Information Technology and Returns to Scale

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WHAT'S IN THE PAPER?

What They Do

▶ Deliver interesting facts about IT, labor shares, and concentration from French firm microdata

▶ Put a fancy production function on the table which rationalizes these facts in light of IT price declines

▶ Estimate and calibrate a related quantitative GE model

What They Find

▶ IT price declines cause a reallocation towards larger firms with lower labor shares & higher IT shares, together with higher concentration.

▶ Survives GE, although macro labor share doesn't move much due to a positive "within effect."

What I Love About the Paper!

Great Data!
High coverage ($\approx 80\%$) of French firms' financial info and IT/hardware investment. Smaller, but still huge, survey on IT/software investment.

Rich Results from A Single Tweak!
At least six major facts to explain, about big-picture macro topics, generated by a single tweak of the firm production function.

Skillful Implementation!
A pedagogical discussion of the production function and a clean pairing of production function estimation and a quantitative GE model.

What Are their Facts?

1. Bigger firms use more IT.
2. Bigger firms have lower labor shares.
3. IT intensity is increasing over time while price declines.
4. Concentration of output in the largest firms is increasing.
5. Within firms, changes over time in the labor share are positive,...
6. ...while reallocation to bigger firms lowers the macro labor share.

Note: In France, (5) + (6) net to ≈ 0 for the macro labor share. In the US data, (6) dominates for an overall decline in the macro labor share.

How Does the Fancy Production Function Work?

It's a nonhomothetic CES production function with a twist to include IT.

- ▶ The total productivity of a bundle of non-IT inputs (K, L) depends on "organizational productivity."

- ▶ Organizational productivity depends positively on IT intensity, negatively on the total output of the firm.

The Bottom Line
The nonhomothetic function exhibits non-constant and decreasing returns to scale $(RTS = \frac{AC}{MC})$, but IT helps to counteract this force.

How Does the Model Match the Facts?

1. Bigger firms use more IT. A firm invests in PeopleSoft and Concur to counteract scale's negative effect on productivity.

2. Bigger firms have lower labor shares. Lower RTS via lower productivity, lower labor shares, higher profit shares.

3. IT intensity is increasing over time while price declines. Exogenously higher supply of IT.

4. Concentration of output in the largest firms is increasing. Larger, more IT-intensive firms expand more.

5. Within firms, changes over time in the labor share are positive,... More IT yields a shift to higher RTS, lower profit share, higher labor share...

6. ...while reallocation towards bigger firms counteracts lowers the macro labor share. ...but the big IT-intensive firms had really low labor shares already.

I Want to Know More about Three Questions

1. So what?

2. Is the covariance residual negative in your model?

3. Why not a fixed cost model of IT?

My View
The authors are well placed to shed light on all three questions,
with their great data and intuitive theoretical framework.

So What?

Changes in IT intensity, labor shares, and concentration may in principle matter for macro because of their impacts on many outcomes.

- ▶ <u>Selection</u>: important, explored a bit with GE price movements, but this could be pushed further with irreversible exit

- ▶ <u>Dynamism</u>: important, explored a bit with entry, but would need more within-firm dynamics to discuss churning fully

- ▶ <u>Growth</u>: important, but would need a growth model

- ▶ <u>Welfare</u>: important, but would need more of a theory of markups

- ▶ <u>Inequality</u>: important, but would need a theory of heterogeneous exposure to asset holdings, etc...

My View
Right now, the technical subtleties of the production function are central to the analysis, but I'd love to know which of the above to care about.

Is the Covariance Residual Negative in Your Model?

Kehrig & Vincent (2017 WP, p22), $\omega =$ size share, $\lambda =$ labor share.

$$\Delta\lambda_t^{inc} = \underbrace{\sum_i \omega_{it-1}\Delta\lambda_{it}}_{\text{Shift: } +15.0\%} + \underbrace{\sum_i \Delta\omega_{it}\lambda_{it-1}}_{\text{Share: } +8.8\%} + \underbrace{\sum_i \Delta\omega_{it}\Delta\lambda_{it}}_{\text{Interaction: } -26.8\%} .$$

▶ In US data, a distinct decomposition from yours reveals that the last two "between" terms are dominated by negative covariance.

▶ It's not that firms with low labor shares grow, it's that **firms lowering their labor share grow**.

▶ Conjecture #1: In French data, term 3 is dominant and negative.

▶ Conjecture #2: In your model, term 3 is positive, since growing IT intensity at big firms increases their RTS and their labor share.

Why Not a Fixed Cost of IT?

Two Modes of Production

- ▶ <u>"I'm a PC"</u>: $\Pi^{PC} = z^{PC} L^{\alpha^{PC}} - wL$
- ▶ <u>"I'm a Mac"</u>: $\Pi^{Mac} = z^{Mac} L^{\alpha^{Mac}} - wL - \phi^{Mac}$
- ▶ Using a Mac is more productive, less labor intensive, and requires payment of a fixed IT cost

$$z^{Mac} >> z^{PC}, \qquad 0 < \alpha^{Mac} < \alpha^{PC} < 1, \qquad \phi^{Mac} > 0$$

Implications

- ▶ Larger firms spend more on IT, with lower labor shares, higher profit shares.
- ▶ Higher market size (EU integration, French reforms, etc...) would increase IT intensity + cause a big negative covariance in the labor share decomposition.
- ▶ If paired with variable markups, the same shift might also imply a rise in markups and reallocation towards higher markup firms, high IT firms.

A Very Different Flavor
Big firms are using better IT to force out the little guy, reduce their labor shares, raise their profit shares, and raise markups. They're not raising simply raising their own labor shares by increasing organizational productivity. Bring out the yellow vests!

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Now What?
These authors have way more than enough data plus way more than enough theoretical skill to quickly dispatch with each of my questions.