

# Agriculture and poverty

Effects of maize output and price changes on poverty in Kenya

# Overview of study

- Four country studies (Ethiopia, Kenya, Madagascar and Tanzania)
- Studies have common general theme but differ in focus
- Kenya study has four component papers:
  - A policy review (Tegemeo)
  - Poverty impact of maize production inefficiency (Mistiaen)
  - Impact of government policy on maize price (Jayne, Myers and Nyoro)
  - Distributional effects of maize price hike (Mude)
- We summarize here the preliminary findings

# The basic micro framework

Begin with the farmer  $i$ 's profit function:

$$\pi_i = \max_{(z_i, L_i)} [p_i^s q_i^s - p_i^z z_i - w_i L_i \mid q_i^s = \phi \cdot f_i(z_i, L_i)]$$

- $p$ 's are producer (s) and input (z) prices
- $q$  is quantity (of maize) produced
- $w$  the wage rate
- $L$  labor input
- $z$  are non-labor inputs (fertilizer)
- $f$  defines the production function facing the farm
- $\phi$  is a technical efficiency parameter  $\phi \in [0, 1]$

# The three issues raised

We focus on maize and address 3 issues:

- Production inefficiency: are farmers at the frontier of the  $f$  function; if not what is the potential impact of inefficiency on farm profit and poverty?
- To what extent has policy induced higher maize prices?
- What are the distributional effects of higher maize prices?

# (1) Production inefficiency

- We assess whether maize farmers are producing at the frontier, given their *endowments* (farm size, land quality, human capital and access to extension) and the level of *fertilizer input*
- Frontier is defined as:
  - production levels obtained in KARI crop trials (*optimal or absolute measure*). See Table A1
  - production levels obtained by most efficient producers (*relative measure*)

Here we report only the absolute measure

# Inefficiency measure

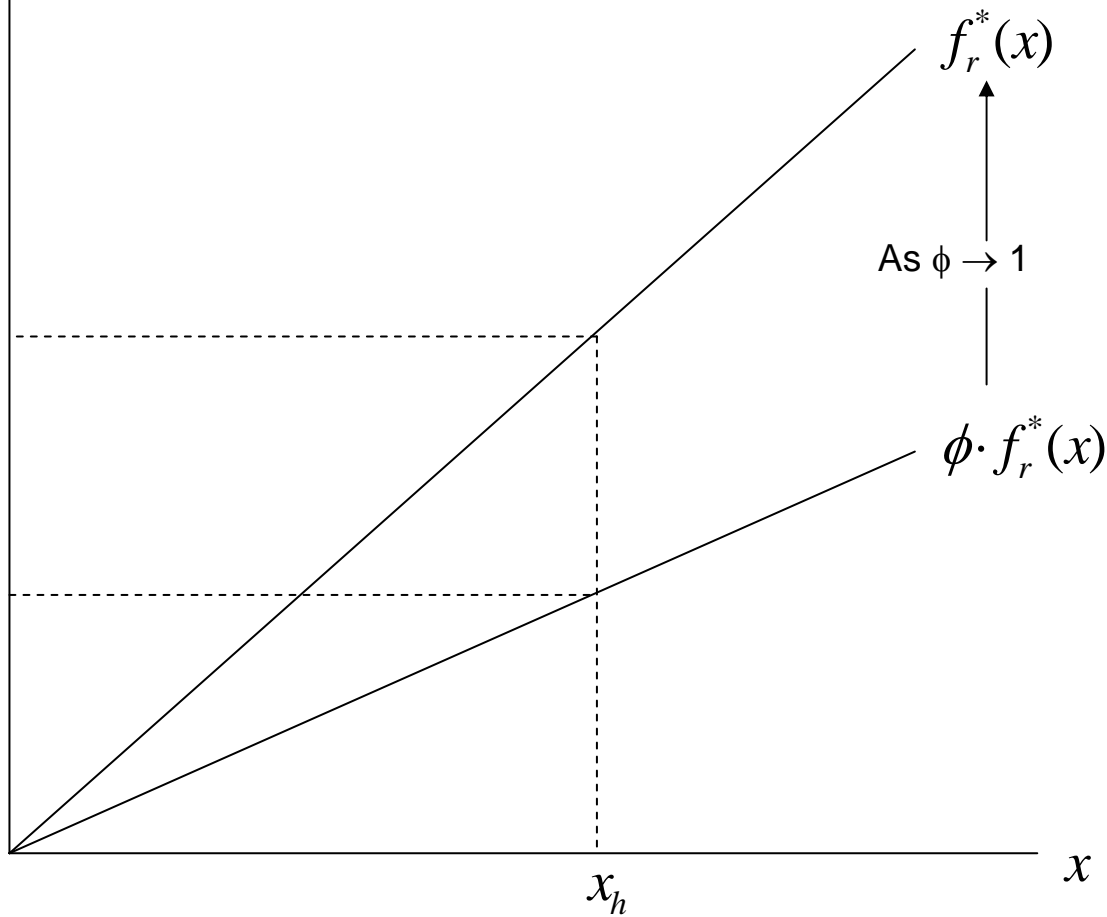
- The 'output distance' function is defined so that it = 1 if the farm's maize production is at the frontier (given levels of the quasi fixed factors and fertilizer input)
- Values  $< 1$  signify inefficiency

