An Assessment of the Regulatory Framework for Electronic Communications – Growth and Investment in the EU e-Communications Sector

Final Report

To

The European Commission

DG Information Society and Media

By

London Economics
In association with
PricewaterhouseCoopers

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This report was produced by London Economics, acting as a consultant to DG Information Society and Media of the European Commission. The views expressed in this report are those of the consultants. www.londecon.co.uk

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Glossary

3G: Third generation mobile

CATV: Cable access television

EU: European Union

GDP: Gross Domestic Product

GVA: Gross Value Added

IP VPN: Internet Protocol Virtual Private Network

ITU: International Telecommunications Union

LLU: Local Loop Unbundling

MVNO: Mobile virtual network operator

NRA: National Regulatory Authority

OECD: Organisation for Economic Cooperation and Development

PSTN: Public Service Telephony Network

SMP: Significant Market Power

ULL: Unbundled Local Loop

VoIP: Voice over Internet Protocol

WLL: Wireless Local Loop

Country abbreviations

European Union

BE	Belgium	LU	Luxembourg
CZ	Czech Republic	HU	Hungary
DK	Denmark	MT	Malta
DE	Germany	NL	Netherlands
EE	Estonia	AT	Austria
EL	Greece	PL	Poland
ES	Spain	PT	Portugal
FR	France	SI	Slovenia
IE	Ireland	SK	Slovakia
IT	Italy	FI	Finland
CY	Cyprus	SE	Sweden
LV	Latvia	UK	United Kingdom
LT	Lithuania		

Other countries

US	United States	JP	Japan
KO	South Korea		

Executive Summary

Introduction

This Final Report is submitted by London Economics to the European Commission (DG InfSo) and reports on our study on growth and investment in the EU e-communications sector.

The overall objective of the study is make a key contribution to the Commission's planned 2006 review of the e-communications regulatory framework.

The study has been undertaken in three phases, comprising:

- **Stage 1:** gathering of data on investments in the electronic communications markets in the EU Member States and analysis of sources of differences across Member States, sectors and competitors (incumbent versus new entrants);
- **Stage 2:** includes the comparative analysis of growth of the electronic communications sector in the EU and in other main geographical markets;
- **Stage 3:** includes the identification and validation of the possible determinants of investments factors, and the identification of aspects of the regulatory framework conducive to growth and investments.

Data sources

The main source of investment data for stage 1 has been company annual reports. The data have been tested at the firm level, and compared to alternative data sources at the aggregate level (OECD, ITU and Eurostat) to confirm their accuracy.

For our stage 2 analysis we have also surveyed e-communications companies across five Member States for views on the drivers of investment, on the impact of the regulatory framework on investment, and on potential changes to the regulatory framework in order to stimulate investment. We also held more in depth discussions on these issues with a smaller number of market players.

Investment in e-communications in EU Member States

London Economics' estimate of investment in tangible fixed assets in e-communciations across the EU25 is €32bn for 2004 (at 2004 prices). This is equivalent to €35bn in 2001prices. The vast majority of EU e-communications investment is in fixed (44%) and mobile (49%) telephony. Overall, total investments were lower in 2004 than in 2001, having fallen until 2003 and

then picked up slightly in 2004. A similar pattern was seen in each of the four sub-sectors we reviewed: fixed telephony, mobile telephony, cable and broadcasting.

In absolute terms, investments by fixed telephony incumbents were eight times higher than those by new entrants in 2004, reflecting their larger size and need to maintain their networks. However, when expressed as a percentage of revenues, new-entrant operators have been investing three to four times more than incumbents over the period.

Results of our regression model show that better performing regulatory regimes, as measured by the OECD regulatory index, contribute to higher investment levels. Other factors that have an important positive influence on company investment levels are GDP per capita, land area and population density, and the size of the company, as measured by total asset value of the company. Incumbents and companies operating in more than one sector also had higher levels of investment.

Comparative analysis of growth of the e-communications

EU15 fixed telephony penetration is falling, and is at a similar level to South Korea, but lower than in the United States. The EU15 has the highest number of mobile telephony subscribers of the regions analysed, but both subscription levels and growth rates vary widely between Member States.

Subscription to cable television is low in the EU15 relative to the United States, Japan and Korea, but ownership of satellite antennae is relatively high. The EU15 also has the largest proportion of homes that receive only terrestrial broadcasting (47%).

No clear pattern can be identified for separate pricing trends in the EU15 and NMS, and we did not find any concrete evidence of a relationship between prices and investment.

Validation of the determinants of investment factors

Three approaches have been used to validate our results: a desk-based study, a telephone survey by PwC companies across five Member States, and interviews conducted by LE with a small number of market players.

There were a number of factors that lead to the increase in investment to 2001. Survey respondents and interviewees indicated that the general factors that are important inputs into decisions to increase investment are the availability of new market opportunities; economic conditions, including the investment cycle; technological change; and regulatory factors, including regulatory uncertainty. There is a view that this increase was a part of the normal investment cycle, with other influences including increased network rollout by new entrants following liberalisation in 1998 and the financial bubble in the sector.

It is also argued that the subsequent decline in investment was a part of the normal investment cycle, with the collapse of the financial bubble contributing to the decline. Following the period of higher investment in the late 1990s, many operators were consolidating their positions and focussing on increasing revenues from their new infrastructure. In survey responses the following factors were noted as the main causes of the decline: economic factors such as the economic cycle and the end of the financial bubble; limited availability of credit and investment opportunities; increased competition; and regulatory uncertainty.

Survey respondents indicated that main factors driving the upturn in investment since 2003 were new market opportunities; economic conditions; and regulatory factors, including improved regulatory certainty.

Regulatory framework and investment

In our survey of companies across five Member States, there were a number of indications that regulatory uncertainty was one important aspect of regulation that affects investment decisions. This was confirmed in the subsequent interview programme.

There are a number of factors that influence the level of uncertainty. Changes to these factors may contribute to improving the climate for investment. In this context it should be borne in mind that the comparative analysis of investment in telecommunications between the EU15, USA, Japan and South Korea suggests an already strong investment performance in the EU15.

The factors that can contribute to more regulatory certainty include:

- clear legislation
- timely implementation of legislation
- comprehensive guidance on the interpretation of legislative requirements
- harmonisation between Member States
- clear communication from NRAs
- adequate appeals processes
- adequate NRA enforcement powers

Whilst many companies have suggested specific improvements to the regulatory framework and its implementation in these respects, many also expressed the view that the current framework was a welcome and significant improvement on the previous regulatory framework. Some also expressed the view that the development of competition meant that there was now no further need for regulation in some or all markets.

It is also clear from our analysis and discussions with operators that NRAs' actions in relation to developing access obligations that encourage entrants to develop their own infrastructures is also an important factor.

1 Introduction and general approach

1.1 Background

This Final Report is submitted by London Economics to the European Commission (DG InfSo) and reports on our study on growth and investment in the EU e-communications sector.

The overall objective of the study is make a key contribution to the Commission's planned 2006 review of the e-communications regulatory framework.

To inform this review, the study is to:

- Examine the contribution to output and growth of the electronic communications sector;
- Undertake an analysis of differences in investment levels and growth in the e-communications market across EU Member States and across the various e-communications channels, and provide an explanation for the observed differences;
- Identify regulatory practices that support and promote e-communication investments and regulatory practices that are barriers to such investments.

In order to meet these objectives, the project team have undertaken the study in three phases, comprising:

- **Stage 1:** includes project launch, gathering of data on investments in the electronic communications markets in the EU Member States and analysis of sources of differences across Member States, sectors and competitors (incumbent versus new entrants);
- **Stage 2:** includes the comparative analysis of growth of the electronic communications sector in the EU and in other main geographical markets;
- **Stage 3:** includes the identification and validation of the possible determinants of investments factors, the identification of aspects of the regulatory framework that influence growth and investments.

