Technology-Based Firms (TBFs) in Brazil: Opportunities and Limits

Marcelo Pinho

Associate Professor, Federal University of São Carlos (UFSCar)

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Presentation Outline

1. Introduction
2. Background – The Brazilian Economy
3. Research Methodology and Database Description
4. Main Research Findings
5. Interpretation
6. Recent Evolution
7. Concluding Remarks

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1. Introduction

- Take a look at those giant hi-tech firms...
- Besides economic weight, they exert a critical role in technological dynamics and innovative networks.
- Can a country of the size of Brazil aspire to a catching-up trajectory with the advanced countries without developing in its business structure a substantial core of such companies?
- *Purpose*: To use a microeconomic analysis approach to discuss the structural constraints to the creation, consolidation and, especially, growth of TBFs in Brazil, departing from the characterization of their typical technological strategies and market insertions.
- *Focus*: instead of TBFs survival, TBFs growth.

Giant High Tech Firms

Firms	Founded	Market Value (US$ M)
Apple Inc	1977	883,339
Alphabet	1998	731,548
Microsoft	1975	660,832
Amazon.com	1994	564,682
Facebook	2004	520,443

Source for market value: Bloomberg.com at 1:30 PM (ET) of Dec. 12th, 2017.

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Microsoft	1975	660,832
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Facebook	2004	520,443
Tencent	1998	478,846
Ali Baba	1999	451,610
Baidu	2000	79,752

Source for market value: Bloomberg.com at 1:30 PM (ET) of Dec. 12th, 2017.

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2. Background – The Brazilian Economy (and NSI)

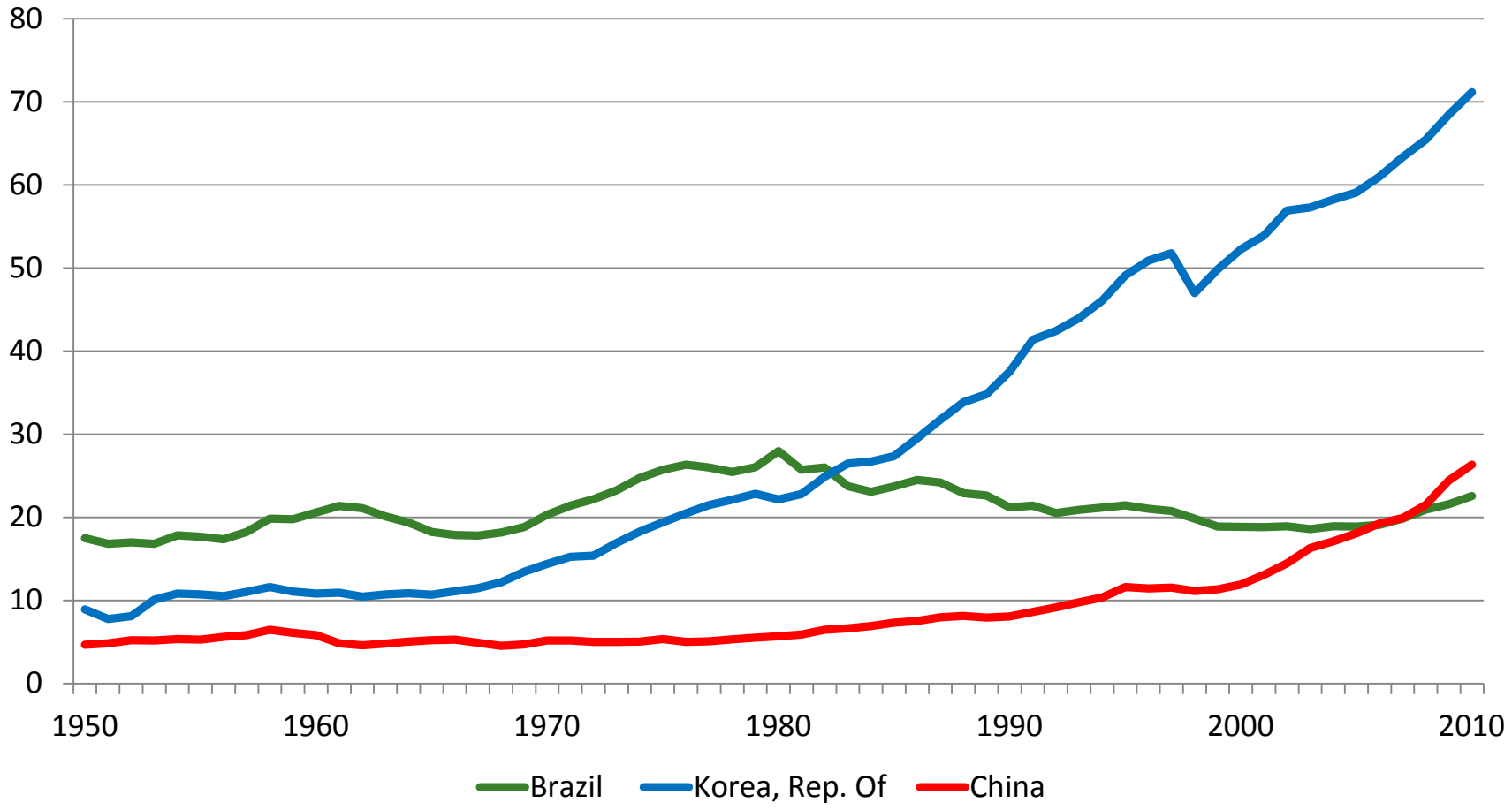
- Population (2016): 206 million persons (2.8% of world total)
- GDP and per capita GDP
- GDP growth
- Gini index: recent evolution, ranking and caveat
- Education: basic education and universities rankings
- S&T: publications, GERD, and patents
- Industrial structure

Brazilian GDP and Per Capita GDP (2016)

	GDP		Per Capita GDP	
	Current Prices	PPP	Current Prices	PPP
Value	US$ 1,799 B	US$ 3,141 B	US$ 8,727	US$ 15,242
Rank	10th	7th	73rd	85th
% of USA's	10%	17%	15%	27%
% of China's	16%	15%	108%	99%

