

Economics and Policy of Innovation

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Globalization of Innovation

(Chapter 12)

The globalisation of innovation (1)

In parallel with the globalisation of production, over the last decades also innovation activities have been undertaken more and more at the global level.

We have seen an example of such globalisation with the global R&D investments of top firms according to EU R&D Scoreboard.

What do we really mean when talking about “globalisation of innovation”?

There are at least 3 distinct concepts, pretty much related with each other → see the article by Archibugi and Michie, *Cambridge Journal of Economics*, 1995.

The globalisation of innovation (2)

3. Three meanings of 'techno-globalism'

As is often the case with neologisms, the term 'techno-globalism' may have different meanings in different contexts and for different authors (see Chesnais, 1992). One such meaning is that an increasing proportion of technological innovations are exploited in international markets: we term this the *global exploitation of technology*. Second, there is international collaboration between firms, sharing know-how with competitors from different countries, along with a parallel process of international collaboration between governments and academic institutions: this we term *global technological collaboration*. A third meaning, dear especially to students of multinational corporations, is that firms are increasing the international integration of their R&D and technological activities: this we term the *global generation of technology*. These three meanings can be separated analytically.¹

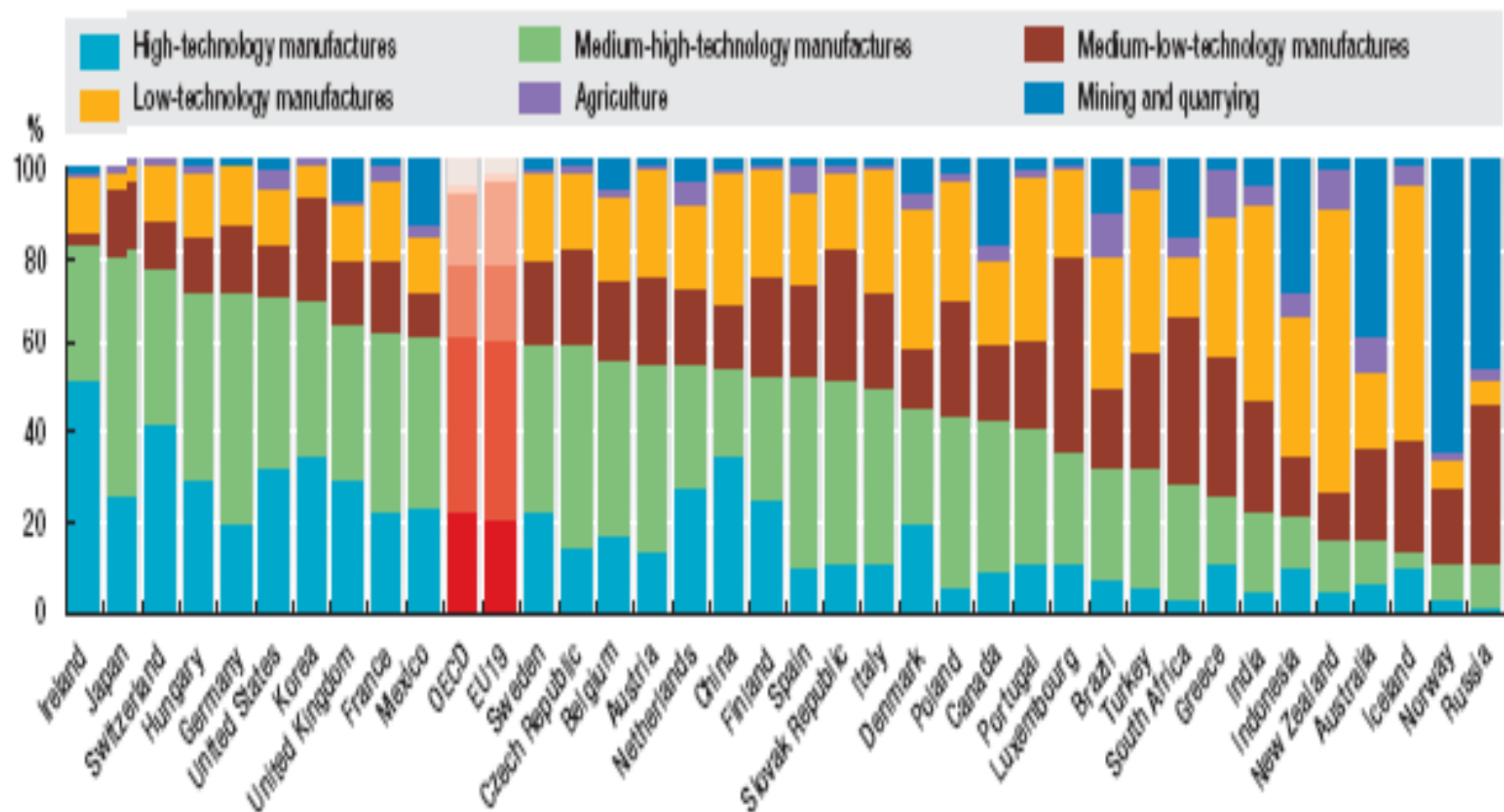
The globalisation of innovation (3)

The first category (*Global exploitation of technology*) involves **all** types of firms (nationals and multinationals, large and SMEs) and we can measure it with:

- International trade flows;
- International patents;
- Technology Balance of Payments.

Technological knowledge is generated in each single country, then exported abroad.

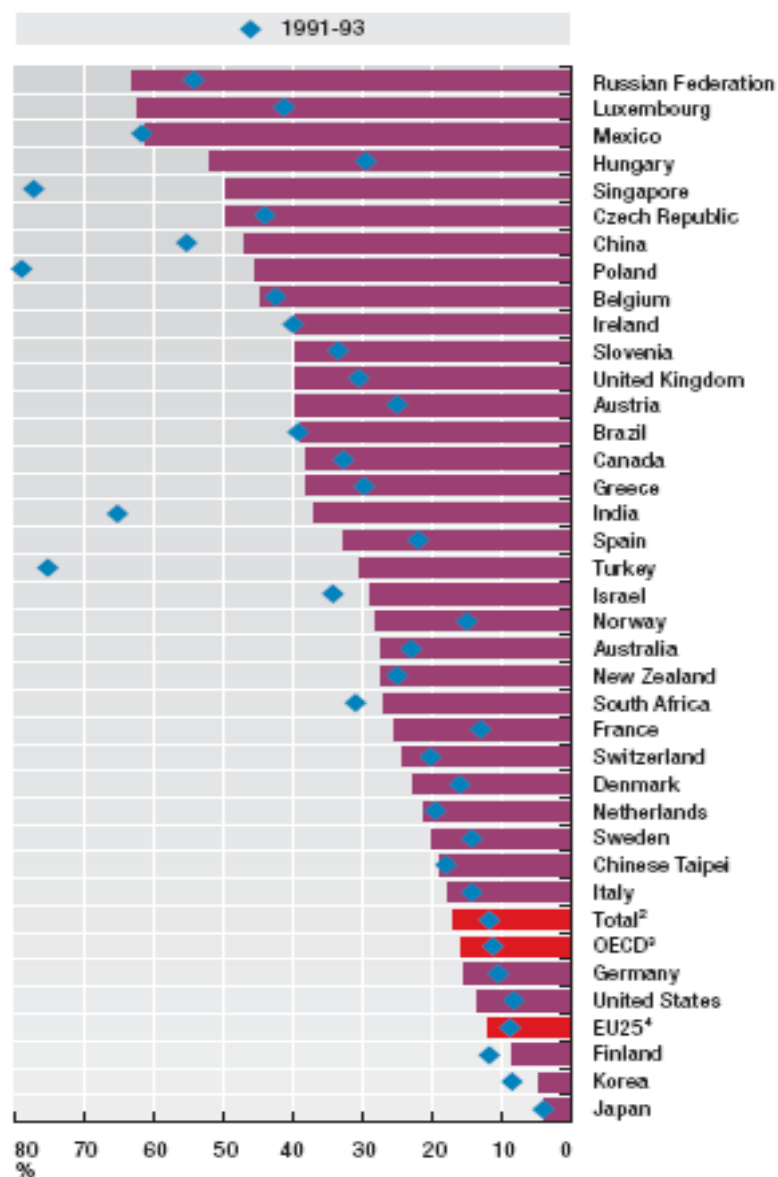
Share of technology industries in total exports of manufactured goods and primary products,¹ 2005



