

# Misallocation: Agriculture

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# Introduction

TFP seems to account for about half of cross-country income gaps.

What determines TFP is not well understood.

The leading candidate for “deep” causes is “institutions”

- but nobody knows how to quantify those

One (quantifiable) candidate for “proximate” causes is **misallocation**

- too much agriculture in low income countries
- poor allocation of resources to highly productive firms

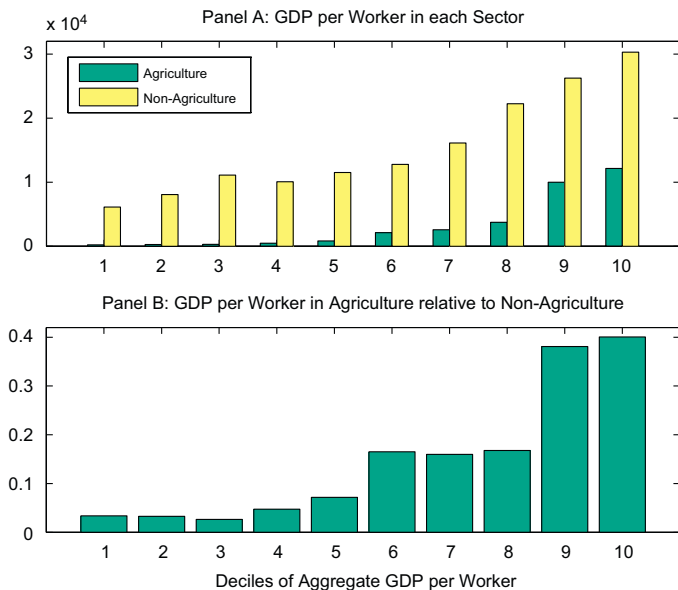
Surveys on misallocation: [Restuccia and Rogerson \(2013\)](#), [Hopenhayn \(2014\)](#).

# Agriculture: Facts

Facts:

1. Low income countries employ most of their labor in ag.
2. Most food needs are met from domestic production.
3. TFP in agriculture varies much more than TFP in “industry”

## Facts



Source: Restuccia et al. (2008)

## Questions

1. Why is ag TFP so low in poor countries?
2. Why do poor countries employ so much labor in ag?

## Why Do Low Income Countries Employ So Much Labor in Ag?

Gollin et al. (2007): subsistence food consumption

- when poor, all resources are devoted to food production
- ag tfp grows exogenously
- at some point, resources are freed up to move into industry

Restuccia et al. (2008):

- some “barrier” prevents labor from moving out of ag

Lagakos and Waugh (2013):

- there is no misallocation
- the wage gap is selection

## Why Is Ag Productivity So Low?

Possible answers:

1. Labor market restrictions push too much labor into ag
  - (a) Restuccia et al. (2008)
2. Lack of intermediate inputs
  - (a) Restuccia et al. (2008)
  - (b) Gollin et al. (2007): lack of capital forces use of an inefficient technology

## Restuccia et al. (2008)

A “representative” paper from this literature: Restuccia et al. (2008)

Points of note:

1. a very simple model
2. some really strong assumptions permit calibration
3. not much data used in calibration

Why did the paper make the JME?

**it has a hook: new data**



## The Story

Countries differ in the relative price of intermediate inputs used in ag.

- this price is observable

Also capture cross-country variation in

- land per worker (observable)
- wage gap between ag and non-ag (observable)

Put these (observable) distortions into a model.

TFP is the residual that matches output gaps.

Ask how much each distortion contributes to output gaps.

# Model

Static

Demographics:

- a representative household with mass  $N = 1$

Preferences:

- $U = a \ln(c_a - \bar{a}) + (1 - a) \ln(c_n)$
- $c_a$ : ag consumption
- $c_n$ : non-ag consumption
- subsistence level  $\bar{a}$  implies: when income is low, most of it is spent on ag.

Endowments:

- $Z$  units of land

## Technologies

Non-ag:  $Y_n = AL_n = \pi X + c_m$

- $\pi$  governs relative price of ag intermediates to final goods

Ag:  $Y_a = X^\alpha [Z^{1-\sigma} (\kappa AL_a)^\sigma]^{1-\alpha} = c_a$

- uses land  $Z$ , intermediates  $X$ , labor  $L_a$
- $\kappa$ : relative productivity in ag
- Cobb-Douglas is an invention

$$L_a + L_m = 1$$

## Markets

- non-ag goods (numeraire),
- ag goods ( $p_a$ )
- land rental
- labor:  $w_a = (1 - \theta) w_n$
- $\theta$ : tax on labor in non-ag (not clear what it represents)

# Calibration

## US data in 1985

Table 1  
Calibration of parameter values to U.S. data

Parameter	Value	Target
$Z/N$	1.6	Land-to-employment ratio
$A$	34,206	Labor productivity in non-agriculture
$\kappa$	34.1	Labor productivity in agriculture
$\sigma$	0.7	<a href="#">Hayami and Ruttan (1985)</a>
$\alpha$	0.4	Intermediate input share
$(1 - \theta)$	0.385	Value of relative marginal labor products
$a$	0.0046	Long-run share of employment in agriculture
$\bar{a}$	752.6	Share of employment in agriculture

No validation (the model is, so to speak, exactly identified).

## Experiment

Vary across countries:

1. labor market distortion  $\theta$
2. price of ag inputs  $\pi$
3. tfp  $A$  (to match  $Y/N$ )
4. land per worker  $Z/N$  (data)

Key: the distortions are observable.

- Measure  $\pi$  using FAO data on the **relative price of intermediate inputs** in agriculture (relative to non-ag output; the numeraire).
- Measure  $\theta$  using data on **relative wages** (ag / non-ag).