1.2 General Approach

Data on market players have been gathered from NRAs and other sources, and company annual reports used to obtain investment data. Where reports or data were not available, alternative data sources have been used, including a survey of e-communications companies.

These data are presented in Section 2, which provides descriptive statistics and graphical analysis of trends in e-communications investment. Econometric modelling is then used to examine the determinants of investment.

In order to analyse economic and sectoral growth in e-communications, in Section 3 we have constructed the value added of e-communications and compared with other sectors. Differences in economic and sectoral performance have been compared to the United States, Japan and South Korea using sectoral indicators.

To explore the links between regulation and investment, a literature review has been undertaken, as well as a telephone survey by PwC, and interviews with market players.

These elements have then been drawn together to provide our conclusions.

1.3 Structure of this draft final report

The remainder of this interim report is structured as follows:

- Section 2 discusses the work undertaken for Stage 1;
- Section 3 discusses the work undertaken for Stage 2;
- Section 4 discusses Stage 3;
- Conclusions are presented in Section 5; and
- There are a number of Annexes which provide additional data and information.

2 Investment in e-communications in EU Member States

In this section we present our estimates of investment[1] in the physical infrastructure used for the provision of e-communications services in the EU Member States. Extensive research has been performed to gather company investment figures, measured as capital expenditures (capex), for the years 2001 to 2004.

Following the terms of reference, our main data source has been company reports from the main players for each of the sub-sectors of the e-communications sector: fixed and mobile telephony, cable, and broadcasting operators.

In some cases, investment data from company reports are not available.[2] In those cases, investment data have been complemented with data from alternative sources. All such cases are clearly indicated in the detailed methodological tables in Annex 1.

In addition, to corroborate and complement our data, we have sent a survey to the major e-communication companies asking for information on investment. The questionnaire was sent to 256 companies across the EU (a copy of the survey questionnaire is included in Annex 6).

2.1 Methodological approach

Data collection process

The data collection process has been the following. First, the names of the main market players in each sub-sector and country were assembled with the aim of identifying sufficient market players to represent 90% of the overall market for these services. In order to achieve this, we relied on a number of sources, including the websites of the National Regulatory Authorities (NRAs) in each country[3] and a previous consultancy study prepared for the European Commission.[4] In the case of CaTV, information from the European Broadcasting Union (EBU) and European Platform of Regulatory Authorities (EPRA) websites was used. For Broadcast, the InfSo Article 7 Procedures

[1] Defined as capex expenditures, or property, plant and equipment.

[2] Especially for companies that have been recently merged or companies that have operations in many different sectors or countries, and provide no geographical breakdown of their results.

[3] NRAs were identified using information from the European Regulators Group for Electronic Communication Services.

[4] International Data Corporation (IDC), Monitoring European Telecoms Operators: Final Report (2002) for the EC.

website and the European Audiovisual Observatory (EAO) were valuable sources of information.

The list of market players for which data has been collected is presented in Table 2.1 (see Annex 1 for details of the data collection methodology in Table A.6 to Table A.30).

Table 2.1: List of market players for which data has been collected, by country and sub-sector

Country	Fixed	Mobile	CaTV	Broadcast
Belgium	Belgacom Colt Telecom Scarlet (KPN) UPC Telenet Versatel	BASE (KPN) Mobistar (Orange) Vodafone (Proximus)	Coditel Telenet UPC Belgium Interelectra	VRT RTBF
Czech Republic	Cesky Telecom eTel GTS Contactel UPC	T-Mobile Eurotel Oskar Vodafone	UPC Karneval	České Radiokomunikace Ceska Televize
Denmark	TDC Tele2 Telia Denmark	Orange Sonofon TDC Mobile Telia	TDC Kabel Telia Stofa	Broadcast Service Denmark
Germany	Deutsche Telekom Arcor Versatel Freenet Envia Tel	T-Mobile Vodafone E-Plus O2	Kabel BW Kabel Deutschland Unity Media	T-Systems
Estonia	Elion	EMT Elisa	Starman	***
Greece	OTE Forthnet Hellas On Line Lan Net Newsphone	Cosmote TIM Vodafone-Panafon	**	ERT
Spain	Telefonica Auna (now ONO) Cableuropa Jazztel Tenaria	Telefonica Amena Vodafone	Telecable de Asturias ONO R Cable y Telecomunicaciones de Galicia	Abertis
France	France Telecom Neuf Telecom Iliad Colt Tiscali	Orange Bouygues Vodafone (SFR)	NC Numericable UPC Noos Est Video Valvision Paris Cable	TDF Towercast
Ireland	Eircom Esat Colt Energis	Meteor O2 Vodafone	NTL	RTE
Italy	Telecom Italia Wind Tiscali Tele2 Fastweb	TIM Wind 3 Vodafone	*	RAI Way Elett. Ind.
Cyprus	CYTA	CYTA	n/a	n/a
Latvia	Lattelekom Telekom Baltija Telekomunikaciju Grupa	Tele2 LMT Bite	Baltkom FAO	LVRTC
Lithuania	Lietuvos Telekomas	Omnitel	Balticum TV	LRTC
Luxembourg	EPT Cegecom Tele2	LuxGS Tango	Eltrona	
Hungary	Magyar Telekom Invitel Hungarotel UPC	T-Mobile Pannon Vodafone	UPC EMKTV T-Kabel	Ant. Hun.
Malta	Maltacom	Go Mobile Vodafone	Melita	***

Table 2.1: List of market players for which data has been collected, by country and sub-sector

Country	Fixed	Mobile	CaTV	Broadcast
Netherlands	KPN Versatel UPC	KPN Mobile Orange T-Mobile Vodafone	UPC Essent CAI Westland Casema	Nozema
Austria	Telekom Austria UPC Priority	T-Mobile Mobikom Tele ring	UPC Telekabel	ORF
Poland	TPSA UPC	Polska Telefonia PTK Centertel Polkomtel	UPC Grupa Vectra Aster City Cable Multimedia	Emitel
Portugal	PT Group Novis Telecom OniTelecom	Optimus TMN Vodafone	Bragatel TV Cabo	RTP
Slovenia	Telekom Slovenije	Mobitel Sl.Mobil	Ljubljanski kabel Telemach	***
Slovak Republic	Slovak Telecom UPC	T-Mobile Orange	UPC	***
Finland	Elisa Sonera	Alands Mobile Elisa Sonera	Helsinki Televisio Jyrasiestinta Oy Koklan Puhelin Oy Kotkan Tietoruutu Oy Mariekamns	Digita Oy
Sweden	Telia Telenordia	SpringMobil (Swefour) Telia Vodafone	UPC Comhem Tele2	Terracom
UK	BT NTL Telewest Kingston	Orange O2 Vodafone T-Mobile	NTL Telewest	Crown Castle Arqiva

Note:* According to IDC (2002) 'there is very little CATV in Italy, and what exists is provided by Stream'. Stream merged with Telepiu in July 2003, forming SKY Italia, which then closed down the cable network in February 2004 (Screen Digest, http://www.screendigest.com/reports/edptvp04/italy/edptvp04_12_2/view. ** ITU reports that measuring CaTV is not applicable in Greece. *** EC sources state that Estonia receives some terrestrial broadcasting from Finland, Malta from Italy, Slovenia from Croatia, and Slovakia from Hungary and the Czech Republic.
Sources: NRAs, EBU, EPRA, InfSo, EAO.

In a second step data have been gathered from company annual reports, which are freely available on the internet. The preferred source of data has been cash flow statements or notes accompanying those statements. In these sources, investment is usually specified as "additions to tangible fixed assets", or "additions to property plant and equipment". The main advantage of using data from cash flow statements is that they include only annual acquisitions of property, plant and equipment and not changes in the value of the stock of tangible fixed assets that can occur for reasons other than new investment, such as revaluations and mergers and acquisitions.[5]

Care has been taken to include only capital expenditure relating to investment in tangible fixed assets, rather than intangibles (such as mobile phone radio spectrum licence fees and computer software).

