Discussion of "Capital Obsolescence and Agricultural Productivity" by Caunedo and Keller

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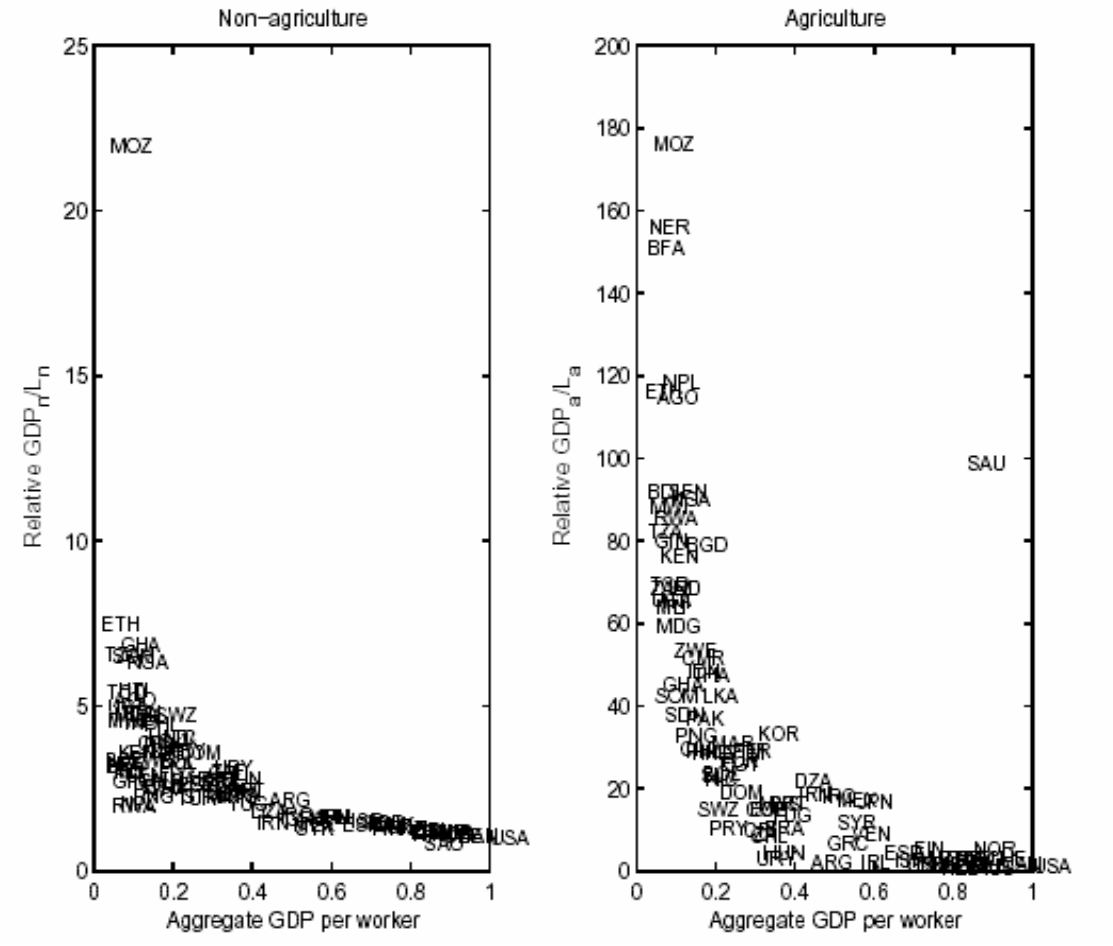
Overview

Nice paper pursuing a difficult but important topic—agricultural productivity and technology adoption (quality upgrade)

Figure : Large differences in agricultural labor productivity



Restuccia, Yong and Zhu (2006)

What this paper does

- Focuses on QUALITY differences in agricultural equipment across countries (abstract from all other cross-country differences).
  - The paper could have done more to motivate the important of *quality* not just *quantity* of machinery used.
- Presents interesting facts on tractors' price-age profile using novel online price data: Older tractors are relatively cheaper in high productivity countries
- Develops a quasi-tractable model of quality upgrade of equipment.
- Quality upgrade decision follows a threshold rule; quantity of capital is always at the target level.
- Model calibrated to the observed price-age profile, initial agricultural productivity (in 1990) and agricultural productivity in 2000.

