***	(0.137)***	(0.132)***
z	-0.114	-0.082	-0.014	-0.062	-0.014	0.007
	(0.026)***	(0.025)***	(0.059)	(0.057)	(0.024)	(0.022)
z × Δ rainfall shock	**-0.226**	**-0.162**	**-0.909**	**-0.841**	**-0.256**	**-0.187**
	(0.087)***	**(0.085)***	**(0.163)*****	**(0.150)*****	**(0.068)*****	**(0.068)*****
Number of Villages	**26,527**	**26,527**	**26,127**	**26,127**	**26,527**	**26,527**

Notes: Significance levels: * 10% ** 5% *** 1%. Standard errors are clustered by district. Bank presence equals one if any banks located in village's subdistrict and zero otherwise; log mean household expenditures/capita obtained from Poverty Map estimates (SMERU, 2006) without any information on household land-holdings; technical irrigation equals one if village has any land irrigated by technical system not reliant on rainfall. See paper for additional covariates and exclusion restrictions.

What about the Extensive Margin (First Stage)?

Estimator	SU-LPM		Bivariate Probit	
	2008	2005	2008	2005
	(1)		(2)	
log maximum landholdings in v	0.017 (0.005)***	0.026 (0.006)***	0.062 (0.021)***	0.086 (0.021)***
log minimum landholdings in v	-0.051 (0.013)***	-0.049 (0.012)***	-0.194 (0.043)***	-0.174 (0.043)***
Number of Villages	51,592	51,592	51,592	51,592

Notes: Significance levels: $*$ 10% $**$ 5% $***$ 1%. Standard errors clustered by district. SU-LPM refers to seemingly unrelated linear probability models (Zellner, 1965). The minimum and maximum landholdings are calculated over all agricultural landholdings above $\underline{R} = 0.1$ Ha. The specification is suggested by the latent variable model prior to integrating over observable land-holdings extrema. See paper for additional covariates and discussion.

What about the Extensive Margin (First Stage)?

Estimator	SU-LPM		Bivariate Probit	
	2008	2005	2008	2005
	(3)		(4)	
Pareto exponent $\hat{\lambda}_v$	-0.011 (0.005)**	-0.016 (0.006)***	-0.049 (0.021)**	-0.069 (0.023)***
log village population, s	0.081 (0.006)***	0.074 (0.006)***	0.304 (0.020)***	0.277 (0.021)***
log district population less v, s	0.095 (0.034)***	0.091 (0.031)***	0.316 (0.109)***	0.303 (0.101)***
log district area less v	-0.047 (0.018)**	-0.053 (0.017)***	-0.156 (0.056)***	-0.178 (0.051)***
log # of villages in district	0.002 (0.048)	0.019 (0.042)	0.021 (0.135)	0.073 (0.116)
rice price shock, $s-1$	0.041 (0.396)	0.139 (0.421)	0.193 (1.364)	0.499 (1.217)
rainfall shock, $s-1$	0.027 (0.027)	0.034 (0.025)	0.078 (0.095)	0.108 (0.084)
Number of Villages	51,592	51,592	51,592	51,592

Notes: Significance levels: $*$ 10% $**$ 5% $***$ 1%. Standard errors clustered by district. SU-LPM refers to seemingly unrelated linear probability models (Zellner, 1965). This specification is suggested by the latent variable model after integrating over land-holdings extrema. See paper for additional covariates and discussion.

Contributions

- Robust new evidence on extent to which financial barriers limit international migration flows from low-income settings
  - by deriving population-level implications of liquidity-constrained individual migration choice (Orrenius & Zavodny, 2005; McKenzie & Rapoport, 2007)
  - by clarifying among different covariate income shocks with more general implications than studies using non-labor income (e.g., Angelucci, 2005), natural disasters (e.g, Yang 2008a), or financial crises (Bertoli et al, 2010)
  - by focusing on more rapidly changing and policy-relevant variation in ability to finance migration than deep social networks (e.g., McKenzie & Rapoport, 2011)
- New evidence on unintended consequences of distortionary agricultural protection for migration (Meng, 2010)
- New estimating framework at intersection of micro (e.g., Mendola, 2008) and macro (e.g., Mayda, 2010), capable of handling zeros and explaining extensive margin without endogenous migration costs

