

Innovation Capacity Indicators, Personal Freedoms, and GDP Growth Rates

Michael Ickowitz

PhD Student

Department of Sociology



THE UNIVERSITY OF
TENNESSEE
KNOXVILLE

Introduction

The U.S. Federal Government in 2015 made a direct investment of \$135.4 billion in R&D

Billions of dollars alone in the United States alone are invested in STEM (Science, Technology, Engineering and Math) education and workforce development

Prevalent thinking is that investing in innovation capacity and scientific workforce development is the answer to American security, global competitiveness, and becoming a knowledge-based economy

Motivation

Budget uncertainty and instability in science workforce development programs threatened by:

- Budget Reductions
- Sequestration
- Government shutdowns

The fate of science funding (including social sciences) is (often) in the hands of non-scientist law makers who determine the value of science in society

Research funding and investment in innovation infrastructure needs to be defended annually

American (Government) Investment

Table 1. R&D in the FY 2015 Budget by Agency
(budget authority in millions of dollars)

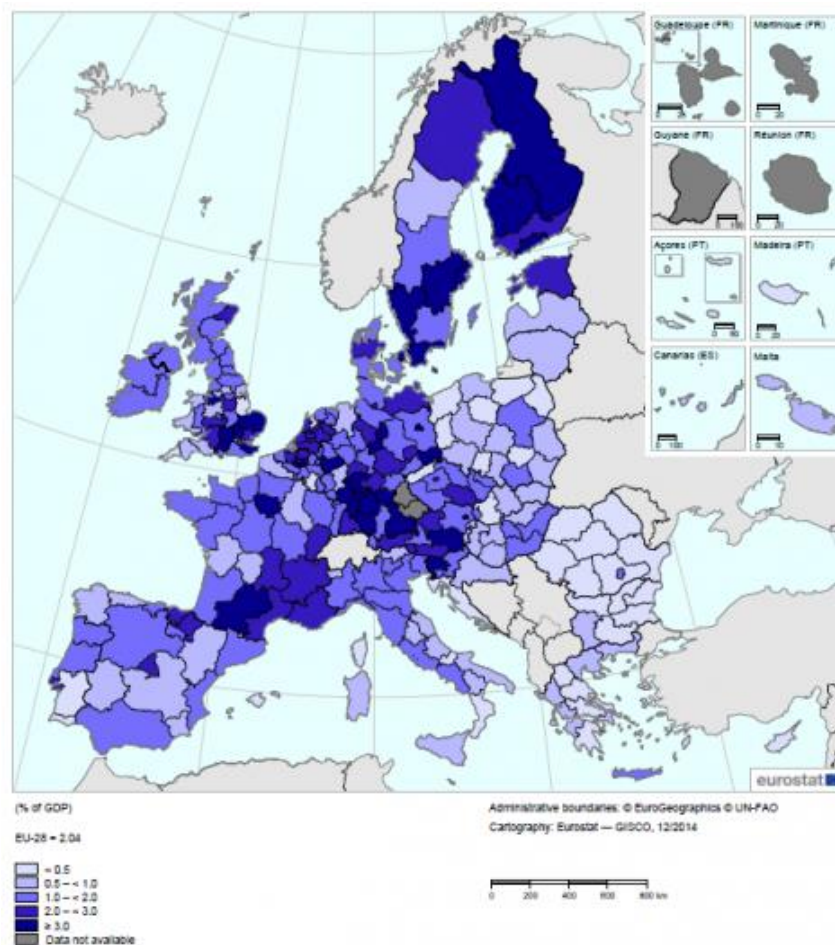
| | FY 2013 | FY 2014 | FY 2015 | Change FY 14-15 | |
|------------------------------|---------|----------|---------------|-----------------|---------|
| | Actual | Estimate | Budget | Amount | Percent |
| Defense R&D | 68,065 | 68,272 | 69,465 | 1,193 | 1.7% |
| Nondefense R&D | 62,267 | 65,410 | 65,887 | 477 | 0.7% |
| Basic Research | 30,648 | 32,410 | 32,079 | -331 | -1.0% |
| Applied Research | 31,199 | 32,059 | 32,641 | 582 | 1.8% |
| Total Research | 61,847 | 64,469 | 64,720 | 251 | 0.4% |
| Development | 66,614 | 66,477 | 68,017 | 1,540 | 2.3% |
| R&D Facilities and Equipment | 1,871 | 2,736 | 2,615 | -121 | -4.4% |

