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Global Exposure: Food Price Spike Effects on Ethiopian Farm Households

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Objectives

- Analyze the extent and magnitude of the impact of food price crises
 - *on agriculture productivity, on farmers' market position (net consumers and net producers)*
 - *on overall welfare*
- We use 4 rounds of panel survey on 1239 Ethiopian farmers – **ERHS** (CSAE – IFPRI) for the years **1994, 1999, 2004, and 2009**, to understand differential impact of two different crisis: mid-nineties, and 2008 spike.
- We focus on return to farming and efficiency change over time and, we analyze the before and after welfare effects on households
- We highlight methodological issues related to source of welfare changes in consumer and producer prices

Motivations

- Since the 2008 spike, large interest in analyzing the disaggregated impact of food price changes on the welfare and poverty of rural population.
- The impact of food price volatility and spikes on the poor in developing countries remains controversial (*Ataman Aksoy and Hoekman, 2010; Barrett, 2011; Swinnen, 2011; Ivanic and Martin, 2011*), and depends on how the households respond in the short- and long-run (*Bellemare et al., 2012*).
- Short run: increase in price: consumer lose / producer gain
- Long run: Behavioral change - Producers can increase output (investment opportunities, increase labor), or switching to more valuable crops. Consumers can embark in agriculture or take labor opportunities thereby increasing their welfare.

Empirical Evidence

- Evidence from Net Benefit Ratio: first order impact of food prices on consumption and production ratios (*Deaton , 1989; Ravallion , 1990; Budd 1993, Barrett and Dorosh 1996, Minot and Goletti 2000, Levinsohn and McMillan 2004, Wodon and Zaman 2008, Ivanic and Martin 2008, Arndt et al. 2009, Simler 2010, Benfica 2012*).
- => As the majority of the HH are net food buyers: benefit of higher food prices for poor farmers are not able to offset the negative impact of higher food prices on net consumers => reduction in real income and an increase in poverty (headcount ratio).
- Long term effects more controversial: differences rely on aggregate welfare effect, demand and supply side.
 - Demeke et al. (2012) - Ethiopia - a positive welfare and substitution effects with gains also for autarkic and net cereal buyers .
 - Ulimwengu and Ramadam (2009) - Uganda - long-run the impact of rising food prices may be mitigated through substitution effects
 - Badolo and Traore (2012) – Burkina Faso - : increase in rice price negative impact on income and poverty in regions with a large proportion of net buyers, and increase inequality in urban areas.
 - Aksoy et al. (2010) and Isik-Dikmelik (2006) – Vietnam - food price increases had large and significant effects on households' net sales, production, and consumption over the period. This suggests that a price increase would lead to higher production, and more importantly to lower consumption, thus attenuating its first-order effects on welfare
 - Minot (2010) - Ghana - rural households were found to be better off in the long-run and when producer prices rose more than consumer prices

Methodological Framework

Two Steps procedure:

- Impact of food prices on farmers' revenue
 - Estimate a panel level agriculture production function and recover unobserved HH ability in two sub-periods (94-99) and (04-09)
 - Analyse the difference in input elasticities in the sub-periods
- Impact of food prices on households' welfare: net benefit ratio
 - before and after response welfare effect of price spikes using different prices: consumer and producers prices at household, woreda and PA level, average of the two.

Step 1: Impact on farmers' ability

We use modified version of the Deininger and Jin (2002) model and specify a deterministic Cobb-Douglas production function as affected by unobserved farmers' ability.

$$y_{it} = \alpha_i + x'_{it}\beta + \gamma t + \epsilon_{it}$$

where:

