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# Productivity Growth, Trade & Poverty

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Presentation for IATRC Meeting, Seville,

3 June 2013

# Roadmap

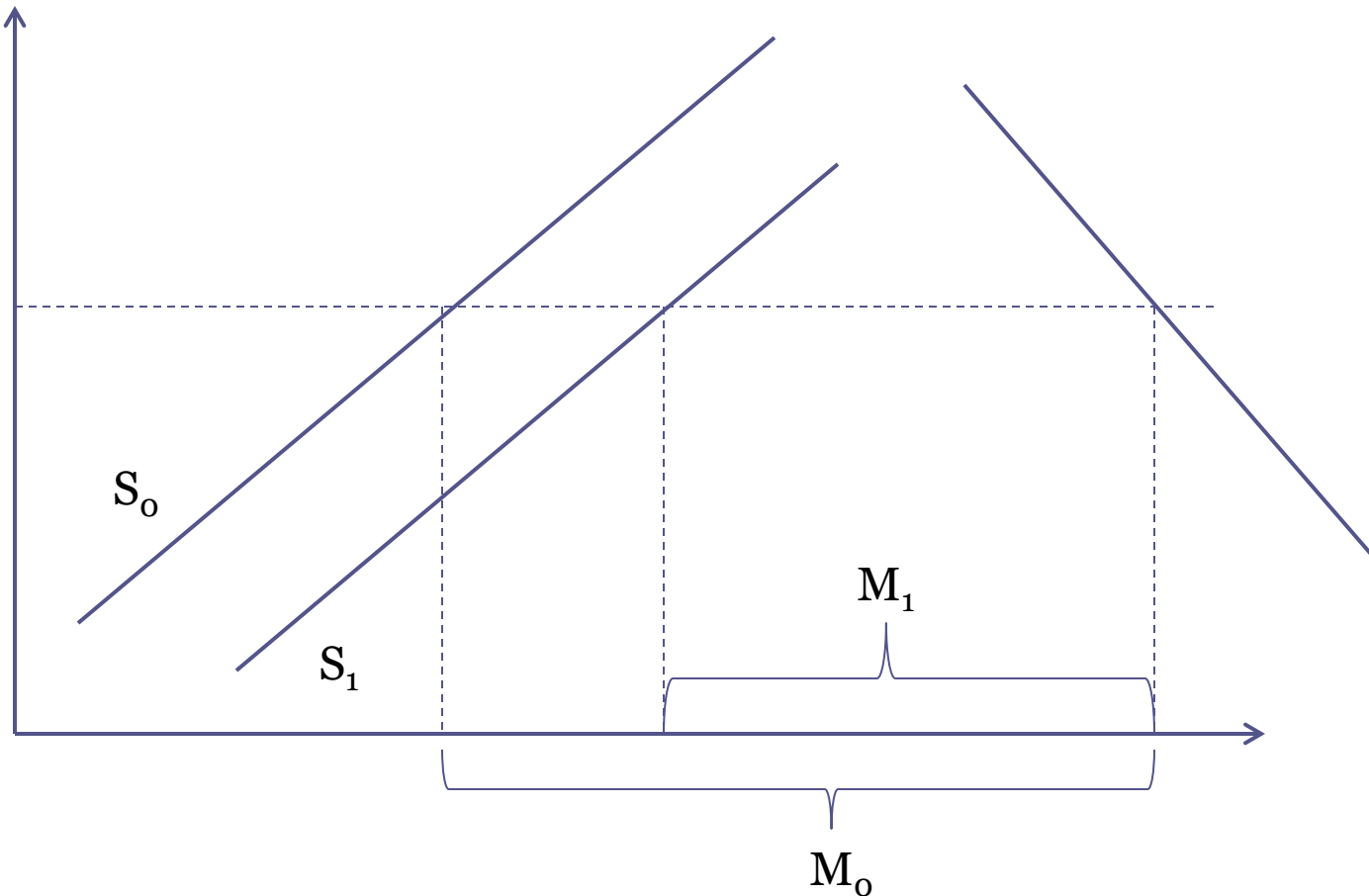
- Small open economies
- Large economies
- Interactions with trade distortions
- Distributional implications

