

The Importance of Building Linkages With Offices of Nation Statistics for Questionnaire and Sampling Harmonization

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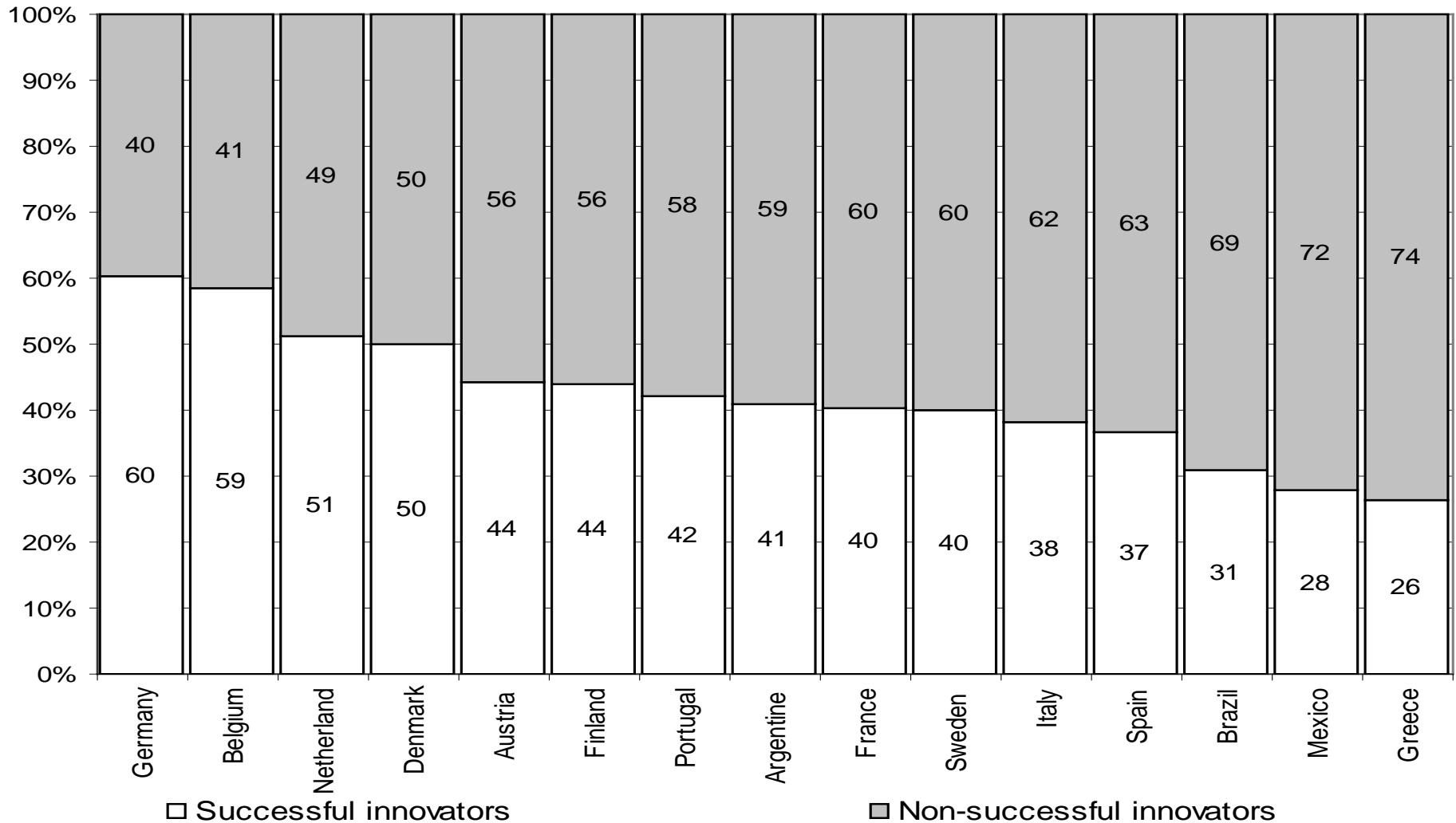
Motivation

- 1. Why is it important to have more information than innovation surveys can provide?**
 - 1.1 Traps and new challenges in innovations surveys**
 - 1.2 World Competitiveness Measurement**
- 2. The Brazilian experience from building linkages with data base from different federal agencies: what do we gain with these linkages?**
 - 2.1 Works using only data from Brazil (Innovation survey linked to other types of data from federal agency)**
 - 2.2 Compare the industrial firms across countries using only innovation surveys. Argentina, Brazil, Mexico and Spain**