Appendix: Why Rainfall and Rice Prices Matter for Migration

- Over 80% of Indonesian emigrants from rural areas
- Over 50% work in agriculture before migrating
- 13+ million households grow rice (3/4 net producers)
  - women 40-45% total rice production labor force and 60% of emigrant labor
- Monthly migration outflows are 15-20% lower during rice growing season
- Migrants hail from middle of land-holdings distribution figure

back

Appendix: Migration Flows and Costs

- approximately 700,000 annual legal departures
- major destinations: Middle East (Saudi Arabia), Southeast Asia (Malaysia), and East Asia (Taiwan, Hong Kong)
- around 60% of migrants are female
- median 2 year contract; 75-80% return within 3 years
- Average pre-departure+placement costs are 800-1200 USD
- Growing evidence that migrants face barriers to financing upfront costs (Bank Indonesia, 2009; World Bank, 2010)
- $>$ 1000 urban-based recruitment agencies are a crucial link between rural areas and distant foreign labor markets

back

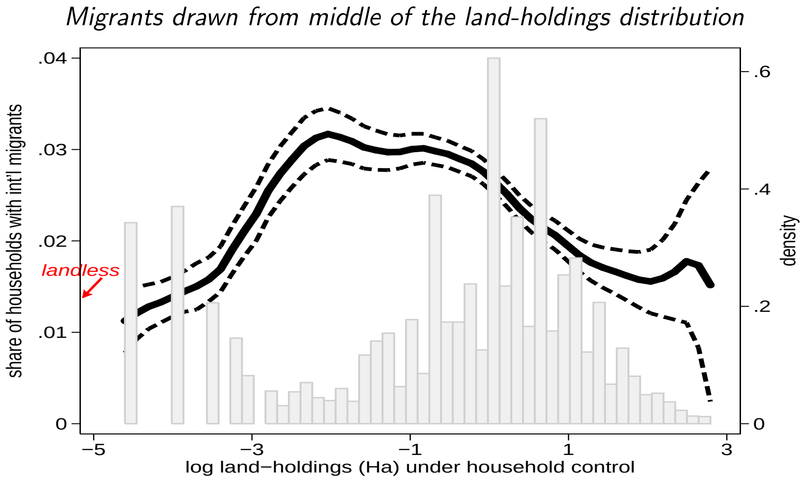
Appendix: International Migration from 65,966 Indonesian Villages

	2008		
	mean	*median*	*std. dev*
population	3,377	2,187	4,330
1**(migrants $>$ 0)**	**0.59**	—	—
migrants $\mid > 0$	35	9	81
migrants/population $\mid > 0$	0.012	0.004	0.026
Δ log (migrants/population)	**0.106**	**0.062**	**1.012**

Notes: "$\mid > 0$" indicates that the given statistics are computed over the sample of villages with at least one migrant. Data from *Podes* 2005 and 2008.

back

Appendix: Inverted U in Land-holdings and Migration



Notes: Calculations based on nationally representative household survey (*Susenas*) data collected in July 2005. The nonparametric regression curve and analytic confidence band is based on a local linear probability regression of an indicator for whether a household member worked abroad from 2002-2005 on log land-holdings under household control. The estimates employ a bandwidth of 0.4 and an Epanechnikov kernel. There are a total of 257,906 households in the data and 124,472 report controlling any land-holdings at the time of enumeration. Both the mean estimate for migration probabilities in landless households and the nonparametric regression employ sampling weights. The histogram shows the density of log land-holdings. The top percentile of land-holdings are trimmed from the figure for presentational purposes.

back

Appendix: Model Foundations and Assumptions

- Income for person $i = 1, \ldots, N_v$ in village v in period t is given by

$$\Pi_{ivt} = p_{vt}\sigma_{vt} Y_{iv},$$

where agricultural (rice paddy) output $Y_{iv} = K_v^{\theta} S_{iv}^{\phi} R_{iv}^{\beta}$

- Wages abroad in destination j: $w_{ivjt} = \delta_{vj} S_{iv}^{\nu} - C_{vjt}$

- Collective household wants to send individual i abroad next period if net returns exceed expected MRPL at home

$$\delta_{vj} S_{iv}^{\nu} - C_{vjt} \;\geq\; \mathbb{E}_t[p_{v,t+1}\sigma_{v,t+1}] K_v^{\theta} S_{iv}^{\phi} R_{iv}^{\beta}$$

but, fraction $\tau_{vj} \in [0,1]$ of direct costs C_{vjt} must be paid upfront so that migration to destination j possible next period only if $\Pi_{ivt} \geq \tau_{vj} C_{vjt}$