# 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

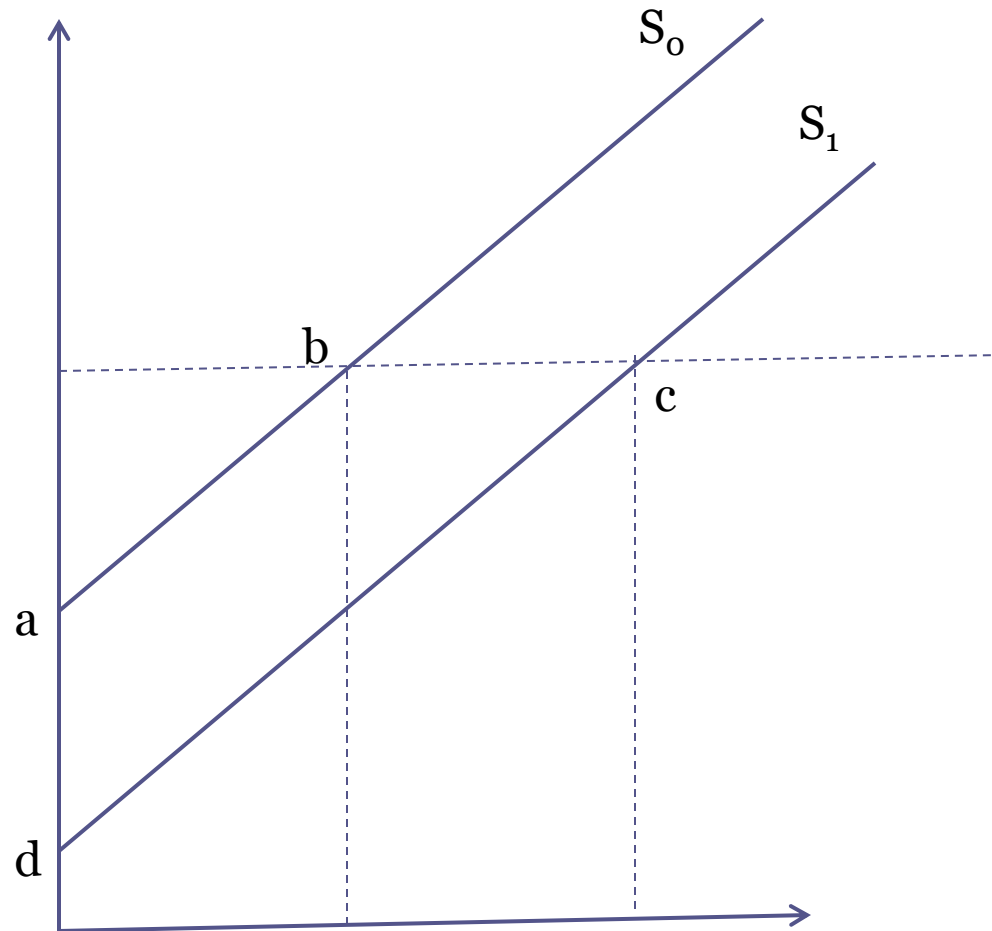


# Relation between Y gain & output

- 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

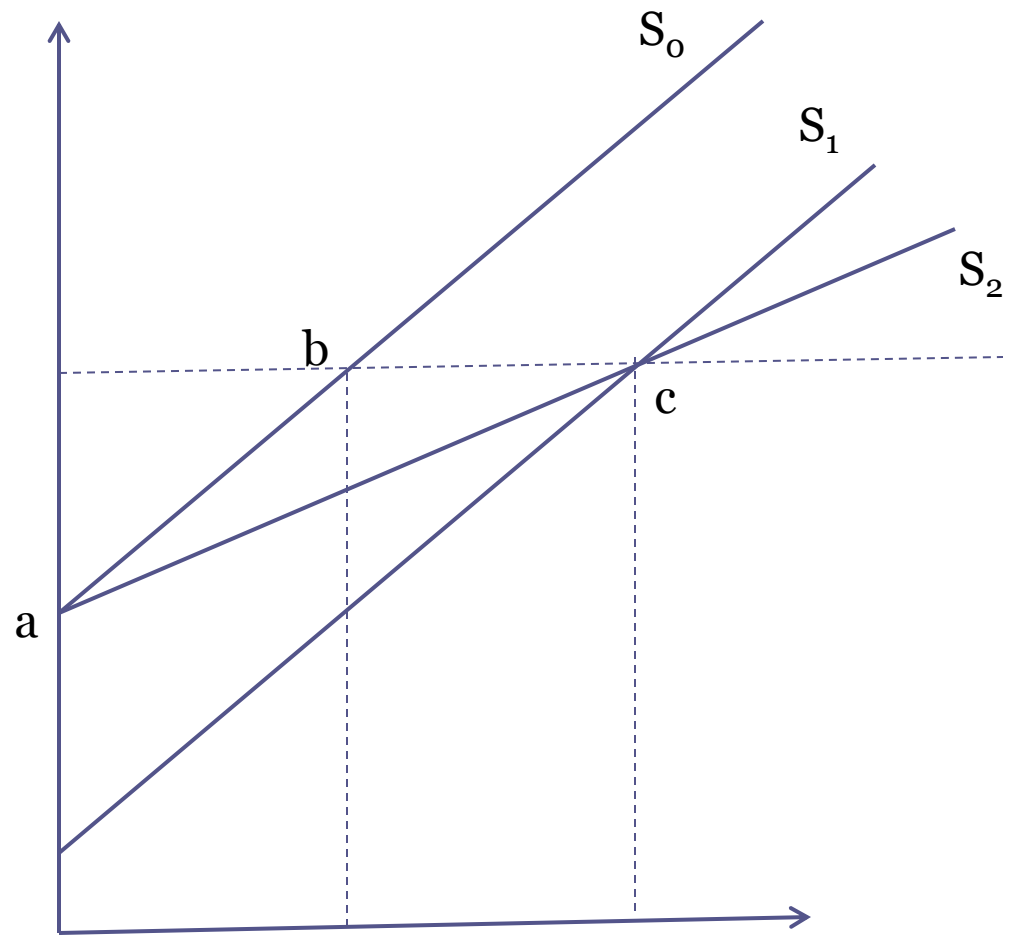




