The R&D drop in European utilities. Should we care about it?

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Abstract: By using accounting data from the largest utility companies of Europe, this note illustrates the recent R&D performance in energy and telecommunication. Although not all the companies under consideration behaved symmetrically, most of them reduced substantially their R&D investment. Over the period 2000-05, their total R&D expenditures at current prices decreased by 33%, while their R&D intensity (on sales) diminished from 1.1 to 0.7%. In discussing the above findings, it is argued that a drop of this size is hardly justifiable and weakens the EU economy in a non-negligible manner.

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Key words: R&D performance; energy and telecommunication utilities.

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* In 2004 I published an article in which, among other things, I stressed the poor R&D record of Italian utility companies (Sterlacchini, 2004). Some colleagues observed that, without international comparisons, my conclusion was debatable. This note extends the analysis to the largest EU countries: my new conclusion is that Italian utility companies perform as badly as their major European counterparts. With the usual disclaimers, I wish to thank Nicola Matteucci for his remarks on a previous draft.

1. The issue

Monitoring the research activities of the major companies is a burdensome but useful task. Technological change, rather than manna from heaven, is the outcome of the intentional efforts of "flesh and body" private and public organisations. Since the largest firms undertake the bulk of a country's business research, a continuous inspection of their R&D expenditures should become customary for economists and policy makers.

From a private perspective, large companies should invest a stable share of their current revenues on R&D in order to sustain their future stream of revenues. From a social point of view, this implies a significant presence of big (industrial) R&D laboratories which, along with obvious direct benefits for the hosting country, generate positive economic externalities (fruitful co-operation with university research, attraction of outstanding scientists and engineers as well as high-tech foreign direct investments, high-tech spin-offs).

Among the largest European companies (or industrial groups), those supplying public utilities (telecommunication services, electricity generation and distribution, gas provision) play a remarkable role. A recent study of the European Commission (2005) provides sales data for 700 major EU companies in 2004: among the first eighteen (all with more than € 40 billion of sales) there are seven utility companies. Thus, in spite of the ongoing process of liberalisation (much more advanced in TLC than energy), the EU utility markets are still dominated by very big players (mostly private entities).

During the last decade, national and European regulation and competition authorities have monitored the behaviour of these dominant firms with a view to favour the entry of new competitors, avoid excessive prices for final customers and maintain the quality of services. In this ongoing process of liberalisation, little or no attention has been put on the research activities of the major utility companies of Europe. After all, in presence of greater competition (stemming from new entrants as well as the possibility of extending their business over national borders), why these companies should have dropped their R&D expenditures?

Actually, this is what occurred in the first half of the 2000s. Obviously, not all the companies under consideration behaved symmetrically, but most of them (and especially the electricity and gas providers) decreased substantially their R&D investment. At current prices (that is neglecting inflation) their total R&D expenditures in the 2000-01 biennium amounted to € 4.5 billion per year while in 2004-05 they became € 3 billion (a reduction of 33%). Their sales, instead, increased from 411 to 440 billions so that, as a whole, the biggest European utility companies diminished their R&D intensity (on sales) from 1.1 to 0.7%.

This note aims primarily at stimulating the attention of European policy markers who, with respect to the above phenomenon, have shown little or no concern. Investors and financial analysts are mainly interested in the short-run profitability of these companies (listed in the major stock exchanges of the world) and this can explain the negligence of newspapers and economic magazines. Instead, the absence of reactions from national political bodies, regulation authorities and the European Commission is hardly justifiable. The EC, in particular, is responsible for monitoring the progress made in pursuing the Lisbon goals among which – as targeted in the 2002 Barcelona European Council - there is that of reaching, for the whole EU in 2010, a 3% share of R&D expenditures on GDP with two thirds of them funded by the private sector. How can this goal be achieved if some of the largest European industrial groups reduce their R&D investment? By evoking corporate responsibility, why the major utility companies should not contribute to the economic progress of the EU?

After describing the processes of data collection and companies' selection (section 2), this note offers a comparative analysis of EU company data for electricity and gas (section 3), telecommunication services (section 4) and aggregate public utilities (section 5). A discussion of the findings is contained in the final section.

2. The data

Data on sales and R&D expenditures are taken from the consolidated group accounts provided by the ultimate parent companies in their audited annual reports (downloadable from their web sites). In most cases I also checked the Forms 20-F compiled by the companies for the US Security and Exchange Commission in which, for the sake of transparency, the R&D section is indexed. When both are available (that is almost always) the Form F-20 and the annual report indicate the same R&D spending.

