Food price shocks-induced poverty traps:

An analysis using panel dataset from Uganda

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Introduction

- Given the recent global food price crisis of 2000s, fear of deterioration of welfare indicators:
  - Food security
  - Vulnerability to other types of shocks and stressors
  - Risks of poverty traps or low well-being equilibrium
- Previous studies (Headey and Fan, 2008; **Ivanic and Martin, 2008**; Boysen, 2009; Hella et al, 2011; Vu and Glewwe, 2011;...) indicate the many households (even millions) might have been pushed into poverty
- **Their limitations:**
  - Fail to theoretically and empirically links exposure to food price shocks and risks of poverty traps
  - Use cross-sectional data
  - Unable to account for household unobserved heterogeneity

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- Model theoretically the link between exposure to food price shocks and welfare dynamics
- Uncover the effects of food price and asset shocks on welfare growth (consumption levels and asset holdings)
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Conceptual model

- Incorporate explicitly food price and asset shocks in households' optimization problem
- Maximization of expected lifetime utility:

$$\underset{c_t,k_{t+1}}{Max}\, U\left(c;\theta^f\right) = E_0\left\{\sum_{t=0}^{\infty}\beta^t\left[u\left(c_t\right)+v\left(u\left(c_t\right)-u\left(c_t|z\left(\theta_t^f\right)\right)\right)\right]\right\}$$

subject to

$$k_{t+1} = \theta_t^k\left[f\left(k_t\right)+\left(1-\delta\right)k_t\right]-c_t$$

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Conceptual model

- Euler equation:

$$\frac{U'\left(c_t;\theta_t^f\right)}{\beta E_t U'\left(c_{t+1};\theta_{t+1}^f\right)} = \theta_{t+1}^k\left[f\left(k_{t+1}\right) + \left(1-\delta\right)k_{t+1}\right]$$

- In case of food price shocks:

$$U'\left(c_t;\theta_t^f\right) \equiv u'\left(c_t\right)\left\{1 + v'\left[g\left(c_t;\theta_t^f\right)\right]\right\}$$

$$-u'\left(c_t|z\left(\theta_t^f\right)\right)\left\{v'\left[g\left(c_t;\theta_t^f\right)\right]\right\} \neq u'\left(c_t|z\left(\theta_t^f\right)\right), \; \forall t$$

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Sample

- Uganda National Panel Surveys (**UNPS**) as part of LSMS and LSMS-ISA of World Bank
- Four waves: **2005/6, 2009/10, 2010/11, and 2011/12**
- Balanced panels of **2,173 households** with complete information over 4 periods
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Food price shock variable

- Construction of a household-specific consumer price index

$$CPI_{hct} = \sum_{i=1}^{I} s^{i}_{hct} \left(\frac{p^{i}_{ct}}{p^{i}_{c0}} \right)$$

- Regress changes in household's price index on lagged values, time dummies and fixed effects

$$\triangle CPI_{hct} = \alpha_0 + \alpha_1 CPI_{hct-1} + \alpha_2 t + \kappa + \varepsilon_{hct}, \quad t = 1, ..., T$$

- Food price shocks: **positive** standardized residuals

$$\hat{\theta}^{f}_{hct} = \frac{(\hat{\varepsilon}_{hct} - \bar{\varepsilon}_{hct})}{s_{\hat{\varepsilon}}} > 0$$

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Asset index

- Distinction between structural changes and stochatic welfare variations (Barrett et al, 2006)
- Livelihood-weighted regression approach

$$\lambda_{ht} = \beta_0 + \sum_{i=1}^{I} \beta_i A^i_{ht} + \sum_{j,k}^{I} \beta_{jk} A^j_{ht} A^k_{ht} + Z'\alpha + D'\omega + (\vartheta_h + \varepsilon_{ht})$$