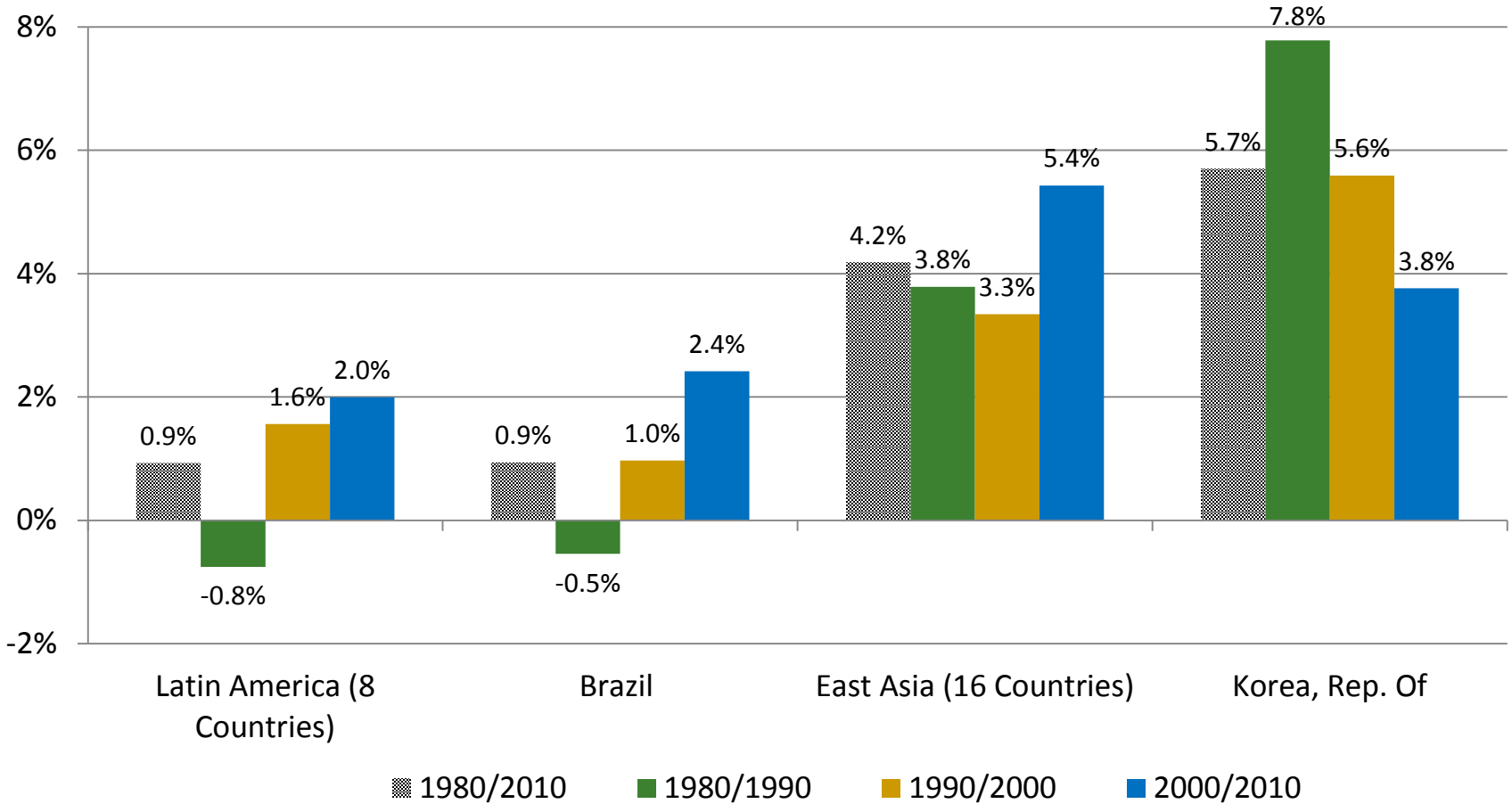
Source: IMF, World Economic Outlook, April 2017.

Per Capita GDP as % of USA's (1950-2010)



