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R&D Internationalisation and the Global Financial Crisis

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Abstract: This paper asks if – and how – the global financial crisis of 2008/09 has affected overseas R&D activities of multinational enterprises (MNEs). Based on a data set of OECD countries, we find that the share of MNEs on total business R&D expenditure decreased for the first time since 2001 in many countries. Data for 2011 indicate that R&D internationalisation is picking up again, but has not yet reached pre-crisis levels.

The impact of the crisis on foreign-owned firms may be explained by their higher export intensity, more demand-driven R&D, the concentration of MNE activity in R&D intensive manufacturing industries, and a smaller effect of public R&D support provided via stimulus packages after 2007.

The crisis led to a modest re-location of MNE R&D activity from the European Union to emerging economies. The shares of the European Union on total overseas R&D activities of US firms indeed decreased between 2007 and 2011, while shares of emerging economies increased; however, in absolute terms, the gains of emerging economies only small and rather a continuation of a trend which started well before 2008.

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1. INTRODUCTION

Multinational enterprises (MNEs) play a pivotal role in the global creation of knowledge. They are the driving force behind the 'internationalisation of business R&D', the trend that firms increasingly perform research and development activities (R&D) outside their home countries (Dachs, Stehrer and Zahradnik 2014; Dunning and Lundan 2009; OECD 2008).

The internationalisation of business R&D is closely linked to the rise of foreign direct investment and the global fragmentation of value chains (Timmer et al. 2014); support of foreign production by adapting products to local markets is a main motive for firms to locate R&D abroad (Kuemmerle 1999; von Zedtzwitz and Gassmann, 2002; Narula and Zanfei 2005). Therefore, the internationalisation of R&D is, on the one hand, driven by the aim of multinational firms to exploit their market potential with respect to technologies and products in foreign markets. R&D labs abroad help adapt these technologies and products to host country conditions. On the other hand, firms increasingly perform more fundamental, strategic R&D abroad, harnessing more beneficial and conducive conditions for R&D in a particular location like the availability of R&D staff, or proximity to universities and firms with superior expertise in a particular field. Thus, a second important motive for overseas R&D is to create knowledge at foreign locations with superior framework condition for R&D, including proximity to leading universities or R&D intensive firms (Belderbos, Leten and Suzuki 2009; Cantwell and Mudambi, 2011).

This paper asks if – and how – the global financial crisis has affected the internationalisation of business R&D. Section two discusses possible linkages between overseas R&D activities of MNEs and the crisis. The crisis may have reduced the level of R&D performed abroad, but may have also changed the distribution of R&D expenditure of multinational firms between countries. Section three reviews the existing empirical evidence on the effects of the crisis on R&D internationalisation. This section is based on data on R&D expenditures of foreign-owned and domestically firms collected by the OECD. Internationalisation of R&D is measured by the share of foreign-owned firms on total business R&D expenditure of countries. Section four evaluates the effect of the crisis on the country-mix – how R&D expenditure of MNEs is distributed between various host countries. Here, we employ

data on overseas R&D expenditures of US firms. The US is still the largest country in terms of outward R&D investments. The paper closes with some conclusions on future directions of R&D internationalisation.

2. HOW THE CRISIS (MAY) HAVE AFFECTED R&D INTERNATIONALISATION

Today it is widely accepted that fluctuations in economic growth can also affect the propensity of firms to invest in R&D and innovation. Investigating the impact of the crisis on R&D internationalisation is basically a question about how incentives for different types of firms to invest in R&D change over the business cycle. Empirical evidence suggests that innovation activity, at least at the aggregate level, tends to be pro-cyclical and increases when economic growth accelerates (Barlevy, 2007, Arvanitis and Wörter 2013).

There are three major associations how the business cycle may influence R&D expenditure at the firm level (OECD 2012, p. 24): First, economic downturns may reduce the actual demand for products of the firms as well as future demand expectations, which in turn lowers the incentives to innovate. Second, an economic crisis reduces liquidity in the financial system and funding opportunities for R&D and innovation. Third, countries may limit public expenditure during an economic crisis, which may also include changes in public funding for R&D and innovation.