Findings

- The model accounts for $>$50% of agricultural labor productivity differences across the 13 countries (3 emerging markets + 10 advanced countries).
- Induced obsolescence cost is key in driving cross-country variations in agricultural productivity

Contributions

- Previous theories: vintage capital models, nonconvex adoption costs, (S, s) adoption rule. Old and new technology coexist in the same economy. Computationally challenging, and hard to define "vintage" empirically.

- To measurement and empirics:
  - Using on-line price data of tractors to estimate obsolescence profile in countries at various development stages
  - Mapping estimated price-age profile to frequency of upgrade (in the model eqm), which helps to identify direct and indirect costs of upgrading

- To theory:
  - Developing macro model to *quantitatively* assess the importance of technology adoption on agricultural productivity
  - Building a (semi)linear system which significantly simplifies the analysis, with certain modeling choices.

Questions about the Empirics

$$\frac{p_{ij}^{\theta}-1}{\theta} = D_j + \beta D_j age_{ij} + \gamma \frac{X_{ij}^{\lambda}-1}{\lambda} + \epsilon_{ij}$$

This paper: Assuming the same responses of price to X_{ij} (i.e. hours, brand, horsepowers), how does the price-age relationship differ across countries?

- The paper could have done a better job justifying this specification: e.g. the choice of the same θ, γ, τ; $age = quality$?.
- Why focus on the slope (βD_j) rather than the intercept (D_j)? Isn't the latter of the first-order importance? For the same vintage(quality) of tractor, its more expensive in poorer countries?
- Separating hours-used and age, horsepowers and quality?
- More countries are available on TractorHouse.com, why choose 3 particular emerging countries only—Mexico, Brazil and Bulgaria? Especially given that the large dispersion in agricultural productivity is reflected in low-income countries.

Comments about the Model: I

From the empirics to the model:

- No within-country heterogeneity (old and new technologies do not coexist). A given country either use q or Q (if upgrade) at time t.
- Should be clear upfront how to interpret qk (aggregate over all vintages?).

Comments about the Model: II

– If upgrade:

$$c_t + Q_t\kappa[k_{t+1} - (1-\delta)\theta(x_t)k_t] + Q_t\kappa_q x_t \leq \frac{Q^{1-\nu}}{\nu}\left[Q_t\theta(x_t)k_t\right]^{\nu} L^{1-\alpha}$$

where $x_t = \frac{Q_t}{q}$, quality gap

1. Relative price of capital is proportional to quality: $Q_t\kappa$
2. One-time direct cost of upgrade, proportional to quality (independent of quantity) and quality gap: $Q_t\kappa_q x_t$
3. Induced obsolescence: immediate shrinkage in capital stock k_t to $\theta(x_t)k_t$ or reduction in (just upgraded) Q_t, where $\theta(x_t) < 1$, $\theta'(x_t) < 0$

– Suspect these are shortcuts to generate a linear system for analytical convenience. But the paper could have do more to motivate/justify these modeling choices.

– Especially, 2 and 3 need more explanation. (Computer software upgrade?).