- **Individuals with following land-holdings will be observed abroad in $t+1$**

$$\underbrace{\left(\frac{\tau_{vj} C_{vjt}}{p_{vt}\sigma_{vt} K_v^{\theta} S_{iv}^{\phi}}\right)^{\frac{1}{\beta}}}_{R_L} \leq R_{iv} \leq \underbrace{\left(\frac{\delta_{vj} S_{iv}^{\nu} - C_{vjt}}{\mathbb{E}_t[p_{v,t+1}\sigma_{v,t+1}] K_v^{\theta} S_{iv}^{\phi}}\right)^{\frac{1}{\beta}}}_{R_U}$$

back

Appendix: Flow Migration Rates

If liquidity constraints are binding, log *flow* migration rate between periods given by

$$\Delta \ln \left(\frac{M_{v,t+1}}{N_{v,t+1}} \right) = \frac{\lambda_v}{\beta} \Delta \ln p_{vt} + \Delta \ln \left[\left(\frac{\overline{\sigma}_v + a_{vt}}{\tau_{vj} C_{vjt}} \right)^{\frac{\lambda_v}{\beta}} - \left(\frac{\overline{\sigma}_v \alpha_v}{\delta_{vj} S_v^{\nu} - C_{vjt}} \right)^{\frac{\lambda_v}{\beta}} \right]$$

If liquidity constraints are not binding in village v, then

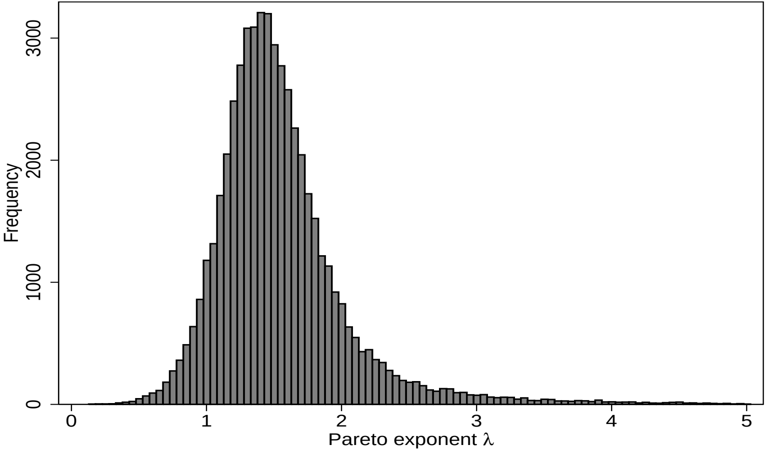
$$\Delta \ln \left(\frac{M_{v,t+1}}{N_{v,t+1}} \right) = \Delta \ln \left[1 - \left(\frac{\alpha_v p_{vt} \overline{\sigma}_v K_v S_v^{\phi}}{\delta_{vj} S_v^{\nu} - C_{vjt}} \right)^{\frac{\lambda_v}{\beta}} \right]$$

where

- rainfall mean-reverting: $\sigma_{vt} = \overline{\sigma}_v + a_{vt}$
- prices $ARMA(1, Q)$: $p_{vt} = \alpha_v p_{v,t-1} + \sum_{q=0}^{Q} \theta_q e_{v,t-q}$
- skill: high (low) w.p. γ_v $(1 - \gamma_v)$ implicit in S_v

back

Appendix: Distribution of $\hat{\lambda}_v$



Notes: The Pareto distribution is given by $\lambda_{i} v \underline{R}^{\lambda_v} R_{iv}^{-\lambda_v - 1}$. The figure shows the distribution of Gabaix & Ibragimov (2011) log rank(-1/2) - log size OLS estimates of λ_v using the average log rank for a given log land-holding size and imposing $\underline{R} = 0.1$ hectares. The estimates were calculated independently across 58,643 villages with at least 3 distinct total agricultural land-holding sizes recorded in the Agricultural Census 2003. In the figure, the top 2 % of estimates are trimmed and bins are set to a width of 0.05.

back