Motivation 1.1

**Traps and new challenges in
innovations surveys**

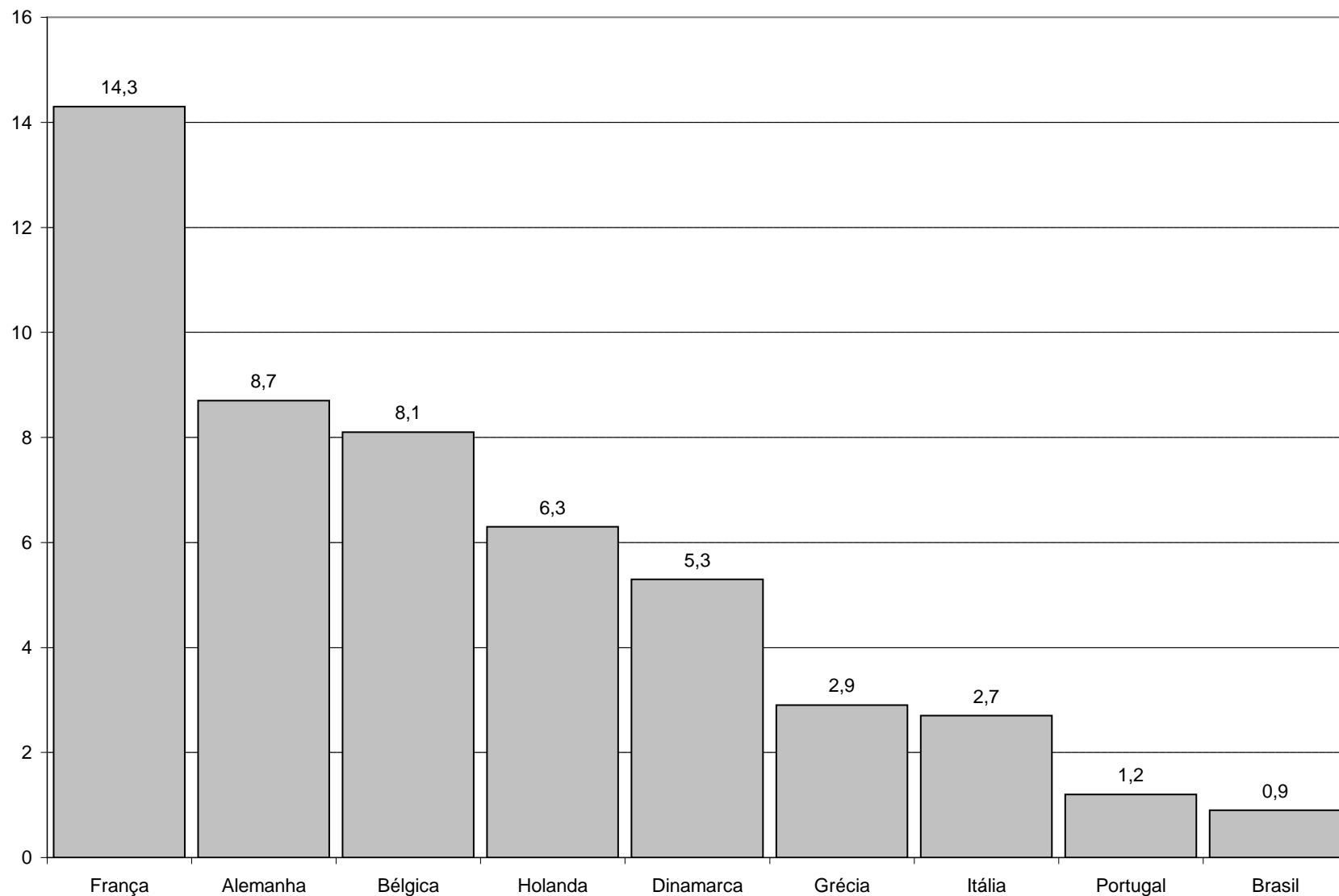
Example 1- Proportion of successful innovators and non-innovators among industrial enterprises: selected countries *



Sources: EUROSTAT, 2006; IBGE, 2004; INDEC, 2005; INEGI, 2003. (authors' elaboration)

Note: (*) The Mexican survey refers to industrial enterprises with 50 or more employees while the other ones refer to industrial enterprises with 10 or more employees. (**) The Argentine survey refers to the period 1998-2001, the Mexican one refers to 1999-2000 and the other ones refer to 1998-2000.

Example 2 - R&D Researchers / workers in Innovative Firms (Average)



Fonte: Newcronos, 2004; IBGE, 2002 (elaboração Ipea).