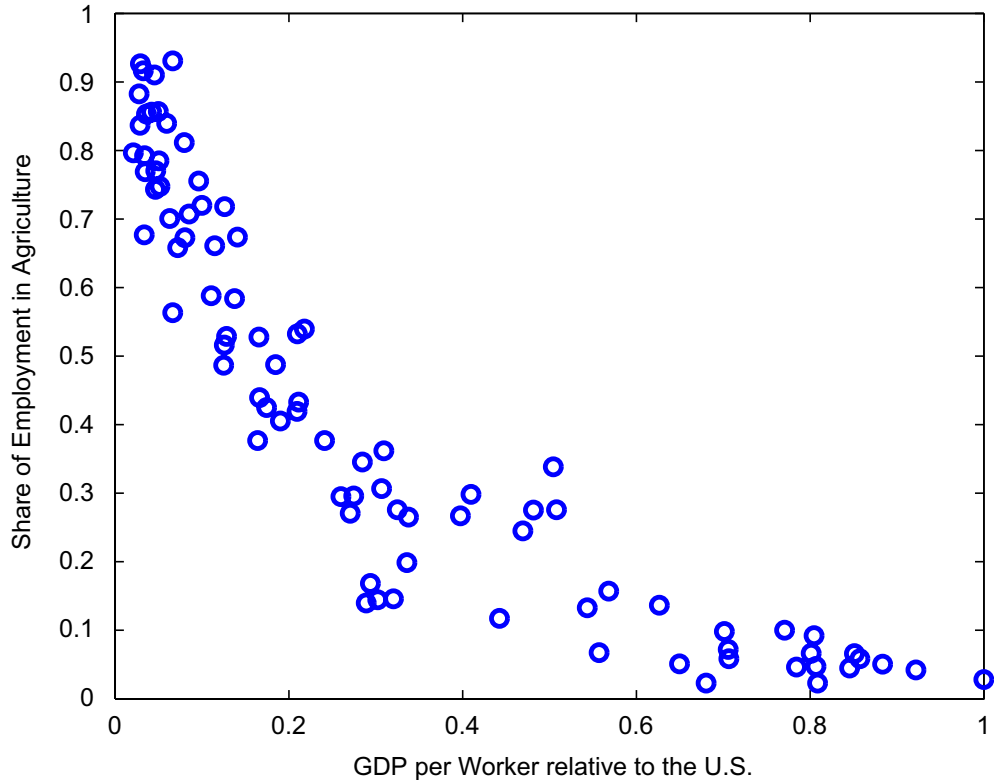
Comments about the Model: III

- This really is a paper about QUALITY of equipment: Countries only differ in parameters related to quality upgrade: $\{\kappa_{Qj}, \theta_j, \epsilon_j, q_{0,j}\}$.
  - Although unclear, countries also seem to differ in price of capital to consumption κ_j (calibrated directly from data)

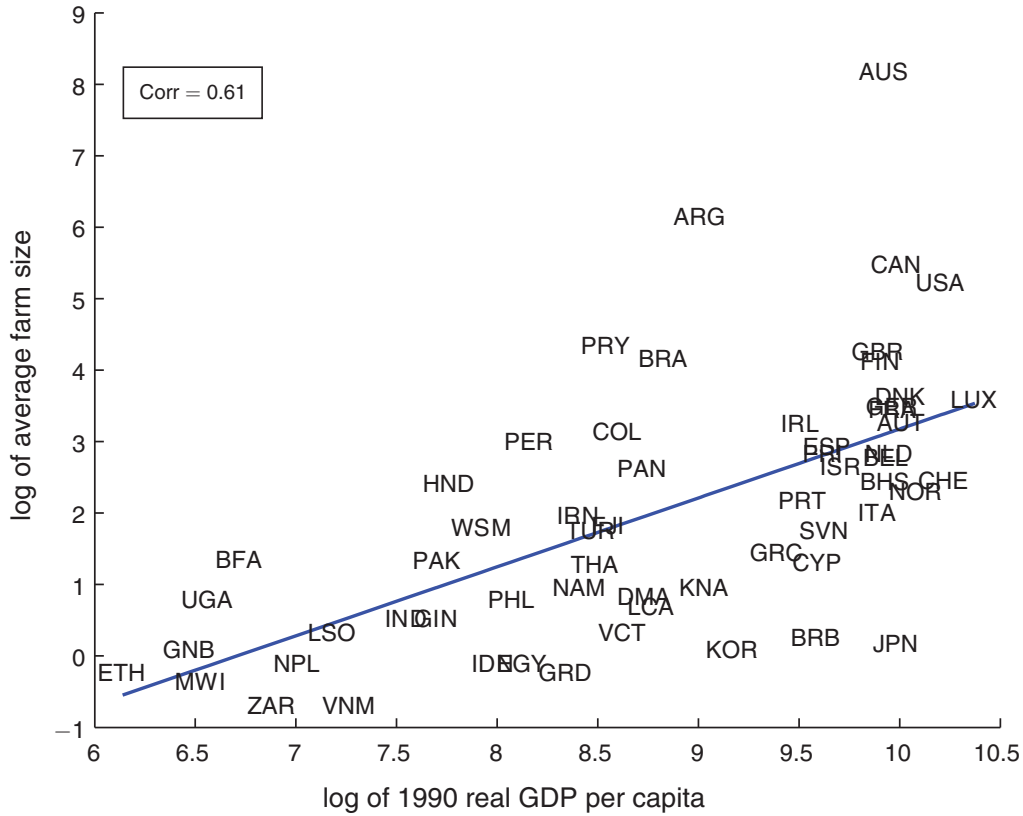
- The model abstracts from other cross-country heterogeneities: capital intensity in agriculture (ν), size of farm land, general TFP (such as roads and distribution infrastructure), intermediate inputs (fertilizers, seed varieties), etc.

