Christian-Albrechts-Univearsität Zu Kiel

Institut für Weltwirtschaft (IfW)

Seminar Innovation Economics

Topic: INNOVATION AND FIRM GROWTH

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1. INTRODUCTION

Since the early evolutionary framework of Joseph Schumpeter on the relationship between innovation and firm dynamics, there has been an increase in the research done to study the role of innovation on firm growth. It is mostly believed amongst economic researchers, that innovation is one of the main sources of growth. Innovation could induce the growth of both small and large firms in terms of employment generation and an increase in product returns. There are, however, some empirical studies that show an opposite view. For examples scholars like Geroski and Machin, (1992); Geroski and Toker (1996); Yasuda, (2005) and their likes found innovation to have a positive impact on firm growth. While some others like Almus and Nerlinger, (1999); Bottazzi et al., (2001); Lööf and Heshmati, (2006), found no significant impact and still some others like Brouwer et al., (1993); Freel and Robson, (2004) found a negative impact of innovation on firm growth. Which brings to bear the complexity of the subject matter. Although, enough empirical researches still need to be done on the subject coupled with the need for a unified scientific data and limit the challenges faced by researchers in accessing comprehensive scientific user data for their research works. Thus, the question remains to be answered. Is innovation a source of firm growth? Since the empirical outcome has so far shown a mixed effect on firms growth and development. Why should companies continue to disburse their resources on innovation and Research and Development (R&D)? Comparing the benefit or returns on firm sales and production. Is it worth it?

However, one cannot be quick to ignore the fact that there is increasing empirical evidence that shows that innovative activities by firms have helped to improve sale, increase productivity and generate more Jobs. Several policies makers have encouraged countries to implements innovative policies as a means to promote long-term growths and building a knowledge economy, based on a qualified and well-paid workforce (Herstad, 2011). And these policies have been targeted towards encouraging Research and Development (R&D) and refining the productive mechanisms of firms in a more modern fashion that can bring about effective growth.

Amongst heterogeneous firm, innovative activities are seen as one of the means through which firms can compete and grow, especially in the current era of the knowledge economy (Mason et al., 2009). Competing firms are made to improve on their product and services delivering through R&D in other to be ahead of their competitors in the market. Firm interactions can also induce innovative performance that is, areas experiencing inflows of highly qualified individuals can create an enabling environment for the development of innovative activities that are beneficial to the growth of firms (Carlino et al., 2007; Glaeser et al., 2010; Kerr, 2010). Firms could take advantage of knowledge flows within these innovation prone environments which could lead to improved performances. According to (Audretsch and Feldman 1996, 2003): the proximity of firms that generate knowledge

spill-overs produces a positive impact on firms that are located in the cluster in terms of performance and efficiency.

Taking a look at Joseph Schumpeter explanation on the impact of innovation on firm evolution, he considered innovation as an essential driver of competitiveness and economic dynamics. Stating that innovation is a "process of industrial mutation that incessantly revolutionizes the economic structure from within, incessantly destroying the old one, incessantly creating a new one" (Karol Śledzik, 2013). He argued, that any firm seeking profits must innovate. He also talked about the government role in providing incentives for firms to implement innovative activities and job creation: Sometimes firms find few incentives to implement innovations and generate jobs for scientific employees, whereas governments play vital roles to fill this gap (Scherer, 1992).

The arguments and analysis of this paper will be centred on previous works by academics scholars and empirical evidence that substantiated the role of innovation as a determinant of firm growth. The paper is organized as follows: Section 2 will review the concept of innovation and growth and also look at some empirical data on European Union (EU) Research and Development (R&D) intensity compare to some developed economies. Section 3 will look at Innovation and Research & Development (R&D) on Small and Large firms' growth. Section 4 will Review Innovation by New and Old Firms. Section 5 will presents the concluding remarks.