Traps from innovation surveys for new absent-minded researchers

- 1. The “technological innovation firms” category is not enough to understand the dynamics of technological innovation in the industry;**
 - The definition of Oslo Manual - OECD;
 - “Product and/or process” and “new for firms or market”: “the relevant market”;
- 2. Firms Heterogeneities in developing countries**
- 3. Different types of spending in innovation activities could provide additional information**

Other examples of measuring innovation performance

- **Business R&D intensity** (share of GDP or value added)
 - ✓ *Strong points*: Linked to productivity growth (OECD, 2003); indicator of relative level of innovative activity
 - ✓ *Weak points*: Measure of input, not output; Influenced by industry structure; Not well-suited to services innovation
- **Patents and patent families**
 - ✓ *Strong points*: related to intermediate output of innovation; reliable administrative data (not survey).
 - ✓ *Weak points*: many inventions are not patented; many patents are not exploited; sectoral differences in propensity to patent.
- **Share of innovative firms** (from innovation surveys)
 - ✓ *Strong points*: captures broad set of innovative activities across sectors; output oriented
 - ✓ *Weak points*: Not available for all countries; Limited cross-country comparability; Sampling biases; No measure of degree of innovativeness
- **Qualitative information**
 - ✓ Based on country-specific knowledge
 - ✓ Innovation system reviews;

New metrics and hidden innovation

- ✓ “NESTA’s previous work on *The innovation Gap*, (published in October 2006) developed the concept of ‘hidden innovation’ – the innovation activities that are not reflected in traditional indicators such as investments in formal R&D or patents awarded.”

- ✓ There are four types of hidden innovation (NESTA 2006)
 - ✓ Innovation that is the same or similar to activities that are measured by traditional indicators, but which is excluded from measurement. Ex: oil exploration;
 - ✓ Innovation without a major scientific/technological basis, such as innovation in organizational forms or business models. Ex: new contractual relationship between suppliers;
 - ✓ Innovation created from the new combination of existing technologies and processes. Ex: Internet Banking
 - ✓ Locally-developed, small-scale innovations that take place 'under the radar' and are therefore unrecognized or accounted for. Ex. Innovation in classroom and multidisciplinary teams

Challenges

- ✓ Researchers have recognized technological innovation as one drive for productivity and growth in developing countries and Policy makers have recognized the importance too.
- ✓ In many countries the government has responded by increasing the investment in R&D and encouraging enterprise to cooperate with universities.
- ✓ However to improve innovation it is necessary that the governments extend the existing policies beyond their historical focus on science and technology.
- ✓ There are broad spectrum of policy instruments that affect innovation performance
 - ✓ Framework conditions: education, labour markets, financial markets competition, IPR, openness to FDI
 - ✓ Innovation-specific policy: funding for public and private-sector R&D; changes in governance of public research; reinforcing industry-science linkages
 - ✓ Involve a number of different Ministries

Motivation 1.2

World competitiveness measurement

Two Competitiveness Indexes

- **Two most famous competitiveness indexes:**
 - ✓ **The Global Competitiveness Index (GCI – the former Growth Competitiveness Index) from the World Economic Forum (WEF)**
 - ✓ **The World Competitiveness Scoreboard (WCS) from the Institute for Management Development (IMD).**
- **Both are published annually.**

Methodology

- Both indexes depart from basically the same definition of competitiveness:
- **GCI:** “Competitiveness [is the] set of factors, policies and institutions that determine the level of productivity of a country” (The Global Competitiveness Report, WEF, 2006)
- **WCS:** “Competitiveness analyses how nations and enterprises manage the totality of their competencies to achieve prosperity and profit” (IMD World Competitiveness Yearbook 2006)

Meet the GCI...

Country/Economy	GCI 2006 Rank	GCI 2006 Score	GCI 2005 Rank
Switzerland	1	5.81	4
Finland	2	5.76	2
Sweden	3	5.74	7
Denmark	4	5.70	3
Singapore	5	5.63	5
United States	6	5.61	1
Japan	7	5.60	10
Germany	8	5.58	6
Netherlands	9	5.56	11
United Kingdom	10	5.54	9
Hong Kong SAR	11	5.46	14
Norway	12	5.42	17
Taiwan, China	13	5.41	8
Iceland	14	5.40	16
Israel	15	5.38	23
Canada	16	5.37	13
Austria	17	5.32	15
France	18	5.31	12
Australia	19	5.29	18
Belgium	20	5.27	20
Ireland	21	5.21	21
Luxembourg	22	5.16	24
New Zealand	23	5.15	22
Korea, Rep.	24	5.13	19
Estonia	25	5.12	26
Malaysia	26	5.11	25
Chile	27	4.85	27
Spain	28	4.77	28
Czech Republic	29	4.74	29
Tunisia	30	4.71	37

Barbados	31	4.70	—
United Arab Emirates	32	4.66	32
Slovenia	33	4.64	30
Portugal	34	4.60	31
Thailand	35	4.58	33
Latvia	36	4.57	39
Slovak Republic	37	4.55	36
Qatar	38	4.55	46
Malta	39	4.54	44
Lithuania	40	4.53	34
Hungary	41	4.52	35
Italy	42	4.46	38
India	43	4.44	45
Kuwait	44	4.41	49
South Africa	45	4.36	40
Cyprus	46	4.36	41
Greece	47	4.33	47
Poland	48	4.30	43
Bahrain	49	4.28	50
Indonesia	50	4.26	69
Croatia	51	4.26	64
Jordan	52	4.25	42
Costa Rica	53	4.25	56
China	54	4.24	48
Mauritius	55	4.20	55
Kazakhstan	56	4.19	51
Panama	57	4.18	65
Mexico	58	4.18	59
Turkey	59	4.14	71
Jamaica	60	4.10	63
El Salvador	61	4.09	60
Russian Federation	62	4.08	53
Egypt	63	4.07	52

