Selected Poster/Paper prepared for presentation at the Agricultural & Applied Economics Association's 2017 AAEA Annual Meeting, Chicago, Illinois, July 30-August 1, 2017

When Induced Innovation Augments and Saves Less Expensive Inputs

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Motivation

- Induced Innovation Hypothesis (IIH) states that technical change in production occurs in the way that producer can economize the use of expensive input (J.R. Hicks 1932)
- Implications on technological change in production
- IIH appeals due to real world evidence

However..

- Firm would reduce use of the more expensive input only if it helped increase profit (or decrease cost)
- Little consideration on innovation supply side
- Theoretical consistency of IIH found in a limited condition

Research Objectives

- The objective of this study is to examine the theoretical consistency of Hicks' IIH with cost minimization
- To find conditions under which they are consistent, if not always consistent

Two-Period Model (Cost minimization)

- 1st period: Research investment allocation decision (innovation supply side)
  - A homothetic research function $R_i = \left(c_{i1}\hat{a}_{i1}\right)^{\theta_i} + \left(c_{i2}\hat{a}_{i2}\right)^{\theta_i}$
  - $\hat{a}$: expected factor augmentation in period 2
  - c : marginal research costs
  - θ : research concavity parameter (>1)
  - Allocation decisions are made to min expected cost (inter-temporal)
- 2nd period: Input allocation decision (innovation demand side)
  - 2 stage CES production function
  - Inputs are allocated to min cost (static)

Findings: when expected input price ratio (w1/w2) increases

Impact on	Inputs Gross Complements	Inputs Gross Substitutes	
	$0<\rho<1$	$1<\rho<\theta+1$	$\rho>\theta+1>1$
Factor Augmentation	Positive	Negative	Positive
Optimal input ratio	Negative	Negative	Positive

Conclusions

- Allocation decisions depend on the magnitude of the elasticity of substitution and research concavity parameter
- Support Salter's (1960) early objection toward the IIH
- Factor-saving behavior in response to a relative price increase is expected over a wide range of substitution elasticities