- Previous literature has shown large cross-country differences in share of labor in agriculture (potentially, different ν), farm size (Restuccia et al...)

- Since the paper is largely a "quantitative" paper, it is important to recognize other important heterogeneities, especially if they are of first-order importance.



Restuccia, Yong and Zhu (2006) and Adamopoulos and Restuccia (2014)



Restuccia, Yong and Zhu (2006) and Adamopoulos and Restuccia (2014)

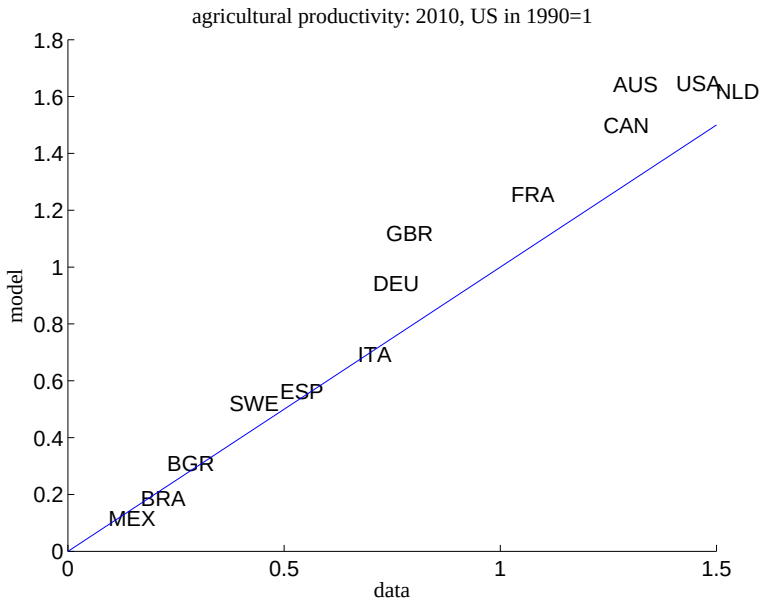
Questions about the Calibration: I

- Calibration targets:
  - obsolescence profiles
  - agricultural value added in 1990
  - agricultural productivity in 2000

- Calibrates 38 parameters to 38 targets (?). Exact identification? Comparing targeted moments with data is not very helpful for assessing goodness of fit

Questions about the Calibration: II

- Untargeted moments (out-of-sample *cross-section*): The model explains 79% of the variation in agricultural productivity across country in out-of-sample (2010)



- ... But if looking at growth rate, big difference for most countries. For example, GBR, Model: 0.8 (2000) to 1.1(2010), compared to data: 0.8 (2000) to 0.8 (2010); FRA, 20% (model) vs. 10% (data); SWE, 20% (model) vs. Data 5% (data).

Other Questions

- capital share in agriculture: 60%. Is it U.S. data?
- How is investment cost (κ_j) calibrated to quantity of tractors in 1990?
- How is the direct cost of adoption (κ_{Qj}) calibrated to price of imports? Imports of tractors? or aggregate imports?

Promising Research Agenda

- Policies? Interesting examples of policies aiming to modernize agricultural equipment in various countries, relaxing credit constraints/tax exemption for purchasing new equipment.
- Unclear how these examples are linked to the rest of the paper.
- These examples may better serve to motivate the paper.