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When Induced Innovation Augments and Saves Less Expensive Inputs

Daegoon Lee, Benjamin W. Cowan, C. Richard Shumway
School of Economic Science, Washington State University



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 $R_i = (c_{i1}\hat{a}_{i1})^{\theta_i} + (c_{i2}\hat{a}_{i2})^{\theta_i}$
 - \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 (w_1/w_2) increases

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