G.1. FOREIGN OWNERSHIP OF DOMESTIC INVENTIONS

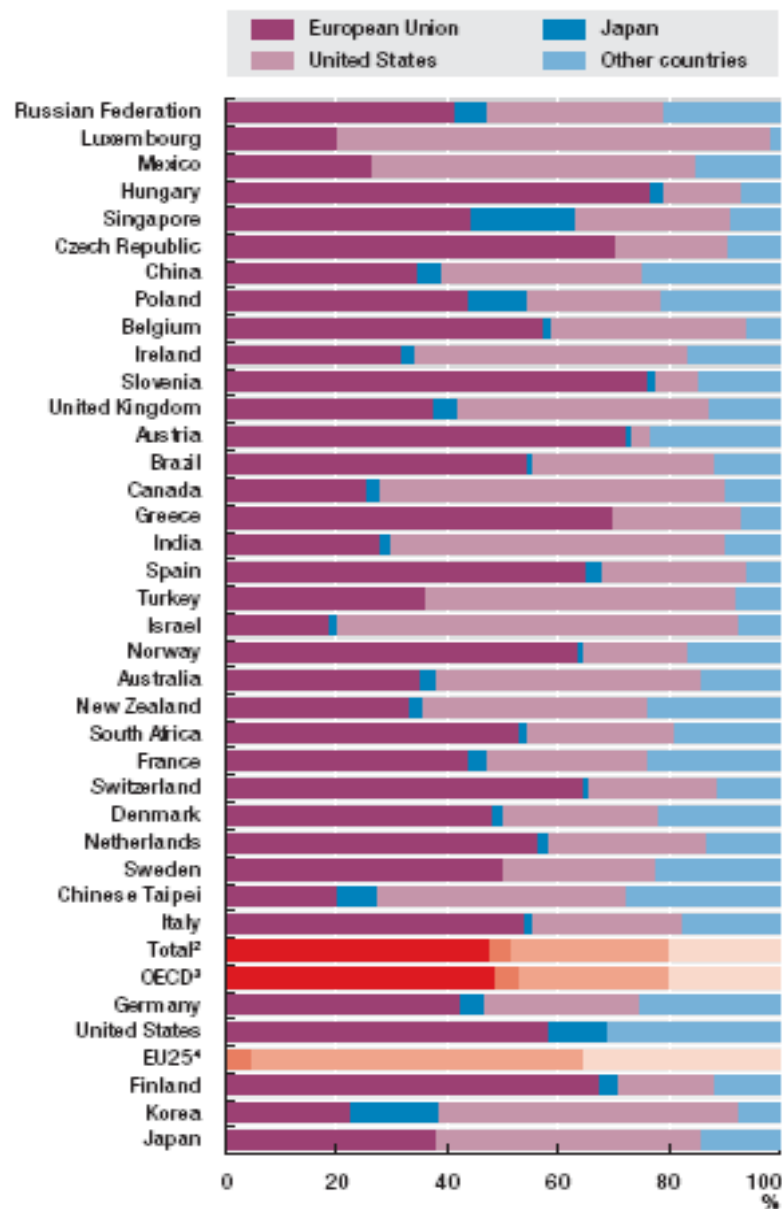
Foreign ownership of domestic inventions¹

2001-03



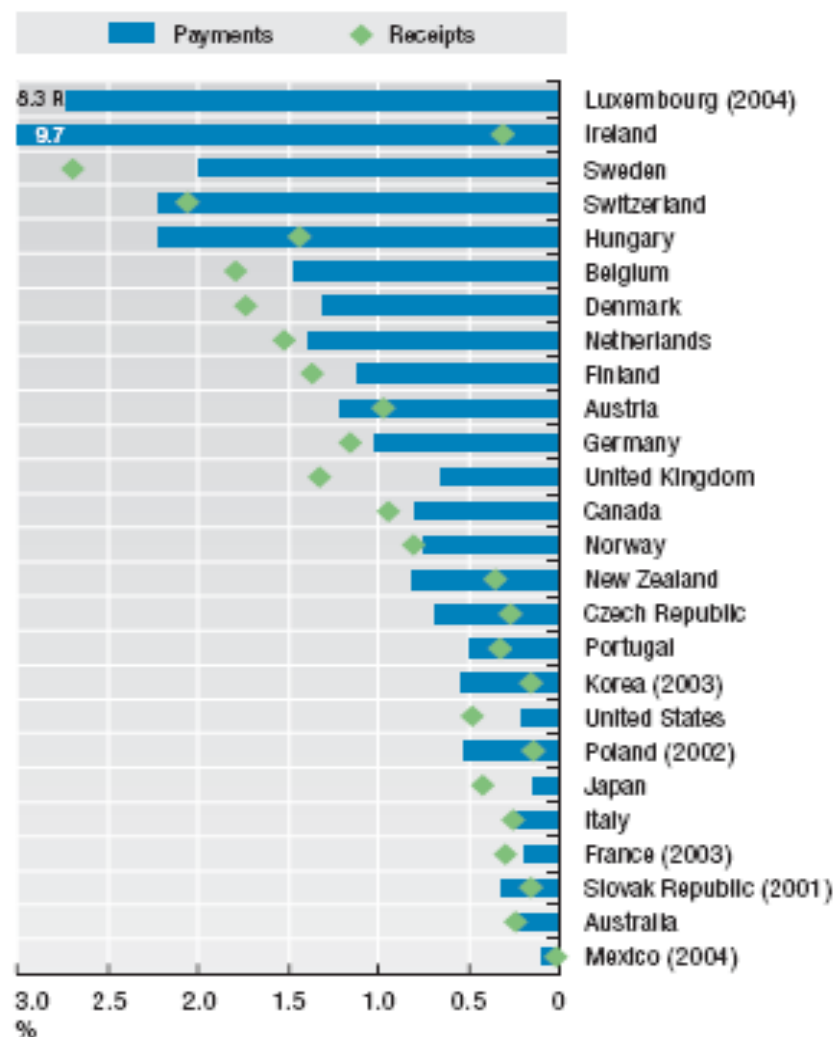
Foreign ownership of domestic inventions¹

Partner in the three major regions, 2001-03



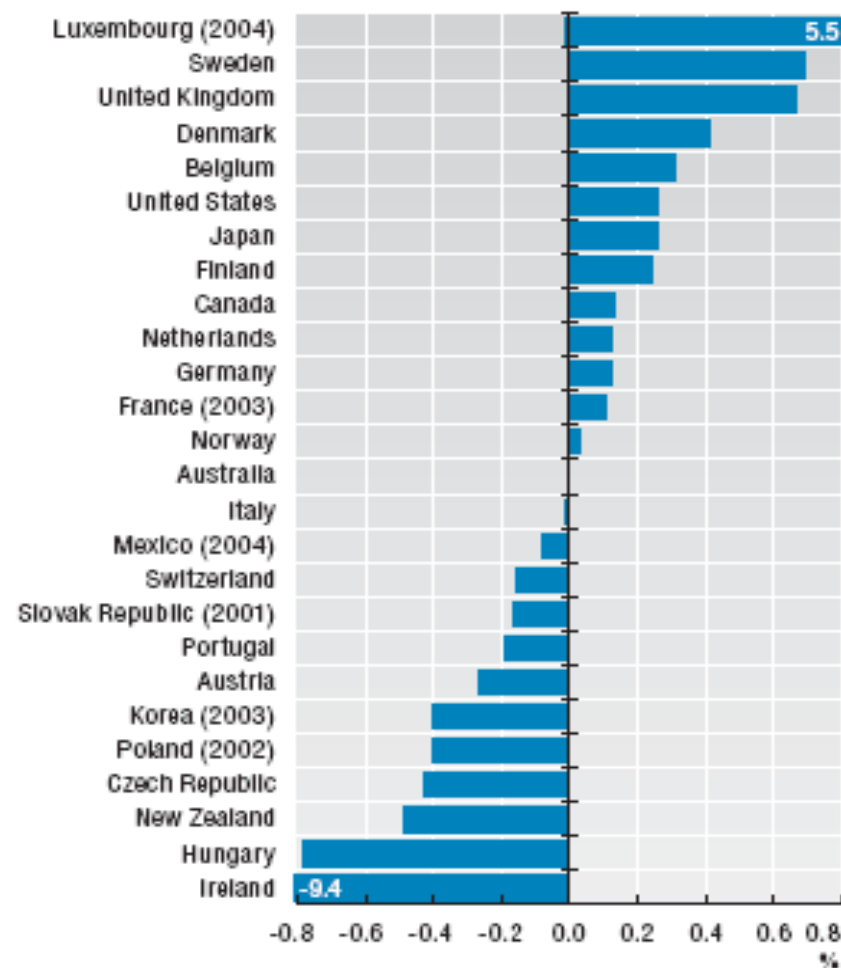
Technology flows,¹ 2005

As a percentage of GDP



Technology balance of payments, 2005

As a percentage of GDP



1. Average of technological payments and receipts.

2. Includes intra-area flows. Excludes Denmark and Greece. Data partially estimated.

3. Excludes Iceland and Turkey.

The globalisation of innovation (4)

