

**2nd International Conference on Sustainability in Technological,
Environmental, Law, Management, Social and Economic Matters
(ICOSTELM 2023)**

**INNOVATION CAPACITY AND ECONOMIC GROWTH: EMPIRICAL
ESTIMATION FOR CEE COUNTRIES**

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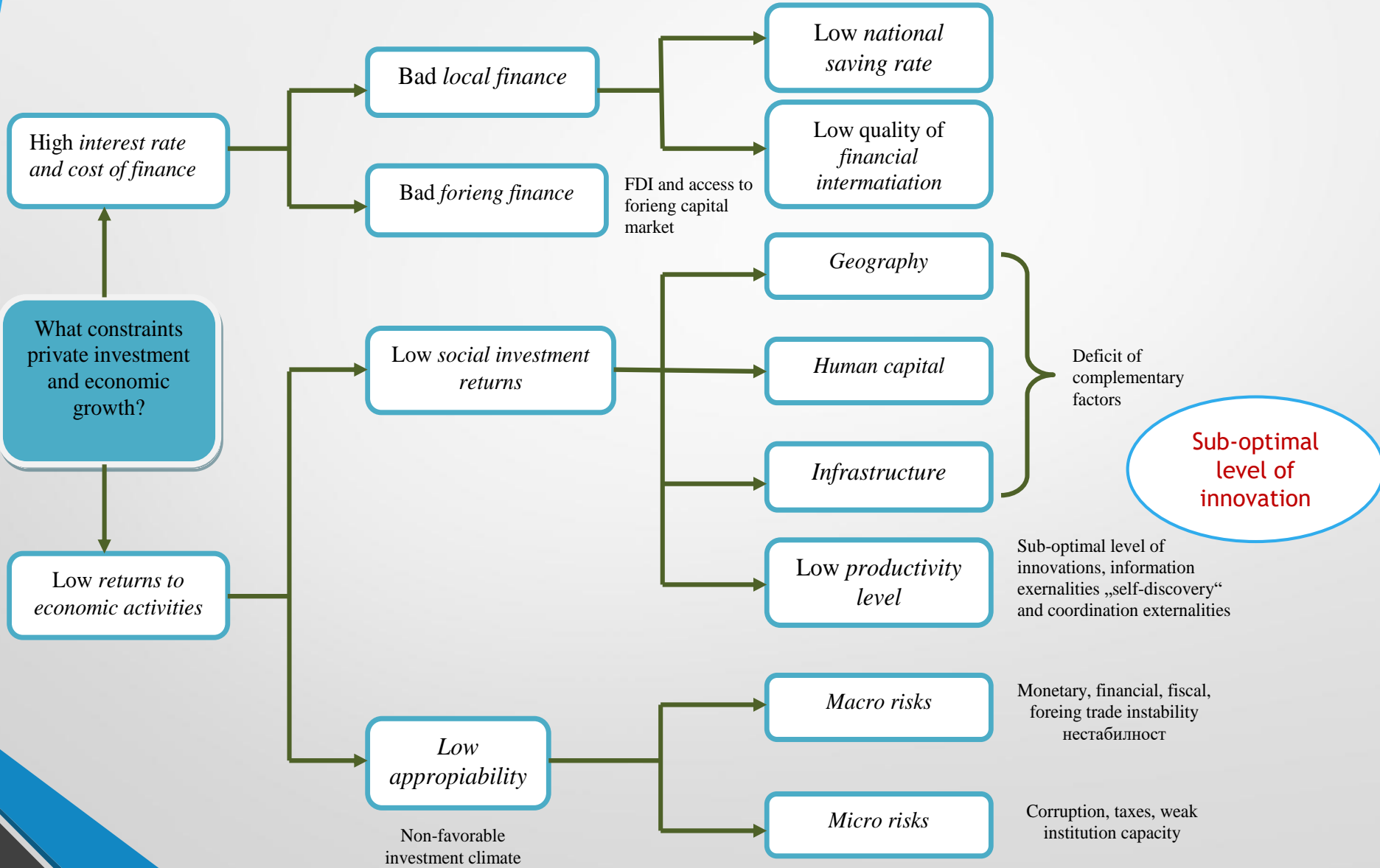
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Lampung - Indonesia, 2023

Introduction

- **The main goal of the paper is** to test the link between innovation and economic growth in CEE countries with special focus on North Macedonia
- **Theoretical background** (Innovation based-growth models and HRV growth model)
- **Methodological framework** (growth accounting based on production approach, GMM panel regression analysis and international benchmarking)

Growth diagnostic and HRV growth model



Growth accounting based on production approach

$$g_Y = g_A + ag_K + bg_L$$

$$a = \frac{\Delta Y / Y}{\Delta K / K} \cong \frac{\partial Y / Y}{\partial K / K} = \frac{MP_K K}{Y}$$

$$b = \frac{\Delta Y / Y}{\Delta L / L} \cong \frac{\partial Y / Y}{\partial L / L} = \frac{MP_L L}{Y}$$

