Comments on Petrin, White, and Reiter "The Impact of Plant-level Resource Reallocations and Technical Progress on U.S. Macroeconomic Growth"

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Great research agenda: Where does productivity growth come from?

Petrin-White-Reiter

- Decompose Petrin-Levinsohn productivity for manufact. :
  - Weighted plant technology
  - Reallocation

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Petrin-White-Reiter

- Decompose value-added Solow residual for manufact. :
  - Weighted plant technology
  - Reallocation

Basu-Fernald (2001, 2002)

- Decompose value-added Solow residual for economy :
  - Weighted industry technology
  - Varying factor utilization
  - Reallocation
  - Average markup/RTS effect

- Extends Basu and Fernald vision to plant-level data !
  - They apply the B-F decomposition, with minor tweaks, e.g.
    - Include average markup in "reallocation"
    - Break out fixed costs explicitly

Plant-level "technology" includes changes in fixed costs

- Plant-level estimates of technology (just labor, ignoring plant's relative price):

$$\Delta \ln Q_i = \varepsilon_{iL} \Delta \ln L_i + \Delta \ln \omega_i$$

- Where did it come from?

$$Q_i = G^i\left(L_i, \tilde{\omega}_i\right) - F_i$$

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$$\rightarrow \Delta \ln Q_i = \varepsilon_{iL} \Delta \ln L_i + \left(1 + \frac{F_i}{Q_i}\right)\left(\frac{\partial G^i}{\partial \tilde{\omega}} \frac{\tilde{\omega}_i}{G^i}\right) \Delta \ln \tilde{\omega}_i - \frac{F_i}{Q_i} \Delta \ln F_i$$

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Reallocation, defined as gap between "productivity" and technology, includes average markup effect

$$[\Delta \ln Q_i - c_{iL}\Delta \ln L_i] - \Delta \ln \omega_i = (\varepsilon_{iL} - c_{iL})\Delta \ln L_i$$

- Typical cost-minimizing FOC implies that $P_i \dfrac{\partial Q_i}{\partial L_i} = \mu_i W_i$, or $\varepsilon_{iL} = \mu_i \mathrm{c}_{iL}$:

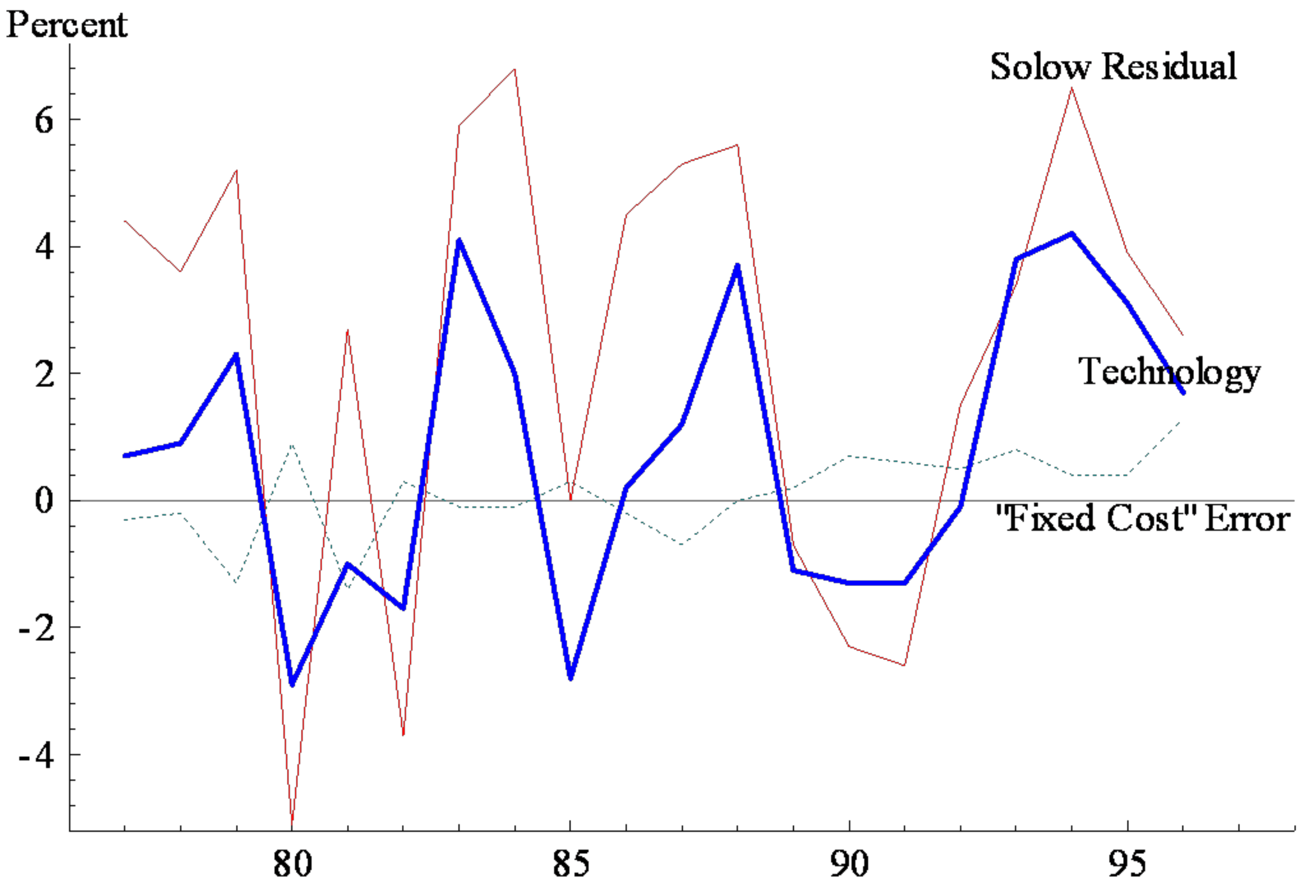
  $\rightarrow$ Labor reallocation = $(\mu_i - 1)c_{iL}\Delta \ln L_i$