OSTP - March 2014

European R&D Domestic Spending

%GDP 2011

<http://ec.europa.eu/eurostat>



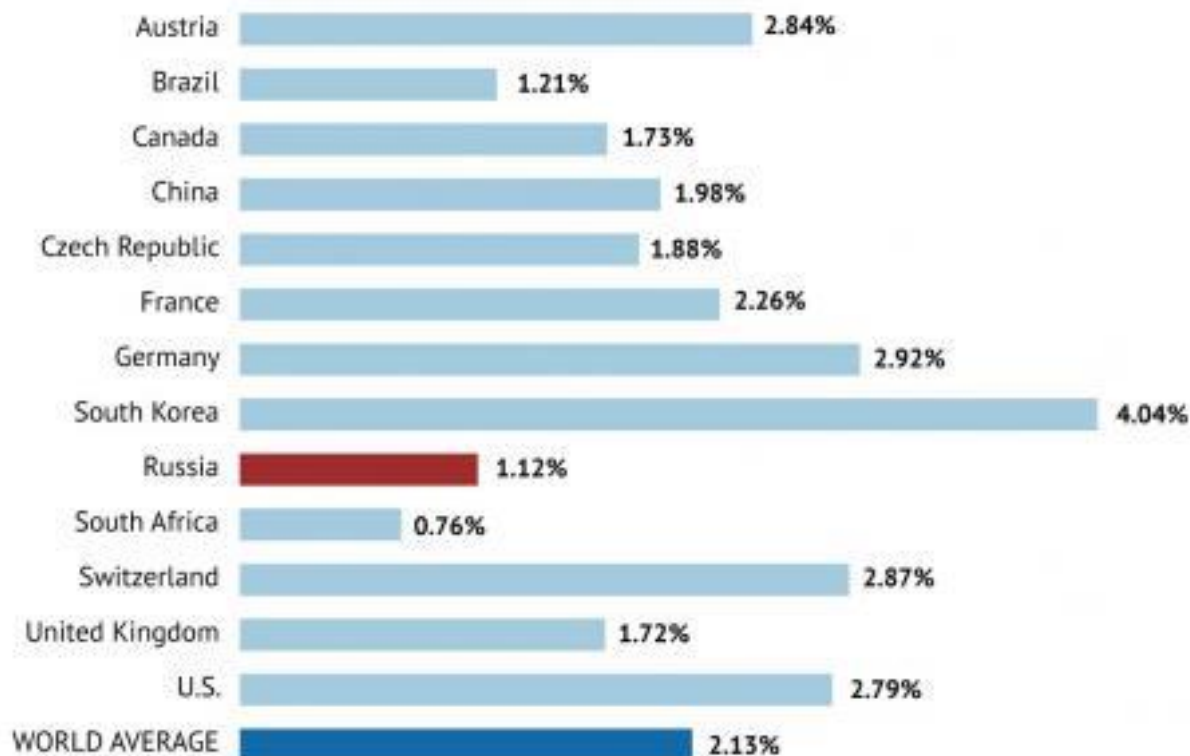
(*) Data for IE and NL are estimates.

(**) GDP data in this map are based on the ESA 95 methodological framework, as at the time of producing this map the Eurostat database was still in the process of transition to national accounts data compiled on the upgraded methodological framework ESA 2010.

Russian R&D Expenditures

EXPENDITURES FOR R&D

The amount of money directed to research and development is one indicator of a country's technological advancement. This shows the percentage of GDP that selected countries set aside for R&D from 2005-2012.



Source: World Bank World Development Indicators

Copyright Stratfor 2015 www.stratfor.com

Innovation Capacity

From an economic standpoint, innovation capacity consists of:

- Strategies and initiatives that interest, educate, and train individuals and provide the infrastructure to meet the needs of current and future science industries
- Maintain a sustainable competitive scientific advantage globally, as well as the value placed on those that train in these fields
- An infrastructure capable of supporting innovation, entrepreneurship, and capital gain and reinvestment

Research Question

Do government investments in a nation's innovation capacity and trust in government result in greater societal and economic prosperity?

Given resources to make these investment, is personal freedom measurably impacted as a result of these prosperities?