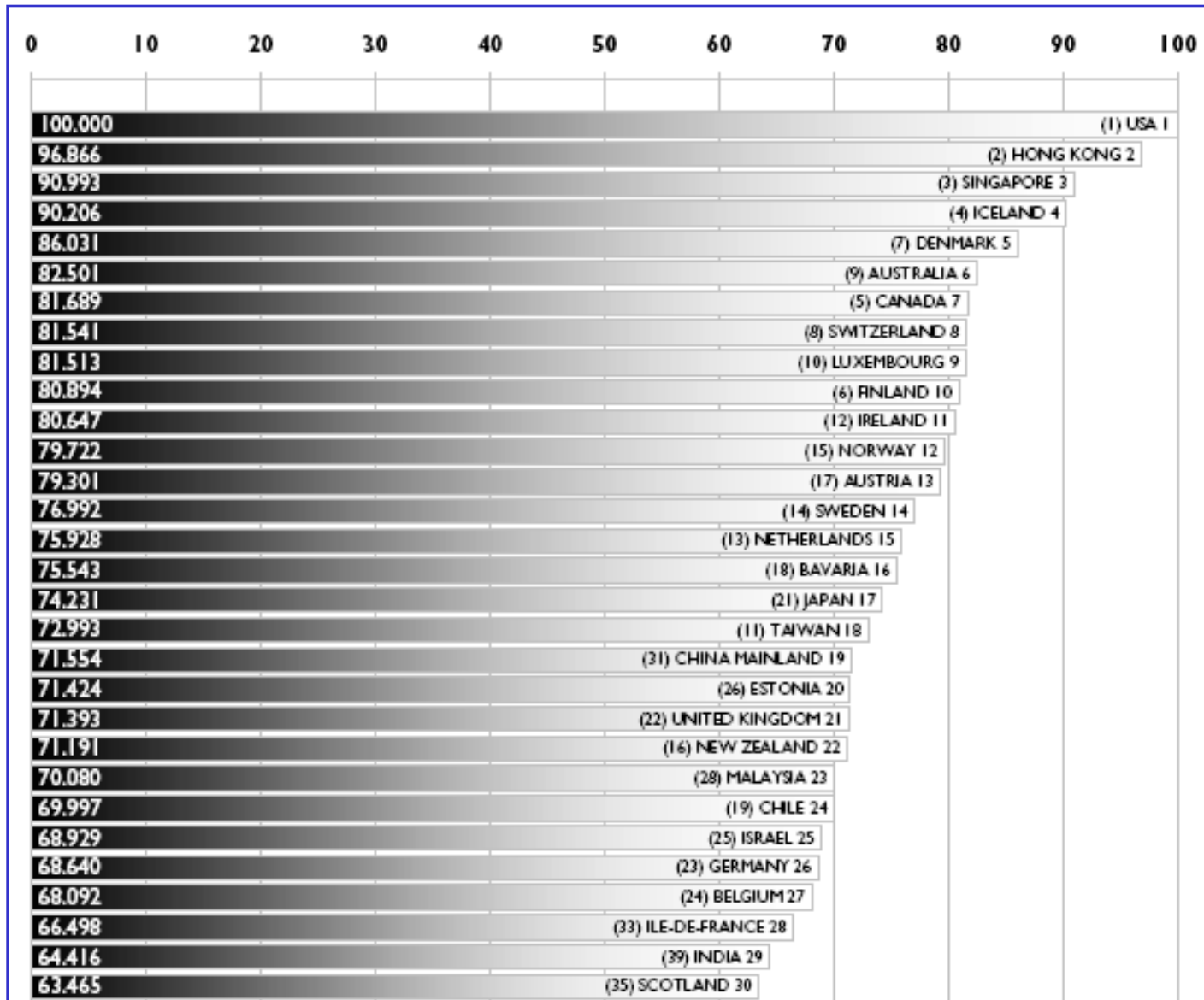
Meet the GCI... (2)