Puzzle/problem: Key accounting identity doesn't hold in their data!

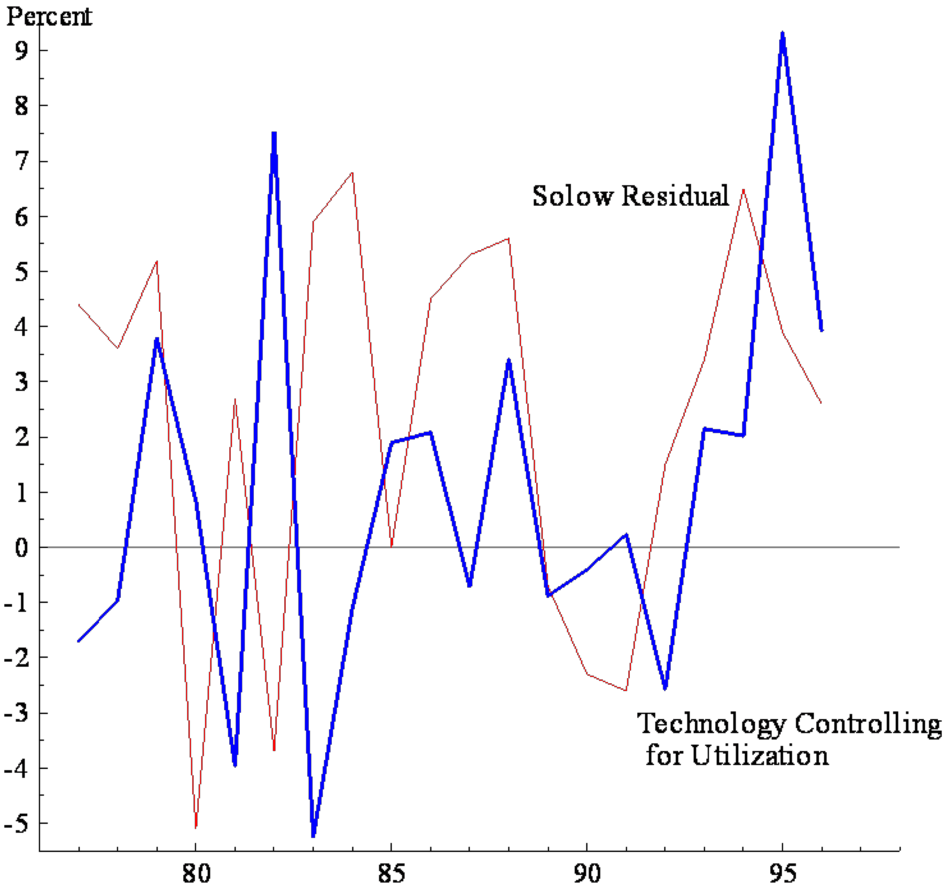
- Accounting identity is in terms of (unobservables) $\Delta \ln F_i$ and $\Delta \ln \tilde{\omega}_i$, but to be relevant, it needs to be in terms of (measured) $\Delta \ln \omega_i$.
  - Want to treat data in identity exactly the same way as in estimation

- Problem: They have an identity and internally consistent data, so shouldn't be a residual!