Definitions

Entrepreneurship & Opportunity:

Infrastructure investments that remove barriers to entrepreneurship and innovation: Research funding, internet infrastructure, tax incentives

Governance:

Stability of government measured by corruption, effectiveness, ability to voice concern, separation of powers

Personal Freedom:

Citizen freedom of expression, belief, association, trust in government, and personal autonomy

Data Description

Legatum Prosperity Index™ - Legatum Institute

Index of national prosperity based on both income and wellbeing.

- 89 Variables
- 8 Indices
- 142 Nations
 - Economy
 - Entrepreneurship and Opportunity
 - Governance
 - Education
 - Health, Safety and Security
 - Personal Freedom
 - Social Capital

Annual percentage growth rate of GDP - World Bank

Growth at market prices based on constant local currency for 214 nations

WIPO Statistics - World Intellectual Property Organization

Total Patent filing count by applicant's nation of origin

OLS regression using GDP % change as dependent variable

5 models - each representing data for a single year for each year from 2009 through 2013

Why 2009-2013?

4/5 Models show that holding other variables constant, that there is a direct correlation between increasing the innovation capacity of a nation and an increase in GDP % change.

No model showed a statistical significant influence that the number of patents filed had on GDP percentage change

OLS regression using overall national prosperity as dependent variable

5 models - each representing data for a single year for each year from 2009 through 2013

All 5 Models show that holding other variables constant, that there is a direct correlation between increasing the innovation capacity of a nation and an increase in the overall prosperity.

No model showed a statistical significant influence that the number of patents filed had on GDP percentage change

Results

Table 1: OLS Regression Analysis of Patents Filed and Entrepreneurial Rankings on GDP Percentage Change, 2009-2013

| | Model 1 2009 | Model 2 2010 | Model 3 2011 | Model 4 2012 | Model 5 2013 |
|---------------------------------|-------------------|-------------------|-----------------|-------------------|------------------|
| Patents Filed | .0001 (.0001) | .0001 (.0001) | .0130 (.172) | .0001 (.0001) | .0001 (.0001) |
| Entrepreneurial Rankings | .105*** (.013) | .053*** (.705) | .019 (.017) | .041*** (.010) | .021 (.015) |
| Constant | -6.659*** | 1.4076* | 2.668*** | .544 | 1.58 |
| R-Squared | .372 | .194 | .038 | .137 | .019 |
| N | 101 | 102 | 103 | 104 | 104 |
| F | 29.02*** | 11.91** * | 2.01 | 8.04*** | .362* |

Results

Table 2: OLS Regression Analysis of Patents Filed and Entrepreneurial Rankings on Prosperity Index rankings, 2009-2013

| | Model 1 2009 | Model 2 2010 | Model 3 2011 | Model 4 2012 | Model 5 2013 |
|-------------------------------------|------------------|------------------|------------------|------------------|-----------------|
| Patents Filed | .0001 (.0001) | .0001 (.0001) | .0001 (.0001) | .0001 (.0001) | -.0001 .0001 |
| Entrepreneurial Rankings | .964*** .029 | .959*** .028 | .955*** .028 | .949*** .031 | .942*** .031 |
| Constant | 1.97 | 1.94 | 2.25 | 3.02 | 3.35 |
| R-Squared | .919 | .924 | .923 | .900 | .905 |
| n | 101 | 102 | 103 | 104 | 104 |
| f | 559.83*** | 609.47*** | 604.74*** | 488.67*** | 481.38*** |

Results

Table 3: OLS Regression Analysis of Entrepreneurship and Opportunity on Personal Freedoms 2009-2013

| | Model 1 2009 | Model 2 2010 | Model 3 2011 | Model 4 2012 | Model 5 2013 |
|-------------------|---------------------|---------------------|---------------------|---------------------|---------------------|
| Personal Freedoms | .6597*** (.0728) | .6540*** (.0733) | .6369*** (.0751) | .6027*** (.0772) | .6018*** (.0774) |
| Constant | 18.943*** | 19.250*** | 20.129*** | 22.145*** | 22.154*** |
| R-Squared | .434 | .426 | .401 | .362 | .306 |
| N | 109 | 109 | 109 | 109 | 109 |
| F | 82.05*** | 79.53*** | 71.82*** | 60.87*** | 60.33*** |

Results discussion

The analysis provides evidence that investment in a strong entrepreneurial climate has a positive effect on GDP growth, personal freedoms, and overall societal prosperity.

