The global technology frontier: productivity growth and the relevance of Kirznerian and Schumpeterian entrepreneurship

Published in: *Small Business Economics*, 55, 153-178

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Academia de Centroamérica 2022

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Recent publications:

1. Lafuente, E., Acs, Z.J., Szerb, L. (2022). A composite indicator analysis for optimizing entrepreneurial ecosystems. **Research Policy**, in press, doi: 10.1016/j.respol.2021.104379
2. Lafuente, E., Abad, J. (2021). Territorial efficiency: Analysis of the role of public work safety controls. **Safety Science**, 134, 105074.
3. Lafuente, E., Araya, M., Leiva, J.C. (2021). Assessment of local competitiveness: A composite indicator analysis of Costa Rican counties using the 'Benefit of the Doubt' model. **Socio-Economic Planning Sciences**, in press, doi: 10.1016/j.seps.2020.100864
4. Lafuente, E., Vaillant, Y., Vendrell-Herrero, F., Gomes, E. (2019). Bouncing back from failure: Entrepreneurial resilience and the internationalization of subsequent ventures created by serial entrepreneurs. **Applied Psychology**, 68(4), 658-694.
5. Lafuente, E., Vaillant, Y., Vendrell-Herrero, F. (2019). Territorial servitization and the manufacturing renaissance in knowledge-based economies. **Regional Studies**, 53(3), 313-319.
6. Lafuente, E., Vaillant, Y., Vendrell-Herrero, F. (2017). Territorial servitization: Exploring the virtuous circle connecting knowledge-intensive services and new manufacturing businesses. **International Journal of Production Economics**, 192, 19-28.

Entrepreneurship & the global technology frontier

What explains the disparities in productivity across economies?

This is an old question… proposed answers include:

Productivity effects: resource allocation & factor endowments
(e.g., Kumar and Russell, 2002)

Technical change: technology diffusion & human capital
(e.g., Lucas, 1988; Romer, 1990; Prescott, 1998; Caselli and Coleman, 2006)

But…

Entrepreneurship & the global technology frontier

What explains the disparities in productivity across economies?

This is an old question… proposed answers include:

What about entrepreneurship? Two issues are worth mentioning…
1) Research on the connection between entrepreneurship and economic performance is limited…but growing!
(e.g., Lafuente, Szerb, and Acs, 2016; Prieger, Bampoky, Blanco and Liu, 2016)

Entrepreneurship & the global technology frontier

What explains the disparities in productivity across economies?

This is an old question… proposed answers include:

What about entrepreneurship? Two issues are worth mentioning…
2) At country level, entrepreneurship is catchy and hard-to-define

We use the concept of Entrepreneurial Ecosystem: the dynamic institutional setting backing entrepreneurship which drives resource allocation through new businesses (Acs, Autio and Szerb, 2014)

Entrepreneurship & the global technology frontier

What explains the disparities in productivity across economies?

How does entrepreneurship contribute to the economy (TFP)?

Efficiency effects → efficient mobilization of resources

Technical change → channeling innovations to the economy

Entrepreneurship & the global technology frontier

What explains the disparities in productivity across economies?

How does entrepreneurship contribute to the economy (TFP)?

Efficiency effects → efficient mobilization of resources

Catch-up effect

Kirznerian entrepreneurship (Kirzner, 1973)

Technical change → channeling innovations to the economy

Shift in technology curve

Schumpeterian entrepreneurship (Schumpeter, 1934)

Entrepreneurship & the global technology frontier

So, can we link TFP to different types of entrepreneurship?

First, some definitions are needed…

Country level total factor productivity (TFP)

- Technology: Countries use inputs (e.g., capital labor) to produce outputs (e.g., GDP)
- The input-output set forms the technology frontier
- Non-parametric approach → Malmquist TFP index (Grifell-Tatjé and Lovell, 2015)

Entrepreneurial ecosystem

- GEDI index (Acs, Autio and Szerb, 2014)

Entrepreneurship & the global technology frontier

So, can we link TFP to different types of entrepreneurship?