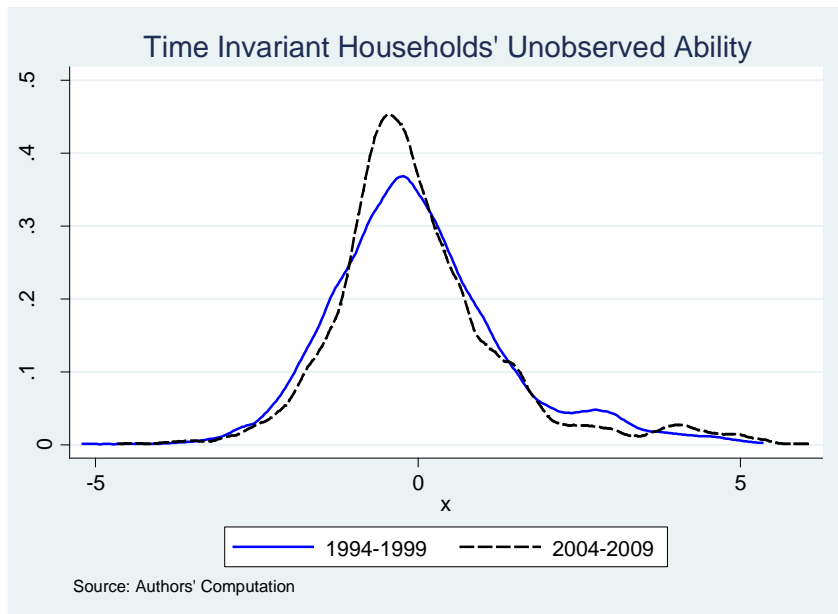
- y_{it} is the value of agriculture output produced by farmer in year t ;
- α_i is the time invariant unobserved farm heterogeneity (e.g. ability);
- x is the set of production inputs including quasi-fixed factors such as land cultivated, labor, agriculture capital, land quality, and topography and a set of variable inputs including chemical fertilizers, organic manure, pesticides, seeds;
- γt is a set of dummies for year fixed effect, to account for some specific time shocks and to control for latent year-to-year variation

Step 1: cont.ed

We repeat the estimation using village fixed effect, an estimate of the average village productivity, and obtain

$$A_{ji} = \alpha_j - \alpha_i$$

Where A_{ji} is differential farm-level productivity relative to that village average



First Evidence:

The two distributions are quite close, the 2004-2009 distribution is more negative skewed and lies to the left of the 1994-1999 distribution

Step 2: Before - Response

We use an extension of the NBR (Deaton, 1989; Ravallion, 1990) applying the Minot and Goletti (2000) concepts of “before” and “after” response effect of price changes on welfare

BEFORE RESPONSE

$$\frac{\Delta w_i^1}{m_{0i}} = \frac{\Delta p^p}{p_0^p} PR_i - \frac{\Delta p^c}{p_0^c} CR_i$$

Δw_i^1 is the first order approximation of the change in welfare for household i of a change in the price index of cereals.

m_{0i} is the original consumption expenditure for household i

p_0^p is the original value of the producer price index for cereal used to value cereal production

p_0^c is the original value of the consumer price index for cereal used to value cereal consumption

PR_i is the value of cereal production for household i as a proportion of m_{0i}

CR_i is the value of cereal consumption for household i as a proportion of m_{0i}

Step 2: After - Response

AFTER RESPONSE: refers to the way household responds to the new prices. Taylor Expansion:

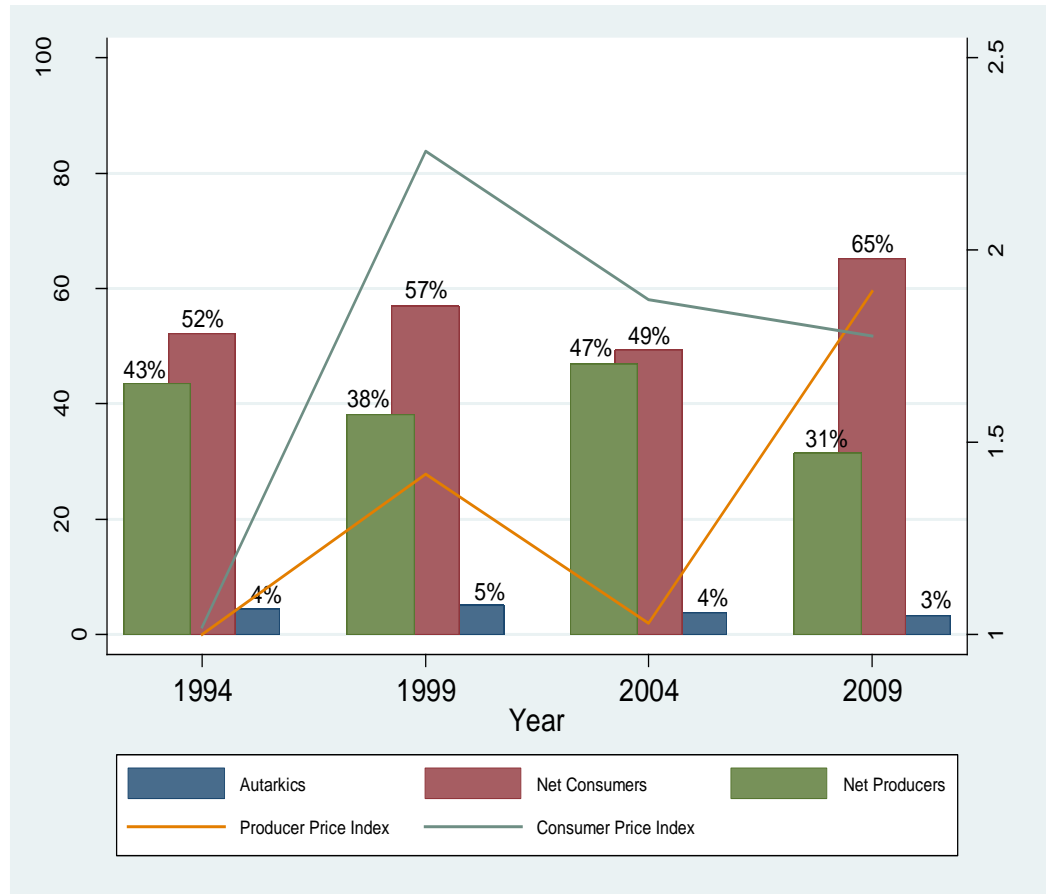
$$\frac{\Delta w_i^2}{m_{0i}} = \frac{\Delta p^p}{p_0^p} PR_i + \frac{1}{2} \left(\frac{\Delta p^p}{p_0^p} \right) PR_i \epsilon_c^s - \frac{\Delta p^c}{p_0^c} CR_i - \frac{1}{2} \left(\frac{\Delta p^c}{p_0^c} \right) CR_i \epsilon_c^H$$

