What makes a country innovative?

IPR and other factors driving innovation

Fernanda De Negri
Institute for Applied Economic Research – IPEA (Brazil)

IPR and innovation: what the empirical literature says

Survey evidence

Mansfield (1986)	Survey with 100 companies from 12 US industries asking the proportion of the inventions that would not have been developed if company did not get patent protection.	• 65% of pharmaceutical and 30% of chemical innovations would not have been introduced in the market • These industries are the most likely to patent
Levin, Klevoric, Nelson and Winter (1987) – Yale Survey	Survey with more than 700 companies asking which was the most effective mechanism of protection of their innovations	• Patents were considered the least effective mechanism for process innovations • For product innovations, patents were reported more effective, but less than other strategies • Patents were considered more effective in chemical industries
Cohen, Nelson and Walsh (2000) – Carnegie Mellon Survey	Survey with almost 1500 business R&D labs asking about which was the most effective appropriability mechanism	• Again, patents were reported to be more important for protecting innovation in the drug and medical equipment industries. • In no industry patent is the most important method

Policy changes

Sakakibara and Branstetter (2001)	The authors use data of 300 manufacturing firms to empirically test if the 1988 Japanese patent reform (that broadened the scope of patent protection) increase research investments	• Their findings show that despite the increase in R&D investments over the years, **there was no change in the trend** in these investments after the reform
Lerner (2009)	The author collected data about major patent policy changes in 60 countries over 150 years and uses patents filled in Great Britain (where the patent policy is relatively stable) as a proxy of R&D investments. The foreigners' decision to file patents in Great Britain would be a function of the changes in domestic patent policy	• He concludes that there is **little evidence** that stronger patent protection in home countries had resulted in increases in patents filled in UK

Cross country panel data

Papageorgiadis and Sharma (2015)	The authors investigate the relationship between intellectual property rights (IPR) and innovation, for a panel of 48 countries between 1998-2011, using a new index of enforcement related component of the patent system and the Ginarte and Park (1997) index of patent strength. The dependent variable is the log of patents of the country	• They find that the levels of IPR enforcement strength of a country's IPR system have a **highly significant effect** on national innovation (measured by patents)
Hudson and Minea (2013)	Data for 62 developed and developing countries for 1980–2009 to evaluate how the Intellectual property rights (IPR) – measured by the index developed by Ginarte and Park (1997), and updated by Park (2008b) – affects the number of US patents per capita granted to residents of a given country each year (proxy for innovation, US was excluded from the dataset)	• They found that the influence of IPR on innovation is nonlinear, depending on the IPR level. • Stronger **IPR would increase innovation** in countries with either relatively low or relatively high initial IPR, and decrease it in other countries • The level of per capita GDP also exerts a nonlinear influence on the innovation/IPR relationship.
Kanwar and Evenson (2003) Survey	Cross-country panel data (around 30 countries) on R&D investment and patent protection, measured by Ginarte and Park (1997) index, for the period from 1981 to 1995	• The results indicate that **IPRs have strong positive influence** on R&D investments

Cross country panel data

Allred and Park (2007)	Empirical analysis of the effects of patent strength (Ginarte and Park index) on different aspects of innovative activity, namely firm-level research and development (R&D), domestic patenting, and foreign patenting	• For developing economies**, patent strength negatively affects domestic patent filings** and insignificantly affects R&D and foreign patent filings. • For developed economies, **patent strength positively affects R&D** and domestic patent filings, and negatively affects foreign patent filings, after some critical level of patent protection is reached.
Schneider (2005)	The author uses a panel data set of 47 developed and developing countries from 1970 to 1990 to analyze if IPRs (Ginarte and Park index) affect the countries' innovation rate.	• The results show that **IPR have a positive effect** on innovation • When the sample is split between developed and developing countries, IPRs have **a stronger impact on domestic innovation for developed countries** and might even negatively impact innovation in developing ones.
Qian (2007)	Effects of patent protection on pharmaceutical innovations for 26 countries that established pharmaceutical patent laws during 1978–2002, using a propensity score matching technique and the Ginarte and Park (2007) index for IPR.	• National patent protection alone **does not stimulate** domestic innovation, as estimated by changes in citation-weighted U.S. patent awards, domestic R&D and exports of pharmaceutical products.

IPRs and technology diffusion

Walsh, Arora and Cohen (2013)	The paper reports the results of 70 interviews with personnel at biotechnology and pharmaceutical firms and universities about the effects of research tool patents on biomedical research	• There has been an increase in patents on the inputs to drug discovery ("research tools"). However, drug discovery has not been substantially impeded by these changes. • The vast majority of respondents say that there are no cases in which valuable research projects were stopped because of IP problems relating to research inputs.
Galasso and Schankerman (2015)	The authors use the patent validity cases reviewed by the U.S. court of appeals in order to measure the effect of patent invalidation on follow-on innovation	• Their estimates suggest that patent invalidation leads to about a 50% increase in subsequent citations to the focal patent. • This impact is restricted to some fields such as computers and communications, but not in drugs, chemicals and mechanical technologies
Sampat and Williams (2015)	The authors focus on the effects of patents on human genes to evaluate if these patents could hamper follow on innovations	• The results suggest that gene patents have not had important effects on follow on innovation using those genes, measured by scientific publications and clinical trials.