Country/Economy	GCI 2006 Rank	GCI 2006 Score	GCI 2005 Rank
Azerbaijan	64	4.06	62
Colombia	65	4.04	58
Brazil	66	4.03	57
Trinidad and Tobago	67	4.03	66
Romania	68	4.02	67
Argentina	69	4.01	54
Morocco	70	4.01	76
Philippines	71	4.00	73
Bulgaria	72	3.96	61
Uruguay	73	3.96	70
Peru	74	3.94	77
Guatemala	75	3.91	95
Algeria	76	3.90	82
Vietnam	77	3.89	74
Ukraine	78	3.89	68
Sri Lanka	79	3.87	80
Macedonia, FYR	80	3.86	75
Botswana	81	3.79	72
Armenia	82	3.75	81
Dominican Republic	83	3.75	91
Namibia	84	3.74	79
Georgia	85	3.73	86
Moldova	86	3.71	89
Serbia and Montenegro	87	3.69	85
Venezuela	88	3.69	84
Bosnia and Herzegovina	89	3.67	88
Ecuador	90	3.67	87

Pakistan	91	3.66	94
Mongolia	92	3.60	90
Honduras	93	3.58	97
Kenya	94	3.57	93
Nicaragua	95	3.52	96
Tajikistan	96	3.50	92
Bolivia	97	3.46	101
Albania	98	3.46	100
Bangladesh	99	3.46	98
Suriname	100	3.45	—
Nigeria	101	3.45	83
Gambia	102	3.43	109
Cambodia	103	3.39	111
Tanzania	104	3.39	105
Benin	105	3.37	106
Paraguay	106	3.33	102
Kyrgyz Republic	107	3.31	104
Cameroon	108	3.30	99
Madagascar	109	3.27	107
Nepal	110	3.26	—
Guyana	111	3.24	108
Lesotho	112	3.22	—
Uganda	113	3.19	103
Mauritania	114	3.17	—
Zambia	115	3.16	—
Burkina Faso	116	3.07	—
Malawi	117	3.07	114
Mali	118	3.02	115
Zimbabwe	119	3.01	110
Ethiopia	120	2.99	116
Mozambique	121	2.94	112
Timor-Leste	122	2.90	113
Chad	123	2.61	117
Burundi	124	2.59	—
Angola	125	2.50	—

Source: Global Competitiveness Report, 2006

And the WCS



And the WCS (2)

63.003	(36) CZECH REPUBLIC 31
62.598	(27) THAILAND 32
61.286	(20) ZHEJIANG 33
61.262	(32) CATALONIA 34
60.813	(30) FRANCE 35
58.384	(38) SPAIN 36
57.861	(42) MAHARASHTRA 37
57.680	(29) KOREA 38
57.436	(40) SLOVAK REPUBLIC 39
57.351	(47) COLOMBIA 40
57.316	(37) HUNGARY 41
54.149	(50) GREECE 42
52.808	(45) PORTUGAL 43
52.007	(46) SOUTH AFRICA 44
51.641	(52) SLOVENIA 45
51.292	(44) JORDAN 46
50.873	BULGARIA 47
49.408	(43) SAO PAULO 48
49.041	(49) PHILIPPINES 49
47.315	(41) LOMBARDY 50
47.069	(48) TURKEY 51
46.416	(51) BRAZIL 52
44.871	(56) MEXICO 53
44.738	(54) RUSSIA 54
43.663	(58) ARGENTINA 55
43.531	(53) ITALY 56
42.130	(55) ROMANIA 57
39.955	(57) POLAND 58
38.957	CROATIA 59
36.051	(59) INDONESIA 60
32.662	(60) VENEZUELA 61

Source: World Competitiveness Yearbook,
2006

The Differences Between GCI and WCS

GCI:

- Institutions
- Infrastructure
- Macroeconomics
- Health and Basic Education
- Higher Education and Training
- Market efficiency
- Technological readiness
- Business sophistication
- Innovation