Maize output

$y$

Optimal output

Farm output

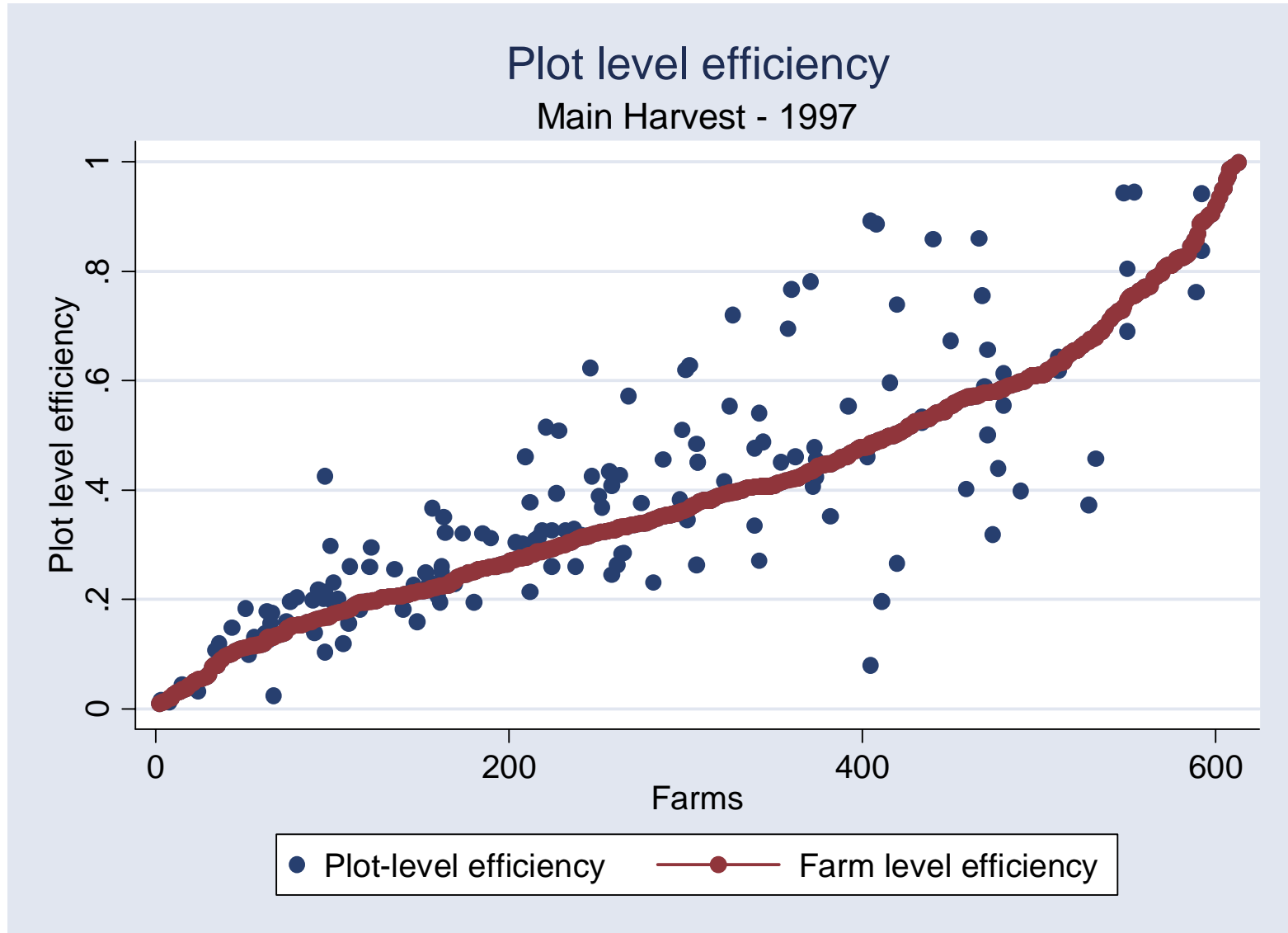


Fertilizer input

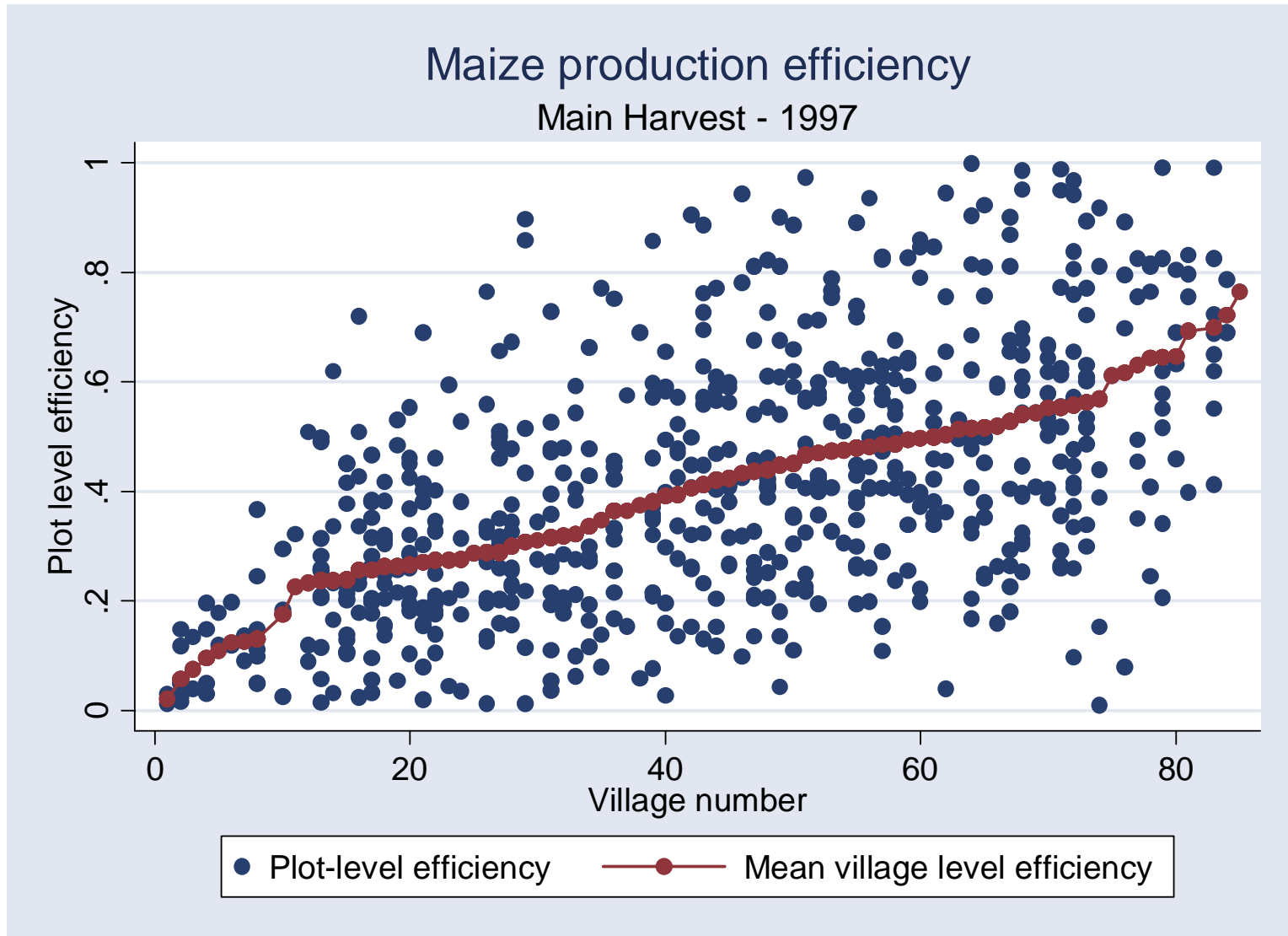
# Data

- Farm output data: two household surveys conducted in 1997 and 2000 by the Tegemeo Institute
- Optimal production data: Kenya Agriculture Research Institute (KARI) Fertilizer Use Recommendation Project
- The skill lies in matching these two data sets

# Absolute inefficiency by plot (farms ranked by mean level of *plot* inefficiency)



# Absolute inefficiency by plot (*villages* ranked by mean level of plot inefficiency)



# Next steps

- Estimate output-distance equation, to assess effective government actions to reduce inefficiency. Preliminary results indicate extension services have big impact
- Translate output increase into net profit increase:
  - Assume existing prices (upper bound)
  - Assume induced fall in prices based on ‘pessimistic’ demand elasticities (lower bound)
- Simulate changes in poverty (for upper and lower bounds): involves calibrating poverty line using WMS97 data

## (2) Government policy and maize prices

- Food policy dilemma in Kenya:
  - ensure that maize producers have adequate incentive to supply maize,
  - and keep prices low enough for maize buying households (many of whom are poor).
- Two types of intervention:
  - buying and selling of the National Cereals and Produce Board
  - tariff restrictions on external trade in maize

# Method

- Time series data (monthly maize price and trade data January 1990 to September 2004)
- Note reliable data on consumption, informal trade, storage are not available—only prices.  
Hence:
- Vector autoregression (VAR) approach used to estimate counterfactual:
  - What would maize prices have been between 1990 and 2004 if NCPB and trade restrictions not existed?

# Historical evidence

Since 1995/96 season NCPB's operations involved (cumulatively) purchasing some 14.8 million bags of maize but selling just 9.7 million bags.