The first factor seems in particular relevant in the context of foreign-owned firms. Export volumes decreased from 2008 to 2009 by 25 percent in Japan, 18 percent in Canada, 15 percent in the European Union, 14 percent in the United States, 11 percent in China, 8 percent in South and Central America, and by 3 percent in India (WTO 2010, p. 8). There is evidence that the innovation activities of export-oriented firms were more severely hit by the crisis (Paunov 2012; Rammer 2012; Archibugi et al. 2013). Foreign-owned firms are more export-intensive than domestically firms (Bellak 2004), and this higher exposure to international trade may have caused larger reductions of R&D expenditure in foreign-owned firms compared to their domestic counterparts, and to a decrease in the levels of R&D internationalisation.

Moreover, the literature stresses that R&D activities of foreign-owned firms are in many cases more market-oriented with the main aim of adapting existing products to international markets (see section

2). This ‘competence-exploiting’ R&D behaviour is demand-driven, in contrast to science-driven ‘competence-creating’ strategies (Cantwell and Mudambi, 2005). Competence-exploiting strategies react stronger to changes in demand, and may therefore lead to a higher elasticity of R&D expenditure of foreign-owned firms with respect to the business cycle.

Finally, MNEs may decrease their R&D expenditure abroad more than at home to cut co-ordination cost, leading to a re-concentration R&D activities in the home country during the crisis. Geographically dispersed R&D activities require considerable management efforts to exchange knowledge between foreign affiliates and the parent company and monitor intra-firm innovation networks (Gerybazde and Reger, 1999, Gensbach and Schmutzler, 2011; Michailova and Mustaffa, 2012). MNEs have to balance the benefits of decentralized R&D in the form of localized knowledge with its diseconomies including the need to organize the exchange of knowledge and technologies between decentralized R&D activities of affiliates and the headquarters. A re-concentration of R&D activities in the home countries may also be motivated by the political commitments of MNEs to their home countries. It is, however, difficult to provide examples of such reactions to the crisis.

These points let us assume that R&D activities of foreign-owned firms have been affected more severely than domestically owned firms by the crisis:

Assumption 1: Foreign-owned firms have reduced their R&D activities more than domestic firms during the crisis, leading to an overall decrease in the level of R&D internationalisation.

However, the literature (Kolasa et al. 2010, Aghion et al. 2012, Leitner and Stehrer 2013) also provides some arguments to assume countercyclical reactions of MNEs to the crisis: credit restraints during a crisis may force domestically owned firms to abandon R&D projects or even leave the market, while foreign-owned firms can rely on internal financial means of the parent company. As a result, the share of foreign-owned firms on national R&D expenditure may increase. In addition, a

crisis may also offer opportunities for MNEs to take-over R&D intensive domestically owned firms, resulting in a countercyclical effect.

Besides changes in the levels of R&D internationalisation, an economic crisis may also lead to *a re-distribution of MNE R&D activities between countries*. Different countries are affected to a different degree by a crisis, and countries also differ in terms of their policy response to the crisis. This was also the case in the global financial crisis of 2008/09: China, India, and other South-East Asian countries were much less affected than the US or Europe; Southern and Eastern European countries were more severely affected than North European countries (Filippetti and Archibugi 2011; OECD 2012, Annex 1A).

These differences may lead to different expectations of future market growth and unequal incentives for MNEs to invest in R&D across countries. As a consequence, foreign affiliates in countries with high future market growth expectations may increase R&D expenditure, while MNE affiliates in countries with weak expectations decreased R&D expenditure, leading to a change in the country mix. The literature points out that foreign affiliates evolve to a considerable degree on the initiative of the local management that makes use of favourable framework conditions, subsidiary autonomy and capabilities (Birkinshaw et al. 1998; Frost et al. 2002, Cantwell and Mudambi, 2005). Corporate headquarters may have amplified this mechanism during the crisis by re-allocating funds for R&D to countries with higher growth expectations.

Changes may arise between US and European locations on the one hand, and South-East Asia and other regions less effected by the crisis on the other hand. Moreover, we may also observe that MNEs from emerging economies took the opportunity of the crisis and increased their engagement in Europe by take-overs or counter-cyclical increases of their R&D activities. We therefore propose a second assumption:

Assumption 2: One effect of the crisis was a re-distribution of MNE R&D expenditure away from the European Union in favour of Asian locations and other emerging economies.