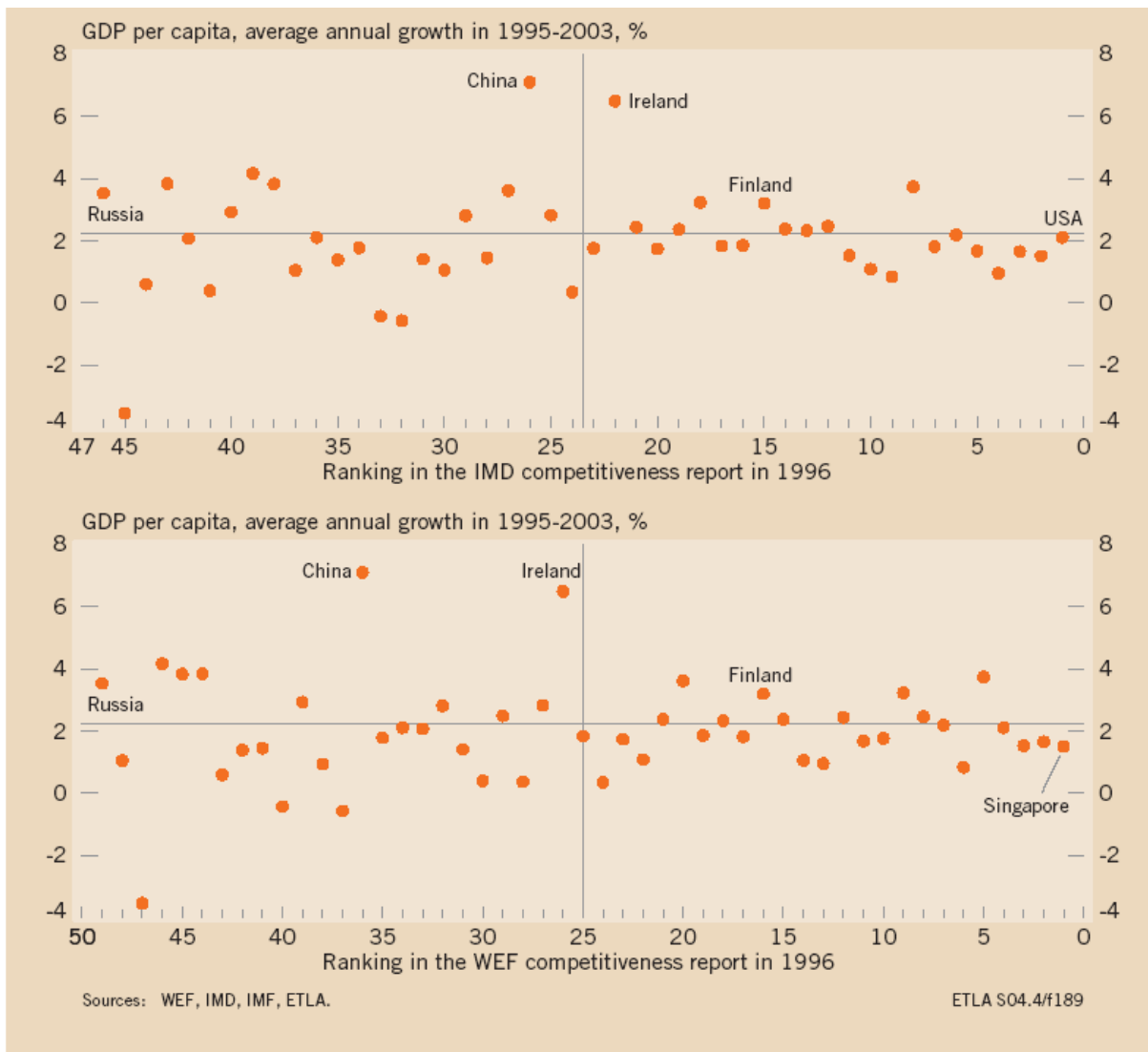
WCS:

- Economic performance
- Government efficiency
- Business efficiency
- Infrastructure

Do they measure growth?

- The answer is “sometimes”. For example, there is no correlation between the rank at the GCI and observed GDP growth, even in the long run.
- Perhaps these indexes are more related to the risk of doing business, or, at some extent, with the level of development (see, for instance, the top 10 list).
- But even if it is the case, there are some surprises: countries switch their positions a lot and conjuncture influences a lot in the classification.

Correlation between the GCI and WCS and observed growth, 1995-2003



Motivation 2.1

**Works using only data from Brazil
(Innovation survey linked to other data
from Federal Agencies)**

Data base

- Building up an integrated database
 - ✓ Original database from Institute for Applied Economic Research (IPEA)
 - ✓ The dataset is the Brazilian Innovation Survey (PINTEC) and Industrial Survey (PIA) matched with 11 other types of data set (international trade, individual workers, patents, government procurement, defense, transnational corporation, Brazilian foreign direct investment, financing banks, fiscal incentives ...)
 - ✓ The database is a sample of approximately 80,000 industrial firms with over 10 employees. These firms are responsible for approximately 95 % of the value added in the Brazilian industry. The analysis covers a thirteen-year period, from 1996 to 2008

Seven Examples – What do we gain?

1. Company competitive strategies
2. Technological Innovation in Brazil
3. Innovation Efforts (national vis a vis transnational firms)
4. Innovation and Wages
5. Brazilian Foreign Direct Investment - Exports and Jobs
6. A new Brazilian entrepreneurial mentality?
7. Policy implications

Company competitive strategies

A. Firm that innovates and differentiates products

- Firms carrying out product innovation for the market
- Firms obtaining at least 30% “price premium” for exported goods when compared to other Brazilian exporters of the same product

Firms focusing on those activities associated with core competences and capabilities in order to perform them better than competitors do

B. Firm specialized in standard products

- Exporting firms not included in the previous bracket
- Non-exporting firms that present the same or better efficiency (value-added per worker by sector) than exporting firms in this bracket

Firms focusing cost advantage by better understanding costs and squeezing them out of the value-adding activities

