Discussion of "Land Misallocation and Productivity" by D. Restuccia and R. Santaeulalia-Llopis

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Introduction

- Setting:
  - Rich data set on inputs and outputs in individual farms.
- Question:
  - Given a technology (assumed Cobb-Douglas) are there efficiency gains associated with reallocating land and capital (but not labor)?

Basic Discussion

- Important question.
- Cannot be approached using randomized control trials (or atheoretical empirical work).
- Very nice paper. It shows how to use a very simple model (technology) to think about policy issues.
- Approach allows one to consider the impact of alternative policies (not yet implemented).

Model: Some Issues

- Data:
  - Measurement error and estimates. Does it matter? Does measurement error bias some/all the findings?
  - Rental markets.
- Choice of technology:
  - Evidence for Cobb-Douglas? Alternatives? Estimation?
  - Intermediate inputs?
  - Do the parameters of the Cobb-Douglas matter for the quantitative results?
- Nature (and limitations) of the exercise:
  - Labor quality
  - Migration.
  - Housing.

Measurement Error

- It is possible (likely?) that some of the data are measured with error. This seems more likely for output and capital but not land.
- Classical measurement error has the effect of biasing downwards the estimated correlation between productivity and land size (but not the covariance), and it also biases the covariance (and the correlation) between farm productivity and capital.
- In particular, it increases the dispersion of measured productivity.
- Most likely source of (non-classical) measurement error: incorrect valuations not necessarily uncorrelated with true productivity.

Rental Markets

- Data from Household Surveys (see Chamberlin and Rickert-Gilbert (2014))

Concept	2002/03	2006/07	2008/09
% Renting in	7.5%	13.4%	15.4%
% Renting out	4.3%	5.3%	8.9%
Av. area (in) (ha)	0.62	0.68	0.63
Av. area (out) (ha)	0.76	0.58	0.47
Real rental price	100	107	175
Real wage rate	100	107	180

Rental Markets

- Tenants, Landlords and Autarkics

Concept	2002/03		2006/07		2008/09	
	Ten	Land.	Ten.	Land.	Ten.	Land.
Labor (number)	4.5	3.9	4.6	4.2	4.8	4.4
Land Owned (ha)	0.7	1.6	0.9	1.6	0.7	1.8
Assets (100)	262	100	236	126	197	175

Technology: Alternatives

- Estimation?

Technology: Alternatives

- Estimation?
- Alternative specification (consistent with U.S. from the 1920s to the 1950s)

$$
\begin{aligned}
F^c(z, n_y, a) &= A_{ct} z^{\alpha_{zy}} n_y^{\alpha_{ny}} a^{1-\alpha_{zy}-\alpha_{ny}}, \\
z &= F^z(z_k, z_h) = \left[\alpha_z (z_k)^{-\rho_1} + (1-\alpha_z) z_h^{-\rho_1}\right]^{-1/\rho_1}, \\
z_k &= F^k(k, n_k) = \left[\alpha_k k^{-\rho_2} + (1-\alpha_k) n_k^{-\rho_2}\right]^{-1/\rho_2}, \\
z_h &= A_h F^h(h, n_h) = \left[\alpha_h h^{-\rho_3} + (1-\alpha_h) n_h^{-\rho 3}\right]^{-1/\rho_3}.
\end{aligned}
$$

implies large elasticities of substitution between mechanical and animal traction

$$\sigma(z_k, z_h) = 5.46, \ \sigma(k, n_k) = 1.68, \ \sigma(h, n_h) = 1.11$$

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- The implicit share of labor is higher than 0.46.

Technology: Intermediate Inputs

- If "true" technology is

$$Y_i = \left[(z_i N_i)^{1-\theta_k-\theta_\ell} K_i^{\theta_k} L_i^{\theta_\ell} \right]^{\eta} X^{1-\eta}$$

  and the price of the intermediate input X in region g is p_g.
- In this case

$$y_i = \underbrace{\left(\frac{z_i}{p_g^{1-\eta}} (1-\eta)^{1-\eta} \right)^{1-\theta}}_{s_i} k_i^{\theta_k} \ell_i^{\theta_\ell}$$

- If this is the technology and p_g varies across areas (or different inputs are necessary in different areas and/or for different crops) and it is not persistent $\longrightarrow$ bias.
- Less of a problem for the computations in narrower (physical) regions.