3. Effects of the Crisis on R&D internationalisation at Country Level

Six years after the global financial crisis reached its climax in 2008 there is sufficient data available to evaluate its effects on the R&D activities of foreign-owned and domestically owned firms and test the two assumptions stated above. We employ data on R&D expenditure of foreign-owned and domestically owned firms provided by the OECD (2014). Most countries collect this data only every second year, so we will look at changes in the period 2007-2009 and 2009-2011, the period after the crisis.

Table 1 gives an overview of changes in R&D expenditure of foreign-owned firms (inward BERD), domestically owned firms (domestic BERD) and the two groups combined (total BERD) for the periods 2007/09 and 2009/11 in current US$ PPP. Countries in the table have been divided into highly internationalised (share of inward BERD on total BERD in 2007 is higher than 50 percent), medium internationalised (inward BERD share is between 25 and 50 percent), and moderately internationalised (inward BERD around 25 percent or below).

(Table 1)

The data indicate that R&D activities of foreign-owned firms suffered much more than R&D of their domestic competitors during the crisis. The median change of inward BERD between 2007 and 2009 is zero, compared to a growth of 25% in domestic BERD. Around half of the countries in the sample report a rising inward BERD between 2007 and 2009. The negative effect of the crisis on inward BERD seems to be independent of the overall degree of R&D internationalisation in a country; we find losses in highly, medium and low internationalised countries.

A surprising result from Table 1 is that inward BERD not only dropped more than domestic BERD; both indicators moved in completely different directions during the crisis: the correlation between the two variables is -.37 for the period 2007-09. One explanation for this asymmetric impact of the crisis is the higher exposure of foreign-owned firms to external markets, as has been noted above. A second possible explanation are differences between the two groups in the effects of the stimulus packages

introduced in 2008 by national governments to fight the crisis. Due to these measures governmental funding of business R&D increased considerably after 2007 (Veugelers 2014). It may be that these measures were mostly tailored to the needs of domestically owned firms; foreign-owned firms made less use of these funds because a lack of incentives - and not a lack of R&D financing - was the main obstacle for foreign-owned firms to invest in R&D during the crisis.

Evidence that supports this assumption comes from data for the period 2009-11 (Table 1). Inward BERD increases in many countries, as growth expectations in export markets improve. The median growth of inward BERD (11%) in this period considerably higher than the median growth of domestic BERD (4%). We may relate this development to the end of stimulus packages in many countries, which also led to a decline in public support for R&D (Veugelers 2014).

The full effect of the crisis on R&D internationalisation can only be considered if we look at the combined effect of the movements in inward and domestic BERD. Inward intensity is the share of inward BERD on total BERD at country level. Inward intensity therefore measures changes in the share of foreign-owned firms on total R&D activity in a particular country, which depends on the inward and domestic BERD.

Figure 1 depicts the development of mean and median inward intensity from 1999 to 2011. The period between 1999 and 2007 is characterized by a faster increase of R&D expenditures of foreign-owned firms compared to total BERD, leading to a rising inward intensity in almost all countries were data is available. Mean inward intensity (unweighted) increased during this period from 27% in 1999 to 35% (mean) and 33% (median) in 2007.

(Figure 1)

Between 2007 and 2009, in contrast, mean as well as median inward intensity of the whole sample dropped by -1.9% or -3.7%, respectively. This was the first decrease in inward intensity since the crisis of 2001. The size of this effect is largely due to the asymmetric impact of the crisis on foreign-owned and domestically owned firms described above.

At country level, inward intensities drop in 12 out of 18 countries between 2007 and 2009. Particularly large slumps in inward intensity can be observed in Belgium (-9 percentage points), Spain and Sweden (-8 percentage points each). Inward intensity in Israel even falls by 13 percentage points; however this was mainly due to a rapid expansion of R&D in domestically owned firms between 2007 and 2009.

Inward intensity increases during the crisis only in Poland, France, Ireland and the UK. Economic activity in Poland was largely unaffected by the crisis, while France introduced a new tax credit for R&D in 2008 which may have spurred R&D expenditure by foreign affiliates. Ireland and the UK have benefited from their role as the preferred locations for European headquarters of US and Asian multinational firms.

