



# DOES INNOVATION PROMOTE REGIONAL ECONOMIC DEVELOPMENT? EVIDENCE FOR COUNTRIES IN EUROPE AND CENTRAL ASIA

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## ABSTRACT

The aim of this study is to assess the relationship between innovation and economic development in a sample of 47 countries from Europe and Central Asia for the years 1990-2020. We use patent applications per 100,000 people as a proxy for innovation. Our results suggest increase in the number of patents per 100,000 people by 10 (slightly less than 1 standard deviation) is associated with 3.4% increase in GDP per capita. The results remain robust after accounting for determinants of economic growth.

## CCS CONCEPTS

• innovation; • patents; • economic development;

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## 1 INTRODUCTION

The literature on econometric modeling economic growth has skyrocketed since 1990's [1-2]. However, in a seminal paper by Solow [3] there has been consensus in the theoretical and empirical research that innovation is one of the core drivers of economic growth in developed and developing countries. For example, Pece et al. [4] using data for CEE countries explore the relationship between innovation and economic growth. The study relies on R&D, number of patents and investment in technology as measures of innovations. The study shows that overall innovation has significant positive impact on GDP growth. Maradana et al. [5] assess the relationship between innovation and GDP growth, using data for 19 EU countries

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for the years 1980-2014. The study relies on patents, R&D spending, scholarly output as proxies for innovation. Using Granger causality tests, the study finds mixed results on the innovation-growth nexus. However, the study highlights that overall innovation is important for long-run economic growth. Lebel [6] relies on a panel of more than 100 nations over the period 1980-2005 to explore the links between institutions, innovation and economic progress. The study finds that creative innovation has significant positive implications for economic growth across nations even after accounting for institutions and other variables.

The goal of the study is to offer novel evidence on the relationship between innovation and economic growth focusing on a panel of 47 countries in Europe and Central Asia as classified by World Bank. We use data for the period 1990-2020 which allows us to maximize the period of analysis. Using OLS regression method with robust standard errors we find that innovation as proxied by patent applications per 100,000 people has significant positive effect on GDP per capita. The results hold even after including a rich set of confounding variables. The policy implications are discussed.

## 2 DATA, METHODS AND THEORETICAL FRAMEWORK

We use data for 47 countries from Europe and Central Asia for the years 1990-2020. Our data was collected from World Bank's Development Indicators Database. We proxy economic development with GDP per capita adjusted for purchasing power parity at constant 2017 prices. This allows us to account for inflation and exchange rate differences. As a measure of innovation, we use number of patent applications per 100,000 people. Patents reflect a strong measure of country's innovative activity.

In our study, we formulate that economic development is driven by a number of pillars. The core pillar is innovation which increases efficiency and raises total factor productivity. The other pillars are human capital, foreign capital, demographic changes, globalization and external sector (tourism and remittance inflows). The role of these factors has been highlighted by related research [7-9].

Based on this theoretical framework, we estimate an econometric model that can be expressed as:

$$ED = a_0 + a_1 Innovation + a_2 FDI + a_3 HC + a_4 Demography + a_5 Globalization + a_6 Tourism + a_7 Remittance$$

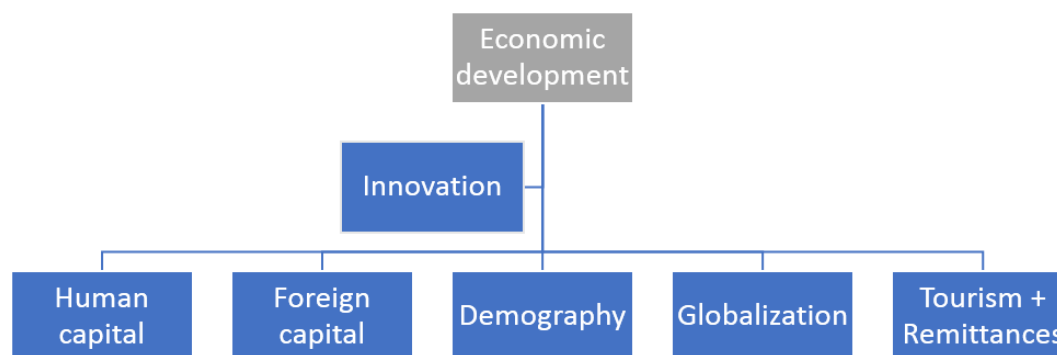


Figure 1: Theoretical framework

Table 1: Correlation matrix

	GDP	Innovation	FDI	Human capital	Globalization	Demography	Tourism	Remittances
GDP	1							
Innovation	0.5093	1						
FDI	0.0568	-0.1079	1					
Globalization	0.2104	-0.1398	0.1789	1				
Human capital	0.6921	0.5047	0.0036	0.1791	1			
Demography	0.7321	0.4839	0.019	0.1248	0.5796	1		
Tourism	-0.1349	-0.3371	0.075	-0.1562	-0.224	-0.1969	1	
Remittances	-0.5769	-0.3038	0.0006	0.0625	-0.3375	-0.5603	0.2833	1

where ED is GDP per capita, a proxy for economic development, Innovation is number of patents per 100,000 people, FDI is foreign direct investment as % of GDP, Demography is urbanization rate, Globalization is proxied by trade openness as % of GDP, tourism is share of tourism in export and remittances is expressed as % of GDP. We estimate this equation with the aid of ordinary least squares method in Stata 16. In order to account for heteroskedasticity we use robust standard errors. Table 1 presents the correlation matrix. As it is evident, innovation, human capital and demography has the highest correlation with GDP per capita. This suggest that knowledge economy is instrumental to support economic progress. In contrast, tourism and remittances have negative correlation with GDP per capita.