2. INNOVATION AND GROWTH

2.1. INNOVATION

The role of innovation to the development of a modern economy cannot be overemphasis. Innovative activity is the main driver of economic evolution, sustainability and the rise in the living standards in any society. Innovation also has the potential of meeting global challenges in the areas of climate change and health care (OECD, 2007). Recent reality has shown that any economy that wants to sustain their development and firms that want to compete more effectively in their business environment must invest in innovation and knowledge generation R&D. The acknowledgement of this reality has led policymakers in recent years to seek new ways to develop the business environment for innovative activities to strive in order to increase productivity and accelerate growth. And even the government are not left out, these have led to increasing call for more government involvement at the centre stage in the strategic roadmaps in fostering innovation and enhance its impacts on the nation's economy.

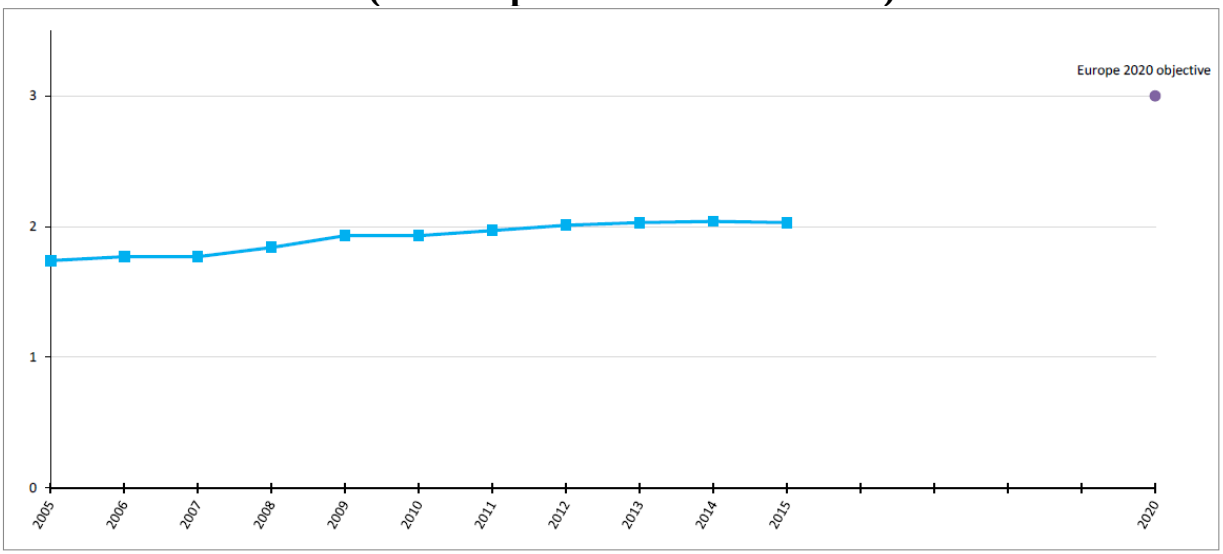
2.2. R&D EXPENDITURE AND INTENSITY

Research and Development (R&D) is a major driver of innovation. R&D expenditure and intensity are two of the key indicators used to monitor resources devoted to science and technology worldwide. Looking at the empirical date from Eurostat, the statistical office of the European Union shows that innovative effort is on the rise as a

share of economic activity in the EU in general and amongst member's states in particular. According to the source data from Eurostat, in 2015, the Member States of the European Union (EU) spent all together almost €300 billion on Research & Development (R&D). The R&D intensity, that is R&D expenditure as a percentage of GDP, stood at 2.03% in 2015, compared with 2.04% in 2014. Ten years ago (2005), R&D intensity was 1.74% (Check Figure 1). This shown that investment in knowledge has grown more rapidly in the EU area compare to Ten years back from 2015. But for other major economies, R&D intensity in the EU was much lower than in South Korea (4.29% in 2014) and Japan (3.59% in 2014) and lower than in the United States (2.73% in 2013), while it was about the same level as in China (2.05% in 2014) and much higher than in Russia (1.13%). To provide a stimulus to the EU's competitiveness, an increase by 2020 of the R&D intensity to 3% in the EU is one of the headline targets of the Europe 2020 strategy (Check Appendix 1: Table 1).