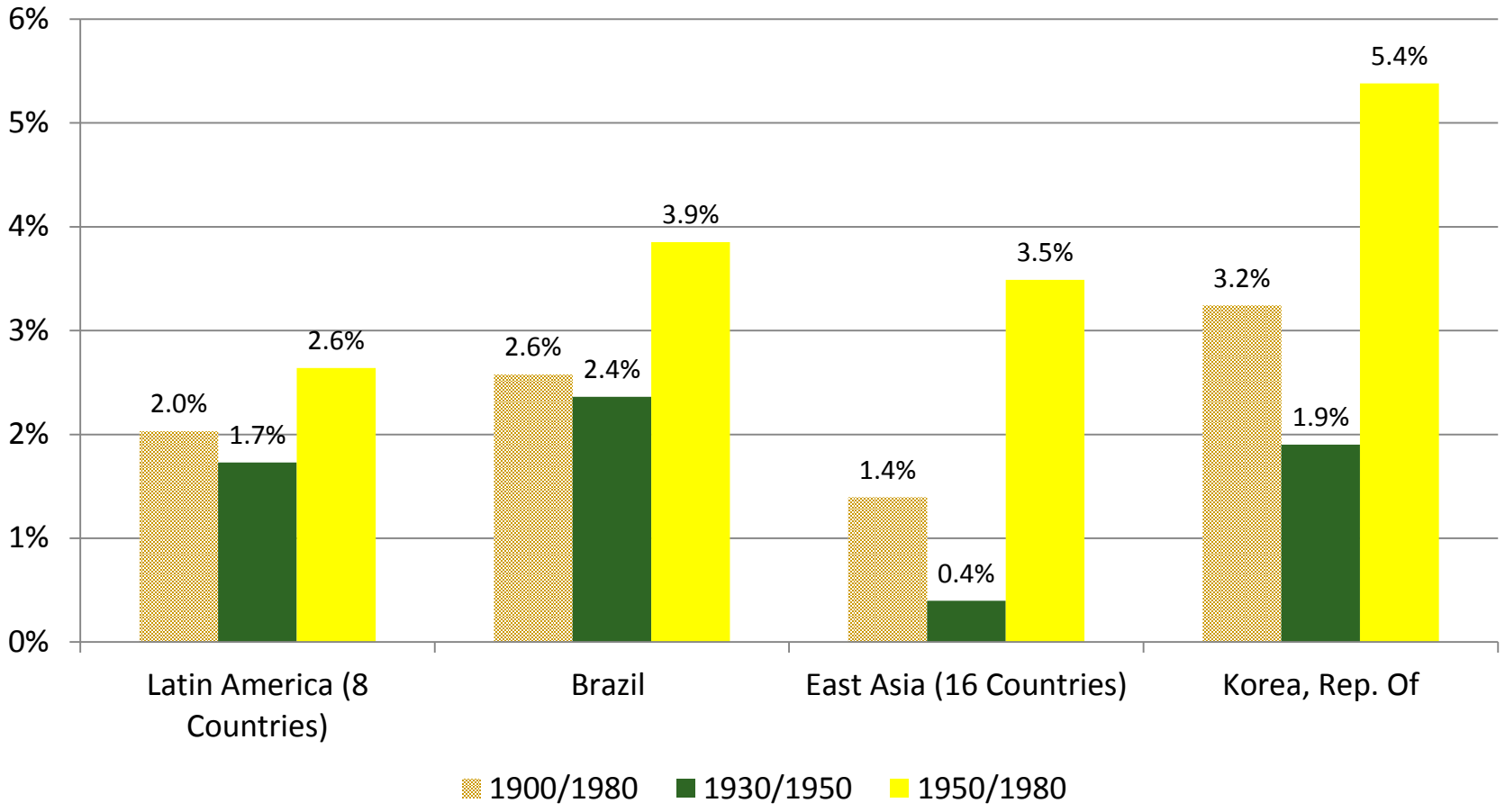
Source: The Maddison-Project, http://www.ggdc.net/maddison/maddison-project/home.htm, 2013 version.

Per Capita GDP Growth (1980-2010)



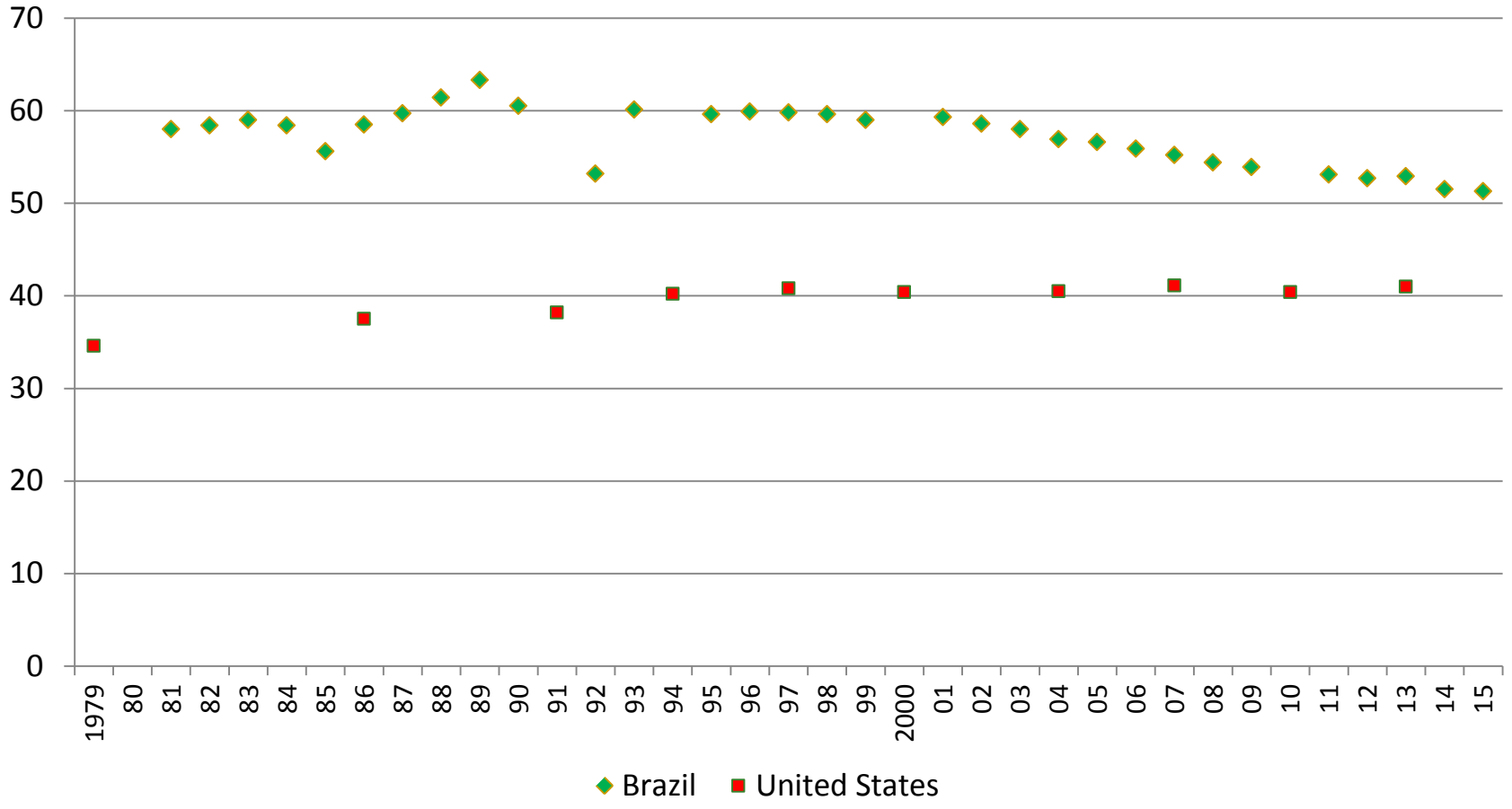
Source: The Maddison-Project, http://www.ggdc.net/maddison/maddison-project/home.htm, 2013 version.