For sales, the usual accounting definition of total sales net of taxes and shares of joint ventures and associated company is used. The R&D figure is the company cash spending indicated in the annual report and, as such, it should only include that funded and performed by the company itself. Such a figure derives from the accounting definition of R&D established by international standards and based on the OECD "Frascati" manual.

The above are the same definitions adopted in two recent studies of the European Commission (2004 and 2005) providing R&D, sales, and other financial data for the EU companies disclosing a significant amount of R&D investment[1]: 500 companies are monitored in 2003 (with retrospective

[1] These two highly meritorious studies, titled *Monitoring industrial research: the 2004 (and 2005) EU industrial R&D investment scoreboard*, are the outcomes of a close co-operation between the Directorate General Joint Research Centre

information until 2000) and 700 in 2004. The independently collected figures presented in this note for the years 2000-04 are almost always consistent with those reported by the above studies: to them, I added the recently available company data for 2005.

Although the EU companies are not compelled to disclose their R&D investment, most of them do, and this also occurs with utility companies. Two relevant exceptions are Endesa and Gas Natural SDG, both Spanish companies[2]: the first is one of the largest electrical companies in the world and the biggest electricity provider in Spain; the second is the major natural gas supplier of the same country.

Along with those of Spain, but for quite different reasons, UK-based electricity and gas companies are not included in the analysis; in fact, thanks to the advanced process of liberalisation, none of them owns a dominant position and records an amount of sales comparable to that of the largest utility companies of Europe. To be added is that among the major players in the UK energy markets there are many foreign companies (such as EdF, RWE and E.ON) which, instead, are taken into account.

Due to their relative low level of sales, all the utility companies based on EU countries other than France, Germany, Italy, Spain and the UK, are not considered in the present note.

With respect to the sectoral grouping, because of the presence of many multi-utility companies, electricity and gas companies are put together under the "energy" label.

Another problem is that of two big energy providers, ENI and Suez, which derive a remarkable portion of their revenues from oil extraction and refinement and the distribution of related products. In these two cases, only the sales referring to gas and electricity are taken into account and, consequently, only a fraction of their total R&D expenditures is considered in line with the share of energy on total sales. With this procedure, the R&D investment of ENI and Suez is likely to be overestimated. In general, for a few other dubious cases (namely, when the R&D investment was missing or inconsistent for only one year) the same strategy, favourable to an overestimation, has been followed.

Finally, for British Telecom I converted into euros its sales and R&D figures reported in UK sterling. For this purpose, I used the same procedure applied in the first of the above mentioned EC studies, concerned with 2003 (which is the central year of the period considered): a 0.7 euro/sterling exchange rate constant over time. This procedure has the advantage of not affecting the R&D changes and intensity of British Telecom while it could produce minor biases only when its figures are added to those of the other EU telecom companies.

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and the Directorate General Research of the European Commission. For the first time in Europe, company level data have not only been systematically collected and disclosed but also compared with those of non-EU based companies.

3. The electricity and gas companies

The R&D performance of energy companies over 2000-05 is illustrated in Table 1. It can be examined by looking either at their current R&D expenditures and R&D intensity on sales.

Table 1 - Sales and R&D expenditures of electricity and gas companies (€ million at current prices)

	2000	2001	2002	2003	2004	2005	Change (%) (2001-02)/ (2004/05)
ENEL (Italy)							
Sales	25109	28781	29977	31427	31011	34059	20.75
R&D expenditures	124	100	100	40	20	20	-82.15
R&D/Sales (%)	0.49	0.35	0.33	0.13	0.06	0.06	-85.36
ENI - Gas & Power (Italy)							
Sales	14427	16098	15297	16068	17302	22969	31.93
R&D expenditures	70	67	56	74	76	64	1.82
R&D/Sales (%)	0.49	0.41	0.37	0.46	0.44	0.28	-20.61
Electricité de France*							
Sales	34424	38153	44643	44919	46788	51051	34.81
R&D expenditures	379	418	432	381	402	455	7.53
R&D/Sales (%)	1.10	1.10	0.97	0.85	0.86	0.89	-20.27
Gaz de France**							
Sales	11210	14360	14546	16647	17731	22394	56.92
R&D expenditures	92	118	118	89	90	73	-22.20
R&D/Sales (%)	0.82	0.82	0.81	0.53	0.51	0.33	-49.06
Suez - Energy (France)							
Sales	19586	26374	24242	26635	29334	30400	29.97
R&D expenditures	113	156	75	53	61	62	-54.12
R&D/Sales (%)	0.58	0.59	0.31	0.20	0.21	0.20	-64.64
E.ON (Germany)							
Sales	74048	69770	36126	42541	44745	56399	-29.67
R&D expenditures	572	510	380	69	55	24	-92.70
R&D/Sales (%)	0.77	0.73	1.05	0.16	0.12	0.04	-88.99
RWE (Germany)							
Sales	56751	60040	43487	42771	40996	41919	-29,01
R&D expenditures	540	650	435	436	128	55	-84,62
R&D/Sales (%)	0,95	1,08	1,00	1,02	0,31	0,13	-78,20