Other approaches

<table>
<tr><td>Budish, Roin and Williams (2015)</td><td>The authors analyze the research investments in different kinds of cancer, according to the expected time length of the clinical trials (a proxy for commercialization lags).</td><td>• They found evidence of a negative correlation between research investments – both public and private – and greater commercialization lags: research investment levels are higher for shorter clinical trials.
• These evidences are consistent with patent length having an impact on research investments</td></tr>
<tr><td>Budish, Roin and Williams (2016)</td><td colspan="2">The authors argue that the little evidence available on the effects of patent laws on research investment is not necessarily a puzzle.
According them, most of available studies analyze how R&D investments by domestic firms respond to changes in domestic patent policies. However, changes in patent policies in large countries, such as US, can affect R&D decisions by firms in other countries as well. Besides that, they argue that the incentives for research are global, because technologies are developed for a global market. Therefore, estimates of the elasticity of research with respect to domestic patent laws might be biased towards zero.</td></tr>
<tr><td>Williams (2017)</td><td colspan="2">The author argues that, to assess the effects of the patent system in stimulating R&D investments it’s is necessary to answer 3 questions:
• How does the disclosure function of the patent system affect R&D investments?
• In what extent is stronger patent protection (length and breadth) effective in inducing more R&D
• Do patents on existing technologies affect subsequent research investments?</td></tr>
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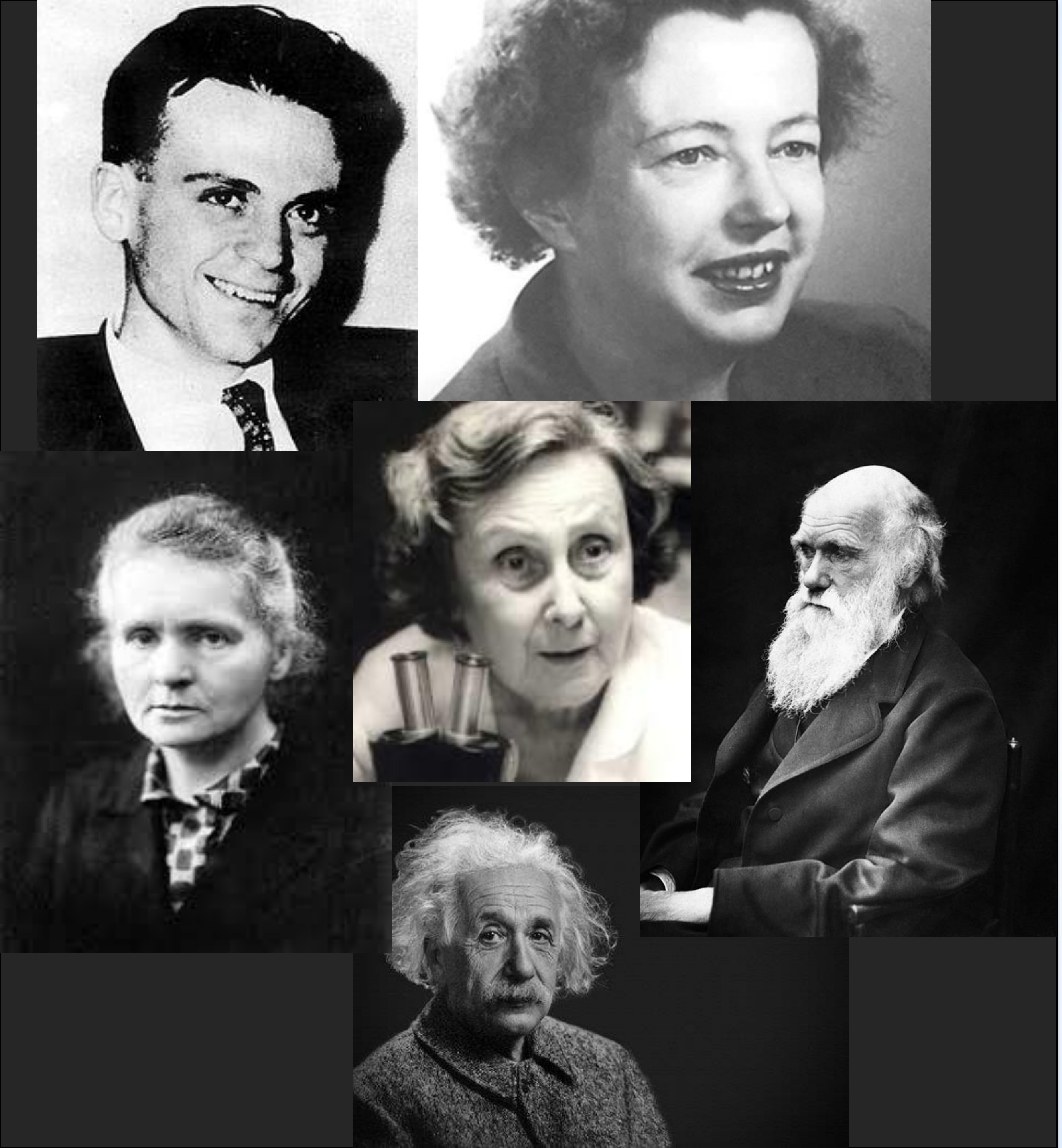
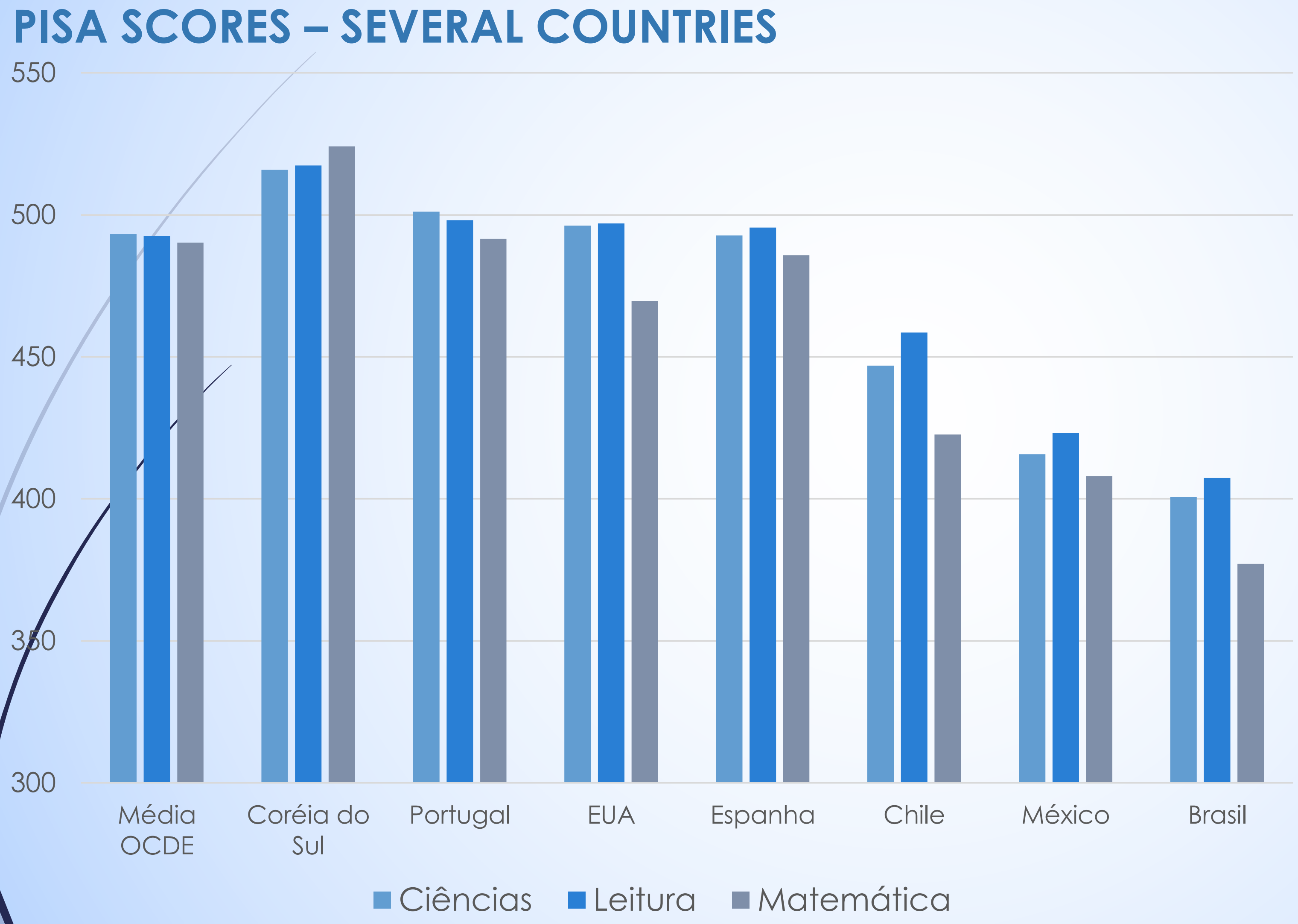
Other factors hampering innovation: the case of Brazil