# “Pivotal” shift in the supply curve

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

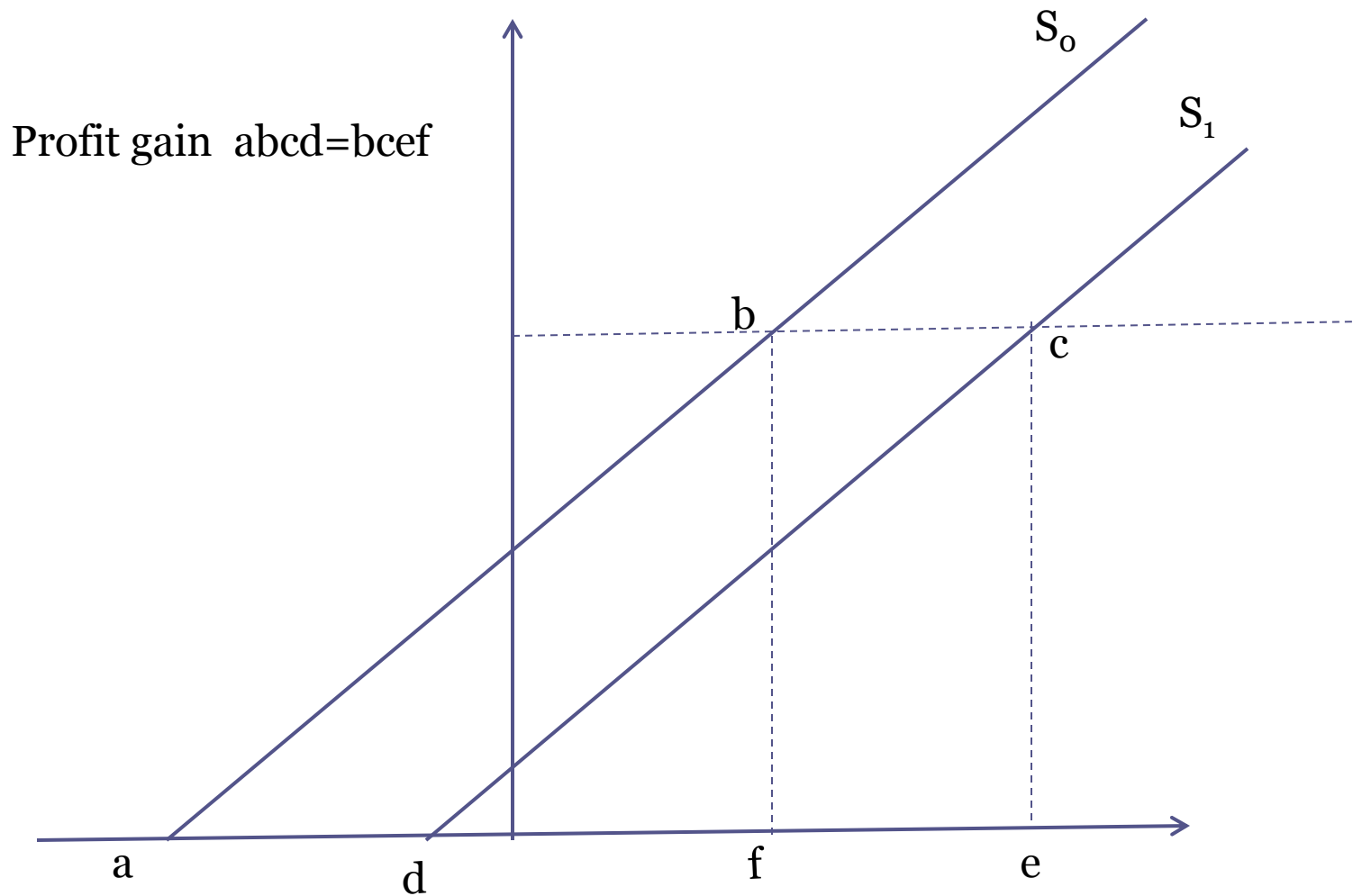
- $\Pi = \alpha_0 + \alpha'P + \frac{1}{2}P'AP$  where  $P = [p' \tau']'$