From the data presented in Figure 1, it seems that R&D internationalisation not only comes to a halt, but even changes into reverse gear during the global financial crisis, and recovers only slowly after 2009. Between 2009 and 2011, the median growth of inward intensity for 16 countries is 0.3 percentage points and mean growth is 1.3 percentage points; internationalisation of R&D is picking up again, but the levels in 2011 are still below the values for 2007. Therefore, empirical evidence supports our first assumption.

Data at the aggregate level may cover in some cases divergent trends at the sectoral level. Cross-country data on R&D activities of foreign-owned firms at sectoral level, however, is not readily available. This is why we employ data from Germany, the largest host country for R&D activities of foreign-owned firms in Europe, to dig deeper into the effects of the crisis on firms in different industrial sectors. With a BERD increase of 19% between 2007 and 2011, Germany mastered the crisis quite well (Table 1). Contrary to the general trends, domestic BERD grew faster than inward BERD between 2007 to 2009, while inward BERD grew faster in the following two years. In 2011, inward intensity of the manufacturing sector was at almost the same level as before the crisis in 2007.

R&D activities of foreign-owned firms in Germany are concentrated in transport equipment, electrical, electronic and optical equipment and in pharmaceuticals. In 2007 these three sectors together account for two thirds of total inward BERD. The three big sectors took different routes

during the crisis (Table 2): inward BERD in pharmaceuticals grew from 2007 to 2009, but dropped significantly between 2009 to 2011, while R&D of domestically owned pharmaceutical companies soared during the crisis (+55% from 2007 to 2011). So, foreign pharmaceutical companies – but not their domestic competitors – were hesitant to increase their R&D activities after the crisis. This may support the argument of a re-concentration of R&D in the home country during the crisis.

(Table 2)

Inward intensity in electrical, electronic and optical equipment remained fairly stable during and after the crisis. Again, inward BERD dropped less than inward BERD, leading to a decrease in inward intensity. The third sector, transport equipment, moved similar to the other sectors in the period 2007 to 2009, but increased significantly after 2009. Inward BERD in Germany's transport equipment industry is about 25% higher in 2011 than before the crisis while the domestic counterpart grew only by 18% over the same period leading to an increase in the inward BERD intensity in this sector. It seems that increases in inward intensity were particularly high in fields where Germany has a considerable competitive advantage.

The big winner of the crisis in terms of inward BERD are knowledge-intensive business services, including information and communication services and professional, scientific and technical activities. Starting from low levels in 2007, inward BERD in these two industries increased by more than 100 percent and nearly 300 percent, respectively. The growth of knowledge-intensive services is driven by a general, global trend towards increasing international activity of firms in these sectors, but also by outsourcing of knowledge-intensive activities to external suppliers (Peneder et al. 2003). Thus, gains in service industries may mirror the decreases we observe in pharmaceuticals and other sectors, because firms in these sectors increasingly buy-in R&D services. A number of firms in commercial R&D services – part of knowledge-intensive services – are even affiliated to multinational enterprises and act as corporate R&D centres.

The example of Germany shows that the crisis had also asymmetric impacts at the sectoral level; R&D intensive manufacturing sectors suffered more than less R&D intensive manufacturing sectors or services. Hence, differences in the sectoral composition of countries may be one potential explanation for the big differences in the changes of inward BERD and domestic BERD found in Table 1.

4. Effects of the Crisis on the Country Mix

Has the crisis changed the distribution of MNE R&D activities between countries? In particular, did MNEs move R&D activities out of Europe and into China, India, and other emerging economies during the crisis? Such a re-allocation may be feasible because Asian countries were much less affected by the crisis than Europe.

To test this assumption, we first look at the share of different host countries on total overseas R&D expenditure of US multinational firms. R&D expenditure of US firms abroad dropped between 2008 and 2009 from 41.7 bn USD to 39.2 bn USD, but rebounded to 45.8 bn USD in 2011. Losses were largest in the European Union (EU), where R&D of US firms dropped by more than 10% - from 25 bn USD to 22 bn USD - between 2008 and 2010 (Figure 2). 2009 was the first year with decreasing R&D expenditure of US firms in the EU since the crisis of 2000/2001. US firms, however, increased their R&D expenditures in the EU considerably from 2010 to 2011, and almost reached pre-crisis levels. Lower R&D expenditures by US firms between 2008 and 2010 are also reported for Japan and other OECD countries. These losses, however, are compensated by the increase between 2010 and 2011.