1
Human capital

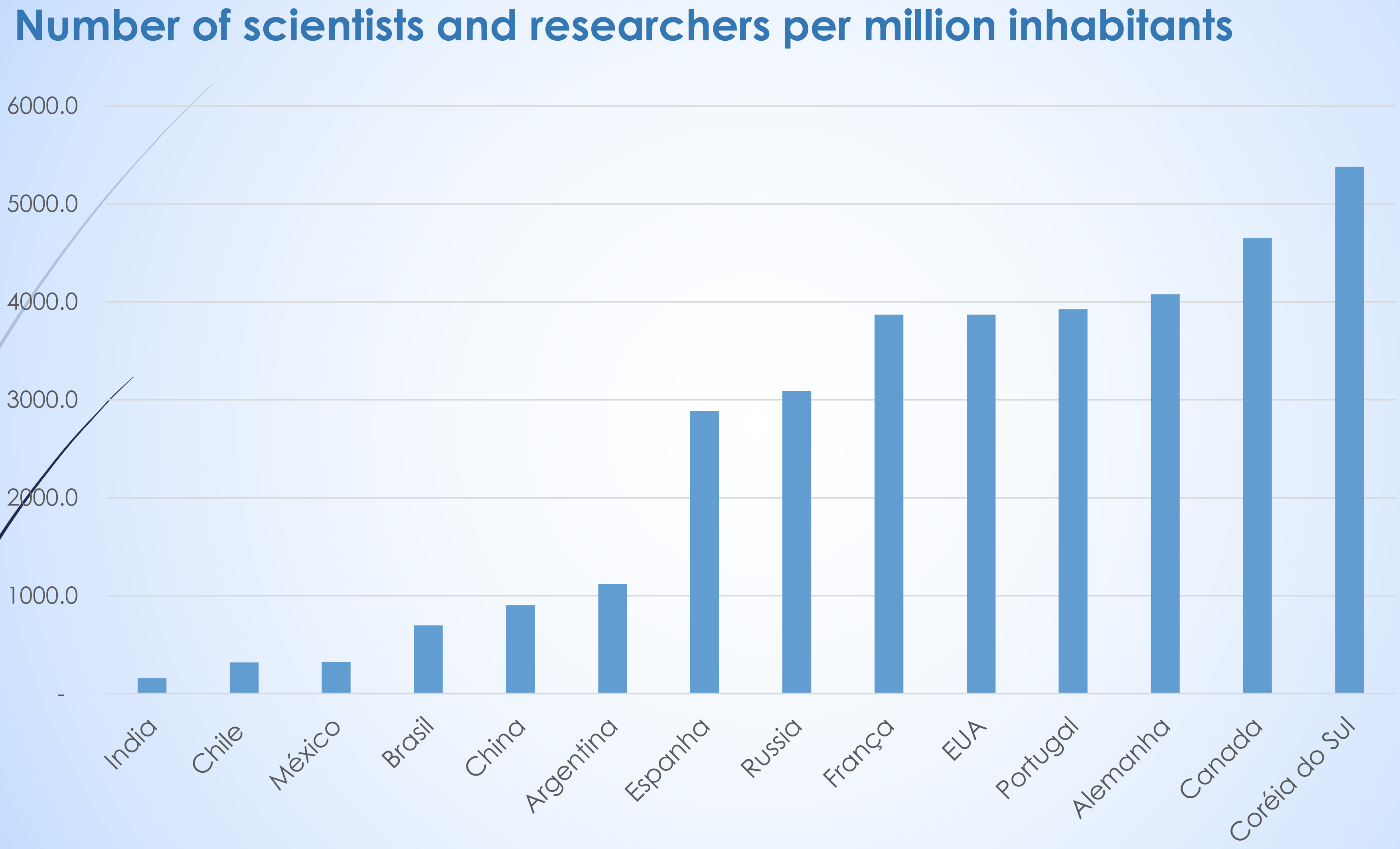
Education



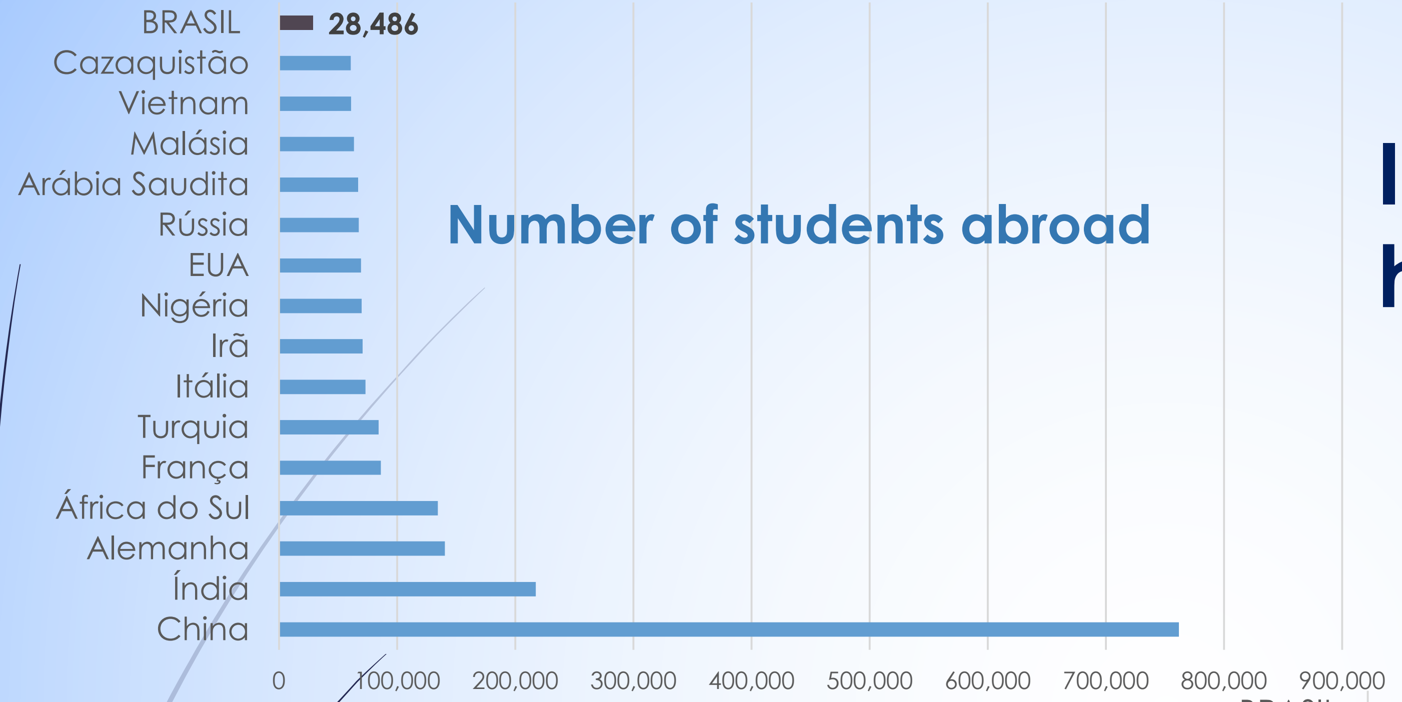
The number of literate adults increased from 86% to 92% in the 2000- 2014 period