[5] While a merger will change the stock of assets a particular e-communications company has, it will not increase the capacity of the economy to produce e-communications services because total assets in the economy remain unchanged.

Since capital expenditure in the e-communications sector is typically in technical plant and equipment[6], a sale of fixed assets does not represent a decrease in investment in the e-communications sub-sector. Hence, only additions to tangible fixed assets are included in the investment figures, and not disposals or writedowns.[7] This means that all figures reported relate to gross and not net investment.[8]

It should also be noted that in the mobile sub-sector, only licence-holding mobile network operators have been included, and not virtual network operators or air-time resellers.

In a minority of cases, data from company annual reports are not available. This has been due to a variety of causes: companies being recently merged or acquired (e.g. Amena was bought by France Telecom in July 2005, so its old annual reports are not readily available), companies not making their annual reports public (such as TDF, which is owned by a private equity firm), and annual reports with insufficient information (as in the case of Tele2, which has operations in a large number of countries and provides no breakdown of data by country).

In those cases, alternative sources of information have been researched. For some companies, figures on the stock of tangible fixed assets (as reported in the balance sheet) have been used. In those cases, investment has been computed as the annual difference in tangible fixed assets from Amadeus data. Data from our questionnaire responses have also been used.

Methodology used to get data for each sub-sector

Many of the players in European e-communications markets operate in more than one sub-sector in a particular country. For example, Telefónica in Spain and Telecom Italia in Italy operate in both the fixed and mobile telephony markets in their respective countries.[9] There are also a number of players that operate in more than one country (for example O2). Many other players only operate in one e-communications sub-sector in a given country, but also do business in other unrelated sectors. A good example of this is Bouygues in

[6] Land and buildings owned by e-communications companies generally account for less than 5% of additions to tangible fixed asset stocks.

[7] In an economic sense, the sale of tangible fixed assets by e-communications companies is not a reduction in the capacity of the economy to produce communications services.

[8] Gross investment simply reflects the capital expenditures undertaken during a given period. It takes no account of decreases in capital stocks due to sales or depreciation. In contrast, net investment is equal to gross investment minus depreciation.

[9] Others, such as France Telecom, operate not only in the fixed and mobile markets in France, but also in the UK mobile market via Orange. Similarly, Deutsche Telecom operates in the fixed, mobile and broadcast markets in Germany, and through their T-Mobile division, also in the mobile market in the United Kingdom.

France, who have interests in construction, property, roads and media as well as mobile telecommunications.

While some companies provide breakdowns of additions to fixed assets by country, large companies or groups of companies often present their results as a whole and do not disaggregate reported investment between industries or countries.

In the cases where company results cover more than one sub-sector or country, the total group investment figures for tangible assets have to be broken down for the different e-communication sub-sectors and countries. To obtain a breakdown for sub-sectors the shares of total capital expenditure, including intangibles, for individual sub-sectors have been used as weights to split up the total. The same method has been used to obtain figures at a country level (using a share of the country's capital expenditure in total capital expenditure). In cases where capital expenditure is not available another variable has been used (such as revenue or number of subscribers).[10]

Detailed tables showing the methodology used in each individual case, along with detailed explanations, are given in Annex 1.

When classifying the companies into the four sub-sectors broadband providers have been included in the fixed telephony sub-sector and satellite operators have been included in the broadcast sector.[11] The breakdown of investment figures for each sub-sector has been obtained as explained above.

To complement annual report data, major companies in the EU e-communications sector have been surveyed asking for investment data for each of the sub-sectors and countries in which companies operate. Although considerable care was taken to keep the questionnaire simple, from 256 questionnaires sent only 38 useful responses were received covering a total of 30 sub-sectors in 21 countries (a copy of the questionnaire can be found in Annex 6).

Data from questionnaire responses have been used in place of data collected from the annual reports to get figures at the sector/country/company level. However, for the total EU e-communication investment figures data from annual reports only have been used, so that a consistent source is used across all companies for the aggregate figure.

[10] We should note that although every care has been taken to ensure that the figures used to weight investments are the best available proxy, there is the possibility of bias if the chosen proxy is not closely related to the actual investment figure.

[11] When an operator provides services in more than one sub-sector, that operator will appear in our tables separately for each sector. This is common in the fixed and mobile sub-sectors (the mobile operator Orange in France is owned by fixed provider France Telecom for example, and they are given separate entries), but also in many countries companies provide both cable and fixed telephony (UPC is a good example of this).

Verification of the data

A number of approaches have been used to verify the data gathered from annual reports.

Firstly, we can test our methodological approach of weighting total capital expenditure data to obtain a breakdown for investment in each country and sub-sector, because O2 provides a breakdown of investment by country. Estimated investments by O2 in Germany (weighting group additions to tangible fixed assets by the share of turnover generated in Germany) are less than 5% lower than the reported results by O2 for the four-year period being investigated. There is, however, considerable variation between years. The weighted estimate is 97% of the reported value in 2002, 124% in 2003, and 118% in 2004. In 2001 the estimate is just 43% of the reported value, but at this time investment by O2 in Germany was at a low level, so even a small change appears large in percentage terms.

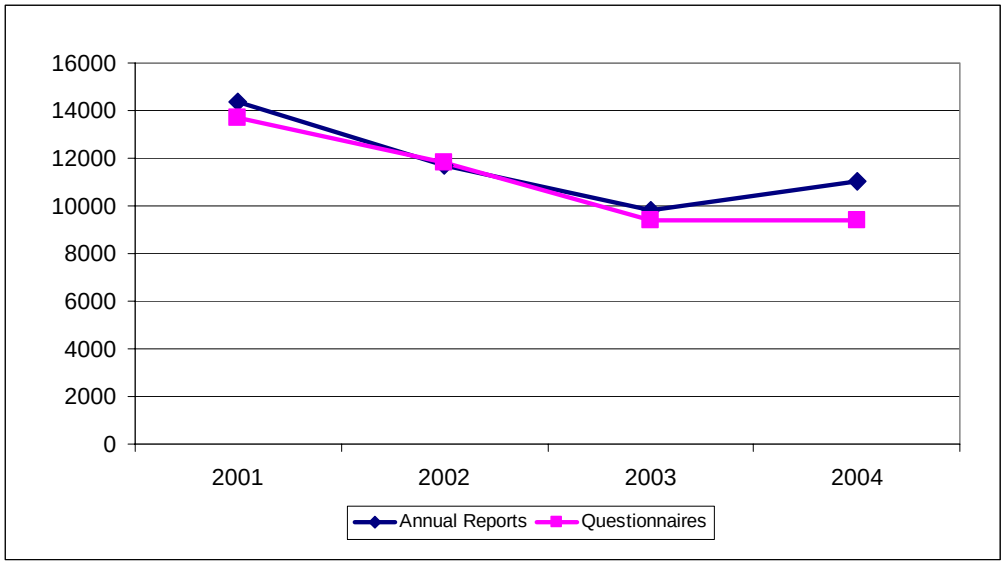
Applying the same methodology to O2 in the United Kingdom, estimated investments over the four year period are an average of 29.2% greater than those reported by O2. The weighted estimate is 89% of reported investment in 2001, 124% in 2002, 138% in 2003, and 165% in 2004.

A second step is to compare annual reports data with data from the survey. Overall, annual report data are 6% greater than the figures provided by the companies themselves. We should note that when we compare pairs of figures individually, there are large discrepancies which cancel each other out when the data are aggregated. This is not the case in 2004, and Figure 2.1 shows that the investment data gathered from the annual reports are greater then those from the questionnaire to companies.

We believe that the figure based on annual report data, and showing an increase in investment between 2003 and 2004, is the more reliable for the following reasons.