In contrast to the European Union, US overseas R&D expenditure increased in Asia (excluding OECD member states Japan and South Korea), and in Latin America between 2008 and 2009. Compared to the total volume of US overseas R&D activities, however, these gains are too small to consider them a significant re-allocation of US R&D activity. The largest gain of Asian countries in the last decade can be found between 2007 and 2008, one year before the crisis. In absolute terms, we see no real winner emerging from the crisis.

(Figure 2)

In relative terms, the share of the European Union on total US overseas R&D expenditure decreases by five percentage points between 2008 and 2010 and reaches a value of 54.5 % in 2011 (Figure 3). This is a serious decrease which is larger than the loss in relative share during the crisis in 2000/01. In contrast to the EU, locations in Asia, Latin America, but also some high-income OECD countries including Canada, Switzerland and Israel are winners of the crisis. Therefore, the main effect of the crisis on the country mix was a geographical de-concentration at the expense of the EU. From the perspective of relative country shares, assumption 2 is confirmed.

It is, however, too early to speak of the end of Europe as the most important host region; despite the erosion of the EU share, more than half of all US overseas R&D activities are still located in the European Union in 2011. Asian countries have gained importance, but their share is still at a low level. Again, it might be interesting to compare the development of 2008/09 with the crisis of 2000/01; Asia gained more than two percentage points between 2000 and 2001, but lost it again in the recovery after 2001 when US R&D activities in the EU soared. In this long-term perspective, the development during the crisis – geographical de-concentration at the expense of the EU – is rather a continuation of trends we can observe since the turn of the Millennium, and not a fundamental shift in the global allocation of US overseas R&D.

(Figure 3)

Unfortunately, only a minority of the EU member states report overseas R&D expenditure, and there is no aggregate for the European Union as a whole. To cross-check the US data, we employ data on R&D expenditure of foreign-owned firms in Germany grouped by their country of origin (Figure 4). A sharp drop of R&D expenditure by European and US firms in Germany during the crisis may be a hint for an ongoing shift towards emerging economies.

(Figure 4)

The figure shows that this was clearly not the case. The shares of inward BERD by country of origin remained quite stable during and after the crisis. Inward BERD from the EU-27 and Switzerland – which dominates total inward BERD in Germany – grew slower than inward BERD from the US and from Asian countries in particular. Japan, for example, increased its share on total inward BERD in Germany from only 2.7 percent in 2007 to 4.1 percent in 2011. Differences in growth rates, however, are too small to cause a large change in the shares of individual countries.

MNEs from emerging economies have considerably increased their R&D activities in Germany during the crisis. The share of Asian countries including China and India increased by 42 % between 2007 and 2011. However, even this increase was not enough to reach one percent of total German inward BERD in 2011.

5. SUMMARY AND CONCLUSIONS

The global financial crisis of 2008/09 has severely affected the internationalisation of business R&D. Empirical evidence indicates that R&D activities of foreign affiliates suffered more from the crisis than R&D activities of their domestic competitors. This may be explained by the higher export intensity and more demand-driven R&D of foreign-owned firms. Moreover, we assume that public R&D support provided via stimulus packages had a smaller effect in foreign-owned firms, because funding was not the main obstacle for MNEs for an expansion of R&D activities during the crisis.

There is evidence for a re-distribution of R&D activity between host countries during the crisis in relative, but not in absolute terms. The shares of the European Union on total overseas R&D activities of US firms indeed decreased between 2007 and 2011, while shares of emerging economies increased. However, US R&D expenditure in the EU reached pre-crisis levels again in 2011. Moreover, it is difficult to constitute a causal relationship between the global financial crisis and this decline because this trend already existed well before the crisis.

In a policy perspective, the internationalisation of R&D benefits the host countries of MNE R&D activities in various ways (Veugelers 2005, Dunning and Lundan, 2008, Chapter 11, Dachs, Stehrer and Zahradnik 2014): first, R&D of MNEs has helped some small countries to increase aggregate R&D expenditure in a very short time. Moreover, the presence of R&D active affiliates of foreign

MNEs has stimulated spillovers in the national innovation system and intensified knowledge exchange between domestic actors and abroad. In the long run, R&D activities of MNEs in a country may also lead to structural change towards a higher knowledge intensity in the economy via a higher demand for R&D personnel and more sophisticated inputs from domestic suppliers.