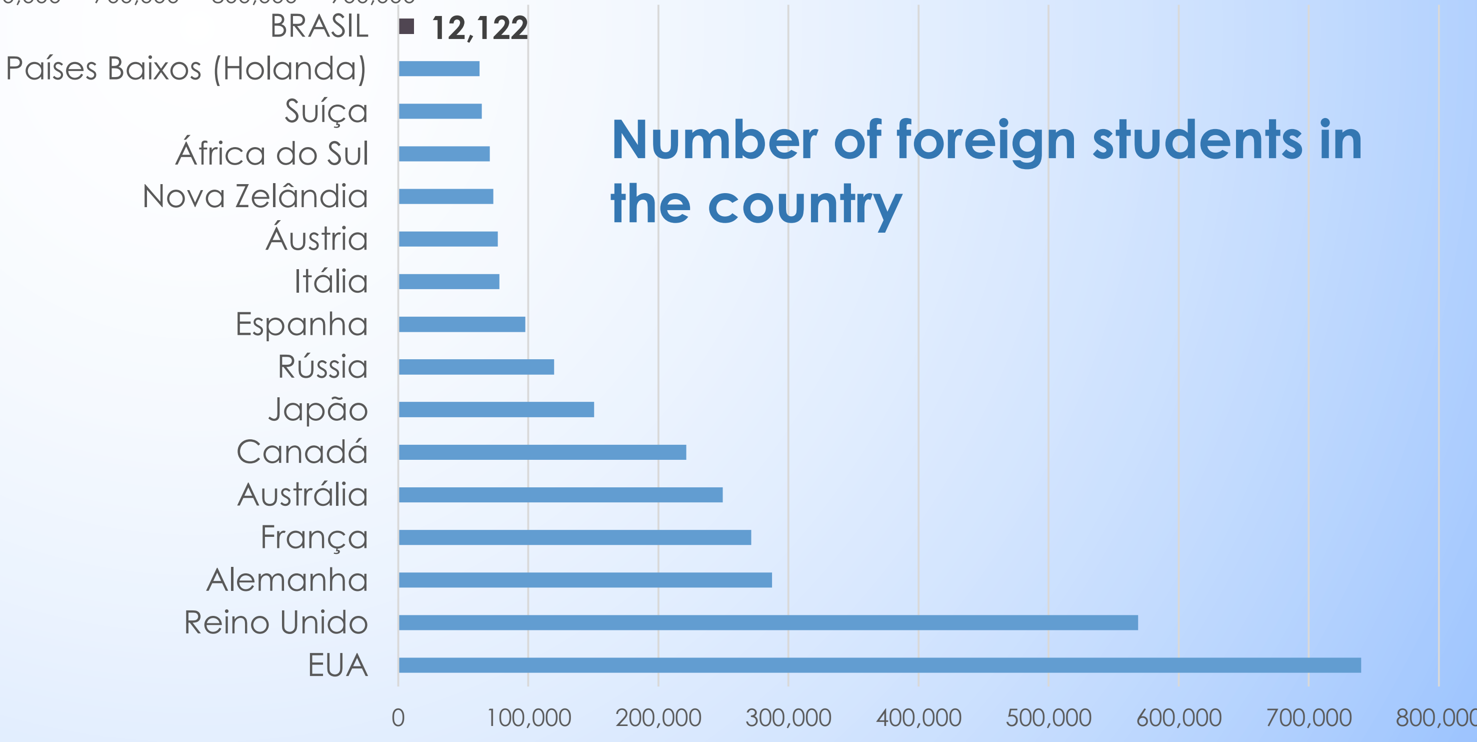
75% of Brazilian adults don't know how to calculate a simple average (Círculo da matemática, 2015)

Few engineers and scientists



Internationalization of higher education





"The Hubble has given us nothing less than an ontological awakening, a forceful reckoning with what is. The telescope compels the mind to contemplate space and time on a scale just shy of the infinite"

