Technical Change in Australian Manufacturing

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Outline

- Modelling Technical Change
- Empirical Results – Rates of Technical Change
- Empirical Results – Investment and Labour Productivity
- Conclusions
- Interpretation
- Policy Implications

Modelling Technical Change

- Vintage-capital models
  - Output depends on the time at which capital is installed
  - Newer equipment more productive, but not necessarily in all dimensions
- Leontief technology
  - Fixed factor proportions
  - $Q = aL'$, $K' \geq Q/b$, $M' \geq Q/c$
- Factor-augmenting technical change
  - $L' = Le^{\alpha t}$, $K' = Ke^{\beta t}$,$M' = Me^{\gamma t}$

Modelling Technical Change

- Leontief cost function

  unit cost = $aw' + br' + cm'$

- Factor augmentation and costs

  $w' = we^{-\alpha t}$, $r' = re^{-\beta t}$. $m' = me^{-\gamma t}$

- Using price data

  Price = (1 + net margin) * (unit cost)

  Net margin depends on market demand and oligopoly conjectures

Empirical Results – Rates of Technical Change

- Data for 38 Australian manufacturing industries (3-digit)
- Cover 1968-69 through 1999-2000 (32 years)
- Estimate separate price equation for each industry
- The hypothesis of price = unit cost is rejected in only four industries

Empirical Results – Rates of Technical Change

- Technical change is significantly labour saving in all industries

  Average = 2.9% pa

- Variation in material saving across industries

  Average = 0.3% pa

- Wide variation in capital saving across industries

  Average = -4.5% pa (capital using)

- Overall cost savings found in 2/3 of industries

  Average = 0.5% pa (as share of total cost)

Empirical Results – Investment and Labour Productivity

- Salter (1965)
  - Examines effect of capital-embodied technical change as modelled above on labour productivity
  - Finds labour productivity rises with investment in new capital equipment
  - Implies that average labour productivity falls with average age of equipment (holding technical change constant)

Empirical Results – Investment and Labour Productivity

- Bloch, Courvisanos and Mangano (2011) extend the Salter model to examine implications for optimal obsolescence
  - Obsolescence quicker with higher labour saving in technical change
  - Implies higher gross investment share when greater labour saving, given output growth rate
  - Find significant positive relationship between proxy for rate of labour saving (past labour productivity growth rate, average 1968 to 1999) and investment share (2000-2004) across 36 industries

Conclusions

- Technical change is labour saving and capital using in Australian manufacturing
- There is a positive impact of past labour productivity growth on gross investment share

Interpretation

- Results are consistent with model in which technical change is embodied in capital equipment
- Suggests rising labour saving results from product development by equipment suppliers
  - Driven by buyers desire to economise on increasingly expensive labour
- Interpretation is contrary to a model of input substitution driven by relative input prices and has different implications

Policy Implications

- Productivity growth
  - Labour productivity rises with investment in new equipment (albeit, with an installation lag)
  - Labour productivity is counter cyclical (falls with capacity utilisation)
  - Labour productivity falls with equipment age (not necessarily plant age)
  - Testing these propositions in manufacturing complicated by imperfect competition (unexploited scale economies, inflexible work rules)

Policy Implications

- International competitiveness
  - Can’t compete with low-wage countries unless have special access to equipment or markets
  - Exacerbated by inflexible work rules impeding effective use of new equipment

THANK YOU

COMMENTS AND QUESTIONS

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References

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