Per Capita GDP Growth (1900-1980)



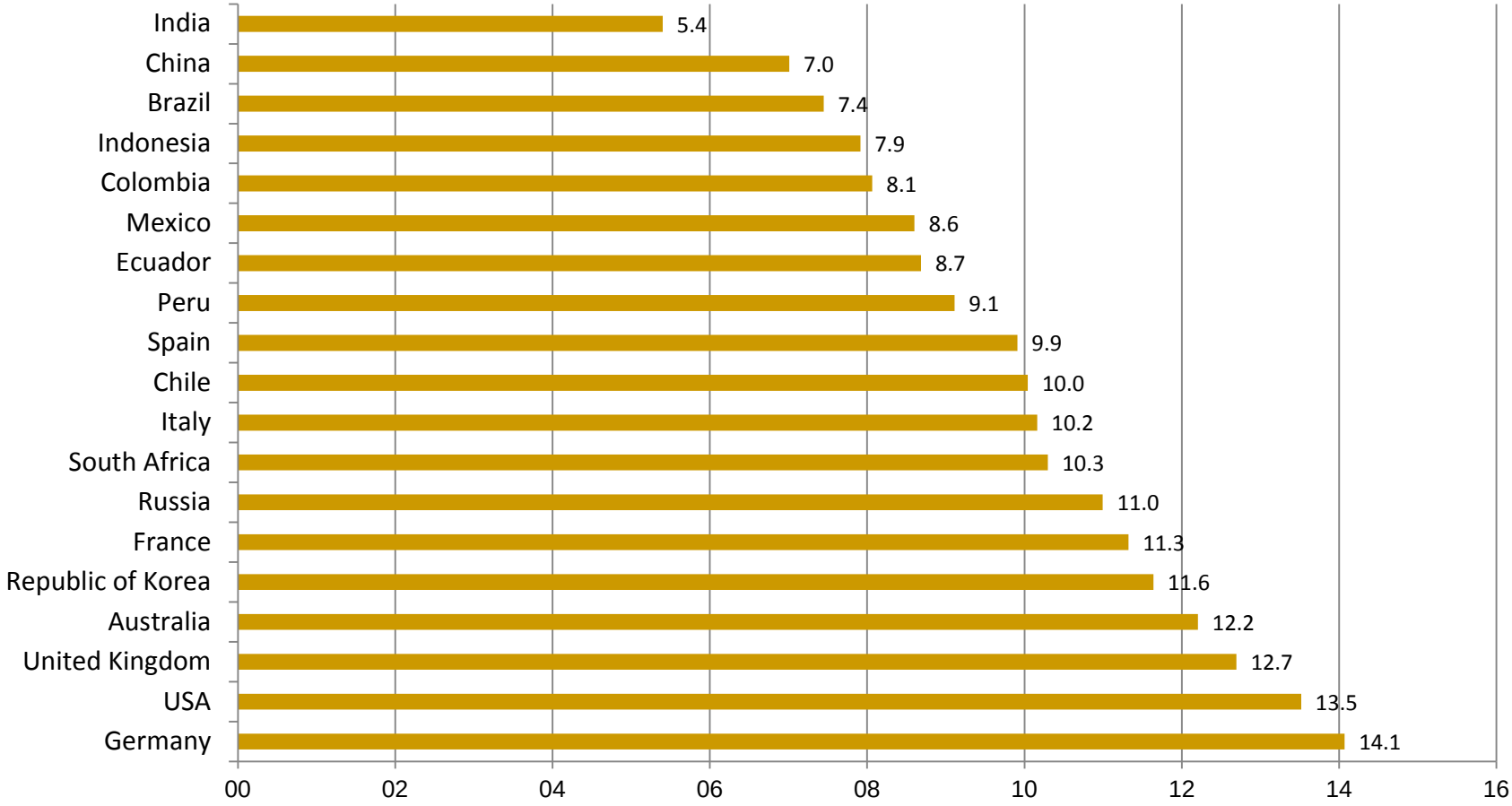
Source: The Maddison-Project, http://www.ggdc.net/maddison/maddison-project/home.htm, 2013 version.

Gini Index Evolution (1979-2015)



Source: World Bank, Development Research Group.
Note: Based on household survey data.