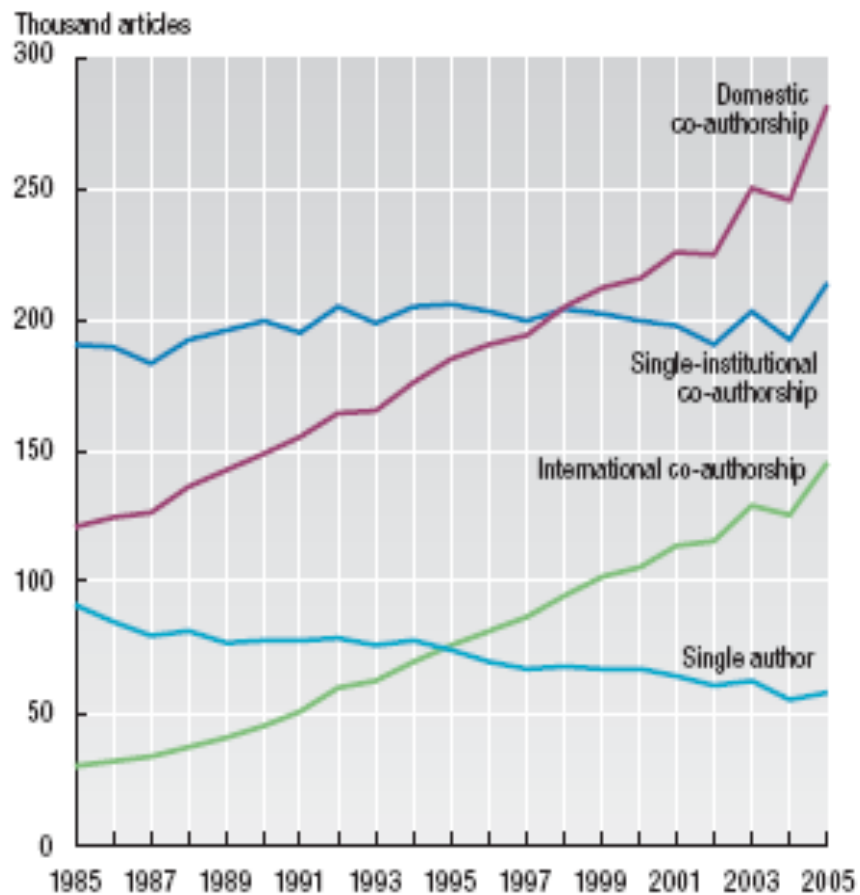
The third category (*Global scientific and technological collaborations*) again involves **all** types of firms, as well as universities and research centres. It can be measured with:

- Patents with foreign co-inventors;
- Co-authorship of scientific publications;
- Cooperation in innovation activities.

The setting up of *non-equity alliances* is a short-term strategy to access knowledge sources outside of the home country.

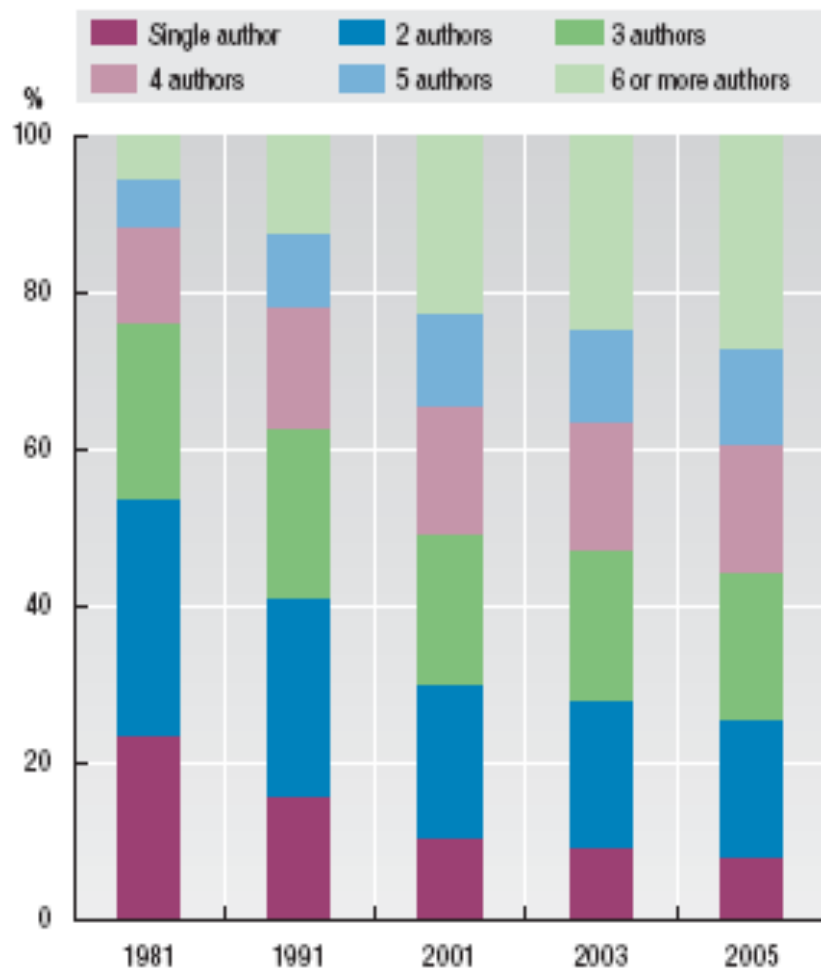
Change in authorship of scientific articles^{1, 2}