### 3 RESULTS

Figure 2 presents visual relationship between innovation proxy (patents) and logged GDP per capita for the year 2015. As it can be seen, the relationship is positive and significant suggesting that more intense innovative activity leads to higher rates of economic progress.

We further offer econometric results in Table 2. Column 1 offers bivariate relationship between innovation and economic development. The coefficient is positive and significant, highlighting the importance of direct and indirect effects of innovation for long-run economic progress. The results imply increase in the number

of patents per 100,000 people by 10 (slightly less than 1 standard deviation) is associated with 3.4% increase in GDP per capita. However, it is important to consider the role of other variables that may affect the innovation-GDP nexus. In column 2, we include remaining variables. We add foreign capital, globalization, demographic transitions, tourism sector and remittances. Of these variables, FDI, globalization, human capital, demography has positive link with GDP per capita, while remittances are inversely linked to economic development. For example, 10% increase in FDI inflows is associated with 1% increase in GDP per capita. One percent increase in tourism share in GDP leads to 1.4% increase in GDP. Innovation remains positive and significant, at the 1% level. In order to account for the effects of time trends, we include year fixed effects in column 3. Again, the coefficient for innovation is unaffected and significant. Overall, the model explains 73% of GDP per capita. F-values across all models exceed 10, suggesting the overall significant fit of the GDP model.

### 4 HISTORY DATES

This study offers additional evidence on the relationship between innovation, knowledge economy and economic progress focusing on countries in Europe and Central Asia. The econometric modeling findings show that innovation is important aspect of economic development in the region. At the same time, the study also shows that foreign capital, human capital and globalization can also boost

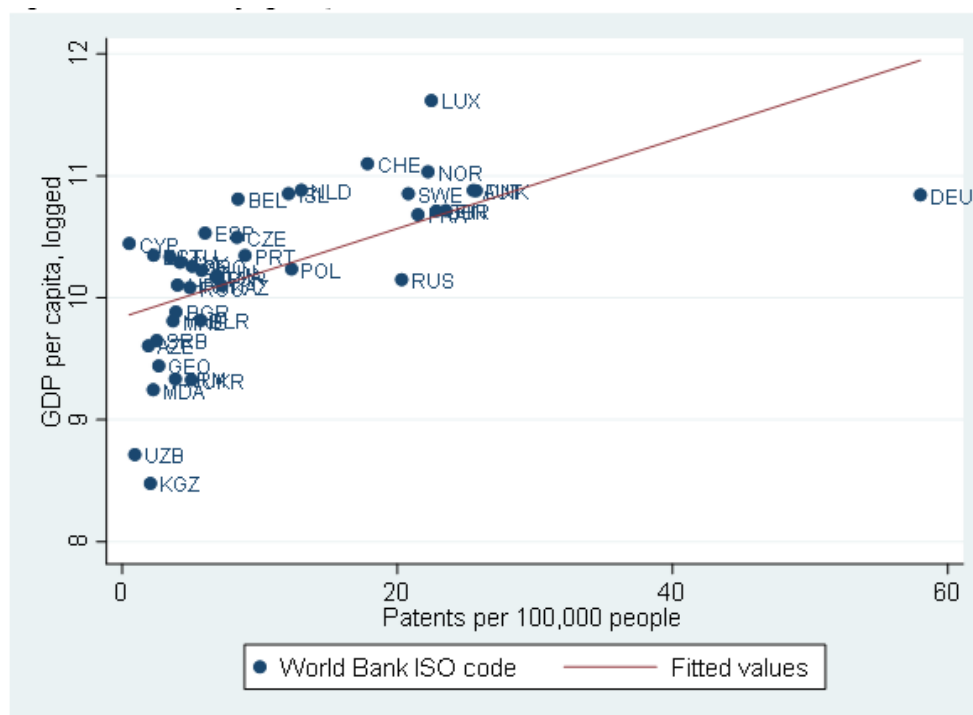


Figure 2: GDP per capita and innovation proxy, year = 2015

Table 2: OLS results

	I	II	III
Innovation	0.0344 (20.41)***	0.0124 (10.87)***	0.0156 (11.68)***
FDI		0.0010 (2.06)**	0.0009 (1.85)*
Globalization		0.0031 (8.52)***	0.0030 (8.60)***
Human capital		3.0451 (12.15)***	2.0428 (8.59)***
Demography		0.0158 (9.76)***	0.0164 (10.39)***
Tourism		0.0141 (9.48)***	0.0139 (9.42)***
Remittances		-0.0370 (12.94)***	-0.0421 (14.16)***
Constant	9.5870 (287.80)***	6.1349 (32.07)***	6.6846 (32.48)***
R2	0.25	0.73	0.75
F-value	416	292	65
N	1,190	824	824

\* p<0.1; \*\* p<0.05; \*\*\* p<0.01

GDP in the region. Therefore, this paper calls for multidimensional approach to attain sustainable development in the region.

In order to promote economic progress, it is important to invest in human capital, establish measures for innovative environment and attract foreign capital. For example, allocating more research grants for scholars, increase in R&D expenditure relative to GDP, focusing on promoting innovation across regions can be used as a good tool to spark innovative activities in the region. Moreover, greater integration of science, academia and private sector can lead to higher rates of scientific commercialization, which in turn creates job, goods, services and promotes GDP. Considering high share of youth as percent of total population in the region, it is recommended to increase popularization of IT, science and innovation in schools and universities.

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