Methodological issues:

- Which Prices?
- Transmission of world price shocks to domestic markets may be incomplete.
Assuming identical food price shocks on world and domestic markets can be misleading
- Magnitude of Elasticities?
- Unique Price Change
(*subjective or unit value from survey data*)
- Different for Producers and Consumers
- HH level, Woreda, Regional, or National Level

Evidence from Rural Ethiopia (1)

Prices and HH Market Position



Evidence from Rural Ethiopia (2)

Agriculture Output and Productivity for Net Consumer (NC) and Net Producers (NP)

	1994-2004		2004-2009	
	NC	NP	NC	NP
% Change				
<i>Income pc</i>	50%	24%	25%	90%
<i>Consumption pc</i>	33%	35%	-15%	19%
Income Source (%)				
<i>Crop</i>	38%	66%	46%	69%
<i>Livestock</i>	24%	15%	22%	17%
<i>Others</i>	38%	19%	32%	14%
Ag. Production				
Crop Profit/ha	-48%	35%	46%	118%
Yield Cereals	177%	60%	-14%	-13%
Crop area	20%	-28%	1%	28%
Fertilizer Exp	370%	172%	-12%	16%
Seeds Exp	100%	100%	77%	125%

Pc income x2 from 94-09 (165\$ to 350\$)
Changes for NP are larger in 04-09

NC are embarking in agric.
rise in % of inc from crop and liv.

- ✓ Profit of NP have increased as a result of the 2 crisis
- ✓ But also for NC whose net revenue doubled in 04-09
- ✓ Yield decreased, stable land area = profit increase driven by prices

Impact on farmers' ability:

OLS on *Log gross agriculture production per hectare* with *HH - FE*

VARIABLES	(1) 1994-2009	(2) 1994-1999	(3) 2004-2009
Log crop area	1.83***	1.15**	3.73***
Log crop area square	-0.87***	-0.67***	-1.83***
Log Nb. of plots with flat slope	0.43***	0.47***	-0.01
Share of land of good soil quality	0.48***	0.64***	0.38**
Log Fert. Exp/ha	0.15***	0.15***	0.08*
Log Seeds. Exp/ha	0.12***	0.25***	0.05**
Log person days for hired labor	0.09***	0.17***	0.03
Log nb. Adult male in HH	0.13	-0.22	0.20
Log nb. Adult female in HH	0.28**	0.25	0.33
Log nb. of donkeys	0.66***	0.71***	0.22
Log years of education of the head	0.05	0.13	0.09
Log years of education of the head	-0.41**	-1.04**	-0.44
Dummy for female HH head	-0.30**	-0.46	-0.01
Constant	5.99***	8.66***	6.47***
Observations	4,956	2,478	2,478
R-squared	0.16	0.26	0.07
Number of hh	1,239	1,239	1,239