Second, the hypothesized effects…

Kirznerian entrepreneurship → productivity effect

- All entrepreneurs (productive and unproductive) fit Kirzner's definition
- Entrepreneurship function primarily relies in the exploitation of opportunities
- Kirznerian e-ship helps countries to move closer to the frontier (catch-up effect)

Entrepreneurial Ecosystem positively impacts **efficiency change**: evidence of enhanced resource exploitation (Kirznerian e-ship)

Entrepreneurship & the global technology frontier

So, can we link TFP to different types of entrepreneurship?

Second, the hypothesized effects…

Schumpeterian entrepreneurship → innovation effect

- For Schumpeter, entrepreneurs spark development by promoting innovations
- Entrepreneurship function primarily deals with 'creative destruction' processes
- Schumpeterian e-ship yields to technical change (shift of production curve)

Entrepreneurial Ecosystem positively impacts **technical change**: evidence of effective innovation processes (Schumpeterian e-ship)

Entrepreneurship & the global technology frontier

So, can we link TFP to different types of entrepreneurship?

Second, the hypothesized effects…

Graphically,

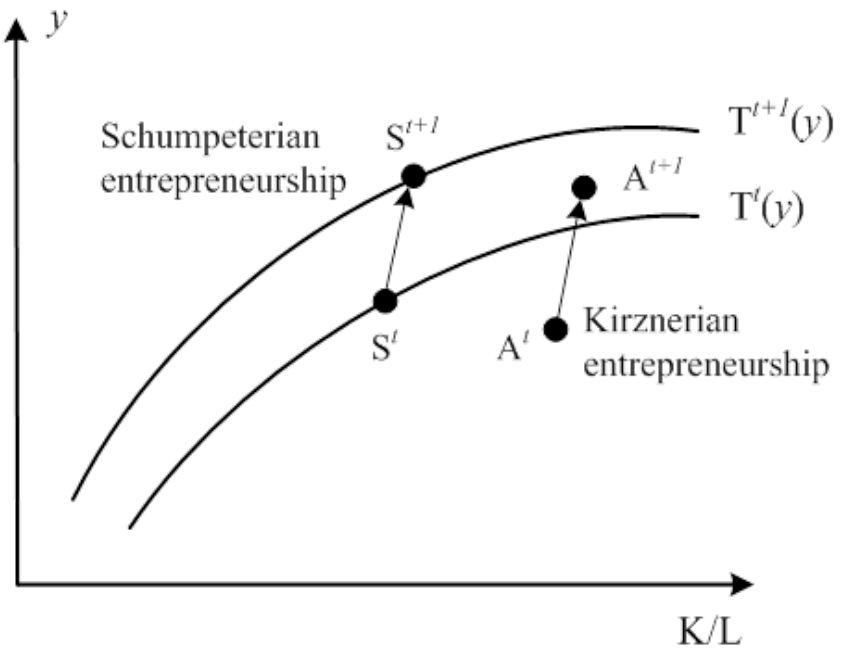
(1) $$Y = K^{\alpha}(AL)^{1-\alpha}$$

(3) $$TFP = \frac{Y(t)}{K(t)^{\alpha} L(t)^{1-\alpha}} = [E(t) \times W(t)]^{1-\alpha}$$