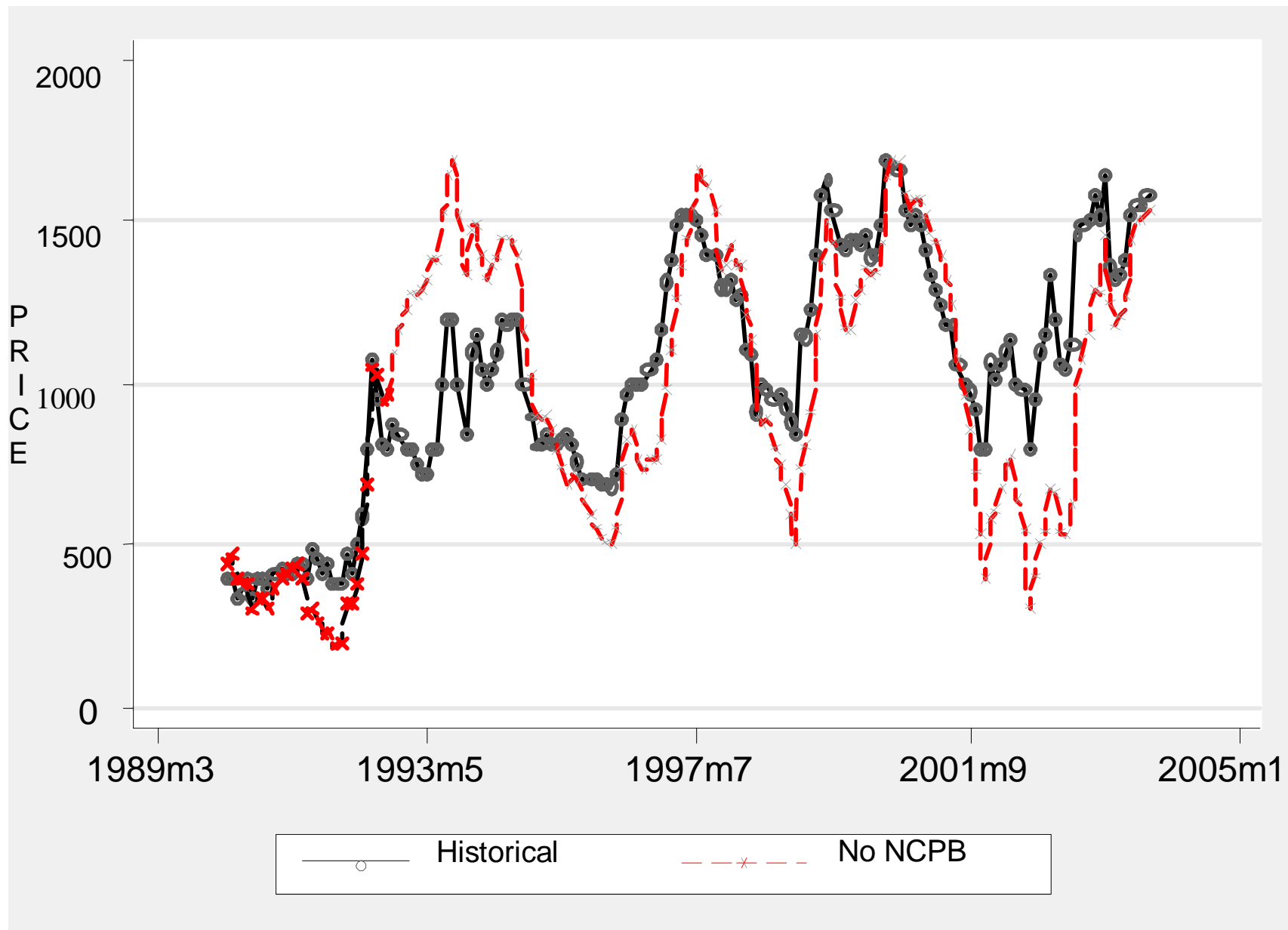
This suggests that (at least since 1995/96) NCPB operations put upward pressure on wholesale maize prices.

# VAR assumptions

- The VAR model is typically not identified, and needs a set of identification restrictions to obtain econometric estimates
- Restriction adopted by authors assumes that the policy shocks (NCPB and tariffs) have no effect in the current period—only lagged effects