Concerning individual EU countries, R&D intensity of the economy has risen significantly in several EU countries as well but remains more or less unchanged in the EU area as a whole since 2005, and important cross-country differentials remain.

Figure 1. Research and development intensity in the EU, 2005-2015 (R&D expenditure as % of GDP)

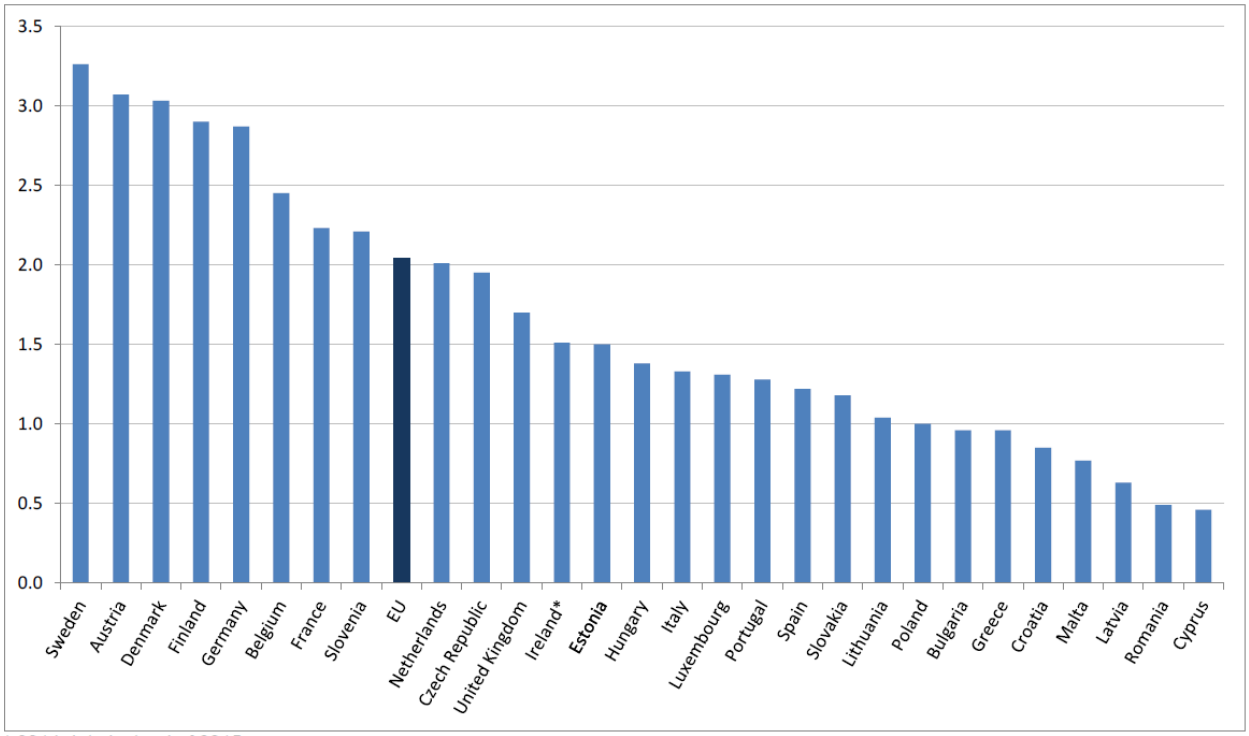


Sources: Eurostat, the statistical office of the European Union, (2015)

In 2015, the highest R&D intensities were recorded in Sweden (3.26%), Austria (3.07%) and Denmark (3.03%), all with R&D expenditure above 3% of GDP, closely followed by Finland (2.90%) and Germany (2.87%). Belgium (2.45%), France (2.23%), Slovenia (2.21%) and the Netherlands (2.01%) registered R&D expenditure between 2.0% and 2.5% of GDP. At the opposite end of the scale, seven Member States recorded a R&D intensity below 1%: Cyprus (0.46%), Romania (0.49%), Latvia (0.63%), Malta (0.77%), Croatia (0.85%), Bulgaria and Greece (both 0.96%). Compared with 2005, R&D intensity increased in twenty-four Member States, decreased

in Finland (from 3.33% in 2005 to 2.90% in 2015), Luxembourg (from 1.59% to 1.31%) and Sweden (from 3.39% to 3.26%), while it remained nearly stable in Croatia (Check Figure 2 and Appendix 2: Table 2).