Mean Years of Schooling of Persons 25+ Years



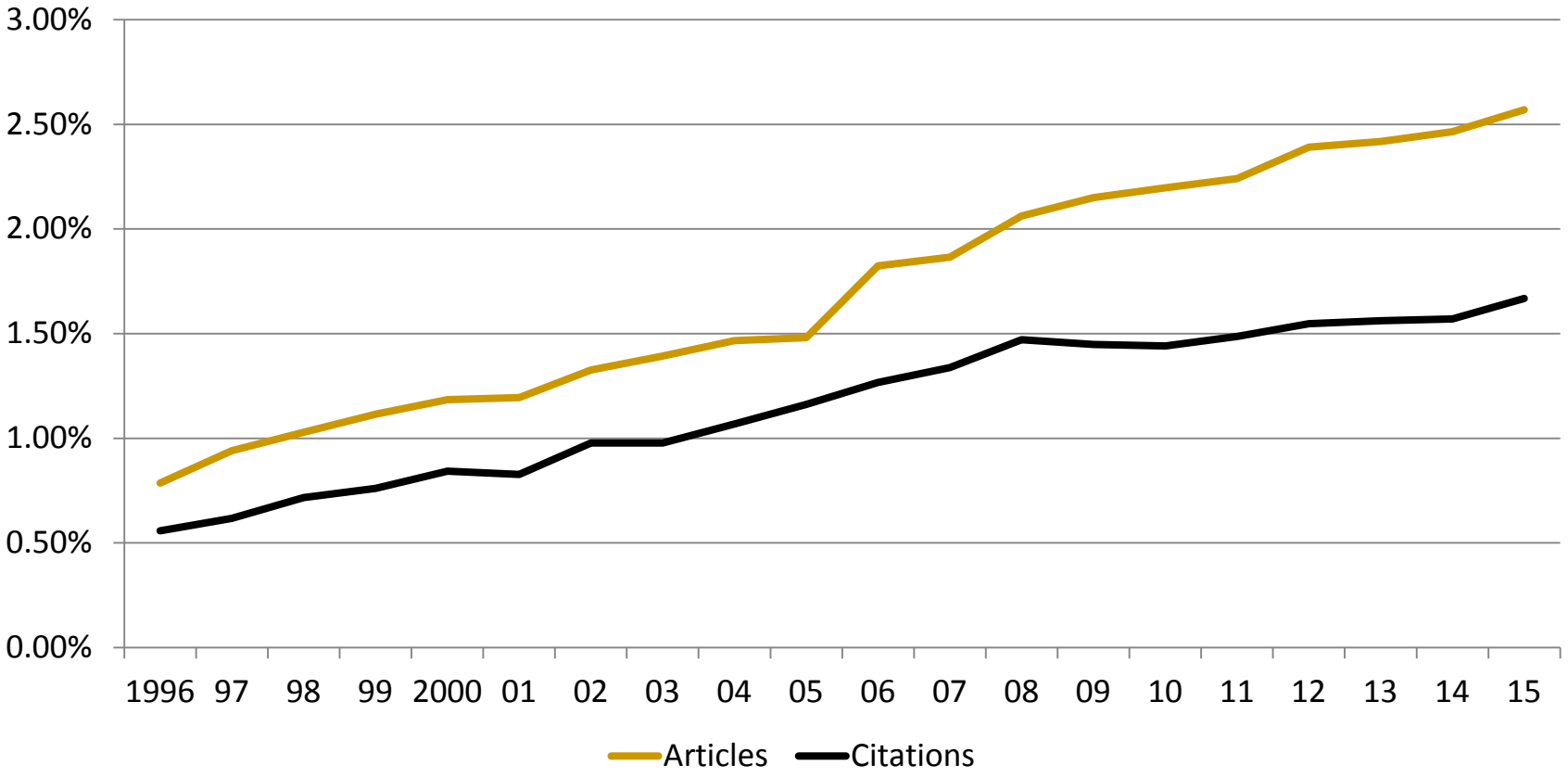
Source: Unesco Institute for Statistics (UIS). Data extracted from UIS.Stat on Dec. 12th, 2017.
Note: Latest available data for each country, mostly 2014 or 2015, except for China (2010) and India (2011).

Word Universities Rankings (2017)

Rankings	Top 500		Top 1000	
	Brazil	Latin America	Brazil	Latin America
The Times Higher Education	2	2	21	47
Shanghai Academic Ranking	6	10	13	23
Webometrics	7	10	19	33
QS World Universities Ranking	4	20	22	89

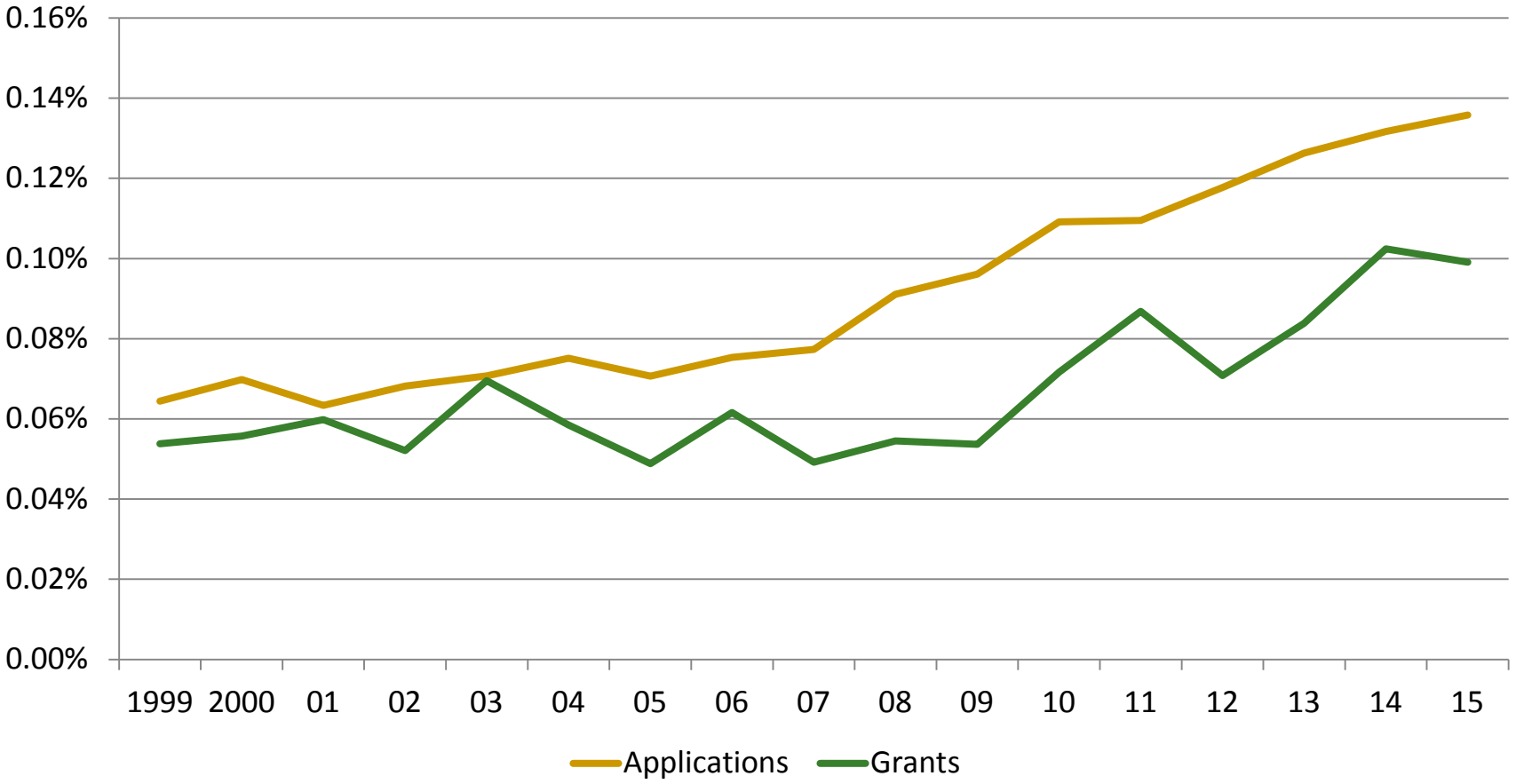
Source: Own elaboration based on data from the websites.

