The optimism effect on country productivity and innovation activities

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Abstract

"This study focuses on how optimism translates into innovation outcomes. While the link has been established at a microeconomic level, its translation to an aggregate economic effect is still an open question. Empirical analysis draws from a yearly sample of 42 (mainly OECD) countries between 2000 and 2020 to test the effect of economic optimism on R&D measures from both the consumer's and producer's points of view at the aggregate level. Using modern econometric techniques that address potential endogeneity issues, the results suggest that economic optimism supports an increase in innovation activity and economic performance but not an increase in innovation outcomes, such as more patent production. The implication is that an economically optimistic environment is an important contribution to a nation's entrepreneurial ecosystem. This novel insight shows that firms need not specifically recruit optimistic individuals to reap the benefits of the optimism effect. Policies that encourage economic optimism can orchestrate an environment in which the benefits of the optimism effect are realized, independent of the individual personality traits of its citizens."

Purpose

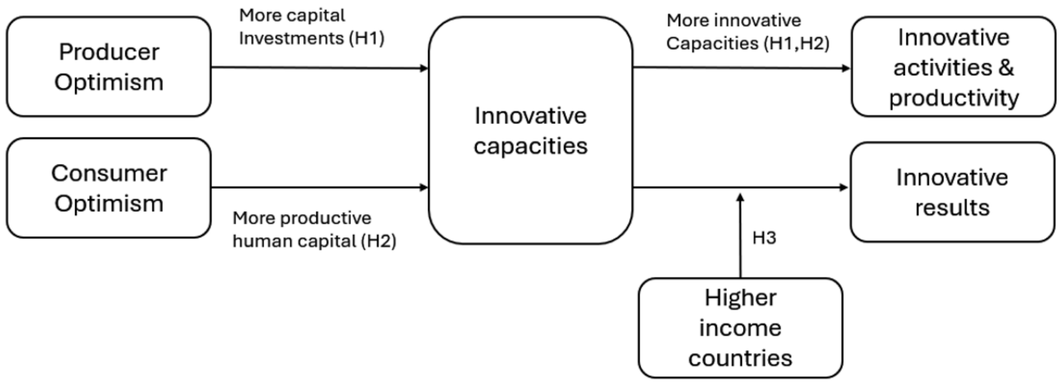
- Evidence support that an individual's level of optimism can enable its creativity, productivity, innovativeness & entrepreneurism.
- While the literature focus is mainly on an individual level, there is little attention on its effect on entrepreneurship, Innovation or productivity levels at the aggregate level.

We develop a theoretical model on how optimism from producers (firms) and consumers (individuals) can increase innovative capacities in an economy.

Hyp. 1: Producer optimism leads to greater innovative activities from greater capital investment in innovative capacities.

Hyp. 2: Consumer optimism leads to greater productivity and enables through more productive human capital.

Hyp. 3: Consumer and producer optimism have a greater effect on innovative results in high-income countries.



Methods and Materials

We empirically test our model using a panel data of 42 High & middle-income countries (ODCE plus) 2000-2019.

Model: $Inn_{i,t} = \boldsymbol{\alpha} + \boldsymbol{\beta_1} Inn_{i,t-1} + \boldsymbol{\beta_2} Opt_{i,t} + \boldsymbol{\beta_3} y_{i,t} + \gamma X_{i,t} + \varepsilon_{i,t}$.

- **Dep Var:** Innovative actions (R&D expenditure/GDP & Researchers in R&D, per million people) & Innovative outcomes (patent applications by residents, per GDP & Total factors productivity level from the Penn World Tables).
- **Ind Var:** Consumer confidence index (CCI) & Business confidence Index (BCI).
- **X:** Innovation usual controls (Access to credit, trade openness, tertiary ed. enrolment, formal institutional development).
- Given the persistence of innovative outputs to their previous year levels, we use Hansen, & Lee (2021) 'iterated overidentified Generalised Method of Moments' estimator, which captures dynamic features.
- We include Hwang et al. (2022) doubly corrected variance estimator to take into account overidentification bias & Roodman´s (2009) recommendations against Instrument proliferation.

Results

. Iterated GMM results.