Figure 2. R&D intensity in the EU Member States, 2015 (R&D expenditure as % of GDP)



* 2014 data instead of 2015

Sources: Eurostat, the statistical office of the European Union, (2015)

2.3. INNOVATION IMPACTS ON GROWTH

On innovation as a determinate of firm growth, there is widespread empirical research that analyses innovation and R&D effects on firm growth like the works of Geroski and Machin, (1992); Geroski and Toker (1996); Yasuda, (2005) all find a positive effect of innovation on firm growth. But most of these studies did not find a direct relationship between innovation and firm growth since what brings about growth realization varies, in other words, different economics factors and features determine what bring about growths. For instance, Becchetti and Trovato, (2002); Lu and Beamish, (200), studied the positive impact of innovation and exports on Small and Medium-sized Enterprises' (SMEs) rate of growth. They did not develop a direct effect of innovation on firm growth. Innovation and firm growth in Coad (2009) and innovation and productivity growth in Crepon et al. (1998) and Ortega-Argile´s et al. (2011). Though the general empirical evidence showed a positive effect between innovation and growth, however, other factors contributed to it. Therefore, one can say that the effects of innovation on firm growth can be said to differ according to the features of the firm which may include, the nature of market selection and the geographical environment the firms are located.

3. INNOVATION AND RESEARCH & DEVELOPMENT (R&D) ON SMALL AND LARGE FIRMS' GROWTH

Innovation has a divergent effect on both small and large firm growth. Since both firms implement different types of innovative activities that differ in terms of scale, scope, and efficiency. A small firm is classified here as an enterprise with an employee of more than 250 workers and less than 500 workers, while a large firm has workforces of more than 500. Akcigit and Kerr (2013) link two types of innovations to growth: Explorative and exploitative innovation. According to James G. March (1991), explorative innovations is the search for new knowledge to create new products and processes while, exploitative innovation According to Rowley et al., (2000); Hagedoorn and Duysters, (2002) is a process that primarily develops the existing knowledge, but not to widen the knowledge base, that is, does not create new knowledge. Akcigit and Kerr (2013) argued that smaller firms are likely to grow faster and that their R&D to sales ratio exceeds larger firms, and that the relative rate of major, explorative innovations is higher in smaller firms compared to a larger firm, who are more preoccupied with refining existing products.

Whenever there is a need for a change, it is easier for a small firm to reshuffle their job scope and responsibility. Since most small companies have a less rigid structure whereby the people who have multiple skills can work across departments. A Smaller firm undertakes more informal R&D that is distributed among various operational units (Santarelli and Sterlacchini, 1990). A Larger firm has a more rigid structure. Most of the roles and responsibilities of many big companies are very well defined and this does not facilitate well with changes. This means that it could take a longer time for big firms to adjust to new technological and administrative changes.

However, according to Cefis, (2003); Geroski et al., (1997), small firms conduct innovative activities on a less persistent basis compare to larger firms which ordinarily have more resources to conduct more research if they want to. This means that larger firm could benefit more from innovation due to economy of scale. They have more resources to invest in R&D and innovation especially on those of long-time benefit. This, on the other hand, may make larger firms to experience more sustainable growth than the smaller firm.

It is also important to note that not all firm are involved in innovation. Some firms innovate while many others do not (Nelson and Winter, 1982). Even among the innovators, there exists a wide range of differences in their R&D capabilities. Most innovating firms tend to innovate occasionally rather than persistently (Geroski et al.,1997). However, persistent innovators, are the source of the major innovative activities in each industry (Cefis, 2003). Many larger firms are more persistent in innovation because they can manage the cost and risk involved. It is one thing to invest in a project and it is another thing for that project to yield the required outcome that will be beneficial to the growth and development of a company. This then means that lager firm could take the risk since they have the resources to invest in the development of new products and processes, which are of vital

importance for their survival and long-term performance, but they also stand a larger risk of incurring excessive costs that can endanger profitability and growth (Nooteboom, 2000; Hagedoorn and Duysters, 2002).