Given these benefits, a lower degree of R&D internationalisation is negative for host countries, because it may lead to lower increases in aggregate R&D expenditure, less spillovers and lower contributions to structural change. Moreover, policy seemed to have only weak means to stabilize growth rates of foreign-owned firms during the crisis; the data suggest that the stimulus packages after 2007 mainly stabilised R&D expenditures of domestically owned firms. Diminishing growth expectations in foreign markets and not a lack of financial means for innovation was the main disincentive of MNEs to invest in R&D during the crisis.

In this perspective, the slow recovery after 2009, in particular in the European Union, gives no reason to believe that R&D internationalisation will pick up speed again in the OECD in the coming years. Overall, it seems reasonable to assume that R&D internationalisation will evolve only slowly over the next years. However, in the long run, the main drivers of R&D internationalisation are still in place: rising incomes and rising knowledge intensity in various parts of the world which give multinational firms an incentive to locate R&D abroad, together with decreasing cost of exchanging information and knowledge over distance.

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Table 1: Changes in total BERD, inward BERD, and domestic BERD (2007-2009), USD PPP

		Total BERD		Inward BERD		Domestic BERD	
		2007/2009	2009/2011	2007/2009	2009/2011	2007/2009	2009/2011
Highly internationalised countries	Austria	18%	5%	6%	n.a.	35%	n.a.
	Ireland	19%	23%	21%	9%	8%	90%
	Belgium	14%	11%	-3%	53%	44%	-40%
	Czech Republic	11%	7%	-3%	n.a.	52%	n.a.
	Israel	19%	-1%	-4%	n.a.	106%	n.a.
Medium internationalised countries	Australia	30%	2%	-3%	-1%	55%	4%
	Canada	-1%	-6%	-5%	0%	1%	-9%
	Germany	15%	4%	13%	12%	16%	1%
	Hungary	21%	37%	12%	n.a.	28%	n.a.
	Italy	31%	5%	2%	6%	44%	5%
	Netherlands	-2%	-2%	-35%	21%	13%	-8%
	Poland	27%	19%	82%	-28%	0%	61%
	Slovenia	31%	26%	33%	20%	30%	28%
	Sweden	12%	-13%	-13%	23%	26%	-28%
	United Kingdom	7%	-5%	17%	13%	0%	-19%
Moderately internationalised countries	Finland	16%	-4%	-25%	-1%	25%	-5%
	France	10%	10%	50%	10%	-1%	10%
	Japan	9%	-8%	11%	-15%	9%	-7%
	Spain	26%	-7%	-24%	36%	39%	-13%
	United States	17%	-4%	-1%	12%	21%	-7%
	Median	17%	3%	0%	11%	25%	-6%
	Mean	17%	5%	7%	11%	27%	4%

Note: Finland and Netherlands: 2008 instead of 2007

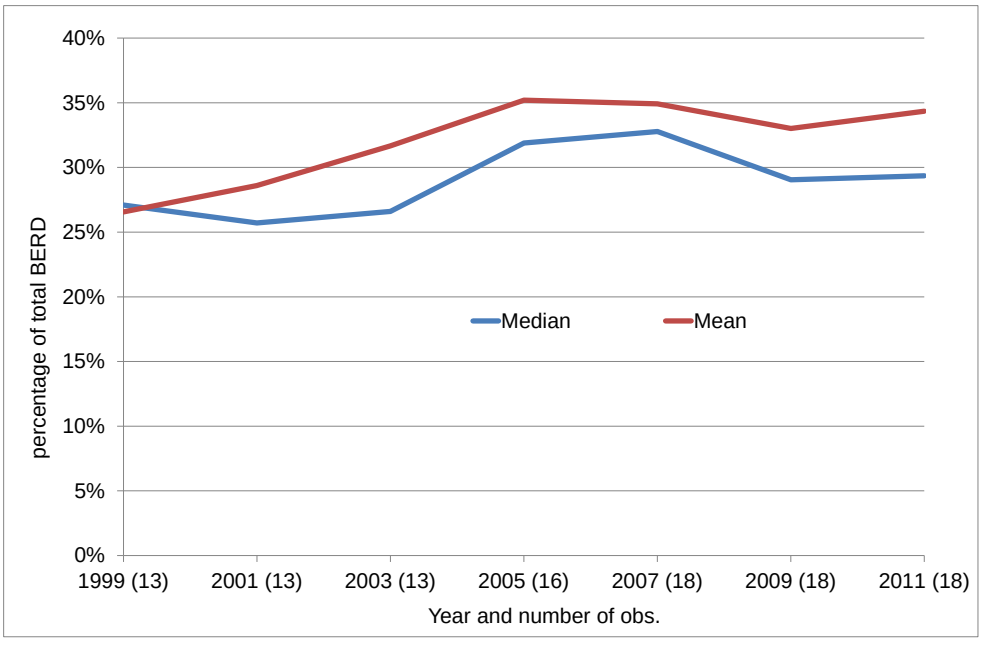
Source: OECD (2014), own calculations, unweighted median and mean