Technology: Specification Bias - Efficient Allocation

- If "true" technology is

$$Y_i = (z_i N_i)^{1-\theta_k-\theta_\ell} K_i^{\theta_k} L_i^{\theta_\ell}$$

then

$$y_i = \underbrace{(z_i)^{1-\theta}}_{s_i} k_i^{\theta_k} \ell_i^{\theta_\ell}, \text{ where } \theta = \theta_k + \theta_\ell$$

- Assume that

$$z_i = \bar{z} e^{\mu_z + \sigma_z \varepsilon_z}, \text{ with } \varepsilon_z \sim N(0,1) \text{ and } \mu_z + \frac{\sigma_z^2}{2} = 0$$

- Efficient aggregate output is

$$y^* = \bar{z}^{1-\theta} \bar{k}^{\theta_k} \bar{\ell}^{\theta_\ell}$$

Technology: Specification Bias - Observed Allocation

- Assume (totally arbitrary but "almost" consistent with the moments in the data)

$$k_i = \bar{k} e^{\mu_k + \sigma_k \varepsilon_k} \text{ and } \ell_i = \bar{\ell} e^{\mu_\ell + \sigma_\ell \varepsilon_\ell} \text{ with } \mu_j + \frac{\sigma_j^2}{2} = 0,\ j \in \{k, \ell\}$$

- in this case, estimate

$$\begin{aligned} \sigma_z^2 &= \frac{var(\ln(s_i))}{(1-\theta)^2} \\ \sigma_\ell^2 &= var(\ln(\ell)) \\ \sigma_k^2 &= \frac{var(\ln(f) - \theta_\ell^2 \sigma_\ell^2}{\theta_k^2} \end{aligned}$$

where $var(\ln(s_i))$, $var(\ln(\ell))$ and $var(\ln(f)$ are taken from Tables 5 and 6 (too lazy to allow for correlation between $(\varepsilon_k, \varepsilon_\ell)$ and ε_z but not hard to do)

Technology: Specification Bias - Observed Allocation

- Observed aggregate output

$$\bar{y} = y^* \underbrace{e^{\theta(1-\theta)\mu_z} e^{\theta_k(1-\theta_k)\mu_k} e^{\theta_\ell(1-\theta_\ell)\mu_\ell}}_{\text{Output Loss}}$$

- The size of the output loss depends on (θ_k, θ_ℓ).
- Question: Does it matter quantitatively?

Estimates: Specification Bias

- Estimates of the parameters that determine the distribution of inputs and productivity:

$$\mu_z = -2.29,\ \mu_k = -1.07,\ \mu_\ell = -0.309$$

- The resulting output losses are

(θ_k, θ_ℓ) = Output Loss
(0.54, 0.27) = 0.50
(0.36,0.18) = 0.40
(0.18, 0.09) = 0.52

- If $(\theta_k, \theta_\ell) = (0.26, 0.60)$ (Chamberlin and Rickert-Gilbert (2014)) then output loss is 0.57
- Here (as in the paper) I **assume** that labor productivity is farm (and **not** individual) specific ... not an obviously reasonable assumption

Market for Capital

- Rental markets for capital (lending an ox/tractor to a neighbor).
- In this case

$$\bar{y} = y^* \underbrace{e^{\frac{\theta_\ell(1-\theta)}{1-\theta_k}(\mu+\mu_\ell)}}_{\text{Output Loss}}$$

  - $\text{Var}(\ln(f)) = .309$ (vs. .297 in the data)
- The estimated output loss

$(\theta_k, \theta_\ell) =$ Output Loss
(0.54, 0.27) = 0.75
(0.36,0.18) = 0.71
(0.18, 0.09) = 0.81

Random Thoughts

- If, in addition to producing farm output, these rural establishments "produce" housing services then the correct evaluation should include housing.
- Are the areas with more active rental markets more efficient?
- Equilibrium rental price of land (in an efficient allocation)? How does it compare with actual rental prices?
- Crop mix? Does it change with size?
- Intermediate inputs (urea, fertilizer)?
- Are the s_i temporary or permanent. Sources of time variation: malaria bouts and deaths (AIDS).

Thoughts on Structural Transformation

- If (à la Lucas (1978)) labor could be reallocated to "other" sectors (urban) the gains would be larger. (Quality?)
  - Value of migration (probably for the $t+1$ generation).
- Should we think of policies that promote increases in agricultural efficiency?
  - Rental markets? Why not more developed?
    - Land titling?
    - Evidence is mixed.
  - Promoting wage labor?
  - Subsidizing migration?
  - Increasing human capital?

Concluding Comments

- Very nice first stab at an important question.
- One can "question" the results because the paper is transparent and the exercise well defined.
- Sensitivity results:
  - Shape of the production function.
  - Markets (formal and informal)
  - Labor quality.
- Insurance: variability of climatic/biological conditions.
- What would be the optimal crop mix?

Additional Material

Parameter	A_h	α_{zy}	α_{ny}	α_z	α_k	α_h
Value	0.75	0.38	0.42	0.56	0.54	0.41