Brazilian Share of World Academic Production



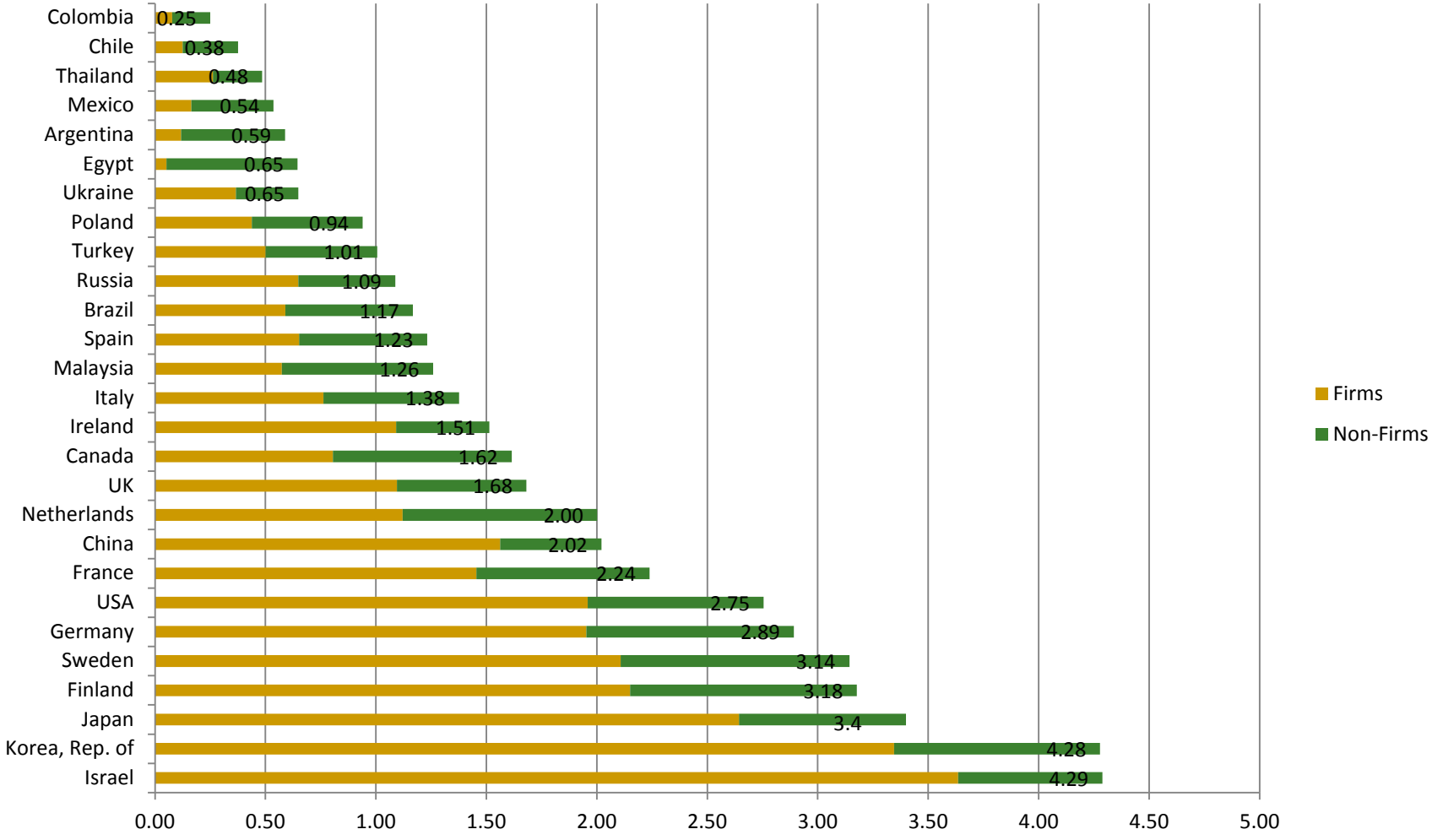
Source: SCImago, *SCImago Journal & Country Rank,* quoted in Brazilian Ministry of Science, Technology, Innovation, and Communication, *National Indicators of ST&I*.
Note: Scientific papers indexed by Scopus.