Ross Andersen

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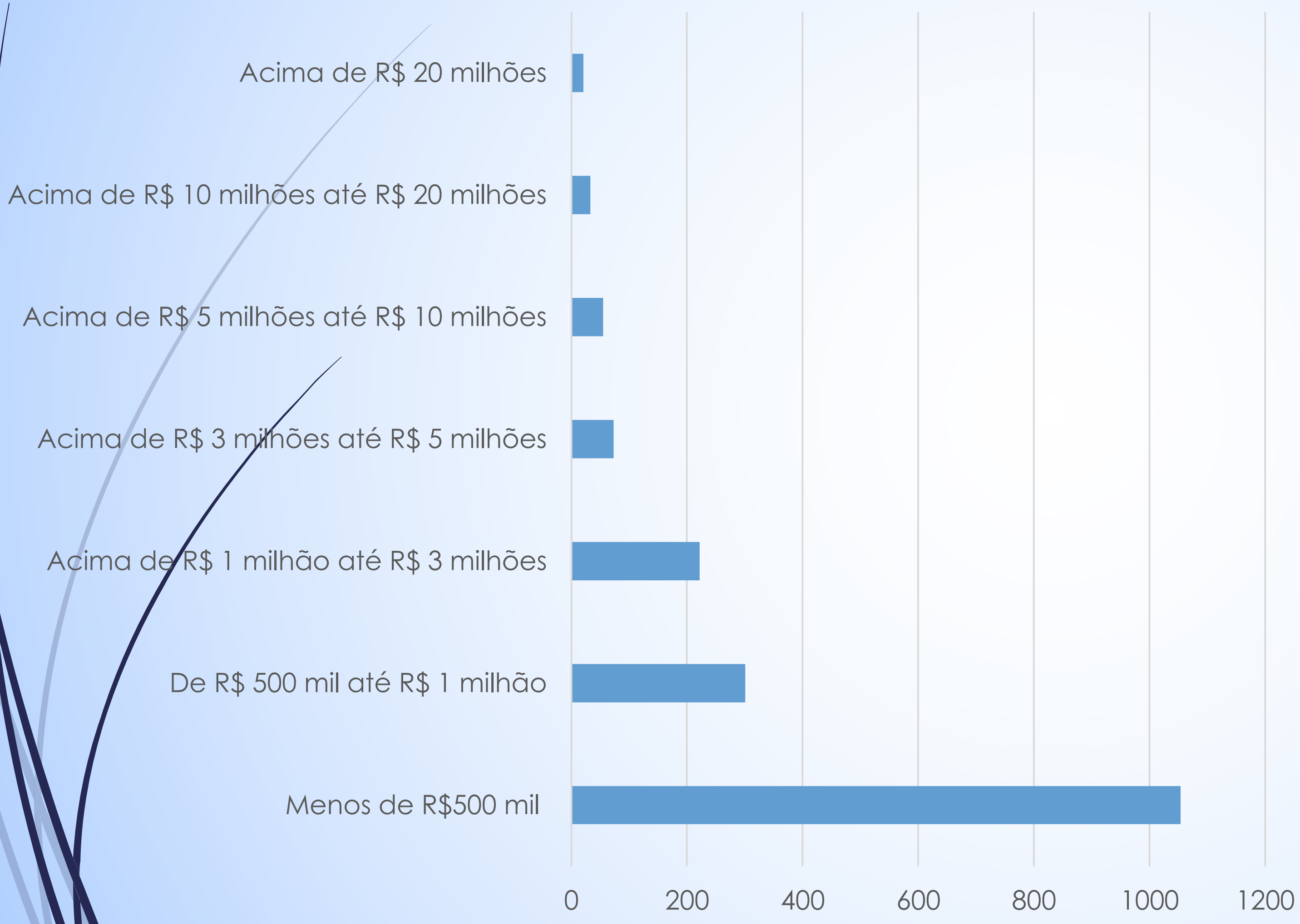
Research infrastructure/facilities

An updated research infrastructure

Ano de início de operação	Number of research facilities	(%)
Pre-1970	50	2.8
1970-1979	110	6.3
1980-1989	193	11.0
1990-1999	410	23.3
2000-2009	654	37.2
2010-2012	343	19.5
Total	1,760	100