The research work of Demirel and Mazzucato (2012) using the US pharmaceutical industry as a case study also gave us an insight on how innovation as a determinate of growth differs between a small and large firm. They observed that the impact of R&D on firm growth is highly conditional upon a combination of the firm size, patenting and persistence in patenting. For larger pharmaceutical firms, R&D affects firm growth positively, excluding those that do not patent. While, for small firms, R&D boosts growth for only a small subset of firms, that is those that patent persistently for a minimum of 5 years. (Note that patenting activity is used to indicate innovative behaviour where the actual innovation would be a new drug). This then means that any firm whether small or large firms that are persistent in innovation have a higher chance to grow than those that do not innovate.

4. REVIEW OF INNOVATION BY NEW AND OLD FIRM

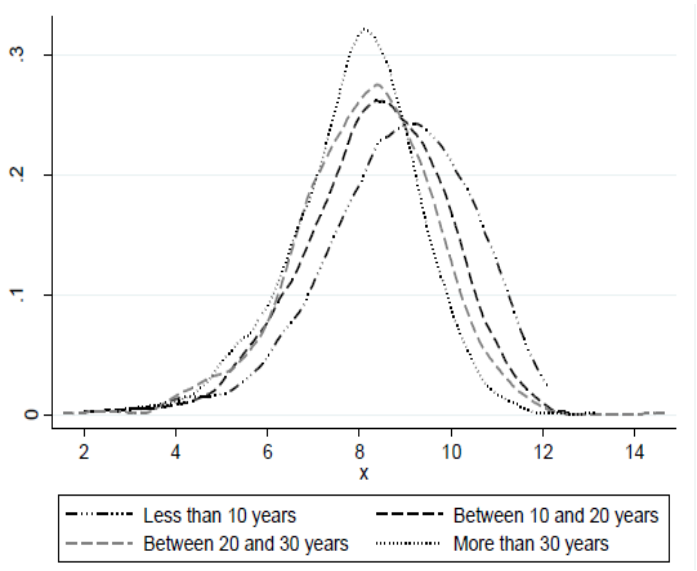
Older firms are mostly ahead of their newer counterparts in the industry because of their prevalent experience. Most big companies could explore different projects that could effectively dilute the efforts of the new firms, who are likely to focus more on profit generation for continued survival and growth. But if a new firm can consistently study their environment they could benefit more by learning. Learning orientation is "an important antecedent of firm innovativeness, which in turn influences firm performance" (Calantone et al. 2002, p515). A new firm has to go through a learning process if it wants to be able to compete well in its business environment. It is through the learning process a firm can discover its true potentials, know its profit capability and the effective ways it can manage its business. Entrants firms need time to get used to the operational environment. They also have to do a comparative assessment of how their early performance relates to the performance of their competitors and in which ways their performance needs to be improved (Taymaz, 2005). Furthermore, a new firm could benefit from knowledge flow within its business environments that can help to boost its performance. As well stated by (Audretsch and Feldman 1996, 2003,) the proximity of firms that generate knowledge spill overs produces a positive impact on firms that are located in the cluster in terms of performance and efficiency.

On the innovativeness of older and newer firms, Abernathy and Clark (1985) and Tushman and Anderson (1986) tried to examine the connection between new entrant and incumbent firms innovative activities. They suggested that incumbent firms may not all the time be better at innovation than their entrant's counterpart. There are some innovations in which the entrants may be better than the incumbent. Especially those that required new structural arrangement from the core in their implementation process. Criscuolo et al. (2012, p321) explain that established firms are more vulnerable to structural inertia, and are less able to adapt their existing 'ways of doing things' in dynamic contexts. For instance, looking at the operational Operandi of the architecture, Henderson and Clark

(1990) observed that architectural innovations tend to modify the existing knowledge embedded in the structure and systems of established firms. This type of innovation may cause incumbents to be less innovative than entrants. Empirical evidence from previous researches like Abernathy and Clark (1985), Tushman and Anderson (1986) and Akcigit and Kerr (2010) show that new firm tends to involve in radical innovation, while the older firms are more involved in incremental innovation. This means that older firms are more preoccupied with refining existing products and exploit previous investment, but newer firms tend to explore more new technologies and are most likely to come up with radical innovations (Casson, 2002a; 2002b). Since they want to create a good impression of their new product in other for them to be able to compete with other older product in the market.