**= missing R&D data for 2000 are estimated by applying the R&D intensity on sales in 2001.*
***= missing R&D data for 2001 are estimated by applying the average R&D intensity on sales in 2000 and 2002.*

[2] The unavailability of R&D data for these companies is confirmed by the already mentioned studies of the EC in which Endesa and Gas Natural SDG are never included.

Five out of seven companies experienced a substantial decrease of the R&D investment at current prices (i.e. gross of the inflation rate). To limit the effect of annual volatility, I computed the rate of change between the biennia 2000-01 and 2004-2005: it ranges from minus 49% of Gaz the France to minus 93% of E.ON. The only two companies showing an increase at current prices are Electricité de France (+7.5%) and ENI (+2%).

To be stressed is that, over the same period, only the two German companies - E.ON and RWE – recorded a reduction of sales of around 30% while all the others had remarkable increases ranging from 21% of ENEL to 57% of Gaz de France. As a consequence, the ratio between R&D investment and sales declined substantially in all the major energy companies of Europe, included EdF and ENI (-20%) although the reduction of the others was by far much intense (from -49% of Gaz de France to -89% of E.ON).

4 The telecom companies

Table 2 two illustrates the sales and R&D data of the five largest EU telecom companies. With the relevant exception of France Telecom, recording an increase of 27%, the other four companies decreased substantially their R&D investment at current prices, from minus 11% of Telecom Italia to minus 57% of Deutsche Telekom. It must be stressed that, for the latter company, the strong R&D drop between 2003 and 2005 (-77.8% at current prices) is confirmed by the reduction of its R&D employees, who diminished from about 6500 to 2600 units (-60%)[3].

Among the five companies, only Telecom Italia had a small reduction of sales (-2.5%) over the period considered, while in the other cases there was a significant rise, especially for Deutsche and France Telecom (+32 and +25% respectively).

As a result, all the major companies but France Telecom decreased their R&D intensity on sales with a minimum of –10% (Telecom Italia) to a maximum of -52% (Deutsche Telekom).

[3] To my request, a responsible of DT investor relations said that the changes in the reported R&D figures are due to different accounting methods. However, the data on R&D employees - consistently defined in the various annual reports as those " involved in projects and activities aimed at creating new products and marketing them to customers" - indicate that the staggering R&D drop of DT was real and cannot be entirely ascribed to changes in accounting procedures.

Table 2 - Sales and R&D expenditures of telecom companies (€ million at current prices)

	2000	2001	2002	2003	2004	2005	Change (%) (2001-02)/ (2004/05)
Telecom Italia							
Sales	28911	30818	30400	30850	28292	29919	-2.54
R&D expenditures	268	141	121	148	181	180	-11.74
R&D/Sales (%)	0.93	0.46	0.40	0.48	0.64	0.60	-10.34
France Telecom							
Sales	33674	43026	46630	46121	47157	49000	25.37
R&D expenditures	449	567	576	478	564	725	26.89
R&D/Sales (%)	1.33	1.32	1.24	1.04	1.20	1.48	0.94
Deutsche Telekom*							
Sales	40911	48300	53700	55800	57880	59604	31.69
R&D expenditures	865	900	900	900	550	200	-57.51
R&D/Sales (%)	2.11	1.86	1.68	1.61	0.95	0.34	-67.68
British Telecom**							
Sales	23036	24487	26353	26753	26456	26604	11.65
R&D expenditures	493	520	517	543	477	367	-16.64
R&D/Sales (%)	2.14	2.12	1.96	2.03	1.80	1.38	-25.32
Telefonica (Spain)***							
Sales	28488	31052	27999	28400	30281	37882	14.48
R&D expenditures	588	641	513	444	461	544	-18.22
R&D/Sales (%)	2.06	2.06	1.83	1.56	1.52	1.44	-28.33