... But a small scale one



Most of research facilities in Brazil are inside the biggest universities

They are smal Labs with 4 researchers, in average

There are few multidisciplinar labs and research centers

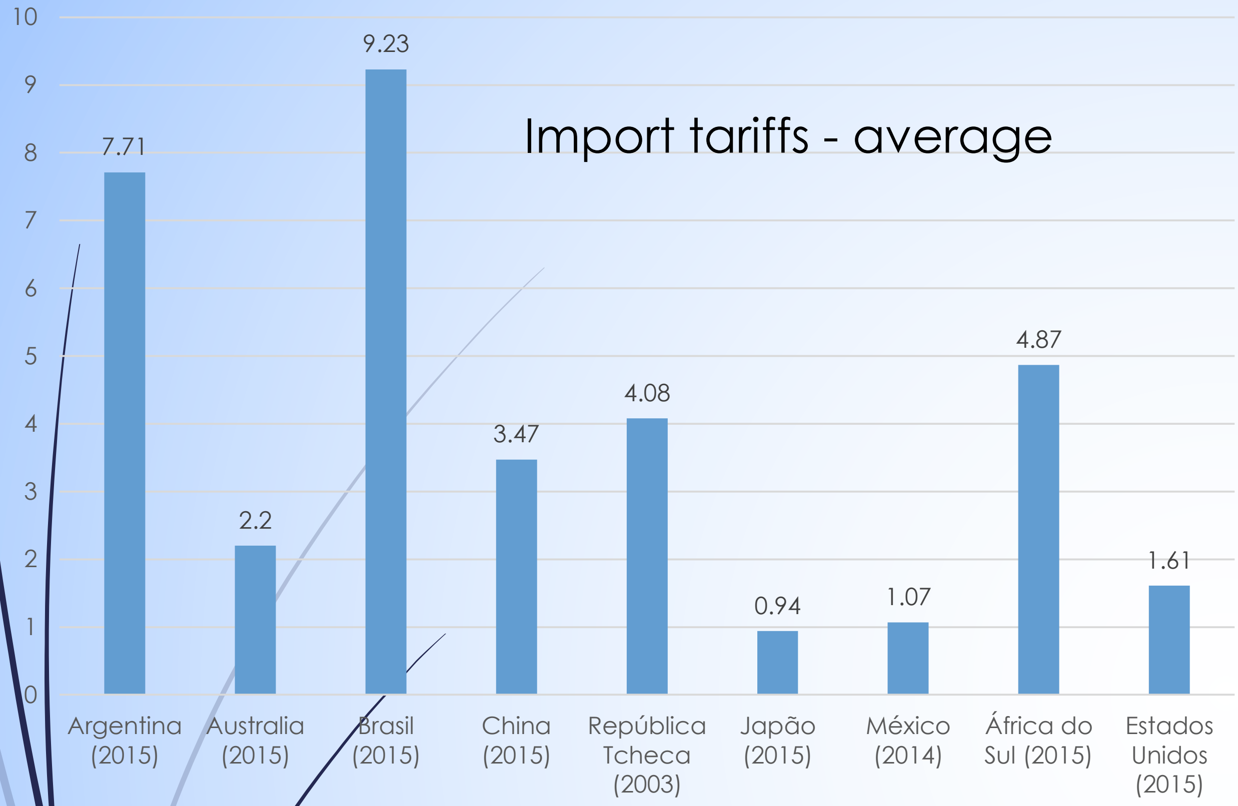
There are few research institutions outside the biggest public universities

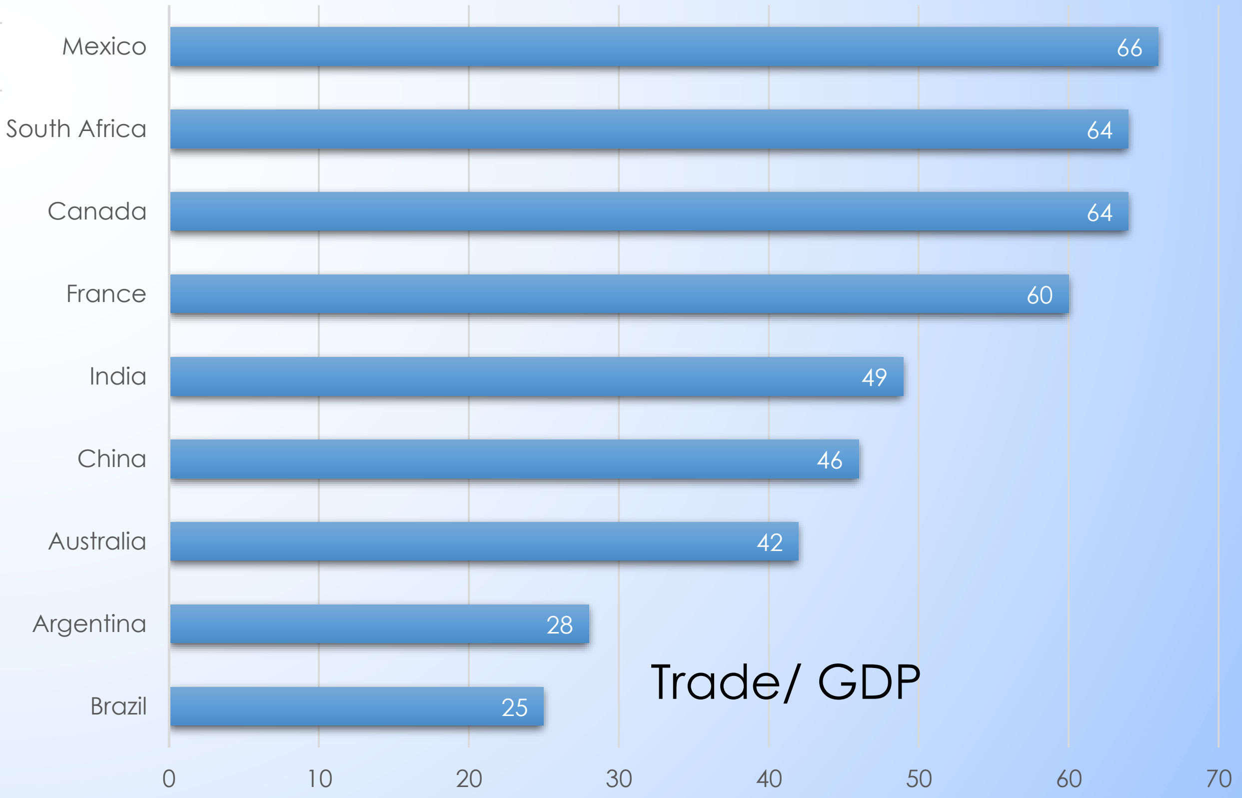
Research institutions funded by the European Union in the FP7 program