C. Firm that does not differentiate product and has lower productivity

- Other firms not belonging to the above brackets

Firms facing efficiency and productivity problems

Company competitive strategies

Firms	Total	Workers (average)	Percentage of industrial turnover	Percentage of industrial employment	Productivity (R\$1000) *
Firm that innovates and differentiates products	1,199 (1.7%)	545.9	25.9%	13.25%	74.1
Firm specialized in standard products	15,311 (21.3%)	158.1	62.6%	48.7%	44.3
Firm that does not differentiate product and has lower productivity	55,486 (77.1%)	34.2	11.5%	38.2%	10.0
Total	71,996		100%	100%	

* value-added per worker

Technological Innovation in Brazil

31% of Brazilian industrial firms carried out some technological innovation. In Europe the average is around 50%

- ✦ Only 4.1% of Brazilian firms put new products on the market and only 2.8% launched a new process
- ✦ **Firms non-differentiating and with lower productivity** innovate less
 - 74% are non-innovating firms
- ✦ Innovation accompanying international standards
 - 23.1% of the **firms innovating and differentiating products** and 13.2% of the **firms specializing in standard products** innovated to adjust themselves to international norms and standards. Some 4,000 firms.

Innovation Efforts

(national *vis a vis* transnational firms)

National firms invest 80.8% more R&D related to turnover than transnational corporation subsidiaries (TNCs) in Brazil

- **TNCs spend less in local R&D and spend more in purchasing abroad**
- **79% of TNCs are specialized in standard products**
 - ✓ **Technological efforts concentrated in head offices**
 - ✓ **TNCs adapt products for Brazilian and South American markets**

Innovation Increases Wages

Firms	Wage (R\$/month)	Schooling (year)	Tenure (months)	Wage- Premium (%)
Firm that innovates and differentiates products	1,255	9.13	54.09	23
Firm specialized in standard products	749	7.64	43.90	11
Firm that does not differentiate product and has lower productivity	431	6.89	35.41	0

Brazilian Foreign Direct Investment Favours Exports and Jobs

- **US\$ 13.7 billion Brazilian Industry Foreign Direct Investment (FDI) in 2003**
- **Average wages**
 - ✓ **Firms with FDI: R\$ 1,318**
 - ✓ **Firms without FDI: R\$ 505**
- **Brazilian firms with FDI in the USA and Europe have 17.4% and 14.0% greater chance of export with *price-premium***
- **FDI is one way to reinforce growth, innovation and product differentiation in Brazilian industry firms**

A new Brazilian entrepreneurial mentality?

- **Firms innovating and differentiating products represent 25.9% of Brazilian industry sales**
- **39% of the firms innovating and differentiating products adopt executive strategy changes**
- **23.1% of the firms innovating and differentiating products and 13.2% of the firms specializing in standard products innovated to adjust themselves to international norms and standards. Some 4000 firms.**
- **Innovative Brazilian firms have sought information abroad to carry out technological innovation**
- **Technological innovation is one of the determining factors of Brazilian exportation**

Policy implications

- **Main lines of Brazilian Industrial Policy (2003 – 2010)**
 - ✓ Innovating and differentiating products is the way for Brazilian industry to gain prominence in the world market
 - ✓ Public policies must reinforce and facilitate competitive strategy based on technological innovation
 - ✓ Biotechnology, nanotechnology and ICTs

- **Inter-ministerial coordination mechanisms. To improve coordination of innovation policy across broader set of ministries:**
 - ✓ Brazilian Developing Industry Agency - ABDI (<http://www.abdi.com.br/>)
 - ✓ National Council for Developing Industry (Minister Council) – CNDI

- **Financial support to business R&D (US\$ 1.5 Billion in 2008)**
 - ✓ Addresses market failure associated with R&D: social returns far exceed private returns
 - ✓ Takes the forms of direct funding and tax incentives, both of which can increase business R&D spending
 - ✓ Direct funding allows greater targeting of benefits; tax incentives reach broader set of firms and are market/technology neutral

Motivation 2.2

Compare the industrial firms across countries using only innovation surveys. Argentina, Brazil, Mexico and Spain

Research Motivation

- **Improve policy via cross-country comparison using micro data from innovation survey**
 - ✓ Measure and compare innovation performance and policy settings across countries
 - ✓ Identify weaknesses and related policy needs using quantitative indicators and qualitative knowledge
 - ✓ Cross-country firm comparison can be made using micro data available from innovation surveys

Company competitive strategies

Criteria used for comparison Argentina, Brazil, Mexico and Spain

A. Firm that innovates and differentiates products

- Firms carrying out product innovation for the market
- Exporting firms
- Firms spending in R&D/turnover more than the average within its sector (reference to R&D/turnover sector: Argentina average)

Firms focusing on those activities associated with core competences and capabilities in order to perform them better than competitors do

B. Firm specialized in standard products

- Exporting firms not included in the previous bracket
- Non-exporting firms that present the same or better efficiency (value-added per worker by sector) than exporting firms in this bracket