	Sources of economic growth	Coef. <i>a</i> and <i>b</i>	Growth rate, %	Absolute contribution%	Relative Contribution n %
A	Labor (L)	0.60	1.40	0.84	35,75
B	Capital (K)	0.40	2.00	0.8	34,03
C	Total factor productivity (TFP/A)			0.71	30,23
	TOTAL	1		2.35	100

Decomposition of Total Factor Productivity - TFP

$$b(\Delta L^*/L^*) = b\left(\frac{L}{L^*}\right)\left(\frac{\Delta L}{L}\right) + b\left(1 - \frac{L}{L^*}\right)\left(\frac{\Delta L}{L}\right) + b\left(\frac{\Delta(L^*/L)}{(L^*/L)}\right)$$

	Sources of economic growth	The rate of growth	Absolute contribution	Relative Contribution
A	Factor accumulation	3.40%	1,64	69,78%
B	„Unqualified“ labor	1.40%	0,84	35,75
C	Capital	2.00%	0,8	34,03%
D	Total factor productivity - TFP	0,71%	0,71	30,23
E	Technological progress	0,19%	0,19	8.5%
F	Improvement in education structure	0,52%	0.52	21,7%
	Gross Domestic Product	2.35%	2,35	100

Panel GMM regression analysis of innovation and economic growth in the CEE countries

$$g = \gamma_0 + \gamma_1 \ln Innov + \gamma_2 \ln Hum + \gamma_3 \ln Ex + \gamma_4 \ln Invest + \varepsilon_i$$

The outcome variable in the model is economic growth measured by the **natural logarithm of real GDP per capita** in different time periods, while the independent variables as determinants of economic growth for analyzed group of the CEE countries are:

- 1) *Innovation capacity* measured by **royalty payments, number of patents, journal articles and GERD**;
- 2) *Human capital* measured by gross enrolment in primary, secondary and tertiary education, education spending and number of teachers per student);
- 3) *Investment rate* - private and public capital investment as a share of GDP;
- 4) *Export* measured as a percentage of real GDP; and
- 5) *Bank credits* to the domestic private sector as a percentage of GDP

The econometric model and estimated results

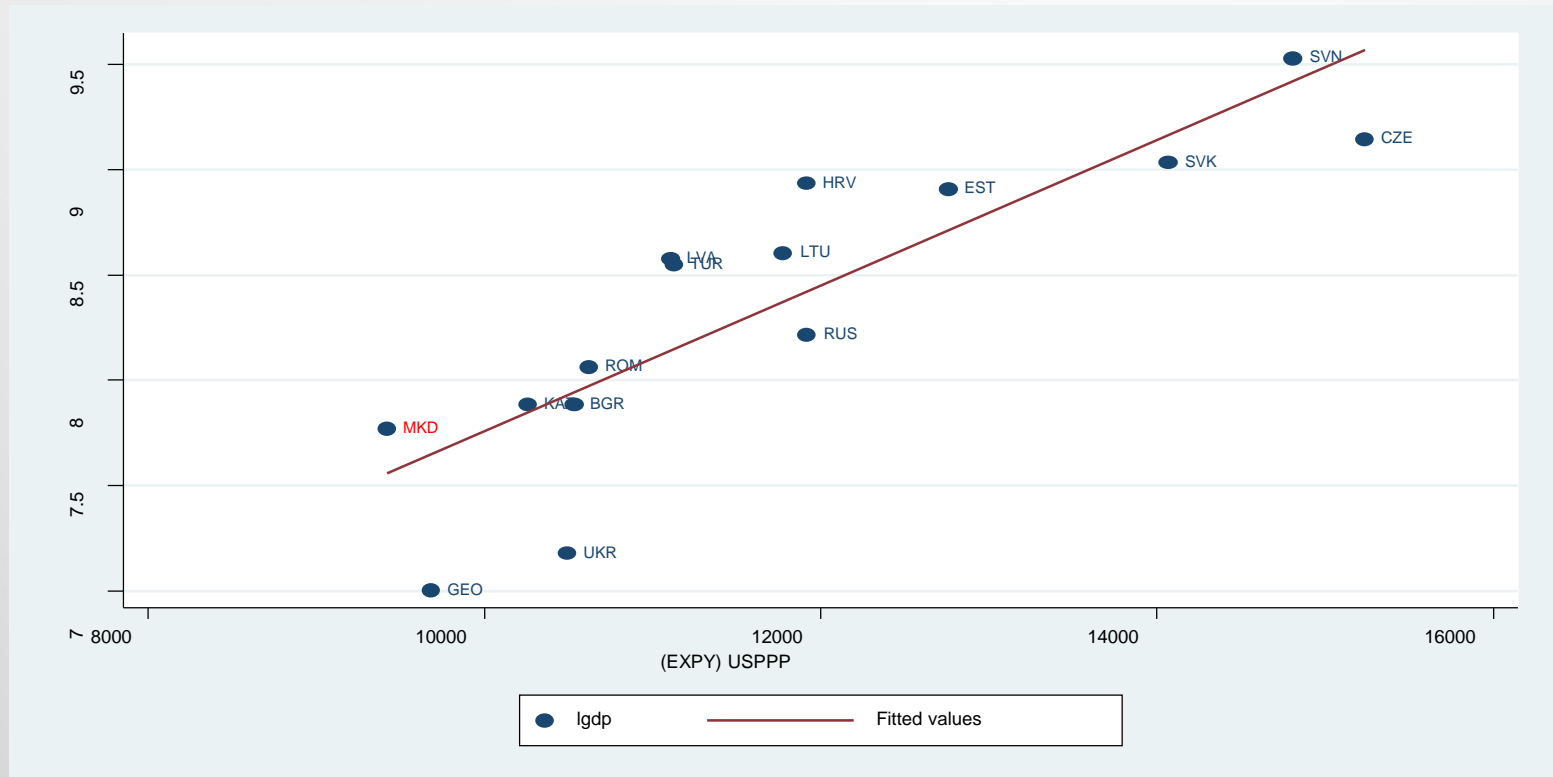
	OLS Panel regression	Fixed effects model
DEPENDENT VARIABLE: Log of real GDP		
INDEPENDENT VARIABLES:		
Innovation capacity	0.642*** (0.175)	0.124** (0.036)
Investment in human capital	2.672*** (0.774)	1.149*** (0.561)
Export, % of GDP	0.178*** (0.0346)	0.534** (0.384)
Bank credit to private sector, % of GDP	0.227** (0.0911)	
Investment rate		0.523** (0.347)
Constant	-5.155* (2.762)	-7.709** (2.940)
Observation	99	101
R-adjusted	0.696	0.474