With cluster-robust standard errors on HH

• Inverted U-Shape IR at 1...Ha

• Adjustments for land quality and topography

• Role of women in farming

Female family labor is 3x higher than hired labor (supervision constraints)

• Importance of pack animals for marketing produce-

TECHNOLOGY: Input elasticities

• Fert in 04-09 = 1/2 of 94-99

• Seeds also significant and lower in 04-9

• Regressive shift in the contribution of technology to ag prod. Price spikes resulted into stagnation of technol. progress

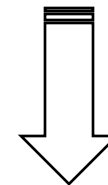
Before - Response Welfare Change

(by quintile of pc exp)

	19994/1999		1999/2004		2004/2009	
	NC	NP	NC	NP	NC	NP
1	-23%	-6%	1%	-11%	15%	51%
2	-20%	1%	2%	-10%	15%	66%
3	-22%	-2%	1%	-9%	20%	77%
4	-24%	-2%	1%	-8%	20%	72%
5	-25%	-0.3%	2%	-7%	19%	59%

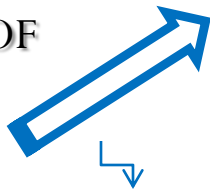
HOW WIN - WHO LOOSE

FROM PRICE CHANGE ?

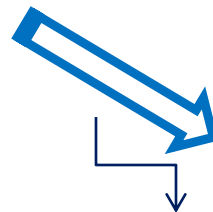


MARGINAL LOSSES AND GAINS?

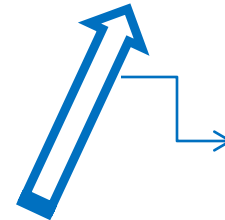
**DIRECTION OF
PRICE
CHANGE**



Consumers LOOSE
Producers: Marginal LOSS



Consumers Marginal GAIN
Producers: LOOSE



Price Spike BUT $P_c \approx P_p$

Consumers GAIN

(Avge change of 15% \approx 30\$ pc/year)

Producers substantial GAIN

Impact on HHs' Welfare (by quintile of pc exp)

HH price indexes

	BEFORE-RESPONSE				AFTER-RESPONSE			
	1994/2004		2004/2009		1994/2004		2004/2009	
	NC	NP	NC	NP	NC	NP	NC	NP
1	-18%	-10%	15%	51%	-10%	-6%	10%	30%
2	-18%	-11%	15%	66%	-12%	-7%	10%	39%
3	-20%	-10%	20%	77%	-14%	-7%	13%	45%
4	-22%	-11%	20%	72%	-15%	-8%	13%	43%
5	-21%	-9%	19%	59%	-15%	-6%	12%	35%

Woreda price indexes

	BEFORE-RESPONSE				AFTER-RESPONSE			
	1994/2004		2004/2009		1994/2004		2004/2009	
	NC	NP	NC	NP	NC	NP	NC	NP
1	-18%	-9%	14%	49%	-11%	-6%	9%	29%
2	-19%	-11%	14%	64%	-12%	-7%	10%	38%
3	-21%	-11%	19%	76%	-14%	-7%	12%	45%
4	-22%	-12%	19%	72%	-15%	-8%	12%	43%
5	-21%	-9%	18%	59%	-15%	-6%	11%	35%

Hyp 1: HH and Woreda separated consumer and producer price indices for cereal from survey data

$$\frac{\Delta w_i^1}{m_{0i}} = \frac{\Delta p^p}{p_0^p} PR_i - \frac{\Delta p^c}{p_0^c} CR_i$$

Note: elasticity estimates for “after-response” from Demeke et al. (2011):

	1994/2004	2004/2009
Own price elasticity of cereal supply	-1.0024	-1.0054
Own price elasticity of cereal demand	-0.637	-0.628

Impact on HHs' Welfare – **Methodological Issues**

Equal % changes for both farm and consumer prices

HH unique price index

Woreda unique price index

	BEFORE-RESPONSE		AFTER-RESPONSE					
	1994/2004		2004/2009		1994/2004		2004/2009	
	NC	NP	NC	NP	NC	NP	NC	NP
1	-6%	14%	-10%	9%	-5%	11%	-10%	8%
2	-6%	12%	-10%	9%	-6%	9%	-9%	7%
3	-7%	10%	-8%	11%	-6%	7%	-7%	9%
4	-8%	9%	-7%	11%	-7%	6%	-7%	9%
5	-8%	8%	-7%	9%	-7%	6%	-7%	8%