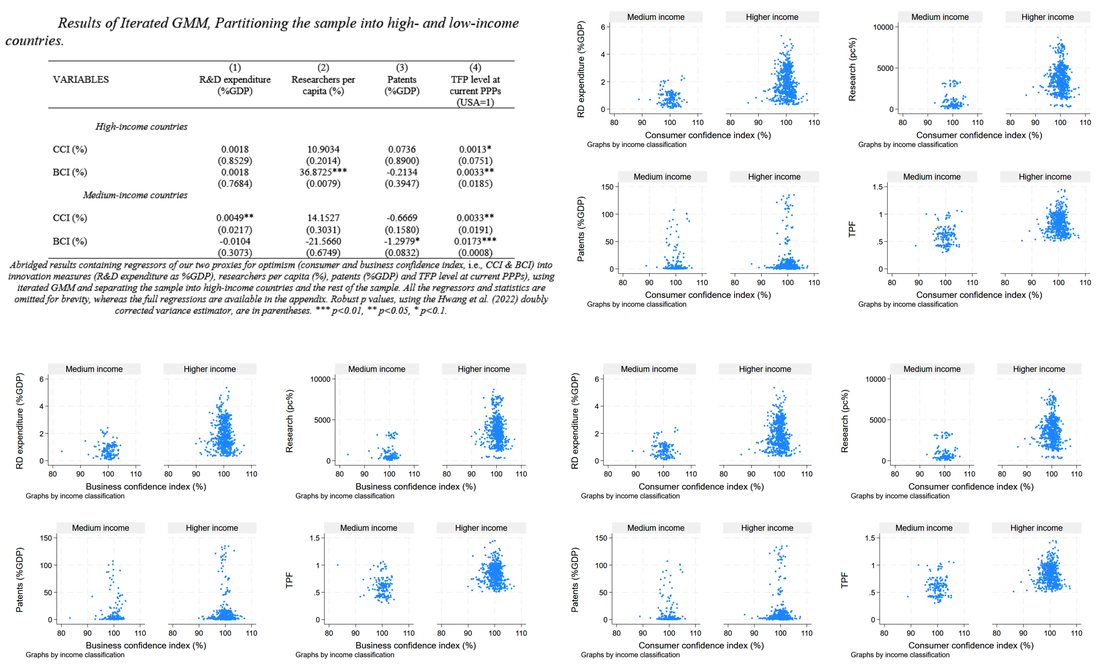
VARIABLES	(1) R&D expenditure (%GDP)	(2) R&D expenditure (%GDP)	(3) Researchers per capita (%)	(4) Researchers per capita (%)	(5) Patents (%GDP)	(6) Patents (%GDP)	(7) TFP level at current PPPs (USA=1)	(8) TFP level at current PPPs (USA=1)
CCI (%)	0.0004		6.4751		-0.1008		0.0030***	
	(0.8992)		(0.2269)		(0.4454)		(0.0020)	
BCI (%)		-0.0018		26.6844**		-0.1069		0.0040**
		(0.7625)		(0.0350)		(0.2236)		(0.0291)
Formal Institutions development	-0.0034	-0.0029	12.8087	13.6664	-0.1523*	-0.1784*	0.0021**	0.0019**
	(0.5246)	(0.5536)	(0.4179)	(0.4050)	(0.0823)	(0.0778)	(0.0356)	(0.0476)
Trade openness (%GDP)	0.0001	0.0001	0.4325	0.3670**	0.0037	0.0040*	-0.0000	-0.0000
	(0.3231)	(0.3903)	(0.1512)	(0.0428)	(0.1271)	(0.0551)	(0.4601)	(0.6941)
Credit to Privates Sector (%GDP)	0.0001	0.0001	0.7319**	0.9242**	0.0141*	0.0146**	-0.0001*	-0.0000
	(0.3978)	(0.5530)	(0.0195)	(0.0158)	(0.0923)	(0.0167)	(0.0762)	(0.2239)
Tertiary education	0.0004*	0.0004*	0.8464	1.1260	-0.0053	-0.0044	0.0001	0.0001
	(0.0731)	(0.0770)	(0.2445)	(0.1268)	(0.3789)	(0.3305)	(0.1197)	(0.2190)
Industry (%GDP)	-0.0009	-0.0008	-5.4676**	-6.5827*	0.1209*	0.1226**	0.0004	0.0003
	(0.4925)	(0.5166)	(0.0142)	(0.0543)	(0.0892)	(0.0197)	(0.2865)	(0.6010)
Agriculture (%GDP)	0.0013	0.0013	-5.3126	-5.2462	0.1228	0.1287	0.0006	0.0008
	(0.5901)	(0.5939)	(0.3881)	(0.4121)	(0.2356)	(0.1436)	(0.5373)	(0.5027)
Services (%GDP)	-0.0009	-0.0009	-8.4015***	-10.3516***	0.0622*	0.0651*	0.0004	0.0002
	(0.5712)	(0.5419)	(0.0050)	(0.0017)	(0.0639)	(0.0558)	(0.5041)	(0.8517)
AR(1)	1.0120***	1.0126***	0.9936***	0.9918***	0.9417***	0.9458***	0.9602***	0.9663***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	0.0324	0.2448	29.5275	-1,789.4310	3.1887	3.1715	-0.3028***	-0.3872**
	(0.9273)	(0.6824)	(0.9588)	(0.1115)	(0.7726)	(0.6896)	(0.0030)	(0.0140)
Observations	723	723	677	677	743	744	709	709
Number of countries	42	42	41	41	42	42	42	42
AR(1)	0.000	0.000	0.001	0.001	0.030	0.030	0.024	0.020
AR(2)	0.316	0.297	0.976	0.844	0.235	0.235	0.661	0.656
Sargan	0.240	0.280	0.528	0.469	0.392	0.514	0.686	0.337
Cragg-Donald	0.005	0.006	0.012	0.042	0.004	0.003	0.000	0.008
Instruments	36	36	36	36	36	36	35	35

