Productivity Growth, Trade & Poverty

Will Martin

World Bank

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Roadmap

• Small open economies

• Large economies

• Interactions with trade distortions

• Distributional implications
Small, open economies
Sources of productivity growth

- **Process improvements**
  - Movement of the frontier
  - Changes in efficiency relative to frontier
  - Changes in the variety of inputs available

- **Product improvements**
  - Changes in the amount of the good required to meet consumer need
  - Changes in the variety of goods supplied
Broad trade impact: small, open economies
Relation between Y gain & output

- Most productivity measurement focuses on Y changes
  - What is the reduction in input needed/unit of output?
    - NB inputs may be intermediates or factors
    - Redn in inputs may have different impacts on output & on trade
      - How much is on marginal needs & how much infra-marginal

- Point developed using PS & shifts in supply curves
  - Classic example of a parallel vs a pivotal shift in supply
  - With income gains measured using producer surplus

- Need to look more closely at nature of productivity change
  - Can be done using modern, dual approaches
Parallel shift in the supply curve

PS increase =abcd
“Pivotal” shift in the supply curve

PS increase = abc

Same impact on trade. Much smaller PS gains
Income gains depend on nature of change

• The implications depend on specifics like
  ▫ Whether the supply moves horizontally to the right
    • eg an increase in the effective supply of an essential input
  ▫ Or shifts down vertically
    • eg a reduction in cost on all units
  ▫ Or the same effective output yields more actual output
    • eg a rise in actual output from the same bundle of inputs

• Each can be represented using fully-specified profit functions
Profit function: horizontal shift

- Assume a quadratic profit function
  \[ \Pi = \alpha_0 + \alpha P + \frac{1}{2}PAP \quad \text{where } P = [p' \tau']' \]

- For a tech change that affects only one output
  \[ \Delta \Pi = p_i a_{ij} \Delta \tau_j = p_i \Delta q_i \]
  
  - Note the output rise depends only on the size of the shock, not on the supply elasticity
Horizontal shift in supply

Profit gain $abcd=bcef$
A cost-reducing technology

- Use the \( \Pi \) function to trace out a virtual supply curve and solve for short & long run effects

\[
\Delta \Pi = q_0 \cdot \Delta \tau + \frac{1}{2} \Delta p \Delta q
\]

- In this case, the output rise depends on the elasticity as well as the size of the shock
Uniform cost reduction

Income gain  $abcd + bce$

$\Delta$ trade depends on elasticity

PS underestimates gains
Most common approach: actual vs effective

- Here we use actual vs effective inputs
  - but also used for input-augmenting technological change

\[ \Pi = \alpha_0 + \alpha' p^* + \frac{1}{2} p^* A p^* \]
  - Where \( p_i^* = p_i \tau_i \) and \( q_i^* = q_i / \tau_i \)

\[ q_i = \tau_i (\alpha_i + \Sigma \alpha_{ij} p_j \tau_j) \]

- NB: two impacts of \( \tau \), multiplicatively & through prices
  - Reflects two channels of effect– more from initial inputs, & more from higher profitability pulling in inputs
  - Not innocuous– has different implications for trade from other forms of technical change
Increasing actual output/unit of effective output

Profit gain bcef +cdf
Productivity ↑ raises inputs in almost all cases

• Not consistent with the usual story that higher productivity saves labor and allows it to move to other sectors

• Consistent with experience in successful exporters

• Need to think hard about trade situation when considering impacts of productivity on sectoral input use
Factor bias also has implications for trade & income distribution

- Labor-saving technical change likely more important when agriculture is highly labor intensive

- Labor-augmenting technical change becomes more important after the Lewis point— as wages rise
  - endogenous (Hayami-Ruttan) technical change may help
Large economies
Large or closed countries & the world

- Now productivity rises push down output prices
  - Relatively large effects where the output rise is large relative to the producer income gain
    - Actual-effective distinction

- If the elasticity of demand is low, the decline in price may well reduce producer incomes
  - Particularly likely in closed economies where demand is just the domestic demand curve
  - And for the world as a whole
  - Inputs particularly likely to be “freed” up in this case
Welfare impacts depend on terms of trade

- TFP growth causes exporters’ terms of trade to deteriorate

- Causes importers’ terms of trade to improve

- Some of the income gains are shared with consumers in the rest of the world
Impact of trade distortions
Impact of trade distortions

- Depends heavily upon whether the distortion and the productivity change work in the same direction
- If a good is subsidized by a tariff or subsidy, the benefits from the productivity gain are reduced
  - If sufficiently heavily subsidized, the productivity gain may be immiserizing
  - Further, this loss accrues as a reduction in government revenues or higher subsidy payouts
    - So should probably be multiplied by the MCF
Size & trade distortions

- From a national perspective, large countries export too much, or import too much, under free trade
  - Optimal export tax for an exporter
  - Optimal import tax for an importer

- Nash-optimal trade tax internalizes the externality faced by a country
  - Allowing evaluation to focus just on net returns

- From a global viewpoint, focus on net returns adequate
Distributional implications
Consider TFP shocks by sector

- Productivity shock scaled to raise 1 percent of GDP
  - Larger shock for smaller sectors—interested in poverty intensity
    - Agriculture
    - Industry
    - Services
- Measure poverty impacts for sample of 30 developing countries
  - Producers benefit from the productivity shock
  - Everyone affected by changes in prices relative to CPI
- Two types of sequencing
  - Each country does shock independently
    - We calculate hypothetical global poverty change
  - All countries experience higher productivity together
## Resulting productivity shocks

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Global poverty impacts, % points

Impact through producers  Impact through food consumption  Impact through other consumption  Impact through wages  Total

-3.5%  -3.0%  -2.5%  -2.0%  -1.5%  -1.0%  -0.5%  0.0%  0.5%  1.0%
Findings of empirical analysis: agric

• Global agric productivity shock reduces poverty most
  ▫ Estimated global reduction of 3.1 percentage points
  ▫ Benefits farmers as prices decline less than income gain
  ▫ Consumers benefit from lower food prices
  ▫ Wage earners benefit from higher wages

• Individual countries can lower poverty independently
  ▫ No need for coordination
  ▫ Poverty reductions smaller but significant (2.4% pts)

• Individual action opportunity- collective action problem
  ▫ Policy makers prefer farm income gains, gains in self sufficiency
    • But get mainly consumer gains
    • WTO wisely does not get in the way
Global poverty impacts

- The poverty impact of an increase in agricultural productivity growth is much larger than for industry or services.

- Much more intensive in unskilled labor on the production side.

- Much more important for poor consumers on the consumption side.
Conclusions

• Impacts on of productivity growth on trade
  ▫ May differ considerably depending on nature of change
  ▫ Interaction with trade distortions affect welfare results

• Size & openness of economy affect prices
  ▫ In small, open economies, higher productivity tends to increase resource use
  ▫ Only frees up farm labor in large or closed economies

• Agricultural productivity growth much more beneficial for poverty reduction than other sectors
  ▫ Labor intensity of prodn & importance of consumer gain
References

