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
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
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
  \[ \Pi = \alpha_0 + \alpha' P + \frac{1}{2} P'AP \text{ where } P = [p' \tau']' \]

- 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

- $\Delta \Pi = q_0.\Delta \tau + \frac{1}{2} \Delta p\Delta q$

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

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

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

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 ↑ almost always raises inputs

- 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.
From a national perspective, large countries trade 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

-3.5%  -3.0%  -2.5%  -2.0%  -1.5%  -1.0%  -0.5%  0.0%  0.5%  1.0%

Global shock—ag
Global shock—ind
Global shock—svcs

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

Individual shock—ag
Individual shock—ind
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
• The poverty impact of an increase in agric productivity growth 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 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