Regression results using iterated GMM of the effect of optimism proxies on innovation measures. AR(1) and AR(2) are the p values for the Arellano–Bond test for autocorrelation of the first-differenced residuals in autocorrelation of orders 1 and 2. Sargan is the p value for the Sargan–Hansen test of the overidentifying restrictions. Cragg-Donald is the p value for the Cragg-Donald robust CUE-based (LM version) underidentification test. Robust p values, using the Hwang et al. (2022) *doubly corrected variance estimator, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1*

Results of Iterated GMM, Partitioning the sample into high- and low-income countries.

VARIABLES	(1) R&D expenditure (%GDP)	(2) Researchers per capita (%)	(3) Patents (%GDP)	(4) TFP level at current PPPs (USA=1)
High-income countries				
CCI (%)	0.0018	10.9034	0.0736	0.0013*
	(0.8529)	(0.2014)	(0.8900)	(0.0751)
BCI (%)	0.0018	36.8725***	-0.2134	0.0033**
	(0.7684)	(0.0079)	(0.3947)	(0.0185)
Medium-income countries				
CCI (%)	0.0049**	14.1527	-0.6669	0.0033**
	(0.0217)	(0.3031)	(0.1580)	(0.0191)
BCI (%)	-0.0104	-21.5660	-1.2979*	0.0173***
	(0.3073)	(0.6749)	(0.0832)	(0.0008)

*Abridged results containing regressors of our two proxies for optimism (consumer and business confidence index, i.e., CCI & BCI) into innovation measures (R&D expenditure as %GDP), researchers per capita (%), patents (%GDP) and TFP level at current PPPs), using iterated GMM and separating the sample into high-income countries and the rest of the sample. All the regressors and statistics are omitted for brevity, whereas the full regressions are available in the appendix. Robust p values, using the Hwang et al. (2022) doubly corrected variance estimator, are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.*



Scatterplot between business and consumer confidence indexes and all four innovation and productivity outputs, separated by income categorisation. Each point represents one country-year.

Key findings

Full sample:

- Results support the effect of business optimism on an increment of innovative activity (number of researchers), but not an increment in innovative performance or quality of those innovations (patents), (i.e. "More efforts, not tangible results").
- Results support an increment on performance (TPF), where the effect from businesses is higher than consumers. Falls under the logic that businesses innovation are more prone to being rather exploitative than explorative.

Subsamples by income levels:

- Where in High income countries the effect is on the number of researchers, in medium-income is on R&D expending.
- Possible reasons by economic characteristics in medium income countries:
  - Less incentives to do real innovations: imitative innovation, importing foreign technology, intermediate goods, or learning-by exporting. These require R&D expending, but with less researchers involved.
  - The positive effect of optimism into TPF is higher in medium-income countries.

Investment in technological capabilities spur productivity catch-up, & as the margins of productivity gains are lower in frontier economies.

Conclusions

- Suggest that the link between optimism and innovation is not straightforward.
  - Optimism supports an increment of innovative activity (R&D expending or number of scientists), not an increment in innovative performance (i.e. patents).
  - Optimism of medium-income countries supports higher TFP, and in high-income, R&D expending. Both fail in supporting patent production.
- The link on which optimism affect innovation in medium income economies is related to productivity factors. In underdeveloped economies the TPF measure is more related to productivity catch-up mechanisms and not new radical innovations.
  - The higher optimism levels of middle-income countries is not sufficient to unleash their innovative potential.
  - Opens venue for studying the effect of optimism on productivity.

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More information on the Published manuscript:
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References

1. Hansen, B. E., & Lee, S. (2021). Inference for iterated GMM under misspecification. Econometrica, 89(3), 1419–1447. doi:10.3982/ecta16274.
2. Hwang, J., Kang, B., & Lee, S. (2022). A doubly corrected robust variance estimator for linear GMM. Journal of Econometrics, 229(2), 276–298. doi:10.1016/j.jeconom.2020.09.010.
3. Roodman, D. (2009b). A note on the theme of too many instruments. Oxford Bulletin of Economics and Statistics, 71(1), 135–158. doi:10.1111/j.1468-0084.2008.00542.x