Error seems small and not cyclical, and estimated technology differs noticeably from Solow Residual



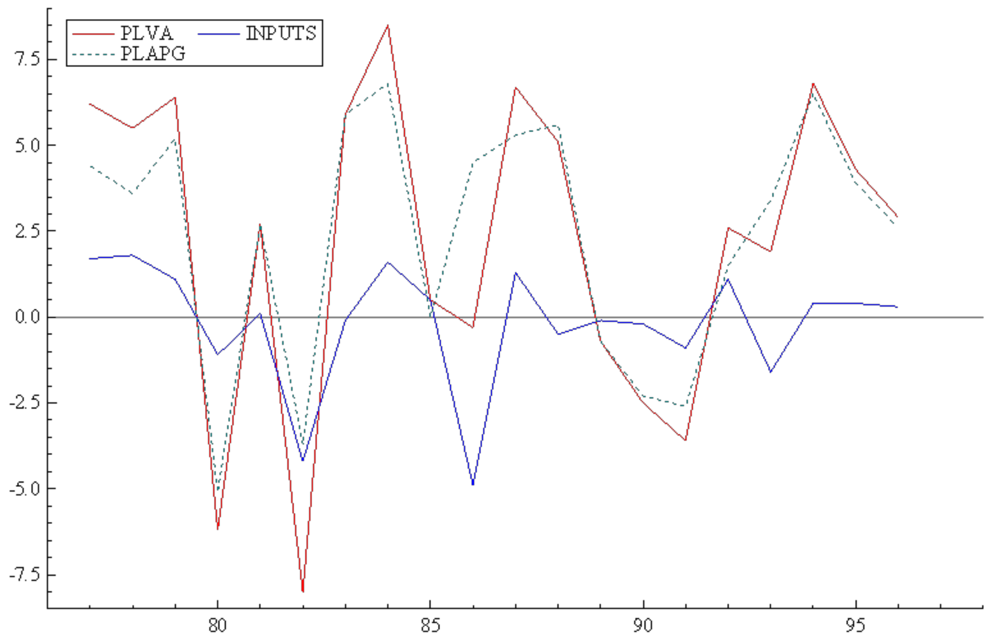
Controlling for estimated utilization, technology even more different from Solow residual



- Basu-Fernald-Kimball (2006) use model-based empirical proxy to control for varying:
  - labor effort
  - Capital's workweek
- Take PWR technology, subtract BFK utilization for manuf.
  - Utilization-adjusted technology is negatively correlated with hours growth

Wrap-up: Paper takes reasonable approach to identify non-technological component of Solow residuals

- Technology differs from Solow residual, especially after adding a utilization control
- Relative importance, let alone interpretation, of different reallocation terms isn't established
  - Accounting identity doesn't quite add up
- Question: How important are reallocations *within* two-digit industries, as opposed to *across* industries?



PLVA
INPUTS
PLAPG
7.5
5.0
2.5
0.0
-2.5
-5.0
-7.5
80
85
90
95

Extra equations and stuff

$$\text{FOC: } P_i \frac{\partial Q_i}{\partial K_i} = \mu_i W_i, \text{ or } \varepsilon_{iL} = \mu_i c_{iL}$$

- Their accounting identity is in terms of (unobservables) $d \ln F_i$ and $d \ln \tilde{\omega}_i$, but it needs to be in terms of (measured) $d \ln \omega_i$.

$$d \ln VA - c_L d \ln L - c_K d \ln = \sum_i D_i (\varepsilon_{iL} - c_{iL}) d \ln L_i +$$

Plant-level "technology" includes changes in fixed costs

- Plant-level estimates of technology (with just L and K):

$$d\ln Q_i = \varepsilon_{iL} d\ln L_i + \varepsilon_{iK} d\ln K_i + d\ln \omega_i$$

  - Where did it come from?