4.1 KERNEL DENSITY

Figure 3. Kernel density of the ln (R&D investment per employee) in 2006.



Sources: Innovation and firm growth: Does firm age play a role? Alex Coada , Agustí Segarra and Mercedes Teruel

The kernel density in Figure 3 shows a "four age groups". It could be seen that the effort of R&D distribution by firm move towards the left when the firm gets older. This shows that younger firm makes more efforts in innovation than older firm since they want to differentiate their products and create a good impression in the market and this also exposes them to high risk. While mature firms tend to adapt existing knowledge to develop incremental innovation, with less risk (Alex Coada, Agustí Segarra and Mercedes Teruel, 2013). This also brings to the understanding that newer firm may not be that productive in growth at their early stage in the business compare to the older firms that are well established in the industry. This may be due to the high expenses that may be incurred by the newer firms in the cause of their developmental process and this may include experimental

cost, the cost and time in training new employees and many other setbacks that they could experience in their cause to establish themselves. Older firms may experience more growth since they could seek to reap from previous investments and get benefit from economies of scale if they are lager firm. However, as times goes on, if new firms are able to strengthen their available resources, managerial knowledge and cultivate the ability to handle uncertainty (Herriott et al., 1984; Levitt and March, 1988), they are likely to experience more productive growth.

5. SUMMARY AND CONCLUDING REMARKS

This paper was able to analyse how innovation is paramount for sustainable growth by firms. It also looks at the forms of innovations and it's determinate on firm growth. The need for persistent innovation was emphases for firms that want to sustain their growth in the industries. While, for Old and New firm, it was observed that older firms are likely to experience more growth than newer firms, even though newer firms may be better in innovation than older firms. Older firms who are mostly large involved in exploitative innovation or incremental innovation. Which means that they tend to adapt existing knowledge, seek to reap from previous investments and get benefit from economies of scale. While the newer firms involved in explorative innovation. Younger firm makes more efforts in innovation than older firm since newer firms want to make a good impression of their products and this also exposes them to high risk which may affect their productive growth at the early stage of their establishment. But with continual learning of their business environment, strengthening their available resources and cultivating the ability to handle uncertainties, newer firms will in time be able to maintain productive growth. It was also point out that apart from the effect of innovation on firm growth, there are other determinate factors that firms most take cognisant of in their growth realization. So, therefore, it can be concluded that innovation it's indeed a determinate of firm growth. This is, however, not a once in a lifetime innovation, but a continuous innovation and investment in Research and Development (R&D) can help to bring and sustain growth in firms.