1985-2005



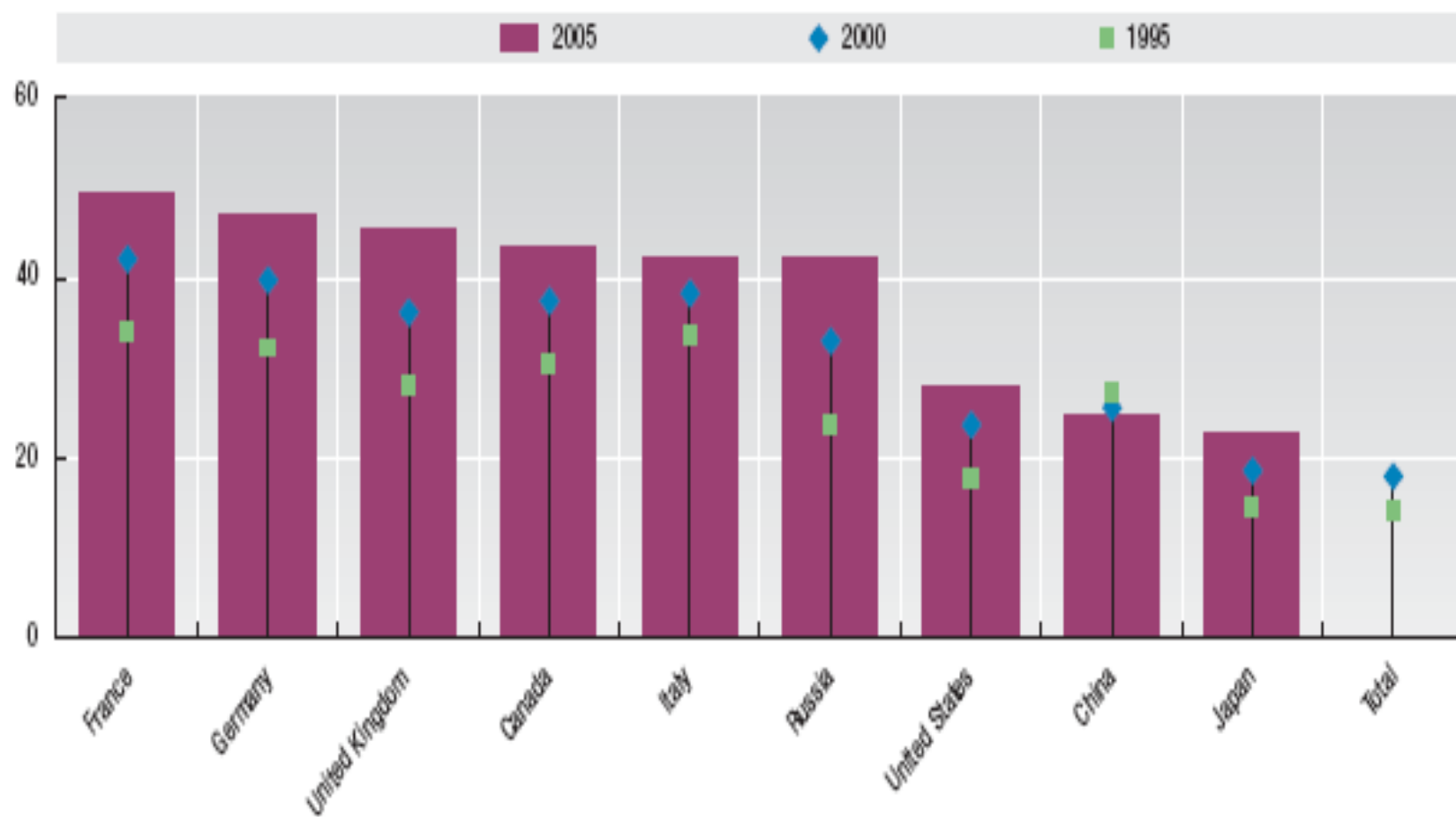
Trends in the authorship pattern in scientific articles^{1, 2}


1981, 1991, 2001, 2003, and 2005



Trends in the ratio of internationally co-authored scientific articles by country^{1, 2, 3}

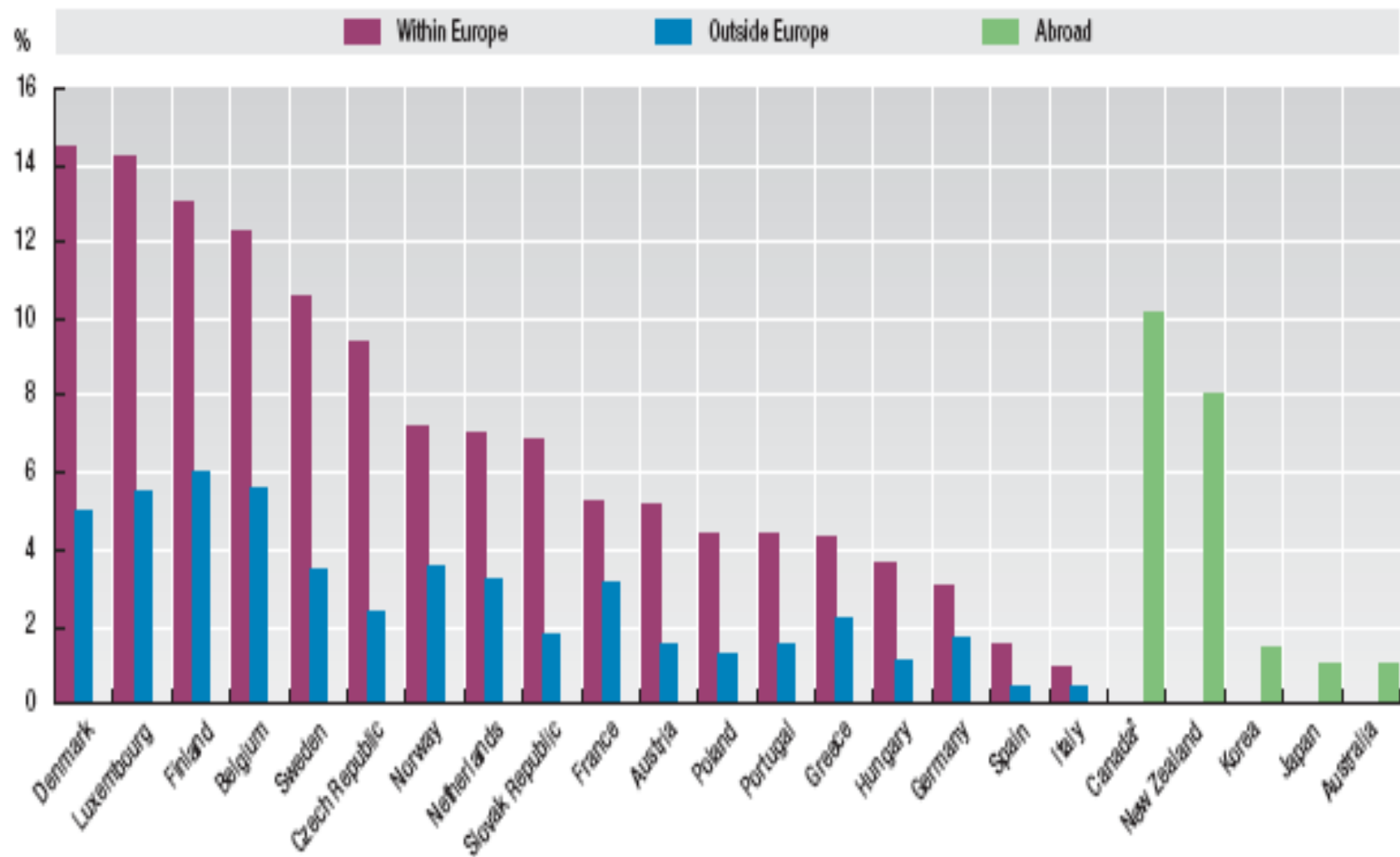
Share in total articles, 1995, 2000, and 2005



StatLink  <http://dx.doi.org/10.1787/118733537462>

Firms with foreign co-operation on innovation, 2002-04¹

As a percentage of all firms



The globalisation of innovation (5)

But the main and crucial category is the second one: the *Global generation of innovation*, that is a strategy involving only **one** type of subjects: Multinational Firms. It can be measured with:

- The setting-up of a foreign subsidiary with research activities (e.g. a new R&D laboratory, but also a new manufacturing plant where R&D activities are undertaken);
- The acquisition of a foreign firm already performing R&D and innovation.

R&D performed abroad is the main indicator for such category of innovation globalisation

Table 12.1 A taxonomy of the globalization of innovation

Categories	Actors	Forms
International Exploitation of Nationally Produced Innovations	Profit-seeking (national and multinational) firms and individuals	Exports of innovative goods. Cession of licenses and patents. Foreign production of innovative goods internally designed and developed.
Global Generation of Innovations	MNEs	R&D and innovative activities both in the home and the host countries. Acquisitions of existing R&D laboratories or green-field R&D investment in host countries.

Global Techno-Scientific
Collaborations

Universities and
Public
Research Centres

Joint scientific projects.
Scientific exchanges,
sabbatical years.
International flows of
students.

National and
Multinational Firms

Joint-ventures for specific
innovative projects.
Productive agreements with
exchange of technical
information and/or equipment.

Source: elaboration on Archibugi and Michie 1995.

The globalisation of innovation (6)

Until the 1980s, it was believed that Multinational Firms were performing (and indeed they were...) almost all their R&D in the home country (and as close as possible to the headquarters)

→ Since the 1990s several studies have instead highlighted an increasing internationalisation trend in multinationals' R&D activities, also very far from their home countries

The globalisation of innovation (7)

Such a shift in multinationals' behaviour and strategy has led to the theoretical distinction into two main motivations for the internationalisation of their R&D:

- 1) Strategies so called asset-exploiting o Home-base exploiting (HBE)** → foreign R&D is just an adaptation of R&D undertaken in the home country;
- 2) Strategies so called asset-augmenting o Home-base augmenting (HBA)** → foreign R&D aims at tapping into and acquiring new knowledge.