**= inconsistent R&D data for 2004 are estimated by applying the average R&D intensity on sales in 2003 and 2005.*
***= the exchange rate to convert into euros the British Telecom figures is 0.7 UK sterling and constant over time.*
****= inconsistent R&D data for 2001 are estimated by applying the R&D intensity on sales in 2000.*

5. Summing up

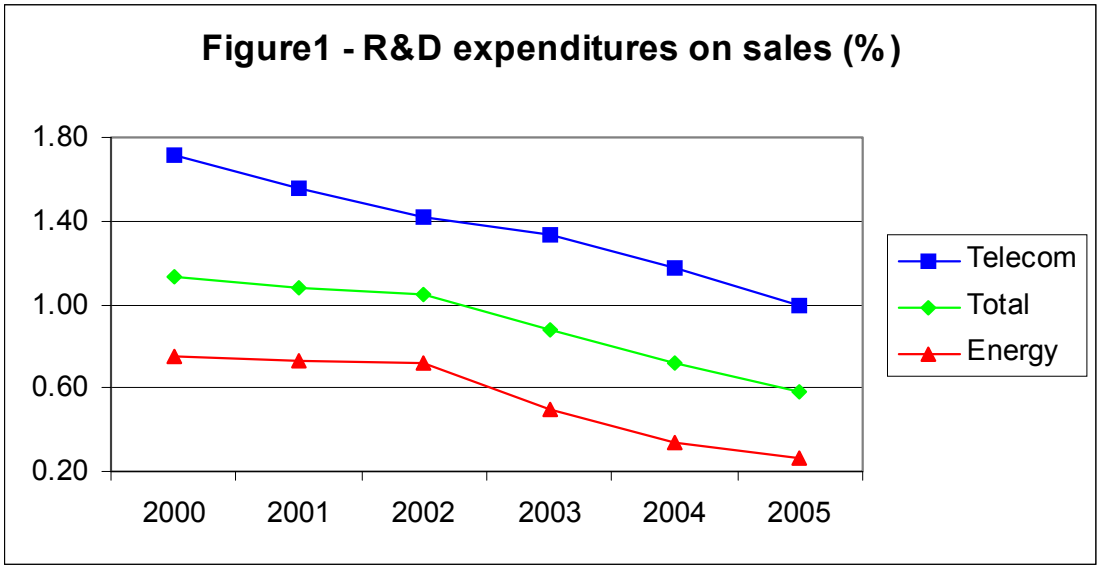
To provide a global picture of the recent R&D behaviour of the largest European utility companies, I summed up their sales and R&D expenditures. Table 3 shows the results for energy, telecom and total utilities, while a graphical representation of R&D intensity trends is depicted in figure 1.

Overall, as compared to a small increase of sales (+7%), there has been a 37% reduction of R&D investment at current prices: as a consequence, the EU utility companies as a whole recorded a 41% decrease of their R&D intensity.

The R&D reduction was particularly severe in the electricity and gas sector in which about 60% of the expenditures reported in the initial biennium vanished. In presence of an almost constant level of sales, the R&D intensity of energy companies decreased by the same percentage.

Table 3 - Sales and R&D expenditures of European utility companies (€ million at current prices)

	2000	2001	2002	2003	2004	2005	Change (%) (2001-02)/ (2004/05)
Total energy companies							
Sales	235555	253576	212771	221008	227907	259191	-0.42
R&D expenditures	1777	1864	1521	1089	771	691	-59.84
R&D/Sales (%)	0.75	0.73	0.71	0.49	0.34	0.27	-59.38
Total telecom companies							
Sales	155020	177683	185082	187924	190066	203009	18.15
R&D expenditures	2663	2769	2627	2513	2233	2016	-21.77
R&D/Sales (%)	1.72	1.56	1.42	1.34	1.17	0.99	-33.82
Total utility companies							
Sales	390575	431259	397853	408932	417973	462200	7.10
R&D expenditures	4440	4632	4148	3602	3005	2707	-37.05
R&D/Sales (%)	1.14	1.07	1.04	0.88	0.72	0.59	-41.00



Considering its higher level of technological opportunities as well as its sales' increase (+18%), also the performance of the telecom sector is quite disappointing: the R&D expenditures of telecom companies dropped by 22% while their R&D intensity on sales by 34%.