- Our survey of companies in the sector (see Section 4.3.4) suggests significant increases in investment in the sector between 2003 and 2004.
- Other sources, such as the Infonetics estimates mentioned on page 24 and our discussions with operators (see Section 4.3.5) suggest an increase in investment between 2003 and 2004.
- One source, Eurostat, suggests a slight decline in investment between 2003 and 2004 (see page 23). However, we discount this because of the missing observations in the later part of the period and the consequent use of extrapolation ot achieve these estimates. The use of extrapolation means that a turning point in the data is likely to be missed.

Figure 2.1: Comparison of total investment data collected from annual reports and questionnaires* (€m)



Note: * Includes 38 companies for which questionnaire responses were received, and excludes outlier data for T-Systems, TDC Mobile and TDC Kabel.
Source: Company Annual Reports and LE calculations, and company questionnaire responses.

This exercise provides an indication that figures disaggregated at the sub-sector/company level can contain some measurement error and should be treated with caution. However, at a more aggregated level, data is more reliable as it comes straight from the annual reports.

Alternative sources of aggregate investment data in the European Union have also been used in order to corroborate the data presented here. Comparisons have been made with investment data published by the International Telecommunications Union (ITU), the OECD and by Eurostat.

Figure 2.2 below shows fixed and mobile telephony investment in Germany, Spain, France, Italy and the United Kingdom. In 2004 these countries accounted for 64% of EU25 investment (based on LE estimates), and have also been chosen to avoid problems with missing data.[12] The estimates of total investment in fixed and mobile telephony vary between the four sources. Although we show investment data from four sources together in the same graph, a direct comparison is not strictly possible because they are based on different definitions of investment. Comparison of the data shows London Economics' figures to be lower than those from the other three sources (see Figure 2.2). This can be explained as follows:

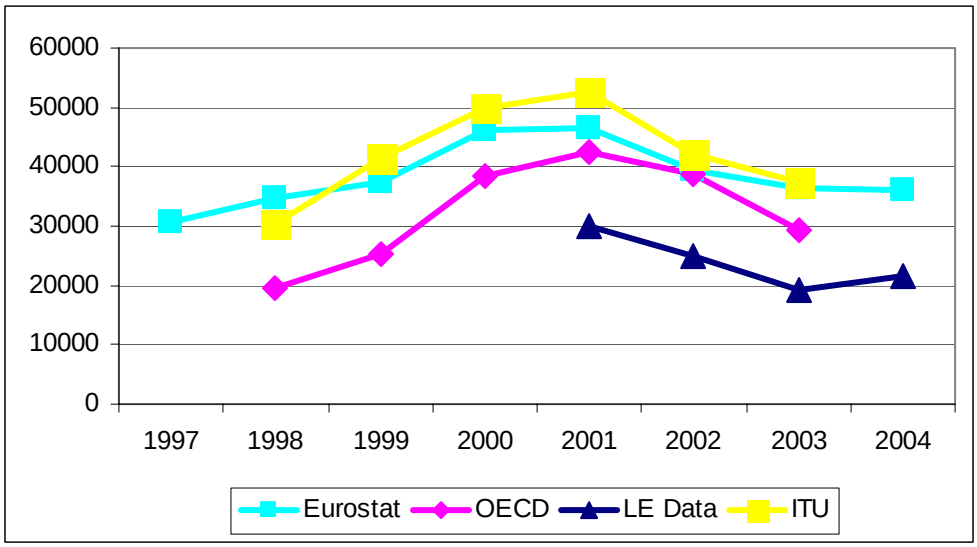
[12] Data are missing from all three alternative sources used here, particularly Eurostat, which is the limiting factor in this analysis.

- Eurostat's definition of investment includes property, plant and equipment and fixed and mobile telecommunications networks. It included intangibles but excludes spectrum licences. However, 27% of the data points are missing from the Eurostat data, particularly towards the end of the period and this will lead the Eurostat data to overestimate true e-communications investment.[13]
- OECD data show higher levels of investment than the London Economics data from annual reports. Part of the explanation for this lies in the fact that the OECD reported investments include tangible and intangible assets (except spectrum licence fees).
- ITU data refer to the expenditure associated with acquiring the ownership of telecommunication equipment infrastructure (including supporting land and buildings and intellectual and non-tangible property such as computer software) but excluding radio spectrum licences and provides figures that are above our estimates. It is interesting to note the discrepancy between ITU and Eurostat data, since the definitions are similar except that the Eurostat data includes satellite investment and the ITU does not. Despite this, the ITU provides higher estimates of investment.
- The London Economics estimates are based on capital expenditure on property, plant and equipment. Since the LE data does not include intangibles, this would tend to lead to lower estimates. Also, since LE have collected data mainly from company reports, data has not been collected from every single company active in the sector, though the data collected is expected to have captured the vast majority if investment.

Despite these difficulties, all the data sources in Figure 2.2 make clear that over the period 2001 – 2003 investment in fixed and mobile telephony in the EU has declined. The data collected by London Economics depict a reversal of this trend in 2004 that cannot be compared with the other sources because they do not provide data for this year.

[13] This is because data have been extrapolated on the basis of prior values and because there has been a reduction in investment over the considered period.

Figure 2.2: Comparison of investment data in fixed and mobile telephony from different sources (€m, 2001 prices)



Note: Fixed and mobile telephony investment for Germany, Spain, France, Italy and the United Kingdom.
Sources: Eurostat, OECD Communications Outlook 2005, ITU World Telecommunications Indicators Database 2005, annual reports and LE calculations.

Further sources of alternative aggregate investment data are also available. The research company Infonetics estimate EU fixed and mobile telephony investment to be €46bn in 2003 and €48bn in 2004. This is not incompatible with the 11th Implementation Report's estimate of €45bn in 2005,[14] or ECTA's estimate of €41.4bn for 2005.[15] In any case, all figures lay a bit above than London Economics' estimate of €32bn for 2004. It should be recognised, though, that the alternative data sources include intangible assets in their investment figures.

Structure of the analysis

The analysis presented in the rest of the section is structured as follows. We first provide an overall look of the evolution of investments in fixed tangible assets between 2001 and 2004. Then, in subsections 2.3 to 2.6, we investigate the same trends separately for each sub-sector: fixed and mobile telephony, cable television and broadcasting. Finally, we explain the differences in the investment patterns in the EU in subsection 2.8.

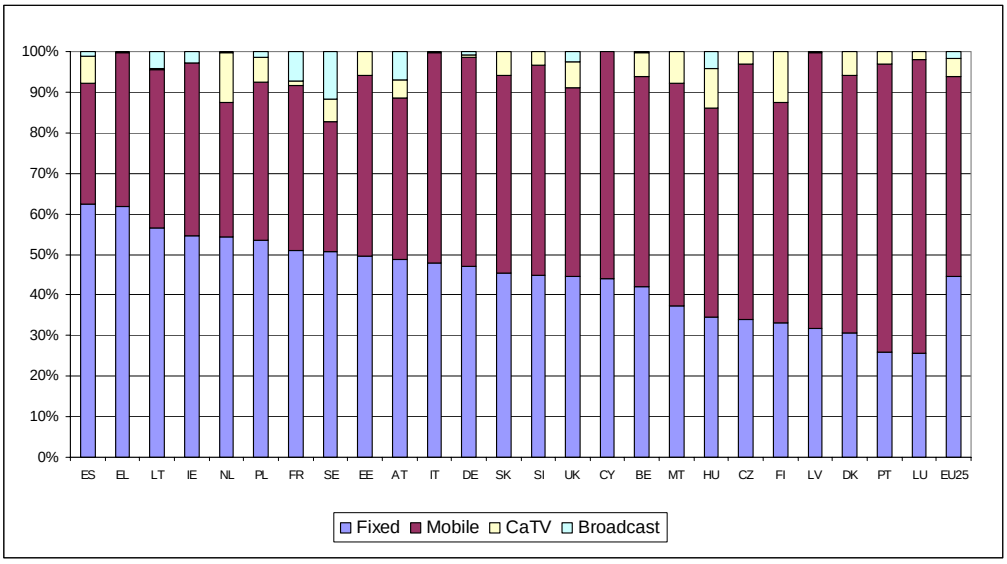
[14] 11th Implementation Report, pg 3.