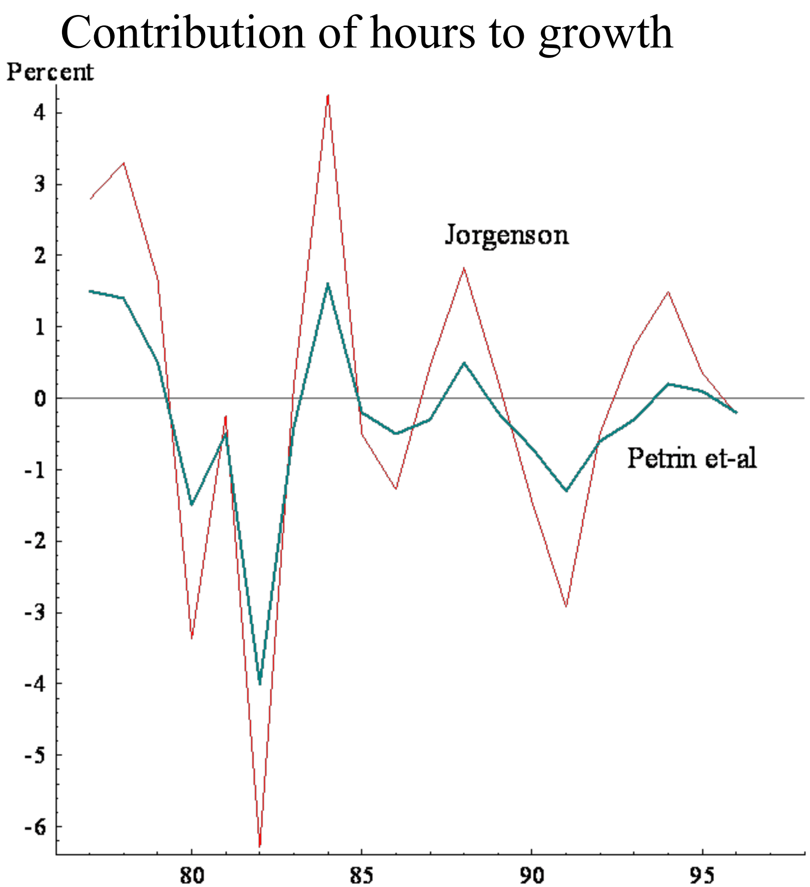
$$Q_i = Q^i\left(L_i, K_i, \tilde{\omega}_i\right) - F_i$$

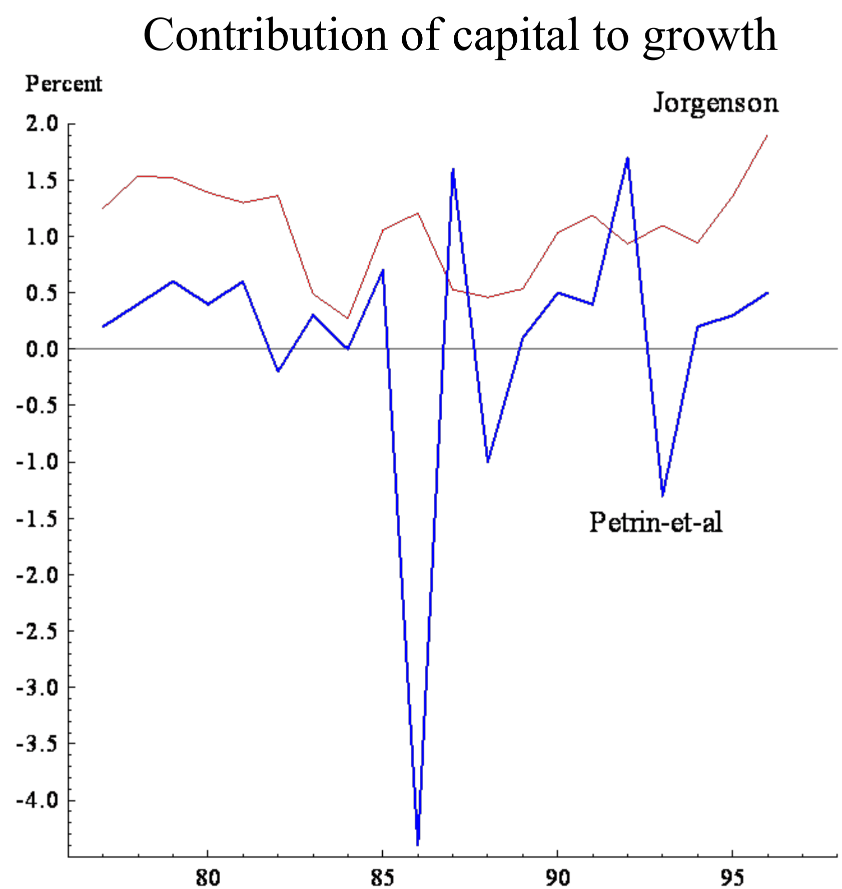
$$\rightarrow d\ln Q_i = \varepsilon_{iL} d\ln L_i + \varepsilon_{iK} d\ln K_i \underbrace{- \frac{F_i}{Q_i} d\ln F_i + \left(1 + \frac{F_i}{Q_i}\right)\left(\frac{\partial Q^i}{\partial \tilde{\omega}} \frac{\tilde{\omega}}{Q^i}\right) d\ln \tilde{\omega}}_{d\ln \omega_i}$$