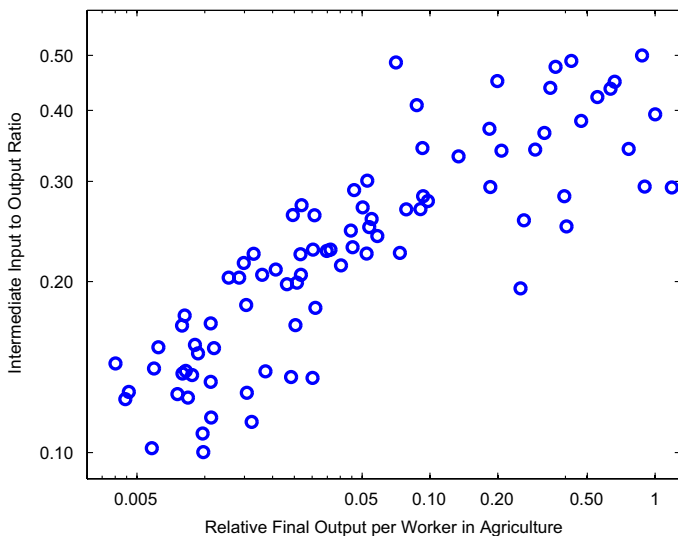
Question:

- to what extent can the model account for variation in  $L_a, X/Y_a, Y_a/L_a$ ?

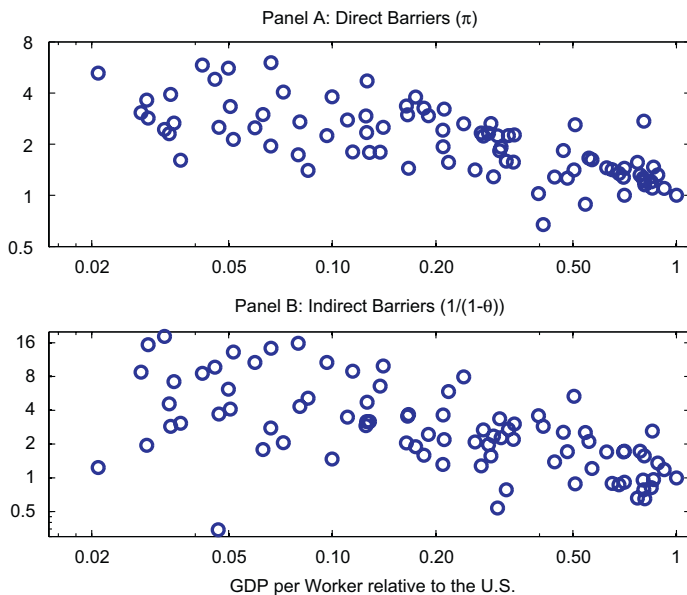
## The Hook

This is the paper's hook:

- the data on  $\pi$  are new
- it shows that  $X/Y_a$  is rising with GDP (not surprising but new)



## Measures of the distortions $\pi$ and $\theta$



$\pi$ : price of ag intermediate inputs / price of ag output

$1 - \theta$ : mean wage non-ag / mean wage in ag

- this gap is huge in poor countries (factor 30!)
- $1 - \theta$  is not taken from data, but model implied
- the range is far, far larger than in the data



# Results

Table 2  
Effects of barriers and economy-wide productivity on equilibrium outcome variables

	$L_a/N$ Rich/poor	$X/Y_a$ Ratio of rich to poor countries	$Y_a/L_a$ Ratio of rich to poor countries	$Y/N$ Ratio of rich to poor countries
Data	0.04/0.86	3.1	109.1	34.3
(7) Baseline model	0.04/0.68	2.7	23.4	10.8
Decomposing the contribution of individual factors				
(6) Add direct barriers $\pi$ only	0.04/0.39	1.5	10.2	6.2
(5) Add indirect barriers $\theta$ only	0.03/0.38	1.5	13.8	7.0
(4) Two-sector with $\{L_a, Z, X\}$	0.04/0.20	0.9	6.3	5.5
(3) Two-sector with $\{L_a, Z\}$	0.04/0.24	—	8.2	5.4
(2) Linear two-sector with $\{L_a\}$	0.04/0.17	—	5.0	5.0
(1) One-sector	—	—	—	5.0
Unexplained % or factor	0.00/0.18	1.1	4.7	3.2

Message: TFP gaps needed to account for 20-fold output gaps are smaller than in standard growth model.

Intuition:

- labor market distortion pushes labor into ag
  - price of ag falls
- $\pi$  keeps intermediates out of ag
  - ag productivity falls
- we end up with lots of labor in a sector with low TFP

## Open Issues and Problems

In the data, the ratio of ag to non-ag wages varies massively less than in the model

- see [Herrendorf and Schoellman \(2015\)](#)

# The Ag Productivity Gap

Other relevant papers...

Herrendorf and Schoellman (2015):

- Question: is the gap in productivity ag / non-ag due to misallocation?
- Fact 1: even in the U.S., there are large gaps in ag / non-ag productivity (median factor 3)
- Fact 2: gaps in wages are smaller than gaps in productivities (U.S., median factor 2)
- Fact 3: measured output fails to count some pieces (land rents, some self-employment income)
- Fact 4: correcting output measures reduces the ag / non-ag gap to factor 2
- Fact 5: similar patterns in other countries
  - especially: wage gaps are smaller than productivity gaps

Gollin et al. (2013):

- adjustments to measured output and inputs (hours, human capital) reduce the productivity gap, but do not eliminate it.
- this sounds pedestrian, but it's a really nice paper with very careful data work

## The Ag Productivity Gap

Adamopoulos and Restuccia (2014):

- in poor countries, farms are too small

Restuccia and Santaella-Llopis (2015):

- land is not used efficiently
- land endowments are poor

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