# VAR results

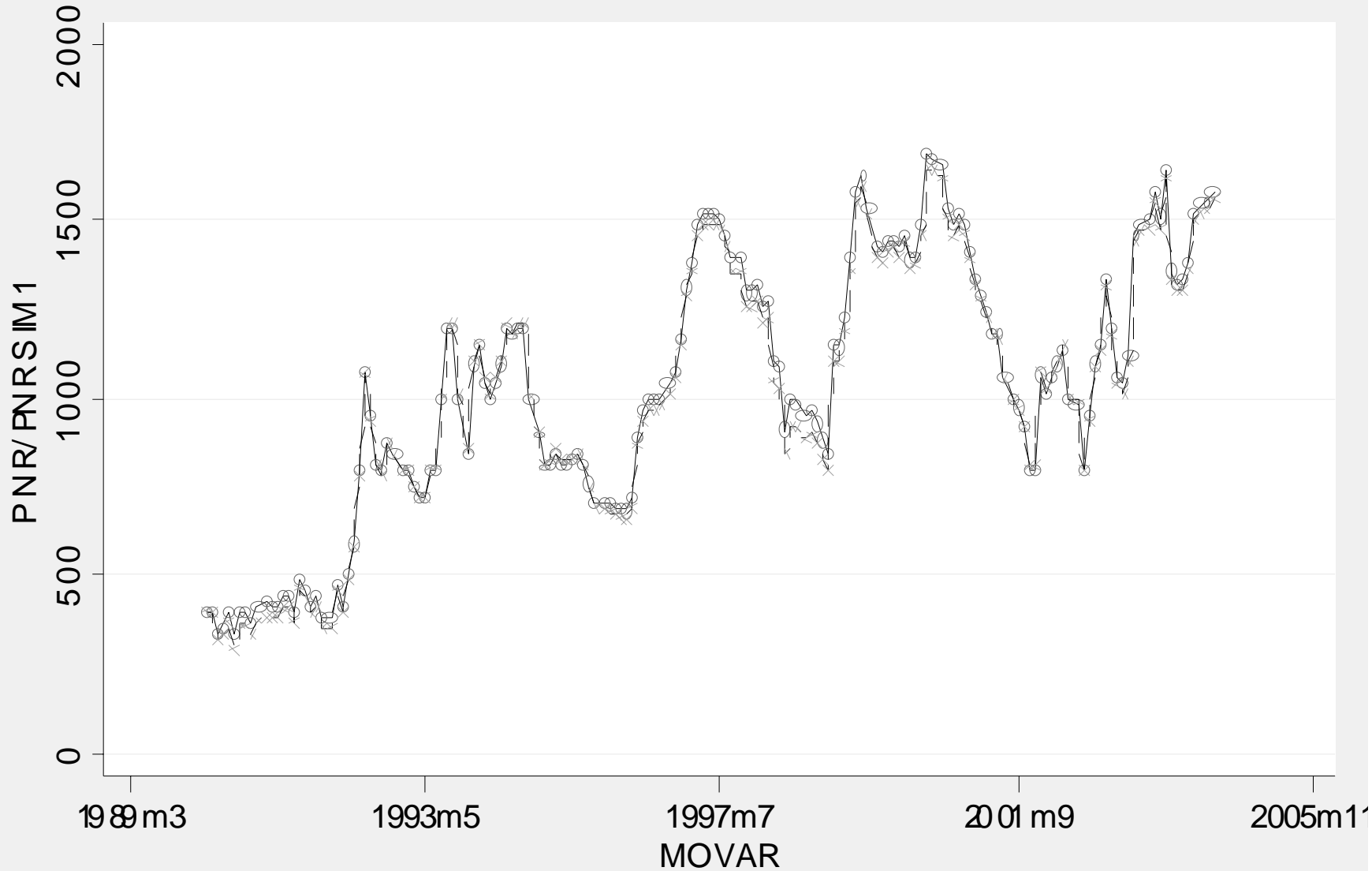
- NCPB effect estimated on prices in just two maize markets (Kitale and Nairobi)
- NCPB's price setting operations on average raised wholesale market prices by just over 5% over the period 1990-2004
- They reduced price variability
- Since 1995/96, they have raised prices by about 16%.



**Historical and counterfactual (no NCPB) Nairobi maize prices**

# VAR results

- Maize tariff has had little effect—raising market levels by about 2%.
- Probably due to informal border trade, especially with Uganda.



