Misallocation: Agriculture

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Econ821

March 8, 2016

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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
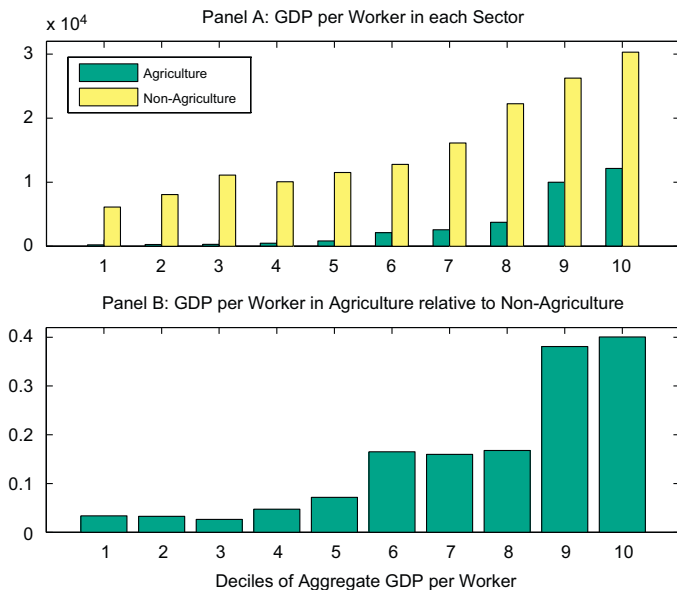- poor allocation of resources to highly productive firms

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

Panel A: GDP per Worker in each Sector

Panel B: GDP per Worker in Agriculture relative to Non-Agriculture

Deciles of Aggregate GDP per Worker

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: $Y_n = AL_n = \pi X + c_m$

- π governs relative price of ag intermediates to final goods

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

- uses land Z, intermediates X, labor L_a
- κ: 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: $w_a = (1 - \theta) w_n$

- θ: 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
κ	34.1	Labor productivity in agriculture
σ	0.7	Hayami and Ruttan (1985)
α	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 θ
2. price of ag inputs π
3. tfp A (to match Y/N)
4. land per worker Z/N (data)

Key: the distortions are observable.

- Measure π using FAO data on the **relative price of intermediate inputs** in agriculture (relative to non-ag output; the numeraire).

- Measure θ using data on **relative wages** (ag / non-ag).

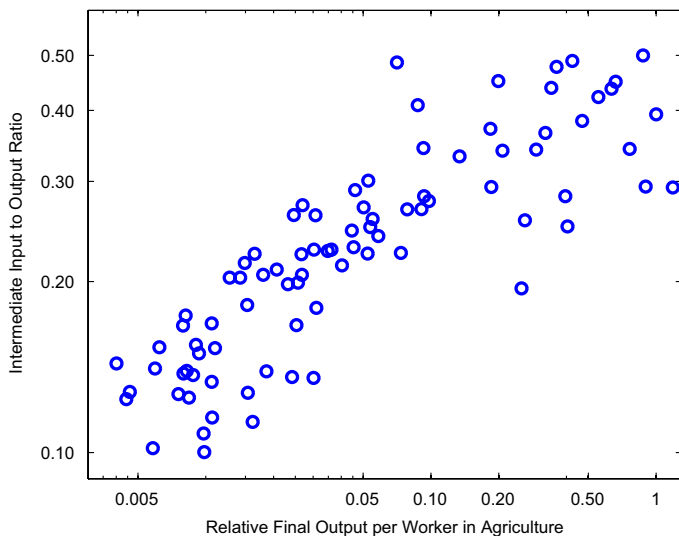Question:

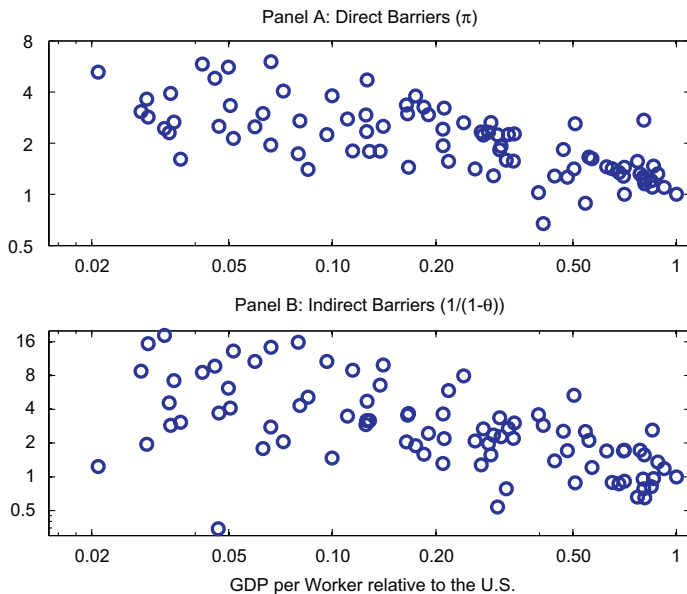- to what extent can the model account for variation in $L_a, X/Y_a, Y_a/L_a$?

The Hook

This is the paper's hook:

- the data on π are new

- it shows that X/Y_a is rising with GDP (not surprising but new)

Measures of the distortions π and θ

Panel A: Direct Barriers (π)

Panel B: Indirect Barriers ($1/(1-\theta)$)

GDP per Worker relative to the U.S.

π: 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 π only	0.04/0.39	1.5	10.2	6.2
(5) Add indirect barriers θ 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

- π 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

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

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