Great research agenda: Where does productivity growth come from?

- Decompose "Petrin-Levinsohn" productivity for manufacturing into :
  - Weighted plant-level (gross-output) technology
  - Reallocation
- Basu and Fernald (2001, 2002) decomposed value-added Solow residual for entire economy into
  - Weighted industry-level technology
  - Variations in factor utilization
  - Average returns-to-scale/markup effects
  - Reallocation
- Extends Basu and Fernald vision to plant-level data !
  - Petrin-Levinsohn productivity ≈ value-added Solow residual
  - They apply the B-F accounting decomposition, with minor tweaks, e.g.
    - Include average markup in "reallocation"
    - Break out fixed costs explicitly

Hours appear excessively smooth, capital excessively volatile…which might affect relative reallocation terms

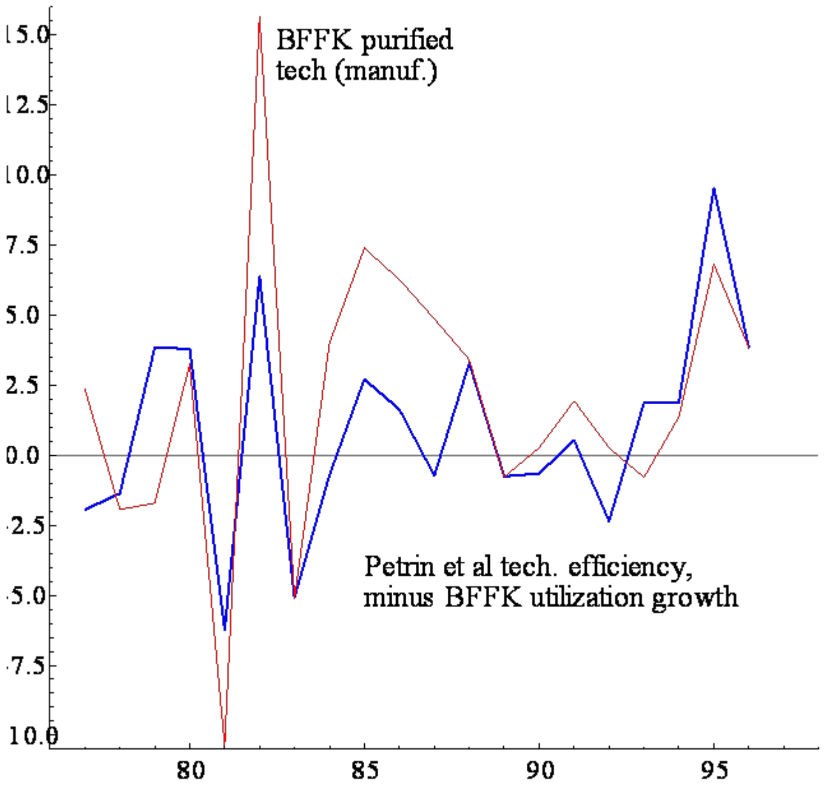




Note: Series are cost-share-weighted growth in labor and capital inputs, respectively, in Petrin et al compared with Jorgenson's dataset

Technology corresponds surprisingly well with Basu, Fernald, and Kimball (2006) estimates

Comparing BFK purified "technology" in manufacturing to Petrin et al technical efficiency *less* BFK utilization



- Petrin et al don't control for variable effort or capital's workweek.
- After subtracting BFK estimate of utilization, Petrin *et al*'s technology is close to BFK "purified technology"
  - Correlation is 0.73…
- …and series is negatively correlated with hours growth