The globalisation of innovation (8)

Strategies asset-exploiting (as in the definition by Dunning and Narula, 1995) or **Home-base exploiting / HBE** (as in the definition by Kuemmerle, 1996)

These are the same strategies that multinationals were already using in the post World War II period: their foreign subsidiaries replicate outside of national borders only *non strategic activities* → R&D and innovation are centralised in the home country → foreign affiliates' R&D = it is simply the adoption, adaptation and diffusion in foreign countries of the technology developed by the mother company

The globalisation of innovation (9)

Strategies asset-augmenting (Dunning and Narula, 1995) or **Home-base augmenting / HBA** (Kuemmerle, 1996)

These are the more recent strategies by multinationals: R&D undertaken by their foreign subsidiaries is needed for the improvement of their existing assets, or for the creation of totally new technological assets → R&D and innovation are strategic activities also when performed abroad → foreign R&D is undertaken in advanced contexts, where other firms have high value added activities

The globalisation of innovation (10)

Both **exploiting and augmenting strategies** usually coexist: top multinationals undertake the first type of R&D and innovation in some countries, while the second type in other countries.

Usually **asset-augmenting** investments are targeting advanced countries (at least in terms of relative advantages, see articles by Patel and Vega, 1999; and by Le Bas and Sierra, 2002). And for very different **motivations** (von Zedtwitz & Gassmann, 2002; Sachwald, 2004).

However, more and more multinationals are internationalising their R&D also in **emerging countries**.

Corporate
technological
activities in the
home country

Technological activities in the host country

Weak

Strong

Weak

Type 1: market-seeking
HomeRTA < 1
HostRTA < 1
(Technology is not a driver
of FDI) (10%)

Type 2: technology-seeking
HomeRTA < 1
HostRTA > 1
(13%)

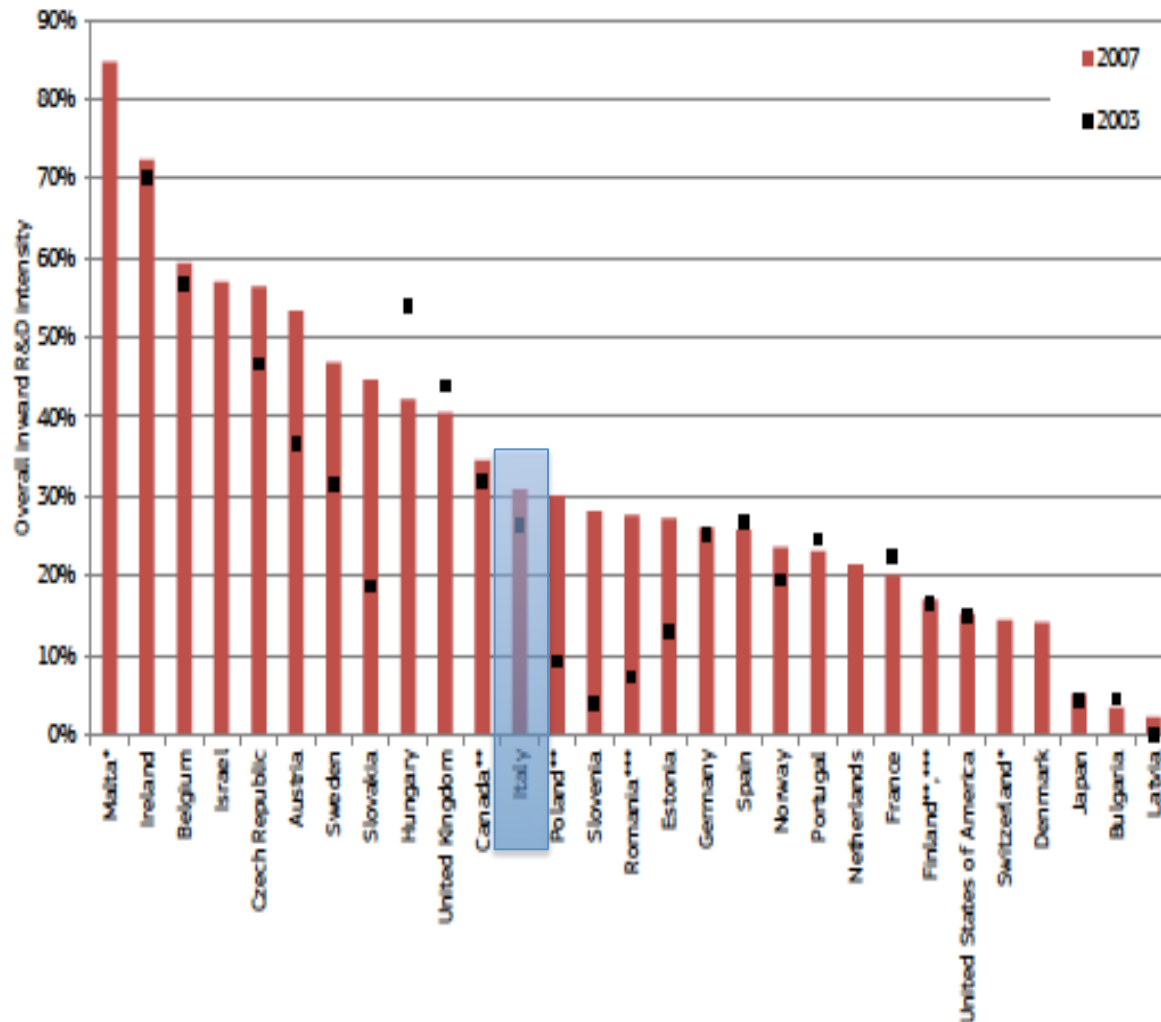
Strong

Type 3: asset-exploiting
HomeRTA > 1
HostRTA < 1
(Efficiency-oriented FDI in
R&D)
(30%)

Type 4: asset-augmenting
HomeRTA > 1
HostRTA > 1
(Learning-oriented FDI in
R&D)
(47%)

Source: adapted from Patel and Vega (1999, p. 152) and from Le Bas and Sierra (2002 p.606).

Italy is not attractive



Note: No 2003 data for Malta, Israel, Netherlands, Switzerland and Denmark; * 2008 instead of 2007;
 ** 2006 instead of 2007; *** 2004 instead of 2003

The globalisation of innovation (11)

Table 1: Reasons to locate 'Research' and 'Development' in a particular location

Reasons to locate 'Research'	Reasons to locate 'Development'
Proximity to local universities and research parks	Local market requirements
Tapping informal networks	Global customers request local support
Proximity to centres-of-innovation	Customer proximity and lead users
Limited domestic science base	Cooperation with local partners
Access to local specialists/recruiting	Market access

Source: von Zedtwitz and Gassmann (2002)