- 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

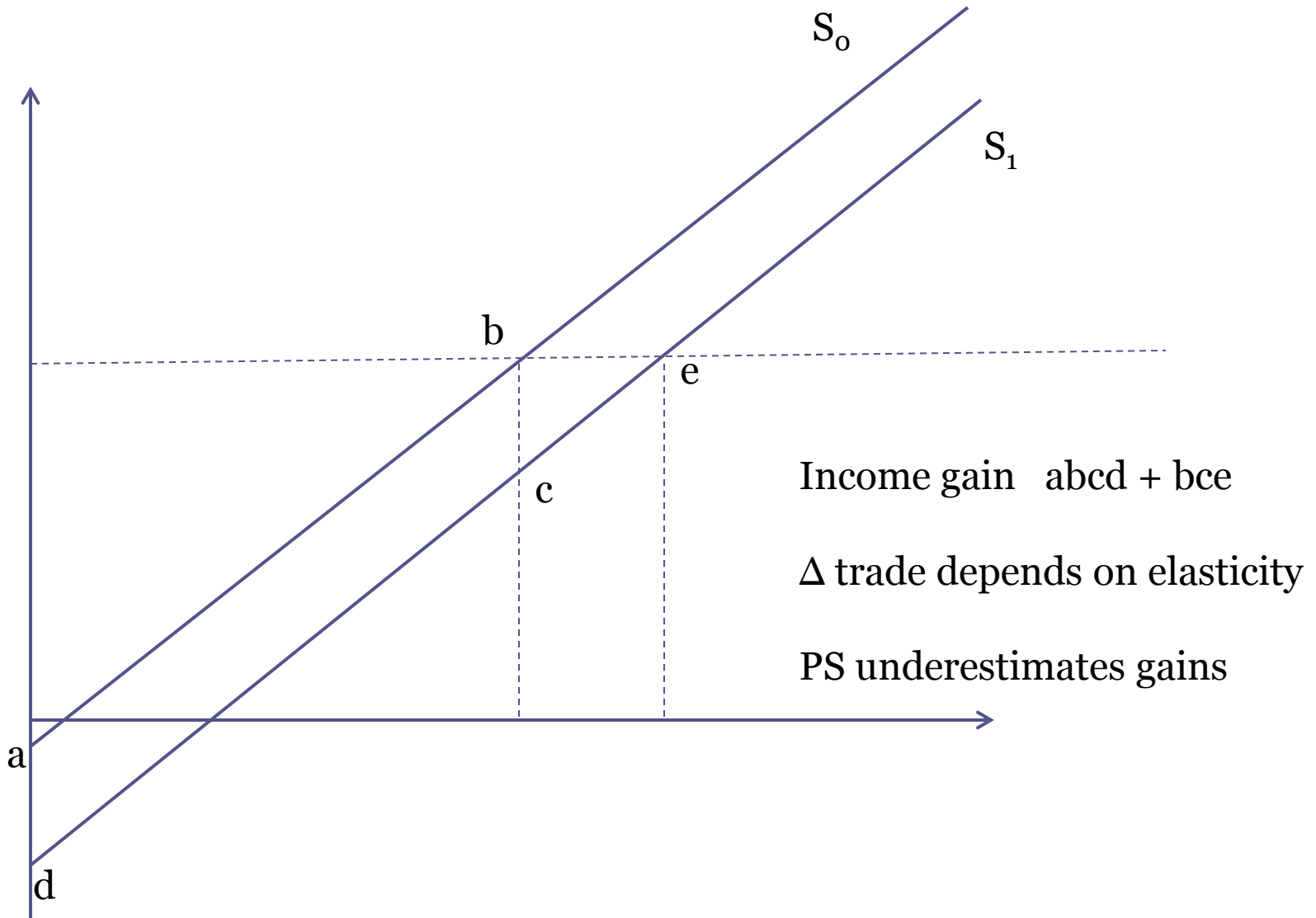
# Horizontal shift in supply



# 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

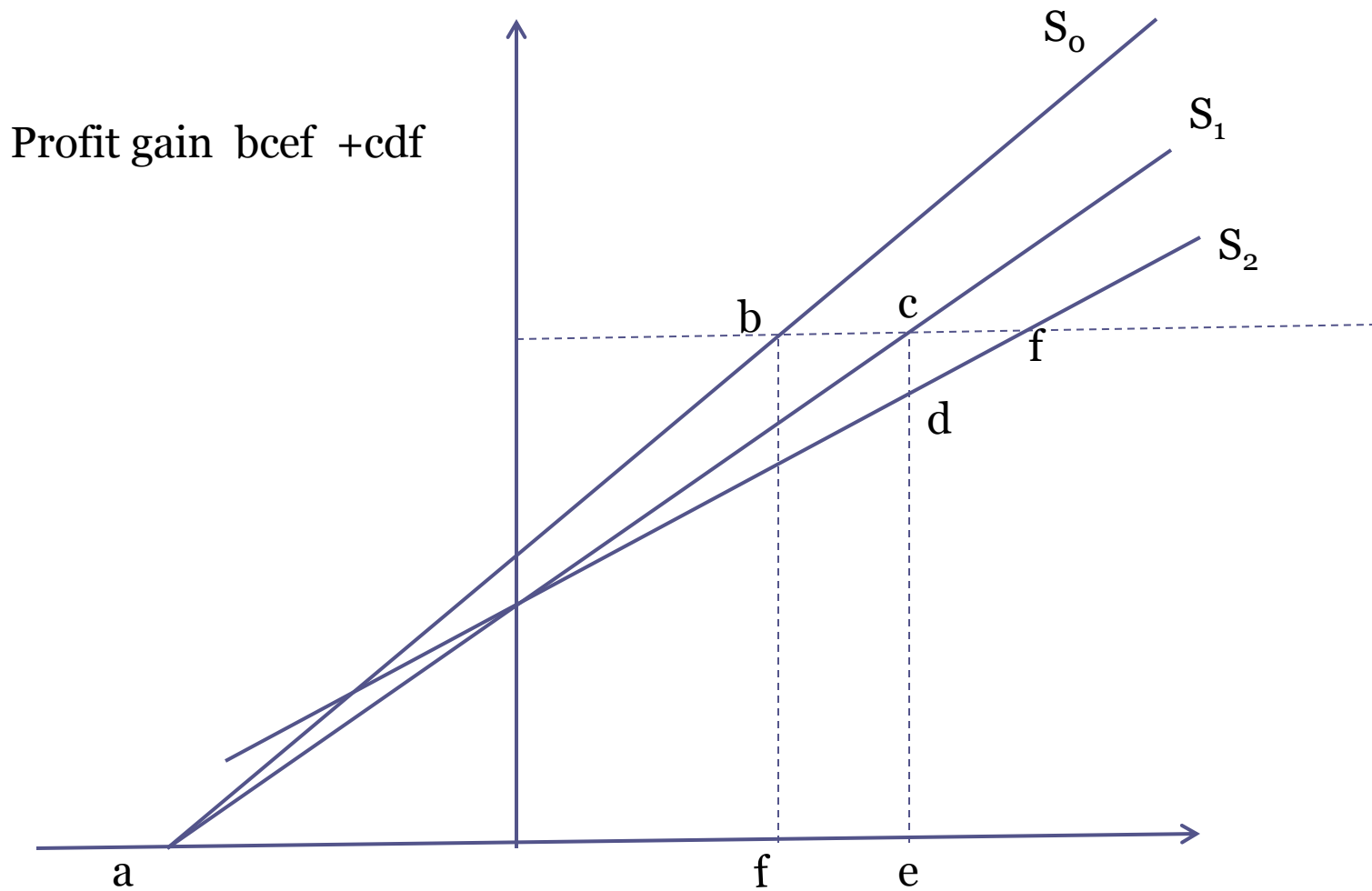
# Uniform cost reduction



# 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  $p_i^* = p_i \cdot \tau_i$  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