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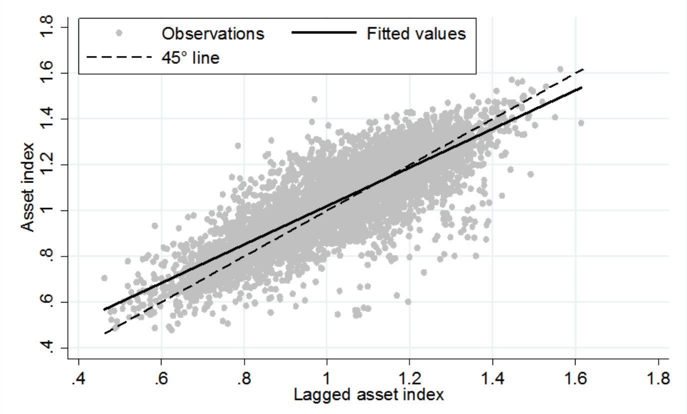
Asset index

- Scatterplot of aseet index



Consumption dynamics

- Extensions of previous studies (Jalan and Ravallion, 2004; Barrett et al, 2006; Naschold, 2013; Kwak et al, 2010):
  - Non-linearities in consumption dynamics: cubic polynomial function of lagged consumption
  - Non-linearities in exposure to price shocks through household's vulnerability to price shocks
  - Incorporation of capital/asset shocks

$$\triangle \ln c_{ht} = \sigma_0 + (\beta_1 - 1)\ln c_{ht-1} + \sum_{i=2}^{3} \beta_i \ln c^i_{ht-i} + \wedge'\alpha$$

$$+\sigma_1 \triangle \ln \theta^f_{ht} + \sigma_2 \left(\triangle \ln \theta^f_{ht} \times vul^\theta_{ht}\right) + \sigma_3 vul^\theta_{ht}$$

$$+\sum_{j=1}^{3} v_j \theta^{kj}_t + \varepsilon_{ht}$$

Consumption dynamics

- Total effects of changes in exposure to food price shocks on consumption groth rate

$$\frac{\partial \triangle \ln c_{ht}}{\partial \triangle \ln \theta^{f}_{ht}} = \hat{\sigma}_1 + \hat{\sigma}_2 \bar{vul}^{\theta}_{h}$$

- Threshold vulnerability index to food price shocks

$$\left(vul^{\theta}_{h}\right)^{*} = -\frac{\hat{\sigma}_1}{\hat{\sigma}_2}$$

- Estimation via Two-step System Generalized Methods of Moments (**S-GMM**)

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Two-step S-GMM results of consumption growth model

- Polynomial terms

	Model I	Model II	Model III	Model IV
c_{ht-1}	**-1.268**	**-2.395**	**-2.972**	**-2.795**
c_{ht-2}	0.562	**0.315**	**0.256**	**0.765**
c_{ht-3}	-0.056	**-0.075**	**-0.074**	**-0.025**

- Model I: Absence of nonlinearities
- Models II-IV: Nonlinear effects of lagged consumption
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Two-step S-GMM results of consumption growth model

- Shock variables

	Model IV
$\triangle\theta^{f}_{ht}$	**-0.775**
$\triangle\theta^{f}_{ht} \times vul^{\theta}_{ht}$	**0.568**
vul^{θ}_{ht}	**-0.207**
θ^{k1}_{ht}	-0.010
θ^{k2}_{ht}	**-0.040**
θ^{k3}_{ht}	**-0.096**
$\left(vul^{\theta}_{h}\right)^{*}$	**1.364**
% above $\left(vul^{\theta}_{h}\right)^{*}$	**57.65 (69.61;62.80;40.53)**

Asset dynamics

- Non-linear model with cubic polynomial terms and interaction between θ_t^k and *apovstatus*

$$\triangle \ln a_{ht} = \beta_0 + \sum_{i=1}^{3} \beta_i \ln c_{ht-i}^{i} + \wedge' \gamma + \beta_4 \triangle \ln \theta_{ht}^{f} + \beta_5 \theta_t^k$$

$$+\beta_6 a_{h,0} + \beta_7 \left(\theta_t^k \times apovstatus \right) + (\tau_h + \mu_{ht})$$