Finding raises new questions in what societal forces are present that impact the investments or efforts made to strengthen these factors and what if any societal barriers exist to prevent those efforts.

Data represents choices made by governments, and in turn represent national/societal priorities. The combination puts sociology in a unique position to study this phenomenon.

Results Discussion

If innovation capacity is operationalized as an economic strategy which aims to ensure continued workforce stability by investing in the intellectual talent and quality of future scientific labor, it then becomes a crucial contributor to economic growth and therefore is of critical significance to modern society (Aguinis and Kraiger 2009).

Societal effort is driven by the needs of individuals, for the overall betterment of society (Haralson 2010).

From a societal perspective, innovation capacity investment and growth is integral to the future economic stability and growth, without which modern societies cannot function (Dahms 2014).

Theoretical Approach

World systems – Does ‘Brain Drain’ explain the lack of investment (causality or result)?

Class Theory – Are nations stratified in to class by innovation? What are the consequences and are these lessons to be learned of what the lack of innovation means to a nation? Is this a source of tension/conflict?

Societal Choice – Does an investment in innovation reflect the attitudes and values of a society? What drives this?

Theoretical Approach

Competition state – Does the Schumpeterian notion that innovation is an activity that creates economic growth of the competition state apply here? Does it explain the global economic system as dynamic and open because new national investments and innovations can enter the system, causing hegemonic influence of states to rise and fall?

***Evolutionary Modernization** - Does survival in the global economy of today and tomorrow dictate that innovation is a paramount need? What are the consequences for failing to adapt?

*6th LCSR International Research Workshop

Additional Analysis

Control factors to be explored:

Region and sub-region

Government type (model and level of stability)

Additional data collection:

Student and scholar movement

Barriers to Education

Longitudinal study

Corporate Investment and Incentives

Thank You

Index

| Variable | Definition | Source |
|---|---|---|
| Business Start-up Costs | Start-up business costs measured as share of GNI per capita. (Logged value). | World Development Indicators |
| Good Environment for Entrepreneurs | Survey question: "Is the city or area where you live a good place or not a good place to live for entrepreneurs forming new businesses?" | Gallup World Poll |
| ICT Exports | Information and Communication Technology (ICT) exports as a percentage of total goods exports. (Logged value). | World Development Indicators |
| Internet Bandwidth | The contracted capacity of international connections between countries for transmitting Internet traffic. Mega bites per second (Mbps). (Logged value). | Int. Telecommunication Union |
| Mobile Phones | Cellular devices per 100 people. | Int. Telecommunication Union |
| Mobile Phones per Household | Survey question: "Does your home have a cellular phone?" | Gallup World Poll |
| Perception that Working Hard Gets You Ahead | Survey question: "Can people in this country get ahead by working hard, or not?" | Gallup World Poll |
| R&D Expenditure | Expenditures for research and development are current and capital expenditures (both public and private) on creative work undertaken systematically to increase knowledge, including knowledge of humanity, culture, and society, and the use of knowledge for new applications. R&D covers basic research, applied research, and experimental development. | World Development Indicators/Own Calculations |
| Royalty Receipts | Royalty and license fees are payments and receipts between residents and nonresidents for the authorized use of intangible, non-produced, non-financial assets and proprietary rights. (Logged value). | World Development Indicators |
| Secure Internet Servers | Servers using encryption technology in internet transactions, per one million people. (Logged value). | World Development Indicators |
| Uneven Economic Development | Group-based inequality, or perceived inequality, in education, jobs, and economic status. Also measured by group-based poverty levels, infant mortality rates, education levels. (Ordinal rating). | Failed States Index |

This report was presented at the 6th LCSR International Workshop
“Trust, Social Capital and Values in a Comparative Perspective”,
which held within the XVII April International Academic Conference on Economic and Social Development.

April 18 – April 22, 2016 - Higher School of Economics, Moscow.

<https://lcsr.hse.ru/en/seminar2016>

Настоящий доклад был представлен на VI международном рабочем семинаре ЛССИ
«Доверие, социальный капитал и ценности в сравнительной перспективе»,
прошедшего в рамках XVII Апрельской международной научной конференции НИУ ВШЭ «Модернизация экономики и общества».

18 – 22 апреля, 2016 – НИУ ВШЭ, Москва.

<https://lcsr.hse.ru/seminar2016>