# Productivity $\uparrow$ 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

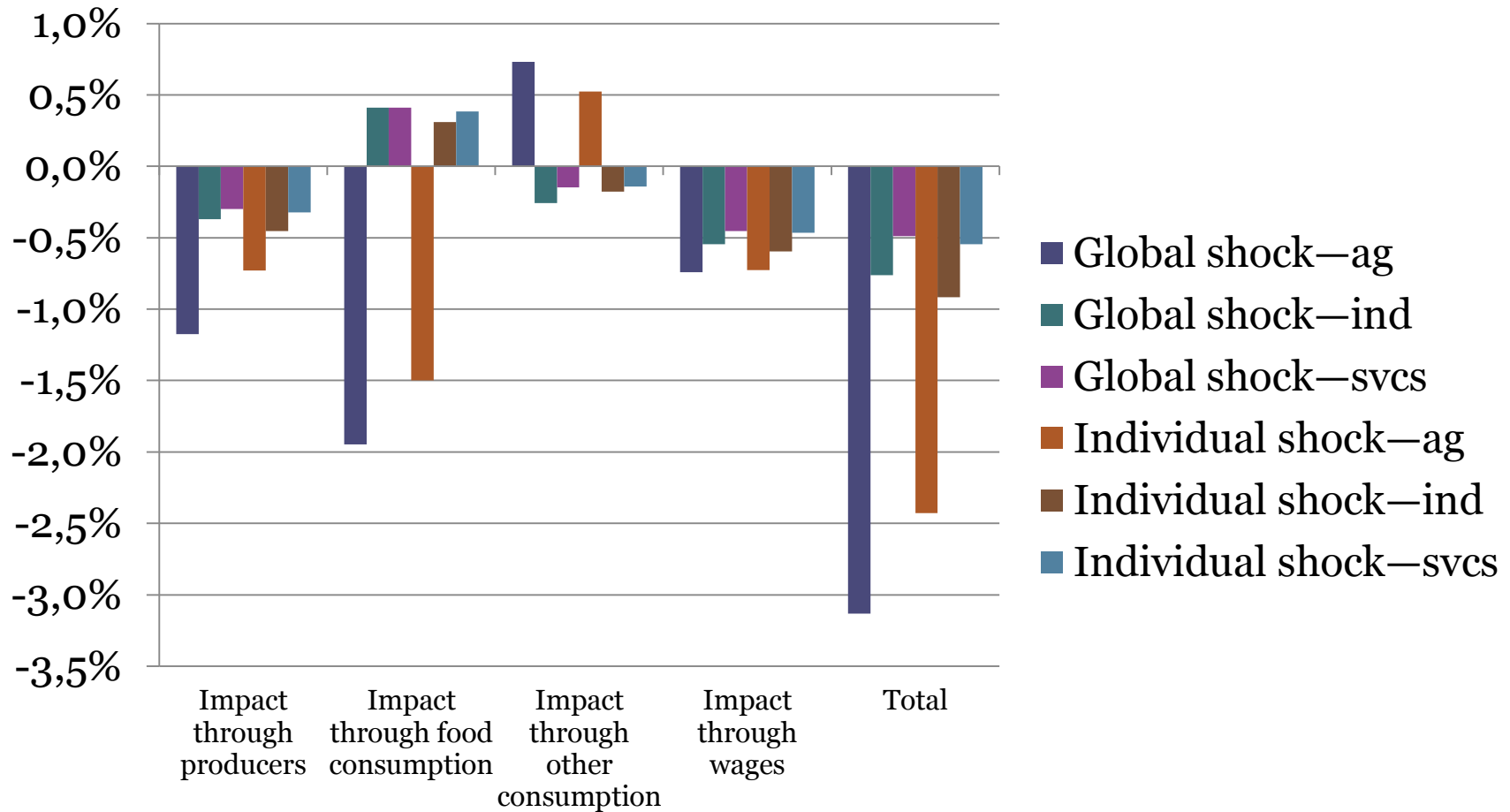
# Consider TFP shocks by sector

- 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

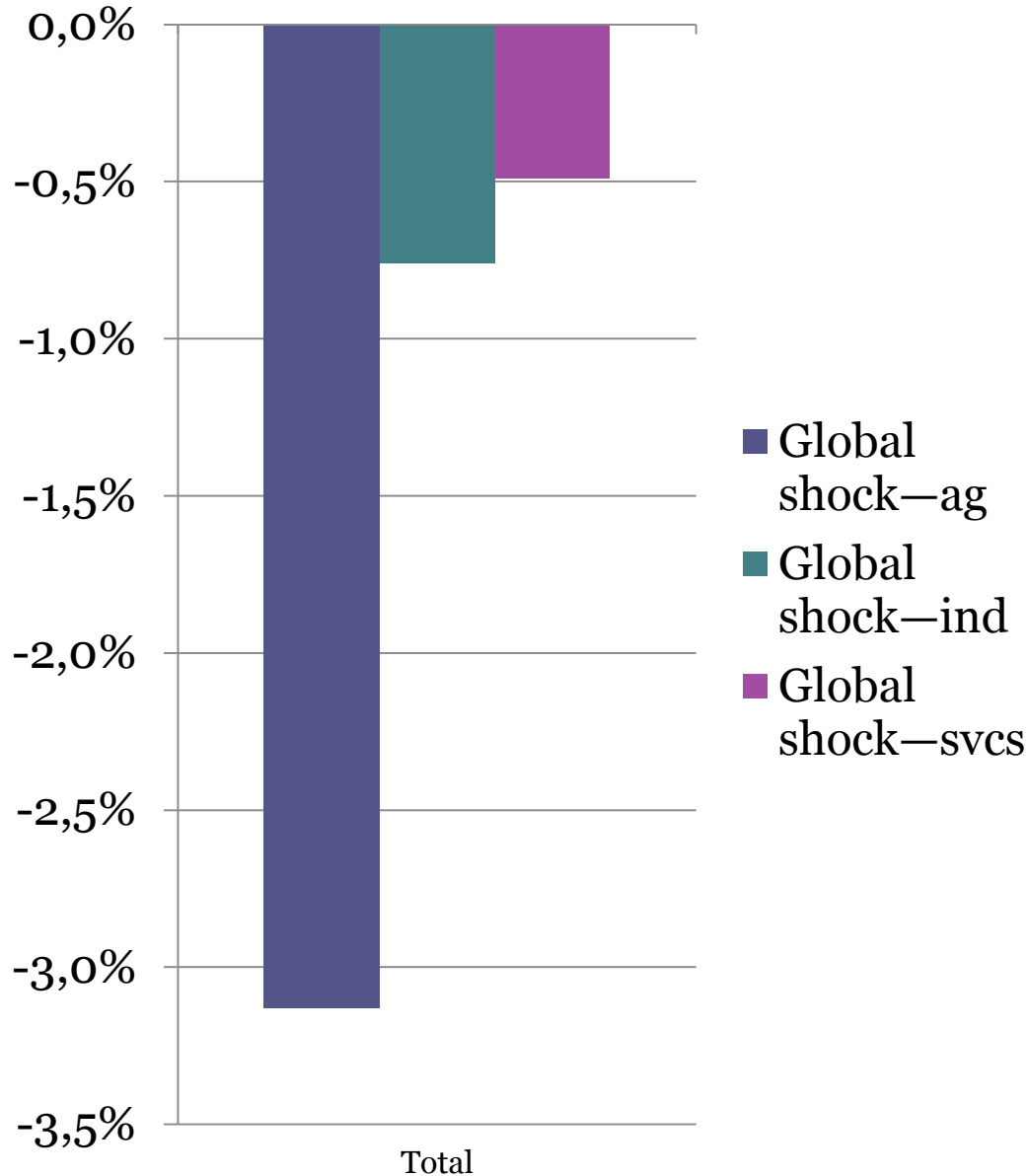
	<b>India</b>	<b>China</b>	<b>Indonesia</b>	<b>Bangladesh</b>
Agriculture	5.6	8.8	5.7	3.7
Industry	3.1	1.8	2.7	4.0
Services	2.0	2.9	2.2	2.1

# Global poverty impacts, % points



# 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

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