Table 2: R&D expenditures of domestically owned and foreign-owned firms, Germany, 2007-2009 and 2007-11, million EUR, current prices

	Domestically owned firms		Foreign-owned firms	
	2007-09	2007-11	2007-09	2007-11
Chemicals	6%	9%	-19%	-16%
Pharmaceuticals	18%	55%	17%	-6%
Rubber, glass, non-mineral	1%	14%	3%	3%
Metals, metal products	7%	13%	37%	27%
Electric, electronics	-4%	14%	-5%	-2%
Machinery	0%	3%	11%	45%
Transport equipment	1%	18%	1%	25%
Other manufacturing	14%	14%	-1%	-22%
Information and communication	19%	37%	298%	391%
Professional, scientific and technical activities	14%	29%	110%	136%
Total	4%	19%	10%	18%

Source: Stifterverband für die deutsche Wissenschaft (2013).

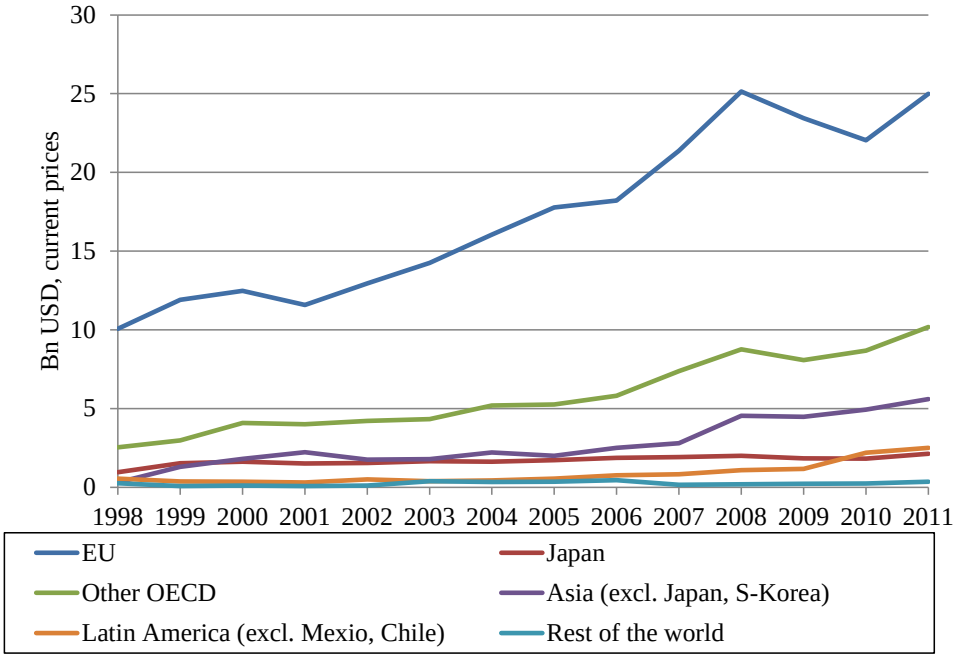
Figure 1: R&D expenditures of foreign-owned firms as a percentage of total business R&D expenditure in OECD member countries, 1999-2011, USD PPP



Note: Finland and Netherlands: 2008 instead of 2007. France: 1998 instead of 1999