[15] European Telecom's Lost Investment: An analysis of the ECTA Scorecard. http://www.ectaportal.com/en/upload/File/Regulatory%20Scorecards/Scorecard280406/20060427%20Updated%20Elasticity%20paper.doc

2.2 Total investments in the e-communications sector

Looking at the sub-sectoral breakdown of e-communications investments in the European Union we observe that most investments (93% on average) were in fixed and mobile telephony (see Figure 2.3).[16] This can be explained by the large investments needed to support the uptake of new technological developments in those sectors, such as broadband services, new generation networks and 3G mobile telephony. The modest share of broadcast investments suggests that the ongoing digitization process in broadcasting is less investment-intensive than current changes in telephony and data transmission.[17]

Figure 2.3: Composition of gross investment by sub-sector (2001-2004, 2001 prices)



Source: Company Annual Reports and LE calculations.

Figure 2.4 shows the total amount of investment[18] in the e-communication sector from 2001 to 2004 in three groups of countries: large, medium and

[16] Fixed telephony also includes broadband services.

[17] Note also that we have not been able to collect broadcast investment data for the following countries :Estonia, Cyprus, Malta, Portugal, Slovenia, Slovak Republic. See Annex 1

[18] We excluded satellite television investments from the figure as in many cases available data would not allow a breakdown for countries. In any case, satellite television investments account for a very small part of total investments.

small (detailed figures are shown in Table A.1 in Annex 1, along with graphs broken down by country for the NMS and EU15 Member States). The countries have been grouped according to their population.[19] Investment figures are expressed both in 2001 prices and as a percentage of GDP.[20]

It is noticeable that total gross investment in e-communications was lower in 2004 than in 2001 in all three country groups (this is also true for all countries but Cyprus, see Annex 1 Table A.1). In particular, a sharp drop took place from 2001 and 2002 in every group. The picture is more mixed after 2002 when investments continued to decrease in large countries and stayed constant in the others.

Figure 2.4: Total gross investment by country groups in the e-communications sector

Source: Company Annual Reports and LE calculations.

The same pattern over time emerges when investment is expressed as a percentage of GDP. We note that large and medium countries spent nearly the same fraction of their GDP on investments in the e-communication sector, whereas this fraction is 3 to 5-fold higher for smaller countries.[21] This may reflect the high proportion of new member states in the group of small

[19] Large countries are the ones with population above 38 million, including France, Germany, Italy, Poland, Spain and the United Kingdom. Medium size countries are the ones with population between 8 million and 18 million, including Austria, Belgium, Czech Republic, Greece, the Netherlands, Hungary, Portugal and Sweden. Small countries are the ones with population less than 6 million , including Cyprus, Denmark, Estonia, Finland, Ireland, Lithuania, Latvia, Luxembourg, Malta, Slovakia, and Slovenia.

[20] Prices of investment goods have fallen in recent years due to developments in the telecommunications sector. We compute investment in real terms to account for this. Price deflators for the e-communications sector are not available for the analysed countries and the US price index for "Communication equipment" has been used to express investment data in constant 2001 prices. Given the high level of international trade in the communications equipment, the US price index is likely to be a reasonable proxy.

[21] Country-level data would show that among the large countries Poland spent the highest fraction of its GDP on e-communication investments.

countries and the need to invest for their e-communications infrastructure to "catch up" with the EU15. It may also reflect the presence of scale economies in investment in e-communications infrastructure.

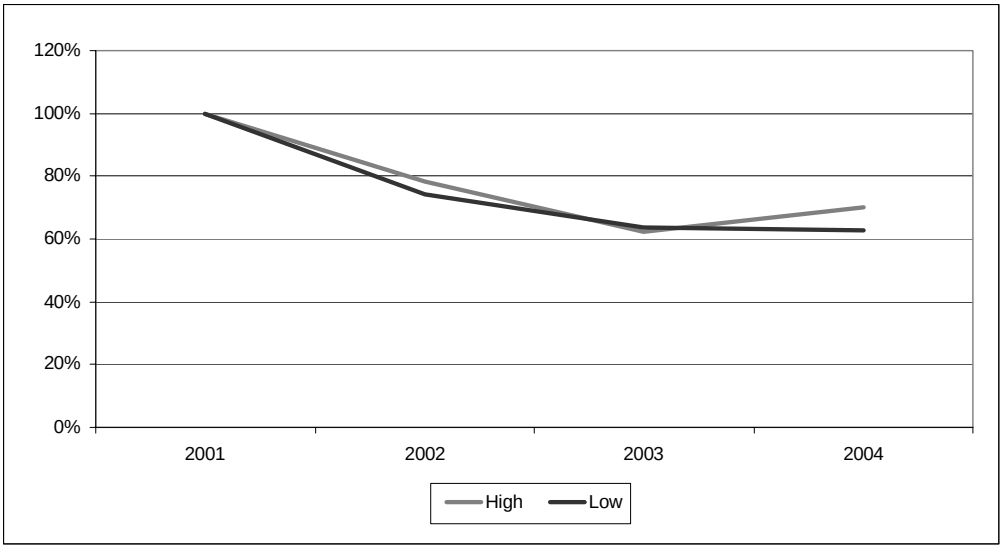
Figure 2.5 shows total gross investment in the e-communications sector for Old (EU15) and New Member States (NMS). EU15 countries invested more in absolute terms than NMS, which is related to the larger size of those countries. However, it is striking that in relative terms (accounting for GDP), NMS invested around double the amount of the EU15 throughout the period. This is probably indicative that firms view NMS as emerging markets with new market opportunities.

Figure 2.5: Total gross investment by EU15 and NMS in the e-communications sector

Source: Company Annual Reports and LE calculations.

Figure 2.6 shows the index evolution of investments between 2001 and 2004 compared to their original level in 2001. The analysis is split into two groups of countries, separated on the basis of their level of GDP per capita.[22] It can be seen that the overall level of investment was similar in both cases.

Figure 2.6: Relative change in investments in the e-communications sector for countries with higher and lower levels of GDP/capita (2001 prices)



Source: Company Annual Reports and LE calculations.

As illustrated in Figure 2.2, OECD and other data also suggest a decline in investment in the telecommunications sector over the same period, showing a peak in 2001 followed by a decline in each year to 2003. The OECD attribute this decline to a number of factors including the end of the financial bubble in the sector and the subsequent focus on achieving better returns from existing investments; improvements in technology and digitalisation; and increases in competition.[23]

In our discussions during the course of this study, market players have also suggested similar reasons for the decline, citing in particular a surge in investment following liberalisation in 1998, followed by a natural decline exacerbated by the effects of the bursting of the financial bubble. Many had

[22] The higher GDP per capita group includes Belgium, Denmark, Germany, France, Ireland Italy, Luxembourg, the Netherlands, Austria, Finland, Sweden and the UK. The lower GDP per capita group includes the Czech Republic, Estonia, Greece, Spain, Cyprus, Latvia, Lithuania, Hungary, Malta, Poland, Portugal, Slovenia and the Slovak Republic.

[23] OECD Communications Outlook 2005. Whilst this pattern applies to OECD countries as a whole, it also applies to the group of countries that are both OECD and EU members.

also experienced the upturn in investment over the last two or three years, with some attributing this to investment in broadband infrastructure and in next generaion networks.