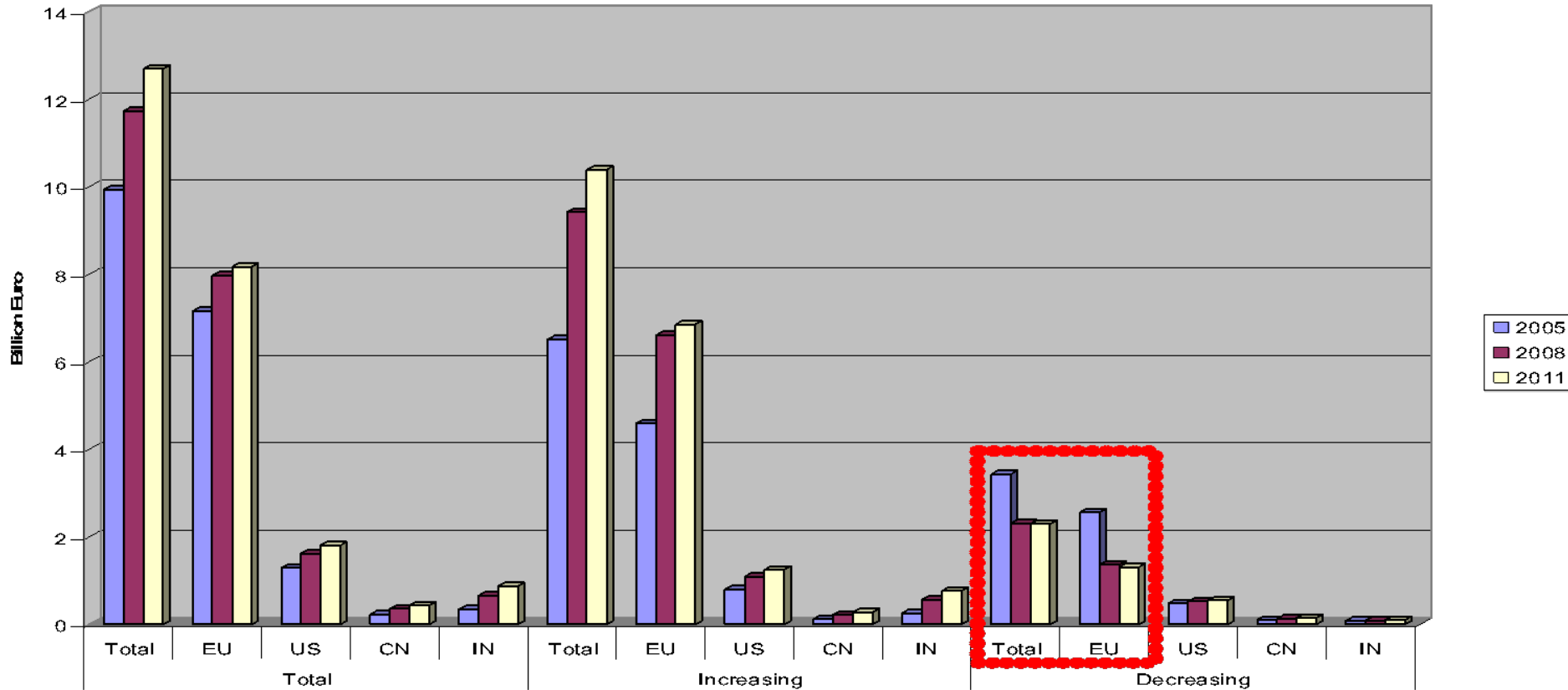
In a similar vein, the function or typology of R&D units to be located is subject to a different set of determinants (Table 2).

Table 2: Determinants for the location of R&D by type of R&D unit

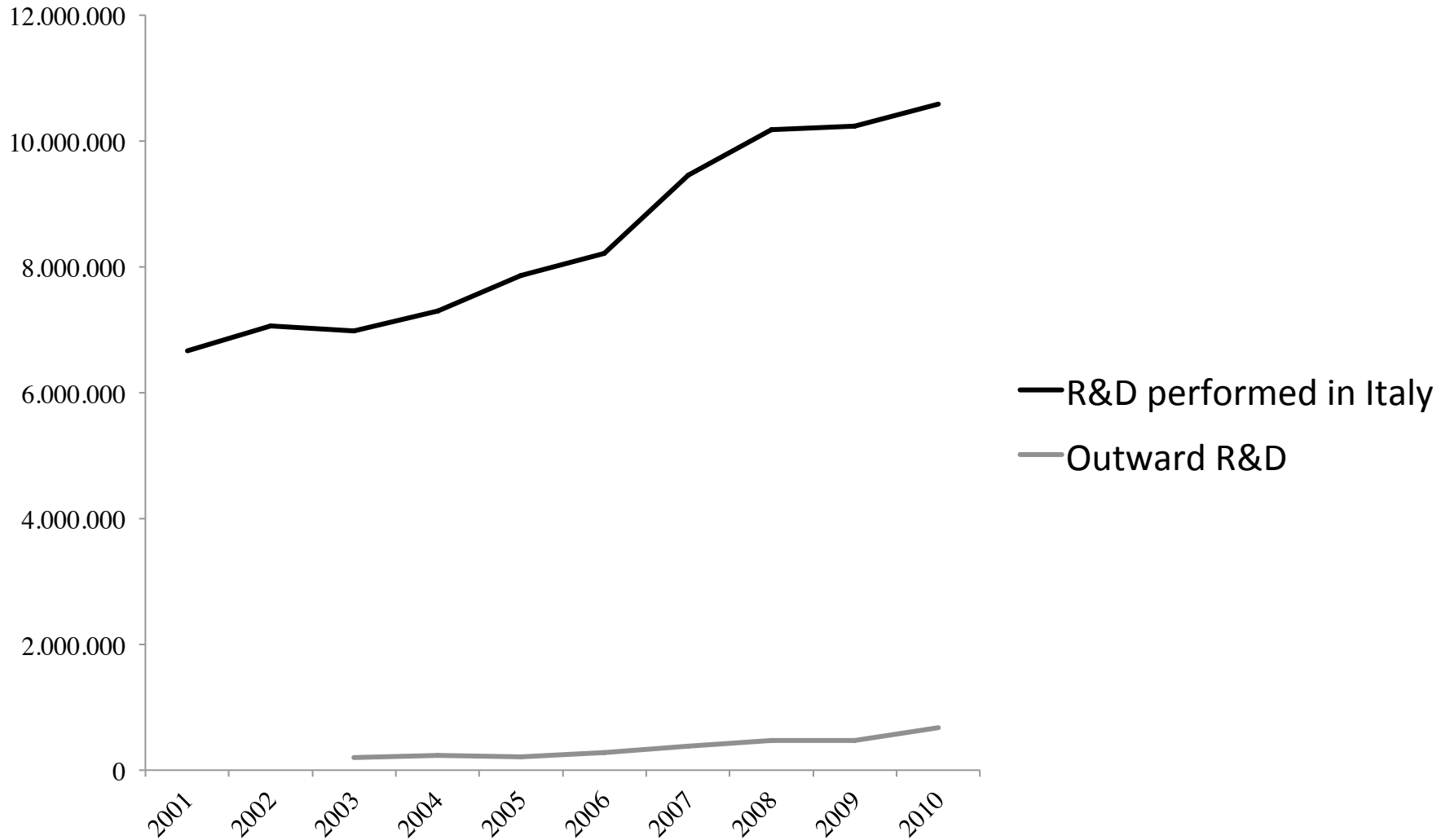
	Scientific and technological supply	Demand
Production support unit	Quality of formation (engineers, technicians)	Important local market (size, purchasing power)
Global unit	Centres of excellence Quality of science-industry relations	Lead market
Rationalisation unit	Cost/efficiency of R&D activities	

Source: Sachwald (2004)