Name	Country	Number of researchers	Investment (€ mi)	Operational costs
Centre d'Elaboration et d'Etudes Structurales (CEMES - CNRS)	France	50 a 100	50-250 M€	0,25 a 1 M€
Forschungszentrum Rossendorf	Germany	101-200	250 - 500 M€	> 10 M€
Research Platform on Nanoelectronic Systems	Germany	1-10	20 M€ - 50 M€	0.25 M€ - 1 M€
Central Laser Facility	United Kingdom	51-100	50 M€ - 250 M€	1 M€ - 10 M€
Robotics Research Platform	Belgium	1-10	< 20 M€	0.25 M€ - 1 M€
Plataforma Solar de Almeria	Spain	11-50	50 M€ - 250 M€	1 M€ - 10 M€
European Bioinformatics Institute (EBI) (European Molecular Biology Laboratory (EMBL)	United Kingdom	201-500	50 M€ - 250 M€	> 10 M€
Center for Biomolecular Magnetic Resonance (BMRZ)	Germany	11-50	50 M€ - 250 M€	1 M€ - 10 M€

3 The business environment

A closed economy hinders competition and the access to foreign technology





A rigid and bureaucratic business environment don't favor innovation

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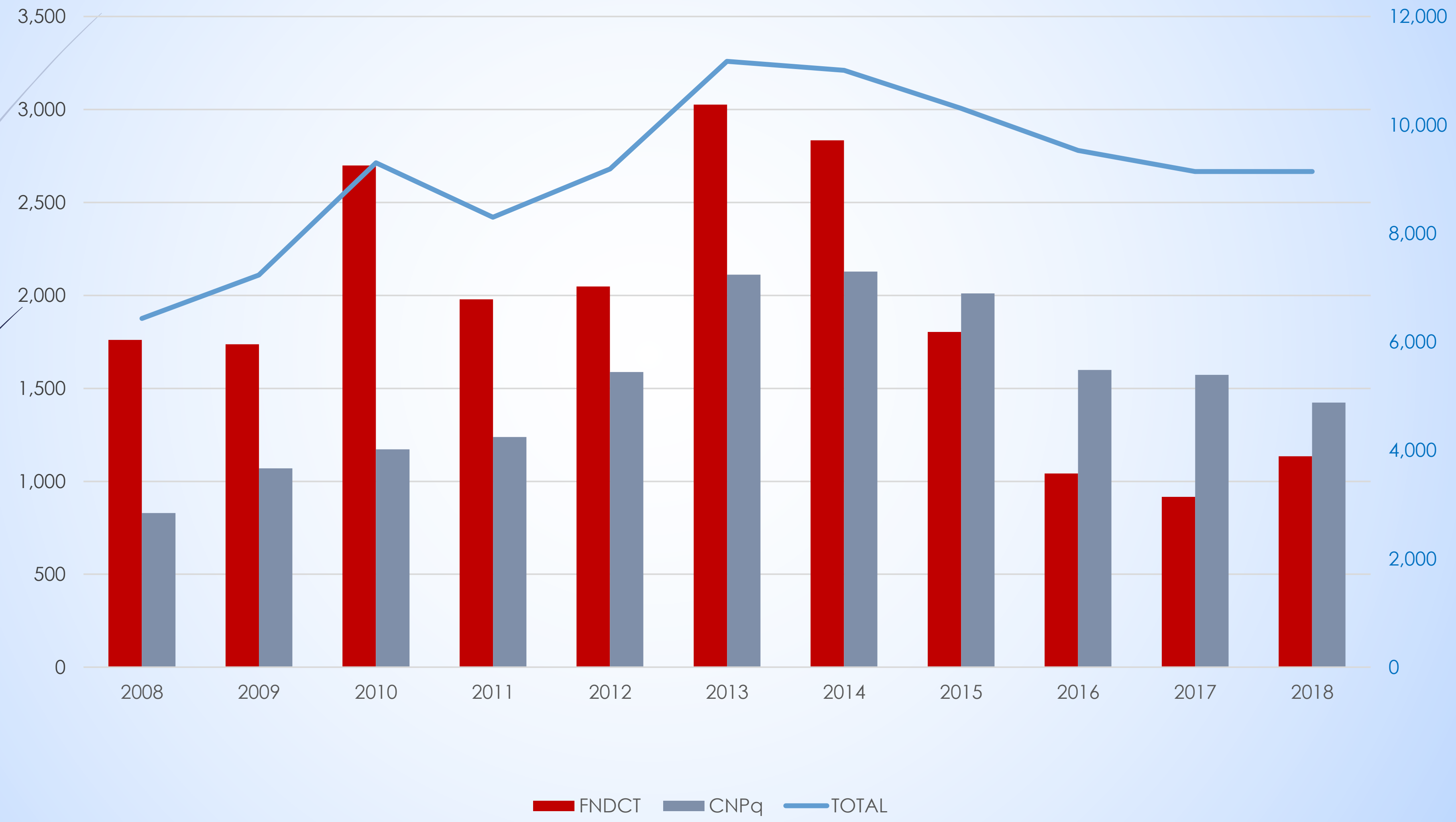
Public Policies

Instability in research funding



Thank you!
fernanda.denegri@ipea.gov.br