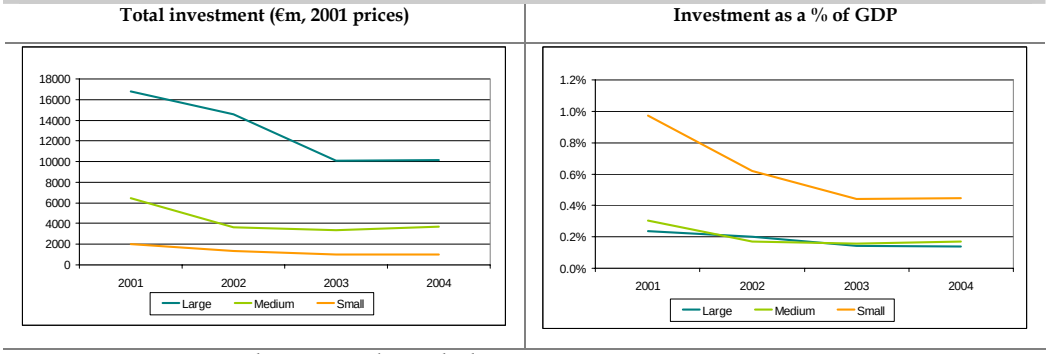
In the next sub-sections, investment at the level of each sub-sector is examined.

2.3 Investment in the fixed telephony sub-sector

As can be seen in Figure 2.7 below, levels of gross investment in tangible fixed assets in the fixed telephony sub-sector vary widely amongst the three groups of countries defined on the basis of population. Again, it is noticeable that in all countries investment in 2004 was lower than it was in 2001 (both in absolute terms and as a percentage of GDP). Detailed figures are given in Table A.2 in Annex 1, which also includes graphs broken down by country for the NMS and EU15 Member States.

It can be seen from Figure 2.7 that the largest decrease in investment between 2001 and 2003 happened in the group of large countries. One of the reasons cited for this is that following their huge investments prior to 2002, many of the incumbents in these countries had become heavily indebted and needed to switch to a more prudent investment policy. Also, after the financial bubble investments plans were more carefully scrutinised and investments were constrained. As a result, companies tried to rationalise their investment plans and undertake those investments that could be proved to be efficient.

Figure 2.7: Total gross investment by country groups in the fixed telephony sub-sector

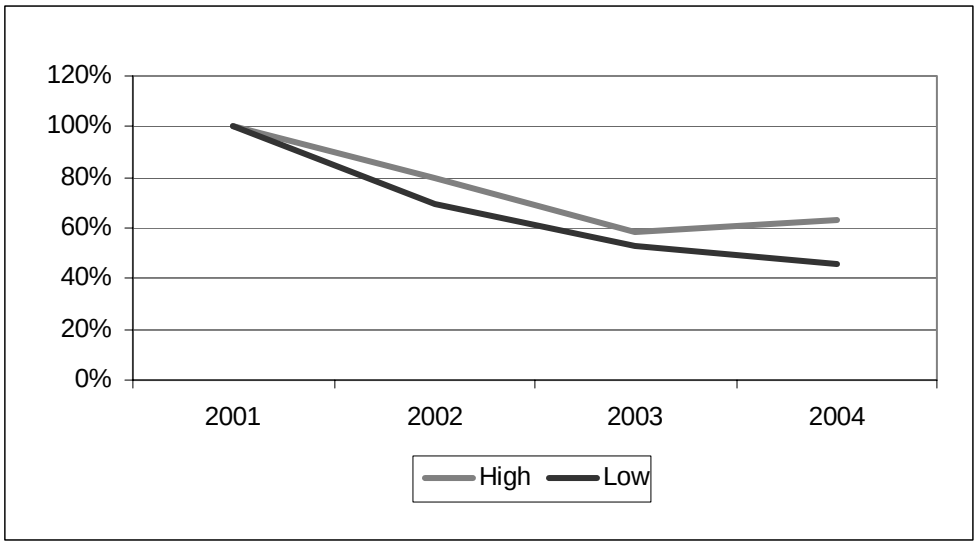


Source: Company Annual Reports and LE calculations.

Figure 2.8 shows the evolution of investments in fixed telephony sub-sector between 2001 and 2004 compared to their original level in 2001. Two series are illustrated, showing the corresponding change in investments in countries with different levels of GDP per capita.

The most noticeable feature of the graph is that investment in countries with lower GDP/capita did not pick up in 2004 as it did in countries with higher GDP/capita. The reasons for this are unclear, but it may be the case that investors see returns in the higher income countries as less risky and that they seek investment opporunties in these countries before turning to lower income countries.

Figure 2.8: Relative change in investments in the fixed telephony sub-sector for countries with higher and lower levels of GDP/capita (2001 prices)



Source: Company Annual Reports and LE calculations.

Fixed line telephony investment by incumbents and new entrants

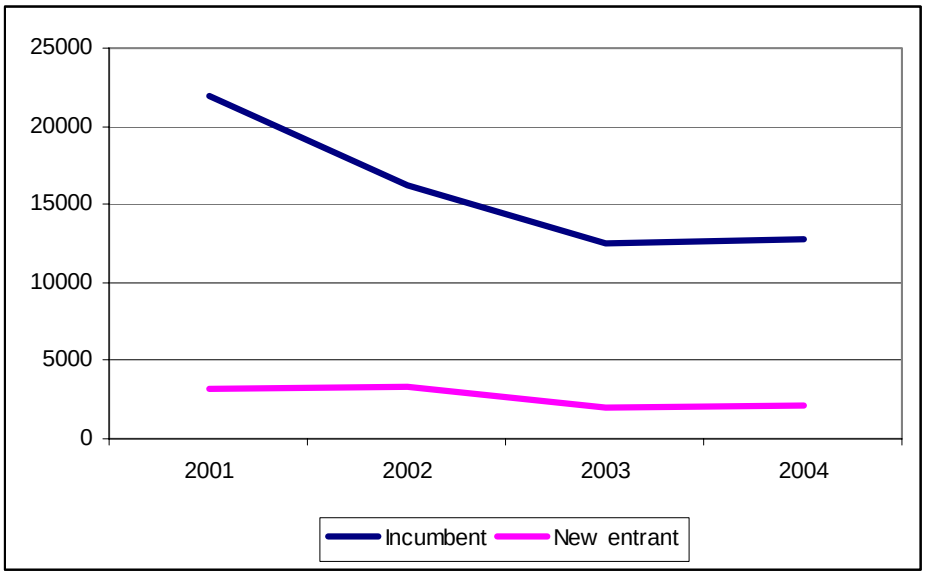
Figure 2.9 below shows that total gross investment by fixed telephony incumbent operators is higher than the investment of their new entrant competitors. Though total incumbent investment has fallen by about half its 2001 value over the period, it is still eight times as high as new entrant investment in 2004, compared to nine times in 2001.

The large difference in investment levels that can be seen in Figure 2.9 might be a reflection of the market structure, as incumbents have a much larger market share in the fixed telephony markets than entrants (the incumbent's market share is greater than 90% in Germany, France and Poland). Moreover, entrants at the retail level do not necessarily need to invest heavily

in fixed tangible assets, as they can use the incumbent's infrastructure for providing their services.

One can also see from Figure 2.9 that entrants made a much smaller contribution than incumbents to the decline in physical investment between 2001 and 2004. This shows that even though they have started to build up their own network well before 2001 and 2002, they managed to settle in the market and to follow technological developments with the necessary investments. For example, GTS Czech invested in its own IP network in 2004 to be able to increase international connectivity and to enhance its national backbone network.