(5) $$M(\mathbf{x}^{t-1}, \mathrm{GDP}^{t-1}, \mathbf{x}^{t}, \mathrm{GDP}^{t}) = \left[\frac{D^{t}(\mathbf{x}^{t}, \mathrm{GDP}^{t})}{D^{t-1}(\mathbf{x}^{t-1}, \mathrm{GDP}^{t-1})}\right] \times \left[\frac{D^{t-1}(\mathbf{x}^{t}, \mathrm{GDP}^{t})}{D^{t}(\mathbf{x}^{t}, \mathrm{GDP}^{t})} \times \frac{D^{t-1}(\mathbf{x}^{t-1}, \mathrm{GDP}^{t-1})}{D^{t}(\mathbf{x}^{t-1}, \mathrm{GDP}^{t-1})}\right]^{0.50}$$

$$M(\mathbf{x}^{t-1}, \mathrm{GDP}^{t-1}, \mathbf{x}^{t}, \mathrm{GDP}^{t}) = EC \times TC$$

where $$D^{t}(\mathbf{x}^{t}, \mathrm{GDP}^{t})^{-1} = TE^{t} = \theta y^{t} / y^{t} \;\forall\; TE^{t} \geq 1$$



Entrepreneurship & the global technology frontier

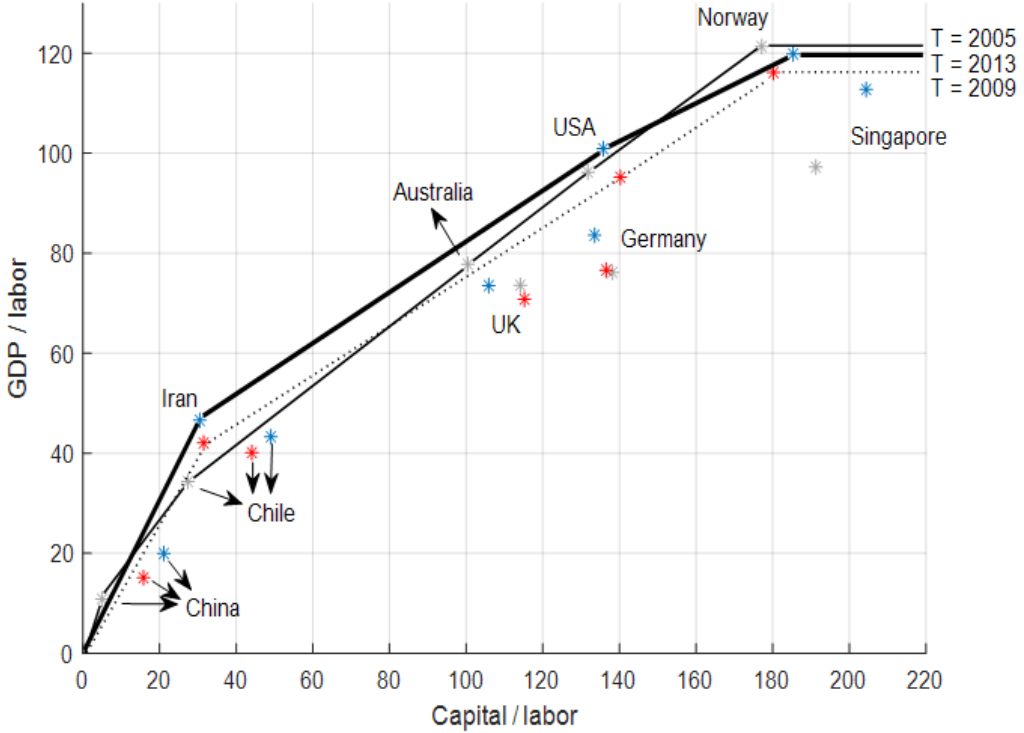
What can we say about the role of entrepreneurship over TFP?