Appendix

Appendix 1: Table 1. Research and development expenditure, 2005 and 2015

	R&D intensity (R&D expenditure as % of GDP)		R&D expenditure (in millions of euro)	
	2005	2015	2005	2015
EU	**1.74**	**2.03**	**202 129**	**298 811**
Belgium	1.78	2.45	5 552	10 072
Bulgaria	0.45	0.96	106	433
Czech Republic	1.17	1.95	1 281	3 250
Denmark	2.39	3.03	5 094	8 054
Germany	2.42	2.87	55 739	87 188
Estonia	0.92	1.50	104	303
Ireland*	1.19	1.51	2 030	2 921
Greece	0.58	0.96	1 154	1 684
Spain	1.10	1.22	10 197	13 172
France	2.04	2.23	36 228	48 643
Croatia	0.86	0.85	312	375
Italy	1.05	1.33	15 599	21 892
Cyprus	0.37	0.46	55	80
Latvia	0.53	0.63	73	152
Lithuania	0.75	1.04	157	387
Luxembourg	1.59	1.31	472	671
Hungary	0.92	1.38	838	1 511
Malta	0.53	0.77	27	68
Netherlands	1.79	2.01	9 772	13 630
Austria	2.38	3.07	6 030	10 444
Poland	0.56	1.00	1 386	4 317
Portugal	0.76	1.28	1 201	2 289
Romania	0.41	0.49	327	782
Slovenia	1.41	2.21	413	853
Slovakia	0.49	1.18	194	927
Finland	3.33	2.90	5 474	6 071
Sweden	3.39	3.26	10 609	14 581
United Kingdom	1.57	1.70	31 707	43 878
Iceland	2.71	2.19	364	332
Norway	1.48	1.93	3 683	6 739
Montenegro*	:	0.36	:	13
Serbia*	:	0.77	:	256
Turkey*	0.59	1.01	2 287	6 055
China*	1.32	2.05	24 030	159 004
Japan*	3.31	3.59	121 831	124 531
Russia	1.00	1.13	6 559	13 437

South Korea*	2.63	4.29	18 966	45 585
United States**	2.51	2.73	263 747	344 083

*: Data not available * 2014 data instead of 2015 ** 2013 data instead of 2015. 2015 data are preliminary for all countries, except Spain, Croatia, Hungary, Poland, Romania, Slovakia, Finland, Iceland and Russia.*

Sources: Eurostat, the statistical office of the European Union and the source dataset can be found here.

Appendix 2: Table 2. Research and development expenditure in the EU Member States by performing sector (% of total)

	Business enterprise		Government		Higher education		Private non-profit	
	2005	2015	2005	2015	2005	2015	2005	2015
EU	**63**	**64**	**14**	**12**	**23**	**23**	**1**	**1**
Belgium	68	72	8	8	22	20	1	0
Bulgaria	22	73	67	21	10	5	1	1
Czech Republic	59	54	22	20	18	25	1	0
Denmark	68	62	6	2	25	36	1	0
Germany	69	68	14	15	17	17	-	-
Estonia	45	46	11	11	41	41	2	2
Ireland*	66	72	7	4	27	23	-	-
Greece	31	33	20	28	47	38	1	1
Spain	54	53	17	19	29	28	0	0
France	62	65	18	13	19	20	1	2
Croatia	41	51	24	25	35	24	0	-
Italy	50	55	17	13	30	29	2	3
Cyprus	22	17	32	14	39	54	7	16
Latvia	41	25	19	26	41	50	0	-
Lithuania	20	27	25	17	55	56	-	-
Luxembourg	86	51	12	31	2	18	-	-
Hungary	43	73	28	13	25	12	-	-
Malta	66	49	5	18	29	34	0	0
Netherlands	53	56	12	12	35	32	-	-
Austria	70	71	5	4	25	24	0	0
Poland	32	47	36	24	32	29	0	0
Portugal	38	47	15	6	35	46	12	1
Romania	50	44	34	38	14	17	2	0
Slovenia	59	76	24	14	17	10	0	0
Slovakia	50	28	30	28	20	44	0	0
Finland	71	67	10	8	19	24	1	1
Sweden	73	70	5	3	22	27	0	0
United Kingdom	61	66	11	7	26	26	2	2

** 2014 data instead of 2015, - not applicable and 0 means less than 0.5%. Shares might not add up to 100% due to rounding.*

Sources: Eurostat, the statistical office of the European Union and the source dataset can be found here.

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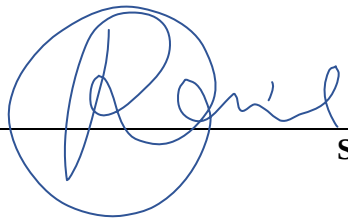
Statutory Declaration

I hereby declare that I wrote this seminar paper without the help of others. Any content drawn from outside sources is marked as such. This seminar paper has never been submitted to any other examination office. I am aware that any untrue declaration can have legal consequences.

Kiel, 16/04/2020  Assimagbe, Albert Raphael

Place and Date **Signature and Name**