The different technological opportunities between energy and telecom companies are well depicted by figure 1 in which the former systematically display a lower intensity of R&D spending. The same figure is also useful to stress that the decline in R&D intensity over 2000-05 was an almost continuous phenomenon although, for energy companies, it significantly accelerated in 2003.

6. Discussion

In this concluding section, the above findings are discussed in the light of some possible objections. A first one is that the R&D drop by utility companies is a recent phenomenon and, as such, it could be transitory and reversible. This argument is at odds with the available evidence indicating that the R&D reduction started well before 2000, pushed by the privatisation of previously state-owned companies and the deregulation (or liberalisation) of utility markets.

According to Florio (2004; table 9.8, p. 321), British Telecom invested 2.7% of its sales on R&D before the privatisation (1980-84) and around 2% after (1985-99); as table 2 indicates there was a little improvement over 2000-03 but, in the subsequent years, the R&D intensity of BT fell significantly below 2%. ENEL, the dominant electricity provider in Italy, began to be partially privatised in 1999. In 1998 it spent € 181 million in R&D which became 145 in 1999 and 124 in 2000. From 1998 to 2000 its R&D intensity on sales decreased from 0.88 to 0.49 and then, as shown in table 1, continued to fall over the next years.

But aside from the records of individual companies, in the case of "energy R&D" a marked decrease was patent since the early 1990s. Dooley (1998) has shown that this occurred in many developed countries (with the exception of Japan) and it was mainly due to the behaviour of energy companies (some already private, others aware of their future privatisation): in some countries (such as the UK and the Nordic European countries) they already operated in deregulated markets, while in others (US, Germany and Italy) they were moving in the same direction. As a result, most energy companies reduced R&D investments by refocusing their innovative strategies towards short-term, customer-oriented goals. The latter have little to do with the long-term goal of guaranteeing the future supply of cheaper and cleaner energy, crucial for the economic prospects of a country. The conclusion was that "long-term energy R&D […] is unlikely to be supported by individual utilities in a competitive, deregulated utility market" (Dooley, 1998., p. 554). Unfortunately, only with the exception of Electricité de France, this prediction is confirmed by the recent performances of the largest energy companies of Europe.

It is likely that the R&D behaviour of European telecom companies can be ascribed to a shift of corporate strategy similar to that stressed for energy companies (more emphasis on short-term goals and customers' needs, less attention on the efficiency of telecom infrastructures). However, before

adopting the same interpretation, it would be necessary to collect a number of consistent pieces of evidence which, at present, are not available.

Another relevant issue is whether the R&D disengagement of utility companies is really important for European countries. To answer, I first assumed that these companies had maintained over 2001-04 the same R&D intensity recorded in 2000. Then, I computed the annual differences between hypothesised and actual R&D expenditures: they raised from € 0.27 billion in 2001 to 1.75 in 2004. These figures estimate the foregone annual R&D expenditures due to the behaviour of utility companies. As a term of comparison, I summed up the total R&D expenditures funded by business enterprises in France, Germany, Italy, Spain and the UK[4]: they were about € 71 billion in 2000 and 80.8 in 2004, with an increase, at current prices, of 13.9%. By adding the R&D expenditures "lost" by the twelve companies considered in this note, there would have been an increase of 15.3%. At a first sight, the difference seems modest but it is instead quite relevant if one considers the small R&D increases experienced by EU countries during the last years (see Eurostat, 2005a). The conclusion that can be drawn from the above exercise is that, with a declining contribution of its largest utility companies, the EU cannot improve substantially its R&D intensity. Obviously, the situation is not the same across countries: French utility companies, on average, performed much better than their German counterparts. However, since the major companies operate in many European markets, the issue should not be left to national policy makers alone.

It must be stressed that, with respect to this phenomenon, the usual political reaction in Europe has been that of resignation, as if the R&D cuts of the largest utility companies were more irreversible than climate changes. Take, as an example, a period extracted from a note of the UK Parliament on electricity networks:

> "Newer technologies offer the hope for cost-effective and environmental less damaging forms of electricity generation, but since privatisation, investment by the Electricity Supply Industry in research and development (R&D) has dropped significantly. R&D in electricity network has been especially poorly served. Recognising this, the Government provides direct R&D support and is seeking to encourage firms to innovate in this area" (Parliamentary Office of Science and Technology, 2001, p. 4).

