The Dynamic Implication of Agricultural Research and Development Investment for Economic Development

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Selected Poster prepared for presentation at the Agricultural & Applied Economics Association's 2014 AAEA Annual Meeting, Minneapolis, MN, July 27-29, 2014.

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2014 AAEA Annual Meeting Minneapolis MN July 27-29, 2014

Introduction

- FAO (2009) projects that by 2050, food production needs to increase by 70% to meet the world need.
- Demographic expansion and climate change put increasing pressure on land. Thus, the future increase in production is expected from productivity increase.
- Productivity increase requires increase in investment in research and development accompanied by a widespread adoption of new technologies, farming techniques and crop varieties in most countries.
- But beyond productivity increase, investment in R&D need to be translated into growth to be sustainable and to contribute to global poverty reduction.

Objective

We reexamine the role of agricultural investment in R&D in developing countries with focus on the dynamic impact on economic growth

Model Specification

- We consider the following ARDL panel equation

$$y_{it} = A_{it} + \mu_i + \sum_{j=1}^{p} \alpha_j y_{it-j} + \sum_{j=0}^{p} \beta_j R_{it-j} + \varepsilon_{it} \quad (1)$$

- y_{it} is the log of per capita output; R_{it} is the agriculture R&D; μ_i is country-specific fixed effects in output
- A_{it} measures productivity is models as function R&D as follows $\Delta A_{it} = \gamma_0 + \gamma_1 R_{it} + \vartheta_{it}$.(2)
- Differentiating (1) and combining with (2) gives
- $\Delta y_{it} = \gamma_0 + \gamma_1 R_{it} + \sum_{j=1}^{p} \alpha_j \Delta y_{it-j} + \sum_{j=0}^{p} \beta_j \Delta R_{it-j} + \vartheta_{it} + \Delta \varepsilon_{it}$ (3)

- First, a growth effect by which investment in agriculture R&D investment affects the growth rate of output $\gamma_1/(1-\alpha_1-\cdots-\alpha_p)$
- The second effect is productivity-conditional level-effect of agriculture R&D investment on y_{it} given by $(\beta_1+\cdots+\beta_p)/(1-\alpha_1-\cdots-\alpha_p)$

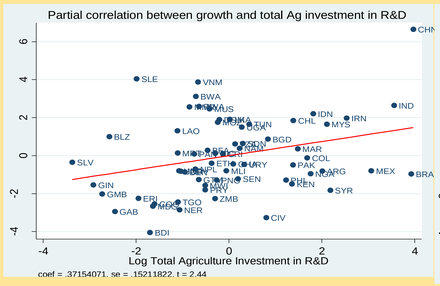
Estimation

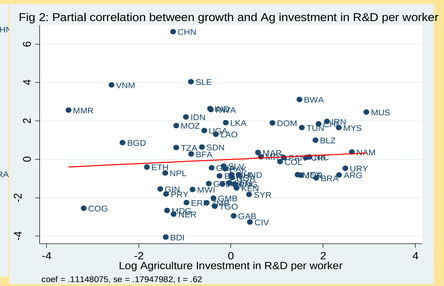
- Taking the difference of equation (1) avoid relying on cointegration for the identification of equation (3)
- Use unit roots test to verify that he series are I(0)
- Use GMM-System estimation to address the potential endogeneity of current agriculture R&D investment and the presence of lags of growth in equation (3)
- Estimates and test the significance of the level and growth effect of R&D

Data and Descriptive Statistics

- Data on Agriculture R&D investment are from the Agricultural Science and Technology Indicators (ASTI).
- GDP data are from the World Development Indicators.
- Sample size is 57 countries over 1981-2010

Table 1 : Descriptive Statistics	Mean	Std.Dev.	Min	Max
GDP growth	1.7	4.5	-19.1	21.8
Ag public R&D Investment ($ Million)	61.6	157.5	0.0	1525.8
Ag public R&D Investment per ag worker ($)	35.2	62.7	0.0	521.7





Results

	Log total Ag R&D Investment		Log R&D Investment per Ag worker	
	OLS	GMM-SYS	OLS	GMM-SYS
Δy_{it-1}	0.209***	0.221***	0.205***	0.187***
	(0.049)	(0.052)	(0.049)	(0.051)
Δy_{it-2}	0.100**	0.063*	0.103**	0.071**
	(0.041)	(0.036)	(0.042)	(0.036)
Δy_{it-3}	0.134***	0.109***	0.143***	0.113***
	(0.034)	(0.033)	(0.035)	(0.033)
R_{it}	0.200***	0.343**	0.007	0.178
	(0.073)	(0.140)	(0.090)	(0.148)
ΔR_{it}	1.708**	0.856	2.663***	2.332**
	(0.800)	(0.991)	(0.590)	(0.929)
ΔR_{it-1}	0.834	1.422	1.081*	1.218
	(0.616)	(0.967)	(0.556)	(0.905)
ΔR_{it-2}	-0.445	-0.350	-0.173	-0.071
	(0.512)	(0.552)	(0.477)	(0.545)
ΔR_{it-3}	-0.333	-0.328	-0.172	-0.118
	(0.473)	(0.541)	(0.463)	(0.526)
Constant	-2.763	-1.117	5.122***	4.320
	(1.733)	(4.639)	(0.547)	(3.843)
Growth effect	0.359***	0.564***	0.013	0.283
	(0.129)	(0.223)	(.164)	(0.233)
Level effect	3.167	2.633	6.198***	5.349**
	(2.589)	(2.868)	(2.211)	(2.703)
N Obs	961	961	935	935
R-squared	0.186		0.184	
Sargan		367.2***		399.9***
AR(2)		0.719		1.089

In all regression the dependent variable is the annual growth rate of GDP per capita.y_{it}. R_{it} stands for the variable in the columns uses as proxy for investment in R&D. Standard errors in parentheses; for OLS they are robust while for GMM-SYS they small sample bias corrected. The number of lags to include is chosen by the minimization of the Akaike Information Criterion. *** p<0.01, ** p<0.05, * p<0.1

Summary and Implications

- Using a simple dynamic model, we find that both the growth and the level effect of agriculture investment in R&D in developing countries are positive .
- Depending on the proxy used either one of these two effect is significant
- The result suggests that intensification of agriculture R&D investment could be an effective approach to increase income and growth in developing countries

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Acknowledgment: Didier Alia acknowledges the graduate Scholl and the Department of Agricultural Economics at the University of Kentucky for financial support in his doctoral studies.