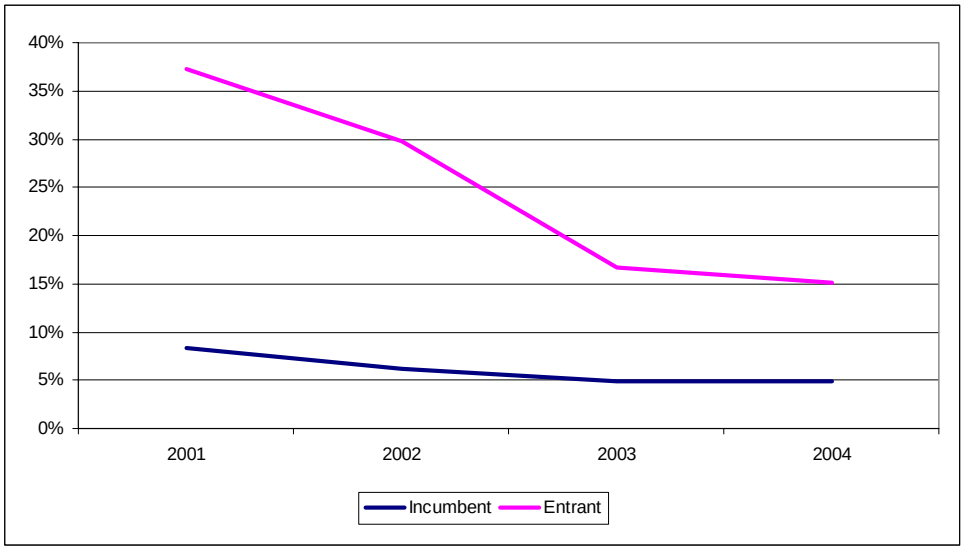
Figure 2.9: Total investment in the fixed telephony sub-sector by incumbents and new entrant operators (€m, 2001 prices)



Source: Company Annual Reports and LE calculations.

Total investment in fixed telephony by incumbents and new entrant operators expressed as a percentage of their revenues provides a different picture (Figure 2.10). The investment/revenue ratio is more than 4 times higher for entrants in 2001, though it reduces to about 3 times in 2004. Moreover, while entrants experienced a big drop in their investment/revenue ratio, incumbents' values remained fairly constant.

Figure 2.10: Fixed telephony investment by incumbent and new entrant operators expressed as a % of revenues*



Note*: Due to lack of revenue data, countries included are Germany, Spain, France, Italy, Hungary, the Netherlands, Poland and the United Kingdom.
Source: Company annual reports and LE calculations.

Investments by new entrants as a percentage of revenues have fallen to less than half their value in 2001. Though investments by new entrants fell slightly over the whole period, this dramatic decline also reflects the increasing revenues generated by the new entrants as their market shares have increased.

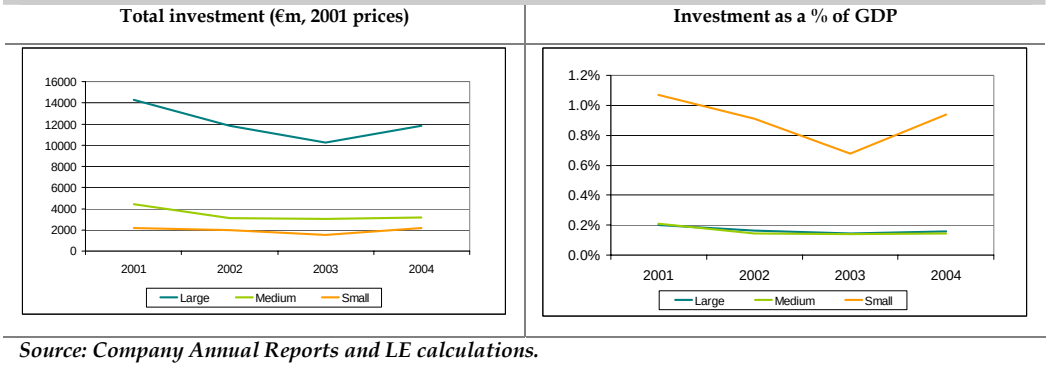
On the other hand, incumbent's investment has remained constant throughout the analysed period. This is because although total investment by incumbents had fallen over the period, this drop went in tandem with a reduction in their revenues. A possible explanation for this could be that increased competition from the new entrant operators has driven down prices and revenues for the incumbents.

2.4 Investment in the mobile telephony sub-sector

Figure 2.11 shows the evolution of gross investment in mobile telephony in the three population-groups of countries. It can be seen that in all the three groups (although to a lesser extent in case of medium-sized countries) investments picked up in 2004 following a decrease in the previous two years. Detailed data are provided in Annex 1 (see Table A.3). Graphs for individual countries are also given in Figure A. and Figure A..

When expressed in terms of GDP, the same result emerges as in the case of fixed telephony, namely that physical investments in mobile telephony count for a larger fraction of the GDP in the smaller countries.

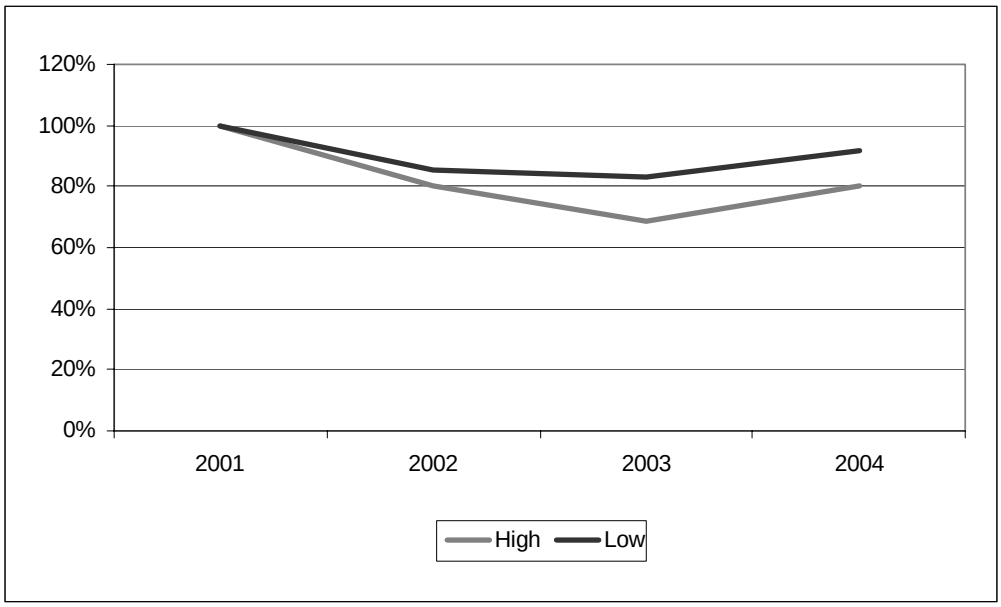
Figure 2.11: Total gross investment by country groups in the mobile telephony sub-sector



Source: Company Annual Reports and LE calculations.

Figure 2.12 shows the evolution of investments in the mobile telephony sub-sector between 2001 and 2004 compared to their original level in 2001. The two series show the corresponding change in countries grouped by their GDP per capita.

Figure 2.12: Relative change in investments in the mobile telephony sub-sector for countries with high and low levels of GDP/capita



Source: Company Annual Reports and LE calculations.

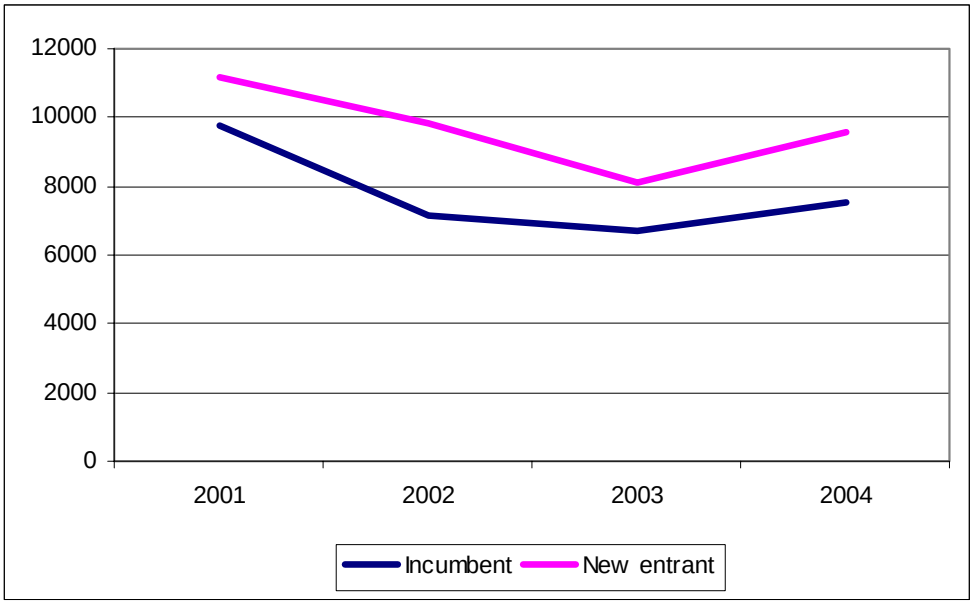
In contrast to the case of fixed telephony, investment in high-income countries fell by a greater extent relative to earlier levels compared to low-income countries. The reason for this could be the lower penetration of mobile services in low-income countries, which offered some investment possibilities with higher expected returns that were no longer available in the high-income group of countries.