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	Model I	Model II	Model III
a_{ht-1}	**-0.711**	**-0.715**	**-0.984**
a_{ht-2}	0.155	0.315	**0.235**
a_{ht-3}	**-0.029**	**-0.026**	**-0.035**

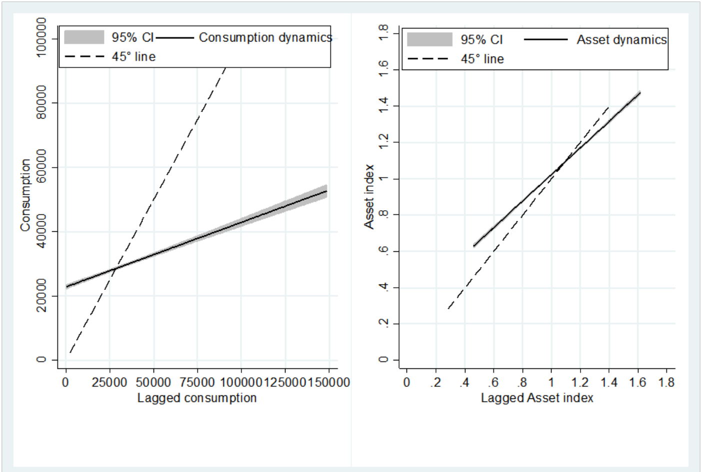
Two-step S-GMM results of asset growth model

- Shock variables

	Model III
$\triangle\theta^{f}_{ht}$	**-0.014**
$\theta^k_t = 0\&apovstatus = 1$	**-0.102**
$\theta^k_t = 1\&apovstatus = 0$	**-0.009**
$\theta^k_t = 1\&apovstatus = 1$	-0.152
$\theta^k_t = 2\&apovstatus = 0$	**-0.024**
$\theta^k_t = 2\&apovstatus = 1$	**-0.157**
$\theta^k_t = 3\&apovstatus = 0$	-0.074
$\theta^k_t = 3\&apovstatus = 1$	-0.177