Standard errors in

*** p<0.01, ** p<0.05, * p<0.1

Source: Author calculation

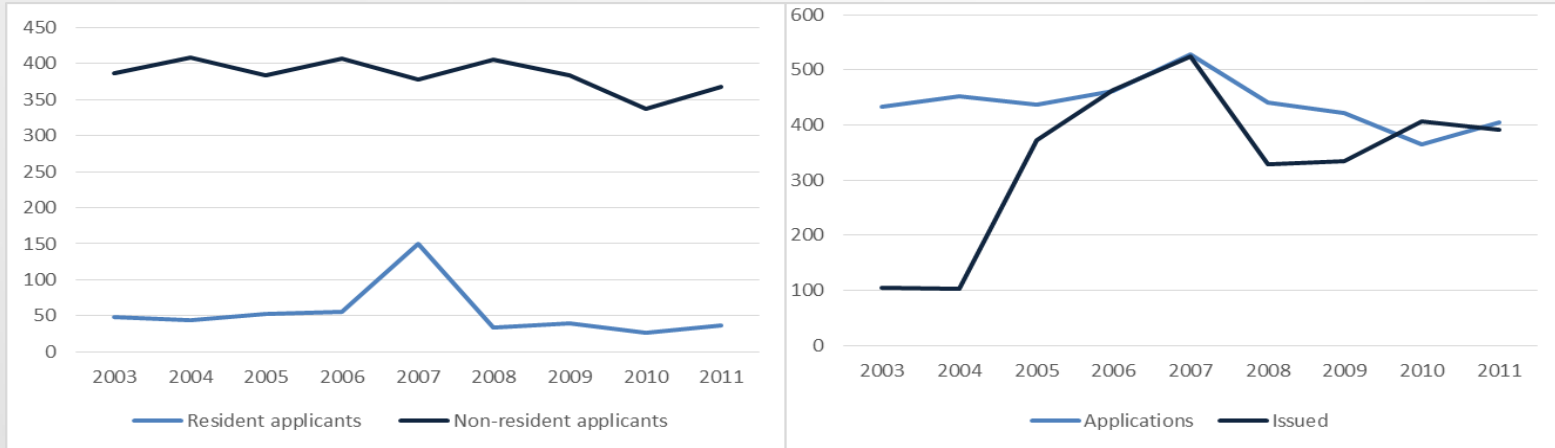
Graphical presentation of the correlation between innovation capacity measured by the product and export sophistication and the economic performance of CEE countries



It is obvious that North Macedonia in this segment is presented as a negative outlier


The analysis of national innovation capacity

Number of applications and issued patents, by the origin of applicants



$$\ln Patents = \alpha_0 + \alpha_1 \ln(GDP / capita) + \alpha_2 \ln(GERD) + \alpha_3 Education + e_i$$

Variable	Coefficient	Standard Error	T-stat
Ln GDP per capita, PPP\$	0.8304339	0.240312	3.46
Human capital measured as average years of education	1.172034	0.6201607	1.89
General expenditure of Research and Development (GERD), % of GDP	0.7557995	0.2922528	2.59
Constant	-21.24028	2.052689	-10.35
			R²=0.6817

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Thank you for your attention!