Brazilian Share of Patents Applications and Grants in the USPTO



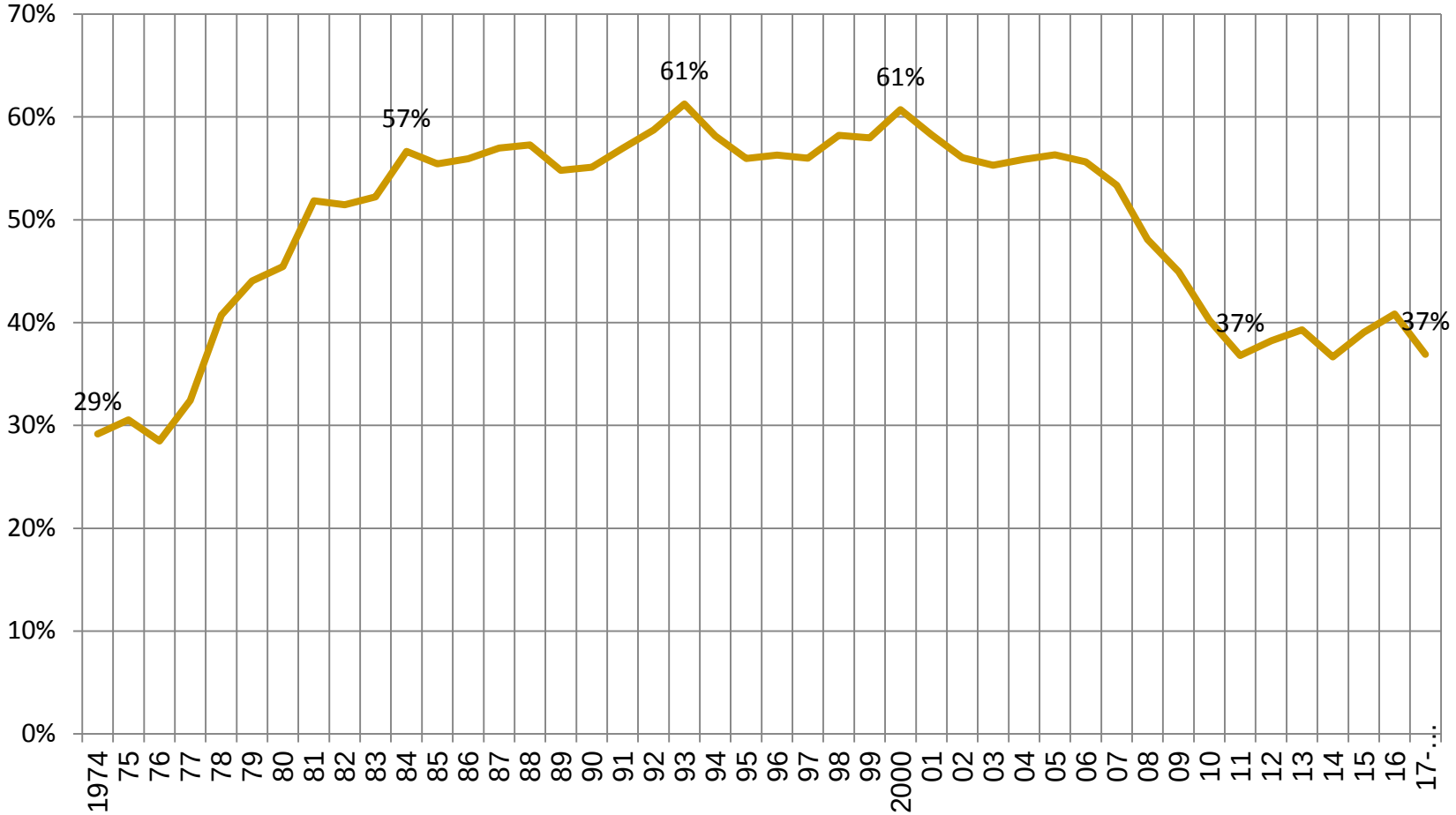
Source: Brazilian Ministry of Science, Technology, Innovation, and Communication, *National Indicators of ST&I*.

Gross Expenditure on R&D as % of GDP (2014)



Source: Unesco Institute for Statistics (UIS). Data extracted on Aug 29th, 2017.

Brazil – Share of Manufacturing Goods on Exports (FOB)



Source: Brazilian Ministry of Development, Industry and Trade.

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Methodological Issues and the Fieldwork

- Conceptualizing TBFs in a developing country: firms that both (1) carry out major technological efforts, and (2) focus their operation on novel products. Efforts include imitation, adaptation, and reverse engineering, while “novel” products, new varieties, adaptations and incremental innovations.
- To address the diverse dynamics these companies are involved in, we avoided other restrictive criteria, except size: small and medium sized TBFs.
- 1,316 TBF “candidates” $\rightarrow$ initial goal: 150 firms $\rightarrow$ 117 were interviewed during 2003-04 $\rightarrow$ assessing quantitative and qualitative information about every interviewed firm, we identified 102 of them as TBFs.

Describing the Set of 102 TBFs

- Total employment of 6,063 people [N = 92 firms] and total revenues of US$ 293 million [N = 80]. (The reference year for quantitative data was 2002.)
- Average size: 66 employees and revenues of US$ 3.7 million.
- Median size: 16 employees and revenues of US$ 0.5 million.
- 71% of employment and 79% of turnover in 13 firms with 100+ employees.
- We calculated a rough productivity indicator (annual revenue divided by employees) 12% above the average in the Brazilian manufacturing industry [N =78 firms].
- 13 different two-digit industries. Six accounted for > 90% of the total by any relevant criterion. The electronic complex accounted for about 80% of the employment and sales.

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Research Findings: Technological Dynamics

- Only 40 companies had structures specialized in technology development [N = 100].
- Presence of structured R&D rises with firm size. Among firms employing 20+ workers, the majority had such departments as well as every firm with 100+ employees.
- 83 firms reported some relationship with universities and research centers and 58 pointed out more intense and stable relations, v. g., cooperation mechanisms [N =100].
- Software and IT companies are less prone to cooperate with university and research centers.
- There is not a clear association between the cooperation practices and firms growth rate.

Research Findings: Technological Dynamics

- As much as 54% of the firms had not filed any patent application in the previous five years [N = 92].
- Just 5% of the firms – mostly the largest ones – had filed applications in foreign patent offices.
- 19% of innovations introduced in previous five years were, according to the respondents' own evaluations, novelty just for the firm itself; 57%, for the regional or national markets; and 21%, for the global market.

Jointly, (1) the adoption of follower strategies, (2) the limited technological capabilities, and (3) the relevant, but also limited, cooperation initiatives result in a technological pattern in which competences, albeit sophisticated, are narrow.

Research Findings: Market Insertion

- Foreign markets were of lesser importance: the average of export ratio was 4.1%. 31 firms did not export and just five sold outside Brazil more than 10% of their revenue [N = 50].
- Despite their small size, many firms stated to control a large share of the markets they focused on [N = 36]. The average market-share in the main product line was an impressive 45% (58% in manufacturing industries and 23% in services TBFs).
- Due to the youth of many firms (25% had less than 5 years) and the lack of answers of others, we could assess a medium-term (5 years) real revenue annual growth rate for just 38 firms: median of 15.3% and weighted average of 5.9%.
- Just four firms sustained above median growth rates 10 years or more after their foundation.