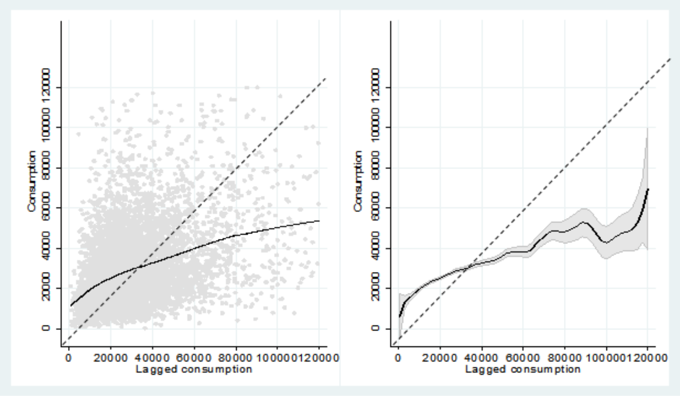
Parametric methods

- Consumption and asset dynamics



Non-parametric methods

- Consumption dynamics: LOWESS and Kernel-weighted local polynomial



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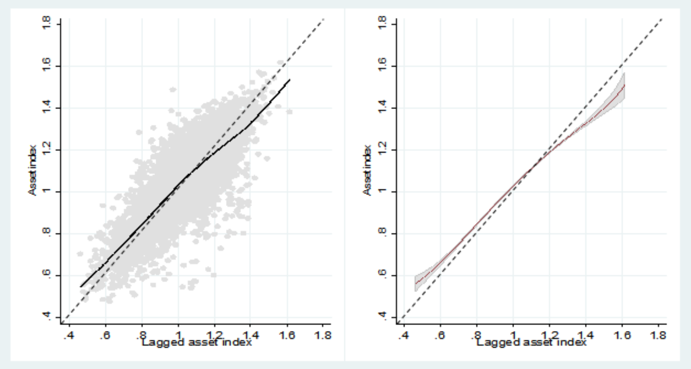
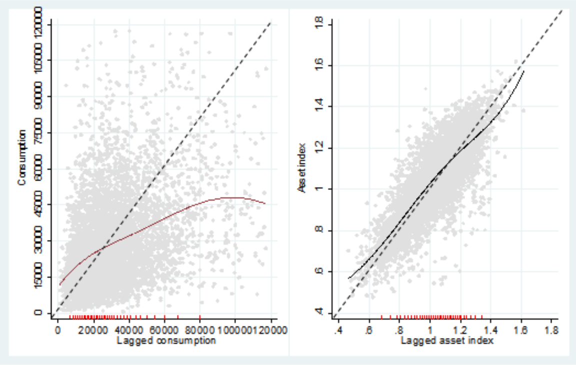


Semi-parametric method

- Semi-parametric penalized spline regression (Ruppert et al, 2003)



Food price shocks-induced poverty traps

- Approximate locations of consumption equilibria

	LOWESS	Kernel linear		Kernel cubic		S-GMM	Semi-par
	Mean	Mean	CI	Mean	CI	Mean	Mean
All	**30.000**	**31.000**	[28,000;32,500]	**30.500**	[29,000;32,000]	**29.000**	**31.500**
Exposed	**30.000**	**29.000**	[24,000;36,800]	**30.000**	[26,000;34,200]	**30.500**	**31.800**
High	28,300	27,000	[24,400;30,000]	28,500	[26,500;33,000]	28,000	29,800
Middle	30,000	31,000	[25,200;33,000]	31,200	[26,000;36,000]	31,000	30,800
Low	31,500	33,000	[29,000;37,000]	33,500	[28,300;35,000]	32,000	32,900
Unexposed	**32.000**	**32.600**	[26,500;36,000]	**32.000**	[28,000;36,500]	**32.000**	33,200
Above $(vul_h^{\theta})^*$	21,000	22,000	[17,000;21,000]	20,000	[18,000;22,000]	21,000	23,000
Below $(vul_h^{\theta})^*$	34,000	34,000	[30,000;37,000]	34,100	[32,000;36,000]	34,000	32,000

Food price shocks-induced poverty traps

- Approximate locations of asset equilibria

	LOWESS	Kernel linear		Kernel cubic		S-GMM	Semi-par
	Mean	Mean	CI	Mean	CI	Mean	Mean
All	**1.15**	**1.18**	[0.90;1.20]	**1.15**	[1.00;1.17]	**1.10**	**1.13**
Exposed	**1.11**	**1.12**	[1.10;1.14]	**1.13**	[1.12;1.14]	**1.05**	**1.10**
High	1.09	1.10	[1.07;1.13]	1.10	[1.10;1.15]	1.03	1.08
Middle	1.10	1.11	[1.09;1.14]	1.12	[1.11;1.13]	1.04	1.10
Low	1.12	1.13	[1.10;1.17]	1.15	[1.14;1.20]	1.07	1.11
Unexposed	**1.13**	**1.14**	[1.14;1.10]	**1.14**	[1.10;1.21]	**1.07**	**1.12**
Above $\left(vul_h^{\theta}\right)^*$	1.06	1.00	[0.08;1.02]	1.05	[1.03;1.06]	1.15	0.97
Below $\left(vul_h^{\theta}\right)^*$	1.18	1.18	[1.17;1.20]	1.17	[1.15;1.19]	1.07	1.01

Conclusions

- Nonlinearities in welfare dynamics (consumption and assets)
- Negative correlation between degree of exposure to food price shocks and growth rates of consumption and assets
- Impacts of price shocks more important than asset (health, agricultural, and income) shocks
- **No evidence of food price shocks-induced poverty traps** or multiple welfare equilibria
- Single welfare equilibria specific to different household categories (**conditional convergence**)
- Households exposed to price shocks or above the vulnerability threshold are converging toward **lower** welfare equilibria

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