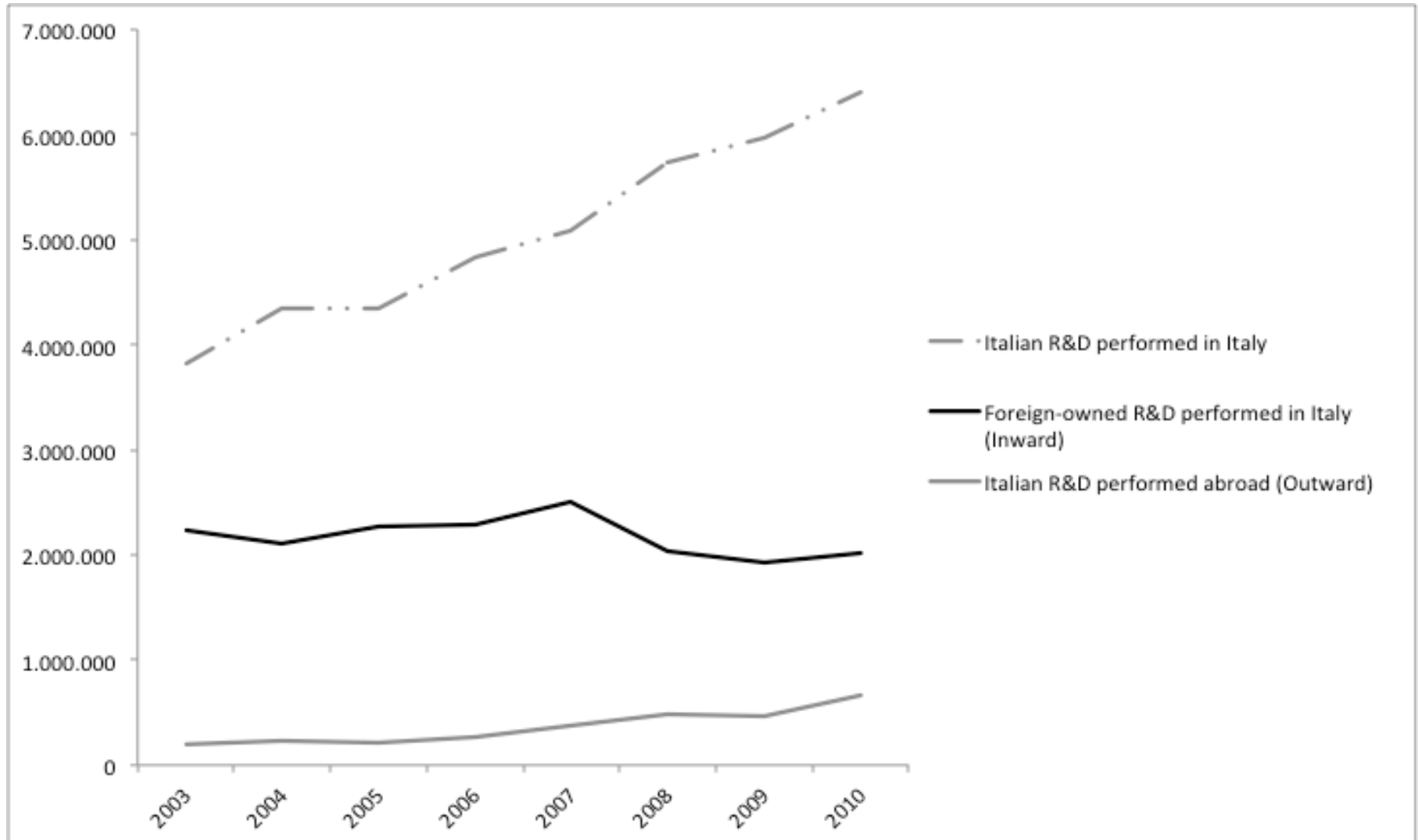
R&D by top EU Multinationals: where?



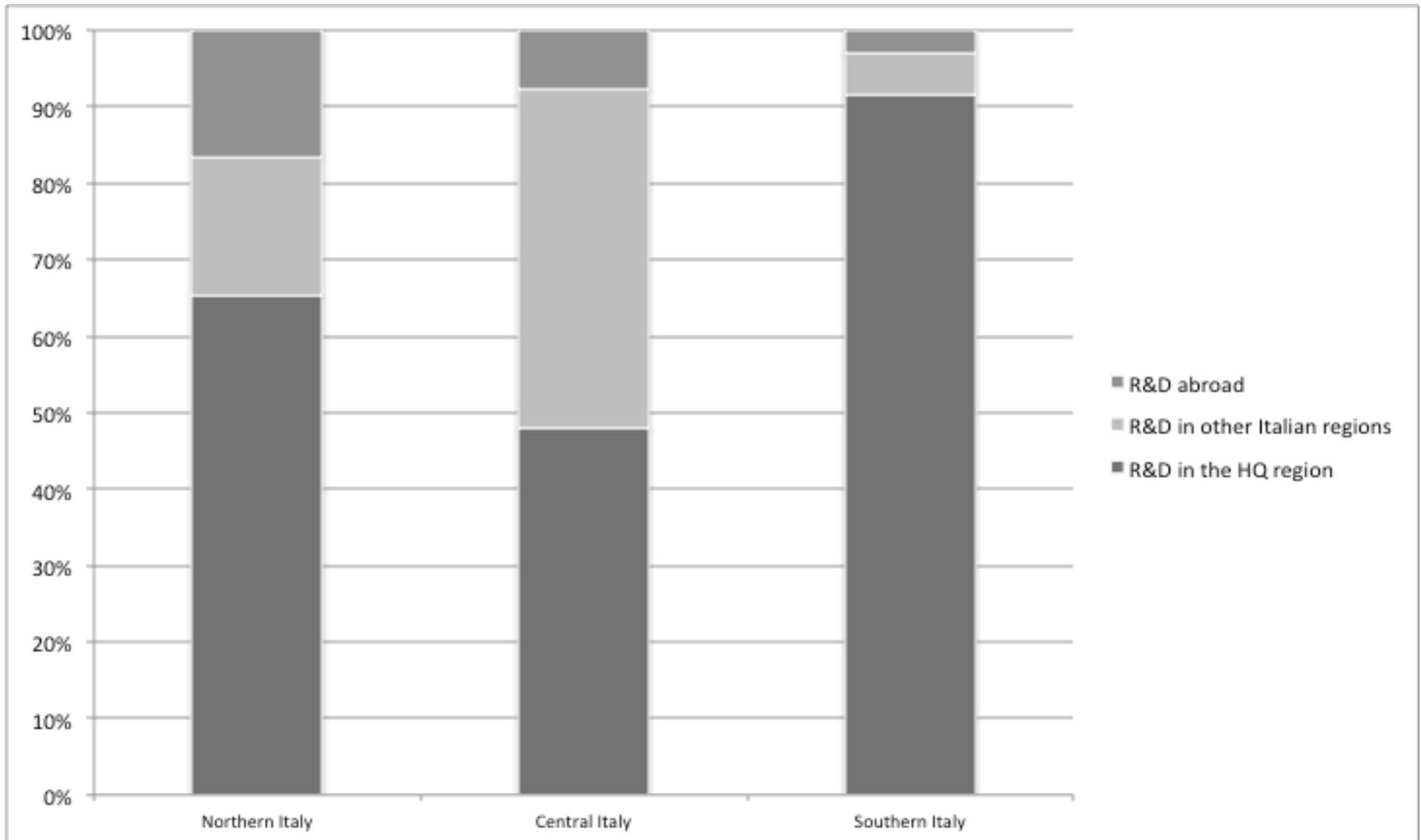
R&D by Italian firms: Outward R&D (R&D done by Italian MNCs abroad) increasing...



... while Inward R&D (R&D done by in Italy by foreign MNCs) is decreasing!



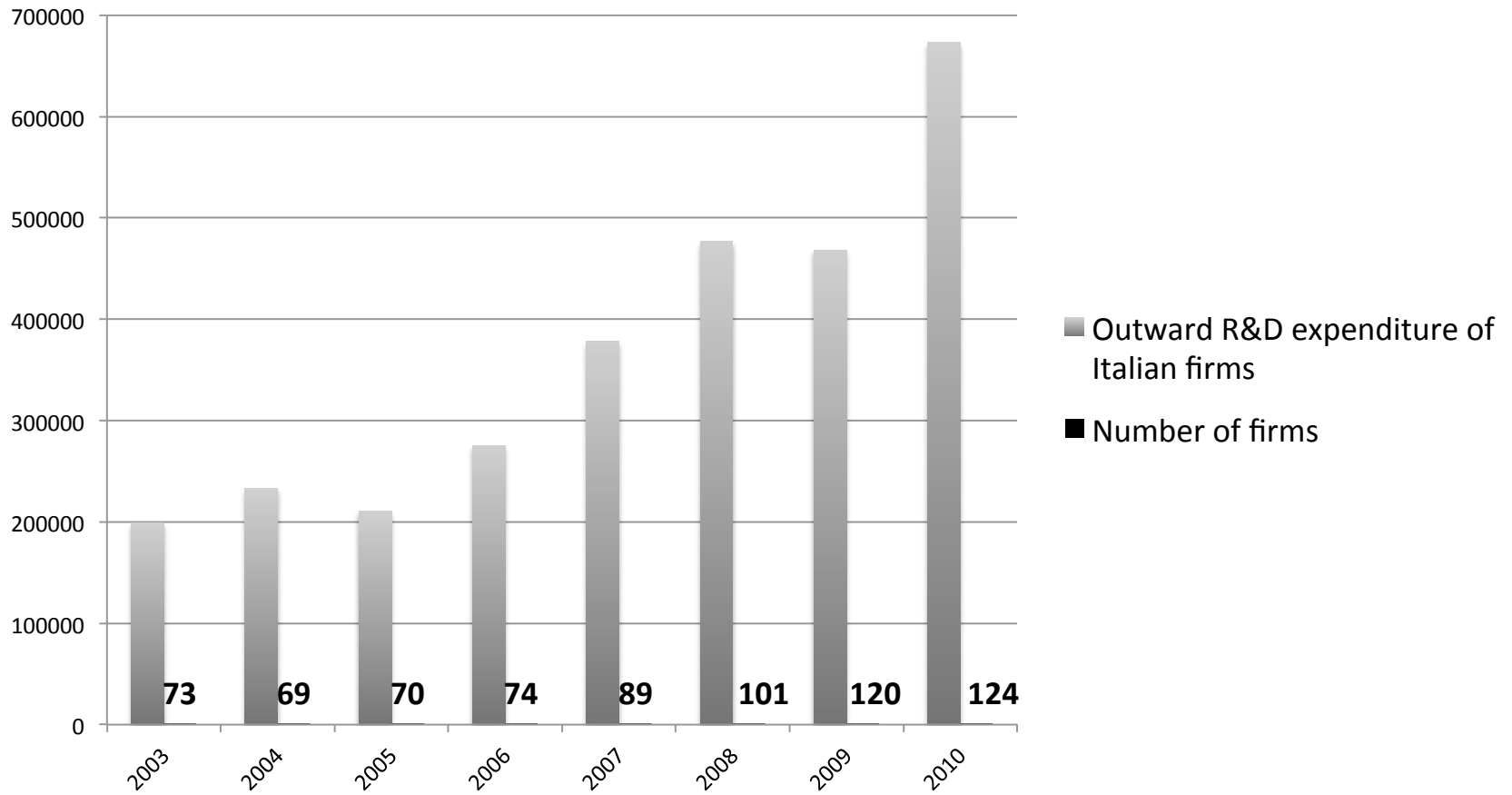
From which regions?