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Barriers to TBFs Creation and Consolidation

- The literature in Brazil focuses on the difficulties faced by newly created TBFs: macroeconomic instability, lack of managerial and marketing competences, and capital shortage.
- Regarding the likely low birth rate of TBFs, the higher education system inability to foster entrepreneurial skills is pointed out, but a more critical issue is overlooked: the weaknesses of the national system of innovation, especially in what concerns to the technological behavior of big firms.
- As Acs et al. (2009) suggested, entrepreneurial activity exploits "*new opportunities created, but not appropriated by incumbent firms*" and thus it will be "*greater where investments in new knowledge are high, since start-ups will exploit spillovers from the source of knowledge production*".

The “Truncate” Dynamics of TBFs Development

- Two essential stylized facts: (1) four out of every five TBFs recognized their products were not innovations at the world level; and (2) 71% of them identified foreign companies among their main competitors, but only 17% pointed out in this same position TNCs with production facilities in Brazil.
- Opportunities to establish TBFs in Brazil are mostly found in small market segments. To survive, they have to settle in markets in which foreign competitors would not retaliate promptly.
- Insulating from foreign competition is easier if two conditions are met: (1) domestic customers cannot be satisfied merely by direct imports – relational markets; (2) overseas suppliers face difficulties in establishing affiliates in Brazil – small or *enfant* markets.

The “Truncate” Dynamics of TBFs Development

- Most Brazilian TBFs operate in **market niches**. Windows of opportunity open up in markets in which domestic demand is [still] too small to a foreign competitor. Within these niches, there is a sound probability of a Brazilian TBF to succeed and control a large stake of its tiny market.
- In the “trench” of niche markets, Brazilian firms can manage to survive, but it is precisely there that the market constraints to their growth are to be found. Even if the business is profitable, when the market size is small, *horizontal growth* is inevitably restrained. Having developed just a narrow range of technological capabilities, they are not able to take profit of technologies of general use to deploy a broad scope *diversification* strategy based on technological synergies.

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Recent Evolution

- Our fieldwork on Brazilian TBFs was completed 13 years ago. Does the framework outlined before remain valid?
- TBFs environment in Brazil has undergone two major changes: (1) many legislative initiatives resulted in a new legal framework to foster technological development as well as improved public support policies; (2) substantial development in capital markets.
- Evidence gathered in a recent study by VALLONE (2017) is not encouraging: using data from the Brazilian Innovation Survey, he found only 176 TBFs in the manufacturing industry (US$ 1.07 billion total revenue in 2014).
- We argue in the paper that the modesty of high-tech IPOs in Brazilian stock exchange and the lack of Brazilian firms in lists of unicorns are further evidences in favor of the hypothesis that Brazilian TBFs' conditions have remained substantially unchanged.

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- You might have noticed that I spoke mostly about the limits Brazilian TBFs face: what about the opportunities mentioned in the title?
- Technological opportunities are widespread. Moreover, **market fragmentation** is a characteristic of competition in many industries. Smartphones apps, for instance, have multiplied at an amazing rate. According to COMINO and MANENTI (2014), by May 2013, Apple's store offered 880,000 apps (236,000 publishers); on 14.11.2017, numbers had grown to 3,146 million applications (689,000 publishers).
- Global Startup Ecosystem Report estimates the city of São Paulo houses between 1,600 and 2,900 IT startups.
- Even if the wider windows of opportunity are not occupied by Brazilian TBFs, the steady occupation of smaller markets may result, as a whole, in a large economic space.

Concluding Remarks

- Anyway, we believe that the typical market insertion of Brazilian TBFs and the adoption of technological strategies that do not usually lead to primary innovations are obstacles to the replication in Brazil of the transformative tales of small TBFs in large firms capable of leading at a global scale the markets they have pioneered.
- Both the number and size of Brazilian technology-intensive firms that can be considered truly successful are modest. To be fair, cases of truly successful TBFs are very unusual in most developing countries, except for China and India.
- This situation might well result from basic characteristics of the technological knowledge generation process and its unfolding in entrepreneurial initiatives. Nowadays, deficiencies in the capacity to start and expand TBFs may be one the defining characteristics of the condition of a peripheral economy.

Valuation of High-Tech Private Firms with Individual Value of US$ 1 Billion or More

Countries & Groups of Countries	CB Insights Database			Crunchbase Database		
	#	Valuation	Share (%)	#	Valuation	Share (%)
USA	108	381.7	50.5	124	407.1	44.2
China	58	255.6	33.8	90	391.5	42.5
Europe	26	53.9	7.1	23	44.2	4.8
UK	12	22.3	2.9	11	17.5	1.9
excluding UK	14	31.6	4.2	12	26.6	2.9
Developing Countries	16	44.0	5.8	16	48.0	5.2
India	10	35.5	4.7	10	37.4	4.1
DCs excluding India	6	8.6	1.1	6	10.5	1.1
Indonesia	2	3.8	0.5	3	5.0	0.5
South Africa	2	2.6	0.3	n.a.	n.a.	n.a.
Colombia	1	1.2	0.2	n.a.	n.a.	n.a.
Nigeria	1	1.0	0.1	1	1.0	0.1
Malaysia	n.a.	n.a.	n.a.	1	3.2	0.3
Argentina	n.a.	n.a.	n.a.	1	1.4	0.1
Developed Asian	4	16.0	2.1	9	24.2	2.6
Other	4	5.3	0.7	5	5.8	0.6
Total	**216**	**756.5**	**100.0**	**267**	**920.8**	**100.0**

Source: Own elaboration of information gathered in www.cbinsights.com/research-unicorn-companies [accessed in 11/15/2017] and https://techcrunch.com/unicorn-leaderboard/ [accessed in 11/15/2017].

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