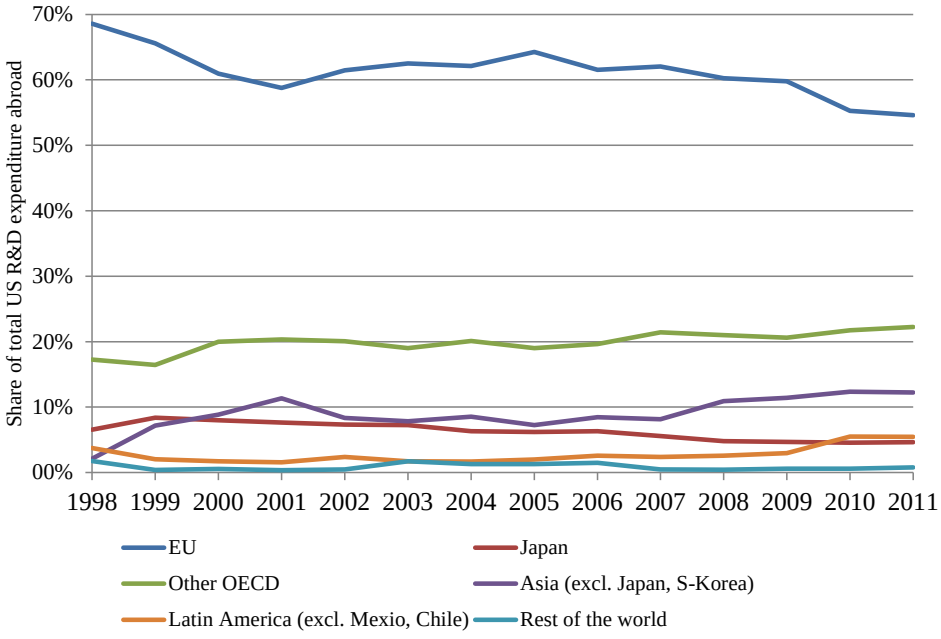
Source: OECD (2014), own calculations, unweighted median and mean

Figure 2: R&D expenditures of US firms abroad in various host regions, 1998-2011, billions USD



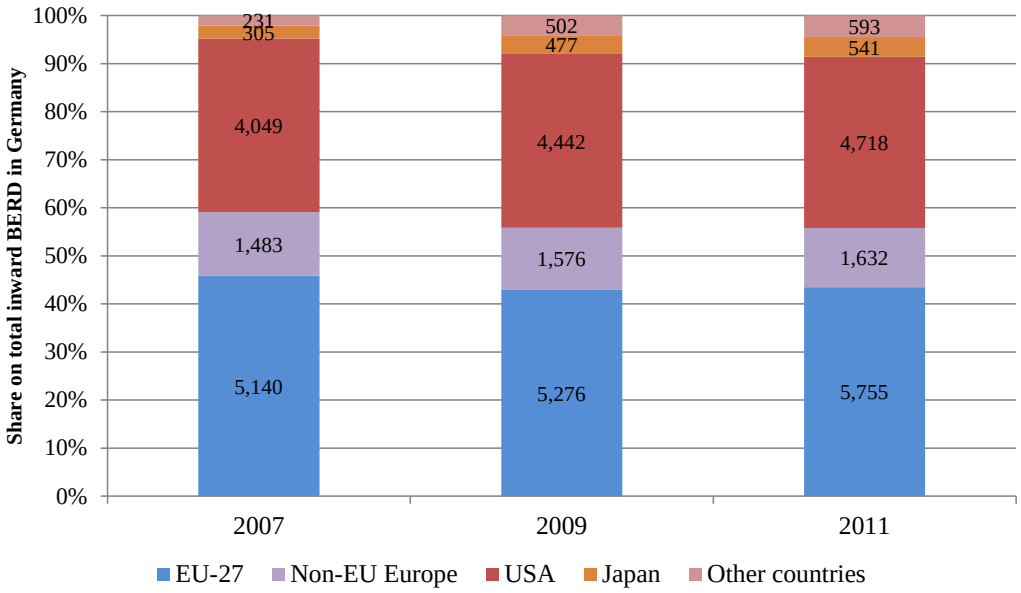
Source: US Department of Commerce, own calculations

Figure 3: R&D expenditures of US firms abroad in various host regions, 1998-2011, share of total



Source: US Department of Commerce, own calculations

Figure 4: Inward BERD by country of origin, Germany, 2007, 2009 and 2011, million EUR, current prices



Source: Stifterverband für die deutsche Wissenschaft (2013).