The global technology frontier

Few countries shape the global frontier

Two country neighborhoods:
- Rich quarter: Norway and USA consistently on the frontier
- Poor quarter: Developing economies can also be efficient (in their neighborhood)

Efficiency is compatible with different levels of factor endowments



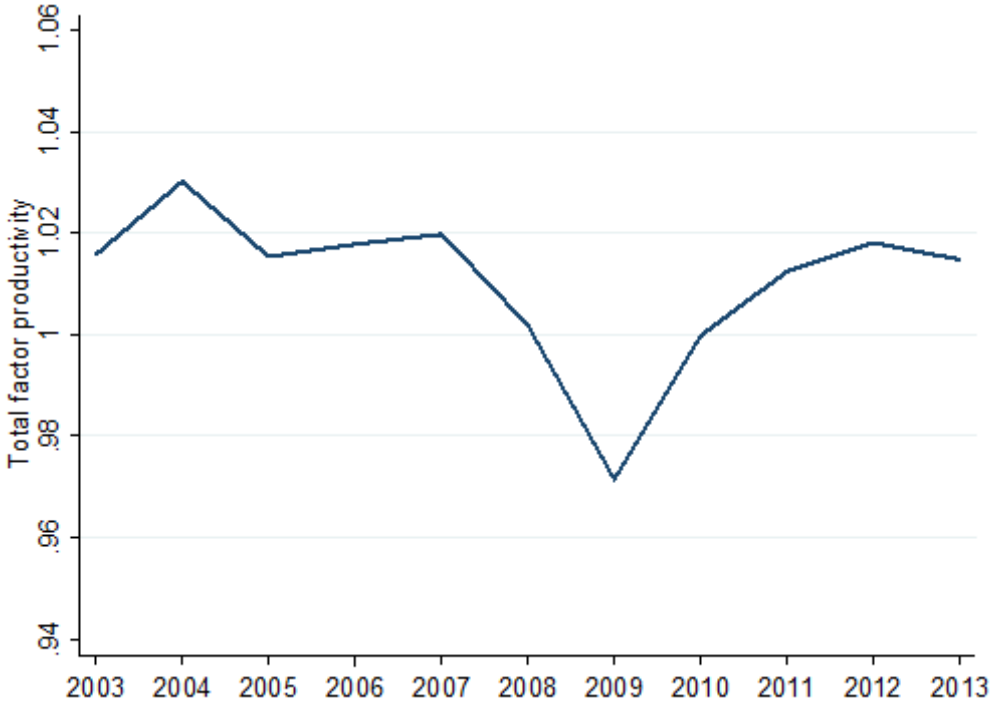
Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

TFP around the globe

TFP grew on average 1% annually
- Efficiency change: 0.91% annually
- Technical change: 0.13% annually

Our technology captures economic trends
Drastic fall in TFP associated with the economic crisis that hit most economies



Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

Entrepreneurial ecosystem and TFP: Regression results (Table 7)

	Fixed-effects models			Common factor models (CCEMG)		
	Total factor productivity (TFP)	Efficiency change (EC)	Technical change (TC)	Total factor productivity (TFP)	Efficiency change (EC)	Technical change (TC)
ln GEI index *t*-1	0.0535**	0.0522*	0.0573***	0.1452*	0.0417	0.0954**
	(2.28)	(1.83)	(2.96)	(1.86)	(1.39)	(2.28)
Capital deepening *t*-1 (ln capital stock / workers)	0.1068	–0.2582**	0.0439**	–0.5094**	–0.6656***	0.1851**
	(1.23)	(2.36)	(2.43)	(1.98)	(3.98)	(2.09)
Country size *t*-1 (ln GDP PPP)	–0.4803***	–0.4663***	–0.1269*	–0.3673**	–0.2940*	0.0297
	(3.70)	(3.18)	(1.95)	(1.97)	(1.82)	(1.21)
Domestic credit / GDP *t*-1	–0.0007	0.0029	–0.0169	0.1443	–0.0652	0.0183
	(0.04)	(0.16)	(1.63)	(1.54)	(0.41)	(1.59)
Intercept	3.2697***	2.5234**	1.6174***	4.0536**	2.5948*	1.5302***
	(3.03)	(2.16)	(5.24)	(2.46)	(1.86)	(4.62)
R2 (within)	0.5473	0.4971	0.6503			
F-test	6.53***	5.34***	10.04***			
	(*p* = 0.000)	(*p* = 0.000)	(*p* = 0.000)			
Wald test (chi2)				24.21***	19.61***	14.55***
				(*p* = 0.000)	(*p* = 0.000)	(*p* = 0.000)
RMSE	0.0247	0.0312	0.0179	0.0037	0.0040	0.0025
Residual diagnostics:						
CIPS test of stationarity (Pesaran, 2007)	I(1)	I(1)	I(1)	I(0)	I(0)	I(0)
CD test (Pesaran, 2004)	–3.85***	–2.19**	–2.13**	–1.29	–1.40	0.87
	(*p* = 0.000)	(*p* = 0.014)	(*p* = 0.017)	(*p* = 0.196)	(*p* = 0.163)	(*p* = 0.387)
Observations	403	403	403	403	403	403
Number of countries	45	45	45	45	45	45

Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

Entrepreneurial ecosystem and TFP: Regression results (Table 7)

Kirznerian entrepreneurship (Efficiency change):

The system of entrepreneurship DOES NOT contributes to TFP via Kirznerian entrepreneurship (efficient resource exploitation)

	Fixed-effects models			Common factor models (CCEMG)		
	Total factor productivity (TFP)	Efficiency change (EC)	Technical change (TC)	Total factor productivity (TFP)	Efficiency change (EC)	Technical change (TC)
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Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

Entrepreneurial ecosystem and TFP: Regression results (Table 7)

Schumpeterian entrepreneurship (Technical change):
A special case of economic function that DOES contribute to TFP by triggering changes in the countries' production function
(technical change)

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Capital deepening *t*-1 (ln capital stock / workers)	0.1068 (1.23)	–0.2582** (2.36)	0.0439** (2.43)	–0.5094** (1.98)	–0.6656*** (3.98)	0.1851** (2.09)
Country size *t*-1 (ln GDP PPP)	–0.4803*** (3.70)	–0.4663*** (3.18)	–0.1269* (1.95)	–0.3673** (1.97)	–0.2940* (1.82)	0.0297 (1.21)
Domestic credit / GDP *t*-1	–0.0007 (0.04)	0.0029 (0.16)	–0.0169 (1.63)	0.1443 (1.54)	–0.0652 (0.41)	0.0183 (1.59)
Intercept	3.2697*** (3.03)	2.5234** (2.16)	1.6174*** (5.24)	4.0536** (2.46)	2.5948* (1.86)	1.5302*** (4.62)
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Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

Entrepreneurial ecosystem and TFP: Contributions and policy

Country-level entrepreneurship: the definitional debate

Need to harmonize the definition and operationalization of country-level entrepreneurship (Acs, Autio and Szerb, 2014)

The debate is still open… this study provides evidence on the value of the system of entrepreneurship as an accurate variable to measure country-level entrepreneurship by considering the systemic interactions that govern entrepreneurial entry actions

Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

Entrepreneurial ecosystem and TFP: Contributions and policy

Country-level entrepreneurship: Policy

Entrepreneurship support programs would become sterile if entrepreneurs navigate in contexts that do not guarantee the effective exploitation of their knowledge

Policy makers should prioritize interventions that seek to improve the way through which the national system of entrepreneurship channels knowledge to the economy

Entrepreneurship & the global technology frontier

What can we say about the role of entrepreneurship over TFP?

Entrepreneurial ecosystem and TFP: Contributions and policy

Country-level entrepreneurship: Policy

Quantitative entrepreneurship: Policies that stimulate growth based on the mere formation of new firms are not beneficial to the economy (Lafuente, Acs, Szerb, 2022)

Qualitative entrepreneurship: In the long-run, successful growth should be grounded in policies that support Schumpeterian entrepreneurship—e.g., via financing innovations and the development of new technologies (Lafuente, Acs, Szerb, 2022)

Entrepreneurship & the global technology frontier

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