Firms focusing cost advantage by better understanding costs and squeezing them out of the value-adding activities

C. Firm that does not differentiate product and has lower productivity

- Other firms not belonging to the above brackets

Firms facing efficiency and productivity problems

Research Features

- Industrial firms with 200 or more employees and/or firms that spend in R&D;

- Period:
 - ✓ Brazil and Spain: 2001/2003
 - ✓ Argentina: 1998/2001
 - ✓ Mexico: 1999/2000

- Oslo Manual: Brazil, Mexico and Spain
- Bogotá Manual: Argentina

- Exchange rate - MX: 9.51 R\$:3,07 Euro:1.14 AR: 1

Number of firms

Firms	Argentina	Brazil	Mexico	Spain
Firm that innovates and differentiates products	407 (18%)	532 (7%)	263 (8,3%)	866 (23%)
Firm specialized in standard products	969 (42%)	3584 (45%)	1988 (63,1%)	2211 (49%)
Firm that does not differentiate product and has lower productivity	898 (39%)	3879 (48%)	899 (28,5%)	652 (17%)
Total	2276	8005	3150	3729

Share in turnover (%)

Firms	Argentina	Brazil	Mexico	Spain
Firm that innovates and differentiates products	16.6	33.1	6.1	18.5
Firm specialized in standard products	72.2	61.0	86.0	76.7
Firm that does not differentiate product and has lower productivity	11.2	5.9	7.9	4.8
Total	100	100	100	100

Firm scale (average)

Firms	Argentina		Brazil		Mexico		Spain	
	workers	turnover	workers	turnover	workers	turnover	workers	turnover
Firm that innovates and differentiates products	178	24.9	1106	50.17	358	37.7	222	58.2
Firm specialized in standard products	242	45.5	515	13.74	522	70.8	299	94.6
Firm that does not differentiate product and has lower productivity	146	7.6	160	1.23	381	14.4	189	20.1

Innovation efforts

(in-firm R&D / turnover - %)

Firms	Argentina	Brazil	Mexico	Spain
Firm that innovates and differentiates products	1.12	1.10	0.81	1.85
Firm specialized in standard products	0.12	0.29	0.09	0.63
Firm that does not differentiate product and has lower productivity	0.23	0.33	0.06	1.06
Total industry *	0.24	0.58	0.08	0.87

* **Germany: 2.7%** **France: 2.5%**

R&D investment (U\$1,000,000)

(Total)

Firms	Argentina		Brazil		Mexico	Spain	
	R&D in	R&D out	R&D in	R&D out	R&D in/out	R&D in	R&D out
Firm that innovates and differentiates products	114	6	931	122	80	823	216
Firm specialized in standard products	56	23	452	65	60	1145	982
Firm that does not differentiate product and has lower productivity	15	2	97	66	13	121	19
Total	186	31	1480	253	152	2089	1216

R&D investment (U\$1,000) (average)

Firms	Argentina		Brazil		Mexico	Spain	
	R&D in	R&D out	R&D in	R&D out	R&D in/out	R&D in	R&D out
Firm that innovates and differentiates products	281	15	1750	230	305	950	249
Firm specialized in standard products	58	24	126	18	30	518	444
Firm that does not differentiate product and has lower productivity	17	2	25	17	14	185	29

R&D personnel (total)

Firms	Argentina	Brazil	Mexico	Spain
Firm that innovates and differentiates products	2,373	20,110	1,859	23,148
Firm specialized in standard products	5,349	39,997	4,712	34,956
Firm that does not differentiate product and has lower productivity	1,509	16,951	1,447	5,229
Total industry	9,230	77,058	8,018	63,333

R&D personnel (average)

Firms	Argentina		Brazil		Mexico		Spain	
	Personnel in R&D	Personnel in R&D / total (%)	Personnel in R&D	Personnel in R&D / total (%)	Personnel in R&D	Personnel in R&D / total (%)	Personnel in R&D	Personnel in R&D / total (%)
Firm that innovates and differentiates products	5.83	3.27	37.8	8.34	7.07	2.49	26.73	25
Firm specialized in standard products	5.52	2.27	11.16	9.06	2.37	0.87	15.81	16
Firm that does not differentiate product and has lower productivity	1.68	1.14	4.37	16.65	1.61	0.83	8.02	24

Export (average)

Firms	Argentina		Brazil		Mexico		Spain	
	Export coefficient (%)	Export (1MU\$)	Export coefficient (%)	Export (1MU\$)	Export coefficient (%)	Export (1MU\$)	Export coefficient (%)	Export (1MU\$)
Firm specialized in standard products	20.3	6	13.8	35	22	7	35.9	27
Firm that does not differentiate product and has lower productivity	15.4	13	15.1	8	55	26	30.6	26

Thank you!

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