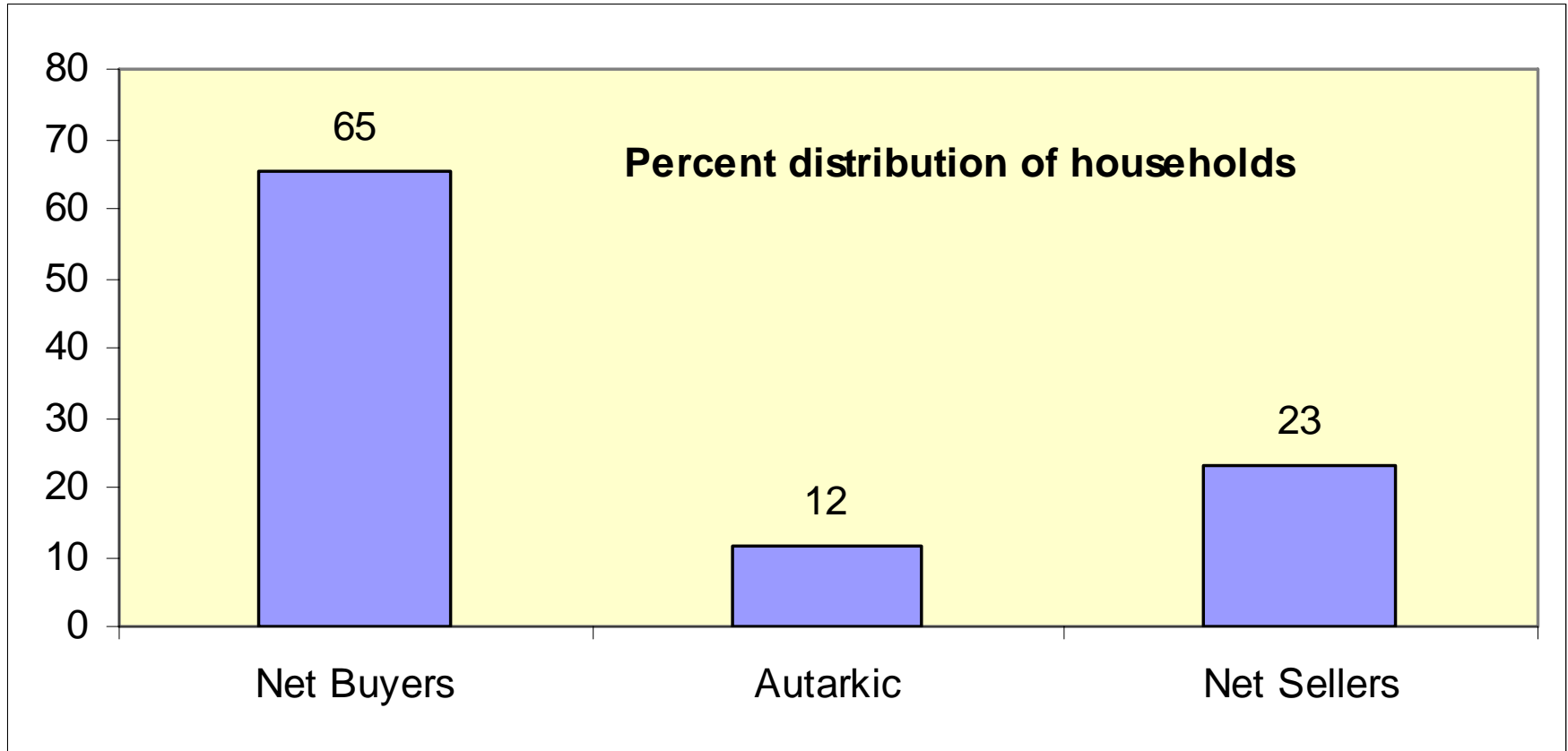
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**Historical and counterfactual (no tariff) Nairobi prices**

### (3) Distributional impact of maize price interventions

- Maize price changes induced by policy will affect groups differently. An *increase* in the maize price will:
  - Benefit net sellers of maize
  - Reduce real incomes of net consumers
  - Leave unaffected pure subsistence farmers (zero net sales/purchases)
- A key question is where are the poor in this?
  - Using same Tegameo data set, we assess this

# Most rural households are net consumers



# Poorest are net buyers

## Net sellers and mostly better off

<b>Income Quintile</b>	<b>Annual per capita income (K Shs)</b>	<b>net buyer</b>	<b>aukarkic (percent)</b>	<b>net seller</b>
<b>Poorest</b>	2788	83.4	8.5	8.1
<b>2</b>	7273	70.8	14	15.1
<b>3</b>	13165	68.6	8.9	22.5
<b>4</b>	22002	57.2	14.4	28.4
<b>Richest</b>	62467	46.9	12.9	40.2

# Poor gain most from fall in maize price. Top quintile loses

Distributional impact of 5 percent reduction in maize price:

Income Quintile	<i>Net Buyers</i>			<i>Net sellers</i>			<i>All households</i>	
	No of Households	Net Revenue Effect	Relative Net Revenue Effect	No of Households	Net Revenue Effect	Relative Net Revenue Effect	Net Revenue Effect	Relative Net Revenue Effect
		(K Sh)	(percent)		(K Sh)	(percent)	(K Sh)	(percent)
Poorest	226	70	4.53	22	-28	-0.93	56	3.7
2	192	75	1.11	41	-35	-0.49	48	0.71
3	186	71	0.55	61	-59	-0.46	36	0.27
4	155	69	0.33	77	-71	-0.32	20	0.1
Richest	127	56	0.13	109	-145	-0.25	-32	-0.04

# 'Higher order' effects

- Output market responses would reduce but not undo the maize price fall
- But labour market responses might overturn the welfare effects -- real wages falling so much that incomes fall.
- Need to assess how much wages would have to fall to counteract the maize price effect—identify the threshold wage response.