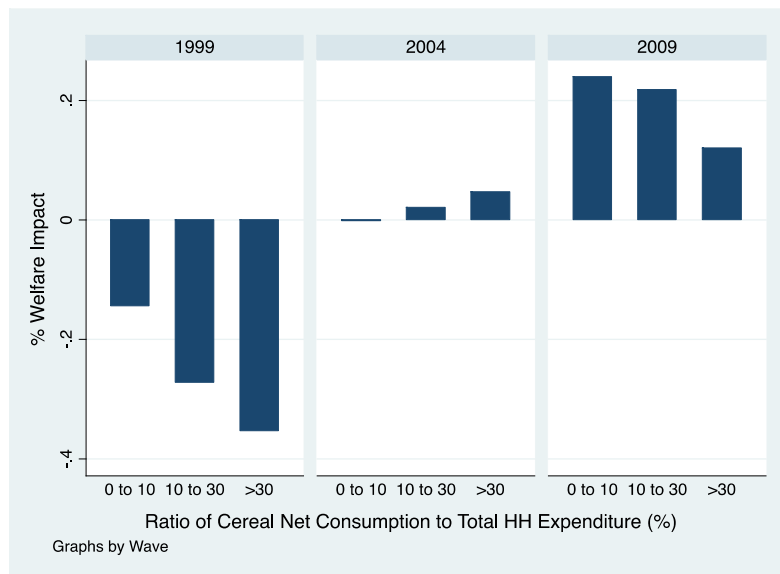
	BEFORE-RESPONSE		AFTER-RESPONSE					
	1994/2004		2004/2009		1994/2004		2004/2009	
	NC	NP	NC	NP	NC	NP	NC	NP
1	-6%	17%	-10%	9%	-5%	12%	-9%	8%
2	-6%	12%	-9%	8%	-5%	9%	-9%	7%
3	-7%	10%	-8%	11%	-6%	7%	-7%	9%
4	-8%	8%	-7%	11%	-7%	6%	-7%	9%
5	-8%	8%	-7%	9%	-7%	6%	-7%	7%

Hyp. 2: HH and Woreda Median Consumer and Producer Price Indices for Cereal

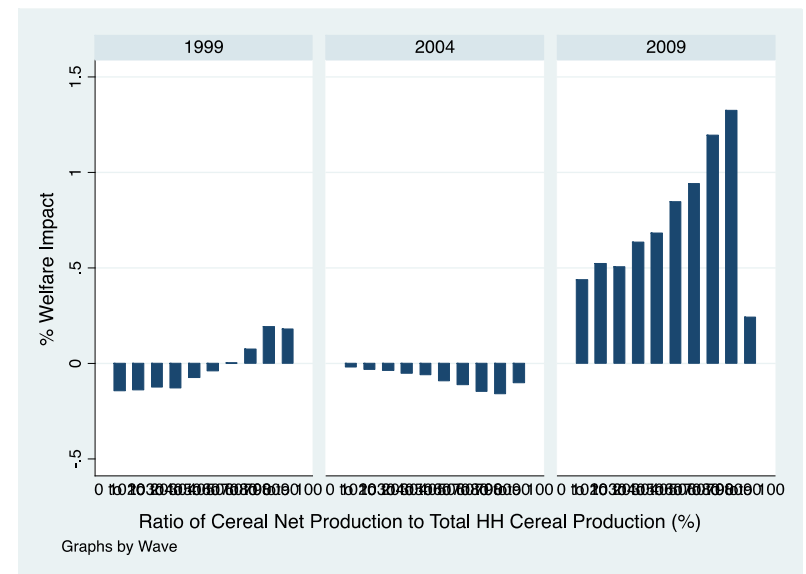
$$\frac{\Delta w_i^1}{m_{0i}} = \frac{\Delta p}{p_0} (PR_i - CR_i)$$

Welfare Impact by Marketing Margins

Net Consumers



Net Producers



Conclusions

- Counterintuitive results. What is the right price of food?
- Importance of the distribution of net buyers and sellers, but still importance of the gains at margin.
- The impact of food prices on welfare has some methodological issues
- But importance of MARGINAL BUYERS AND SELLERS
=>producers gains may outweigh consumer losses
- Gains to producers were not accompanied by long term investment in agriculture with reduced impact on farmers productivity