A further quotation can be found in a report of an European research network composed of recently established R&D agencies working in the electricity field:

[4] To make such a computation I combined the latest statistics available for total R&D (Eurostat, 2005a) and that funded by the business sector (Eurostat, 2005b). The 2004 R&D figures are available, although in a provisional form, only for France and Germany; for the other countries I assumed that in 2004 the R&D share on GDP was equal to that of the previous year. The shares of R&D funded by the business sector refer to 2002 for all the countries considered but Italy, for which the 2001 share is taken from Sterlacchini (2004); these shares are applied to all the examined years.

> "With the liberalisation, the Utility companies, who previously funded much of the research in the electricity sector in-house, have reduced their R&D expenditure. As such, […], funding has become available at national level through various Ministries and Government Agencies in these liberalised markets" (ENIRDGnet, 2004, p. 4).

Thus, if private utility companies invest less in R&D, the only thing that can be done is to increase public R&D. Against this argument two main objections can be raised. First, it is not necessary to be an expert of technology for understanding that public R&D cannot be a substitute for private R&D; at best, they complement each other. In other words, technological excellence requires the presence of both public and industrial R&D laboratories with the former more devoted to the "R" (or to basic research) and the latter more involved in the "D" component. Secondly, due to the budget constraints of European national governments, it is unlikely that public funds may replace the amount of R&D dropped by utility companies[5].

In this respect, the Italian case for electricity provides a good example. Historically, ENEL funded and conducted research for the national electricity system. After the 1999 privatisation, a governmental decree established that CESI (a corporate company) was responsible for this task and ENEL transferred to it all the related R&D facilities and personnel. After that, the system research has been mainly funded by the Italian government (cf. ENIRDGnet, 2004, p. 24). Over the period 2000-05 CESI recorded, on average, € 55 million of revenues due to research activities. By summing up this figure with the R&D expenditures of ENEL (see table 1) it can be seen that the 1998 investment of € 181 million performed by ENEL alone was never recovered in the following period and, during the last years, decreased to € 75.

The Italian electricity story is also useful to contrast the idea that most private utility companies are not less innovative than before but, instead of performing R&D activities in-house, have simply chosen to outsource them to private companies and/or public agencies. The better counter-argument I found with respect to this objection is taken from an inquiry carried out in 1999 by the Parliament of Australia[6]:

> "While outsourcing has its benefits it can exacerbate problems mentioned earlier, such as the move away from long-term R&D – as utilities which outsource R&D tend to focus on short-term projects. The critical mass for R&D can also be affected by outsourcing and downsizing on former centres of excellence, with experts either leaving the field or being distributed over a number of service providers. There are also

[5] Looking at the US, Dooley (1998, p. 554) pointed out that the federal budget deficit could not allow the Department of Energy "to increase its energy R&D investments in order to fill the gap being left by the ongoing reductions in the private sector's investments in energy R&D".

[6] As stated in the executive summary (page xv) "The inquiry was prompted by concerns that competition policy, privatisation and outsourcing during the past decade may have had an adverse effect on the R&D conducted in those corporatised or privatised public sector agencies (such as the energy utilities) now operating in a commercial environment".

> suggestions that outsourcing can favour overseas R&D providers" (Parliament of Australia – House of Representatives, 1999, p. xxii).

To be noticed is that the "critical mass" argument is consistent with that introduced in the introductory section of this note, stressing that the presence of big industrial R&D laboratories provides strong economic advantages to the hosting countries.

A final objection is that the R&D decline in utilities is common to all the developed countries of the world. This is true, but the existing evidence indicates that the problem is much more severe in Europe. According to the last edition of the EC study on company R&D (2005), also the non-EU companies active in telecommunication services and electricity – mainly based in Japan and South Korea[7] – experienced a significant decrease of R&D investment. However, their reduction of R&D expenditures at current prices over 2001-04 was only 0.2% in telecommunication and 9.4% in electricity; in the same sectors, during 2003-04, their average R&D intensity on sales was respectively 2 and 0.9%. Considering the same years, the debacle of the major European utilities is not comparable: R&D expenditures diminished by 19% in telecommunication and 58% in energy while R&D intensities were, respectively, 1.3 and 0.4% (for these computations see table 3).

In conclusion, it is difficult to find convincing arguments that can justify (or reduce the concerns about) the poor R&D performance of the largest European utility companies. I think that, both at the EU and national level, governments and regulation authorities should put this problem on their agendas and react with appropriate measures.

[7] The largest non-EU telecom companies considered are NTT (Japan), AT&T (USA), Telstra (Australia) and two South Korean companies (KT and SK Telecom). Instead, the majority of non-EU electricity companies are Japanese.

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