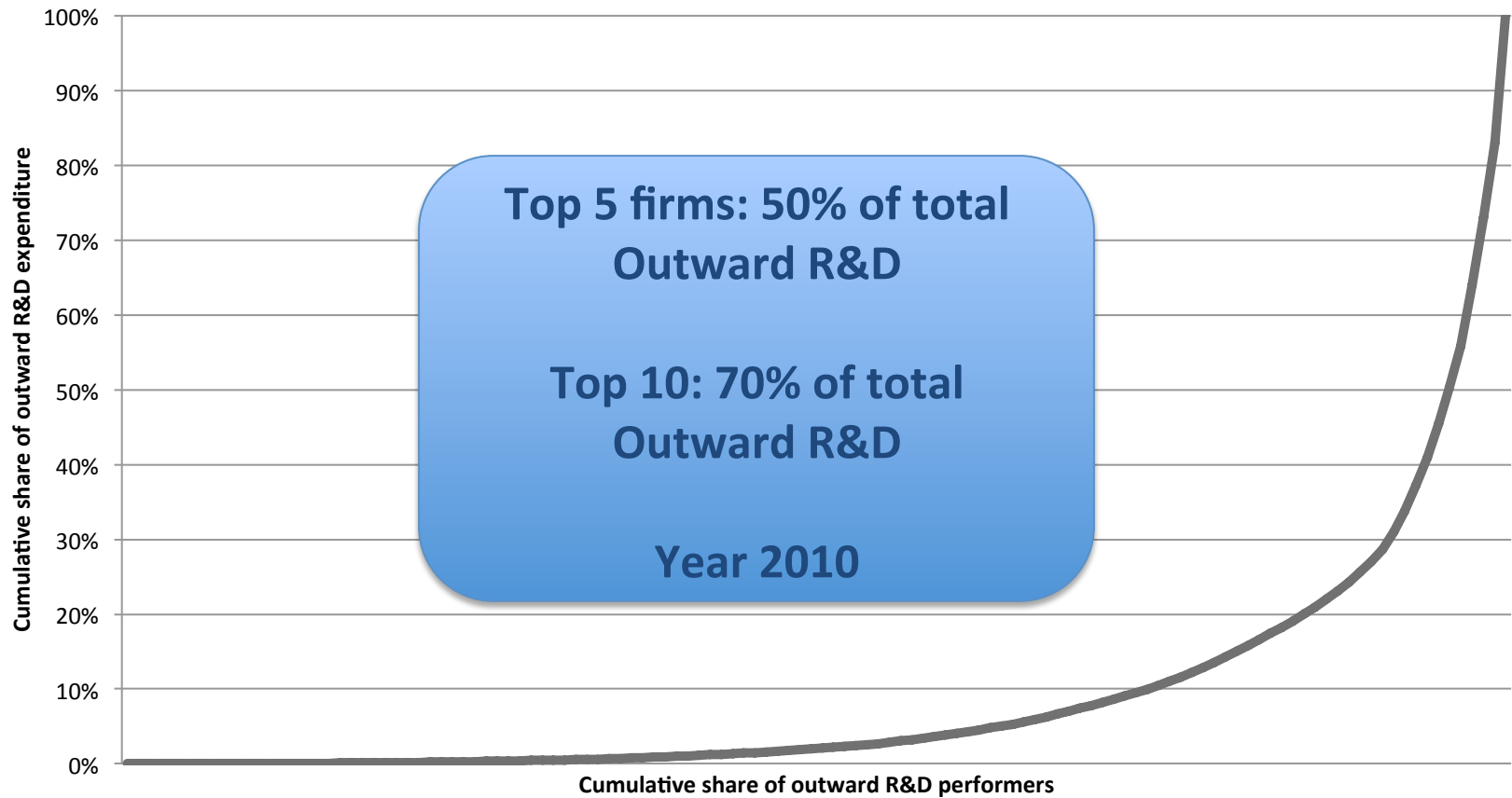
Geographical scope: Inward

Country	2001			2005			2009		
	Expenditure	Firms	Average	Expenditure	Firms	Average	Expenditure	Firms	Average
Netherlands	1,081,518	25	43,261	614,194	16	38,387	733,492	29	25,293
USA	424,882	68	6,248	379,052	73	5,192	287,575	78	3,687
UK	155,324	21	7,396	207,371	16	12,961	200,168	17	11,775
Germany	217,860	38	5,733	324,727	61	5,323	170,655	44	3,879
Switzerland	56,834	19	2,991	174,343	15	11,623	183,053	26	7,041
France	187,970	33	5,696	198,791	34	5,847	135,486	46	2,945
Japan	56,979	11	5,180	18,966	7	2,709	67,417	22	3,064
Other EU countries	106,482	51	2,088	300,390	65	4,621	216,617	87	2,490
Rest of World	51,480	11	5,056	54,983	12	4,582	16,673	43	388
<i>All countries</i>	<i>2,339,329</i>	<i>277</i>	<i>8,445</i>	<i>2,272,817</i>	<i>299</i>	<i>7,601</i>	<i>2,011,136</i>	<i>392</i>	<i>5,130</i>

Focusing on Outward R&D



Focusing on Outward R&D (2)



Geographical scope: Outward

Country	2003	2004	2005	2006	2007	2008	2009	2010	CAGR
Brazil	1,829	5,886	8,565	13,911	15,697	20,194	75,904	177,493	92%
Germany	39,159	42,901	44,717	69,282	107,916	120,663	121,137	135,660	19%
France	56,301	70,181	56,980	57,908	73,118	85,652	72,157	81,846	5%
US	19,622	29,825	28,126	39,025	57,354	85,975	62,215	72,714	21%
Switzerland	14,789	15,851	9,723	10,614	28,088	37,606	38,296	41,897	16%
UK	10,391	9,900	11,136	16,395	12,979	13,643	13,960	38,781	21%
Spain	13,127	12,742	16,721	19,159	24,680	28,302	28,711	30,407	13%
India	320	479	702	697	2,639	2,382	2,009	16,143	75%
Other EU countries	23,014	25,793	16,572	26,016	31,988	28,015	29,646	39,013	8%
Rest of the World	20,276	19,685	17,779	22,412	23,575	54,243	24,268	39,232	10%
Total Outward R&D	198,828	233,243	211,021	275,419	378,034	476,675	468,303	673,186	19%