By comparing the relative changes in investments in time in Figure 2.8 and Figure 2.12, we observe that in low-income countries investments in fixed line fell more than in mobile telephony. This means that mobile operators in countries with low income were apparently in a better financial position than fixed line operators and/or they faced better opportunities to invest. With the telephony market slightly behind compared to the countries with high income, mobile operators in low-income countries may have seen an opportunity to leapfrog some services traditionally provided by fixed line operators.

Mobile telephony investment by incumbents and new entrants

Figure 2.13 below shows that total gross investment by incumbent and new entrant mobile operators. We should note that, because the market for mobile telephony is relatively new, there are no true incumbent operators as there are in the fixed telephony market. In all of the countries in our sample the fixed telephony incumbent launched mobile services, so the latter is considered the incumbent.[24]

Figure 2.13: Total investment in the mobile telephony sub-sector by incumbents and new entrant operators (€m, 2001 prices)



Source: Company Annual Reports and LE calculations.

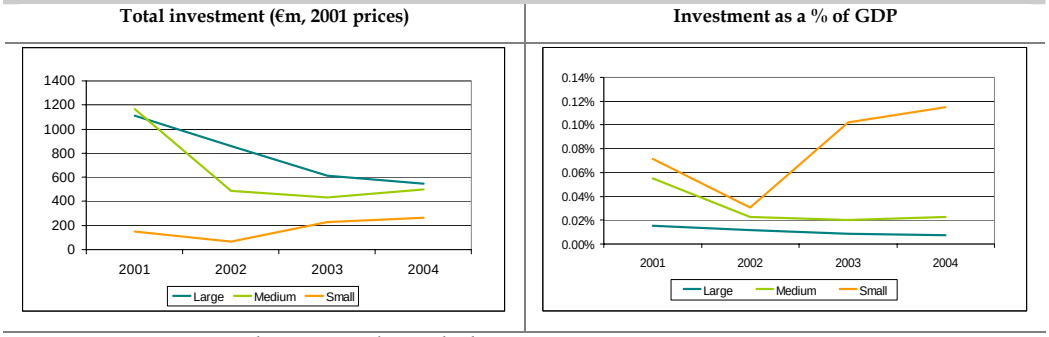
[24] This is the case even where the mobile incumbent is no longer owned by the fixed incumbent. For example, in the United Kingdom the incumbent is O2. This is because O2 was previously BT Cellnet, a subsidiary of the incumbent fixed operator BT. BT sold its mobile business in 2001.

2.5 Investment in the cable sub-sector

Total gross investment in the cable sub-sector shows a mixed picture (Figure 2.14): it decreased through the whole period in large countries, it decreased between 2001 and 2003 and slightly increased in 2004 in the medium-size countries, and increased after 2002 in the small countries.

Similar investment patterns emerge when one looks at absolute investment levels or relative to the GDP, with the only difference that the oscillation in investment is much larger for small countries, which spend a higher fraction of their GDP on this type of investments than larger countries[25] (detailed figures are given in Annex 1, Table A.4, along with graphs broken down by country for the NMS and EU15 Member States).

Figure 2.14: Total gross investment by country groups in the CaTV sub-sector



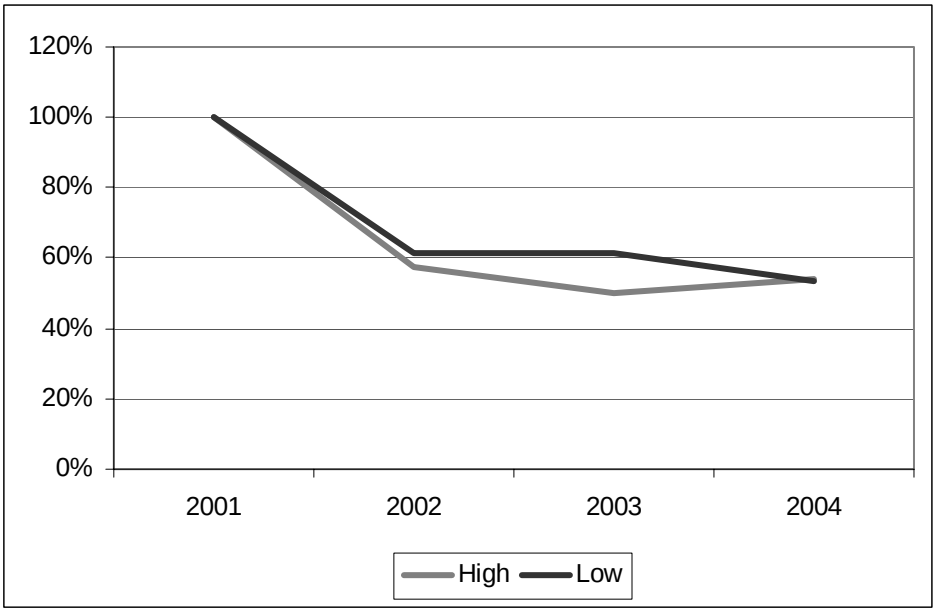
Source: Company Annual Reports and LE calculations.

[25] When investment spending is expressed as a percentage of GDP, Hungary is seen to have invested the greatest amounts, and the noticeable upward spike for Poland in 2003 is due to high investment by Multimedia.

Figure 2.15 shows the evolution of investments in the cable television sub-sector between 2001 and 2004 compared to their original level in 2001. The two series show the corresponding change in investments in low- and high-income countries.

It can be seen from Figure 2.15 that the overall level of investments followed very similar patterns of relative changes in both group of countries. This means that the wealth of a country does not seem to be a major driver for total investment in the cable TV sub-sector.

Figure 2.15: Relative change in investments in the CaTV sub-sector for countries with higher and lower levels of GDP/capita (2001 prices)



Source: Company Annual Reports and LE calculations.

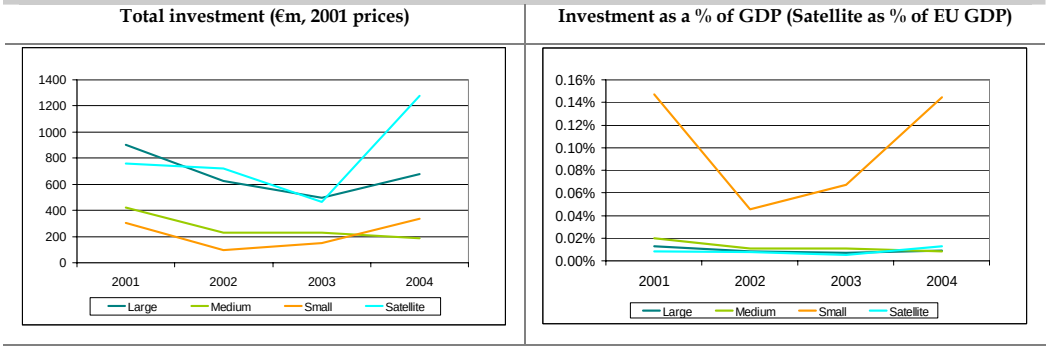
In the CaTV sub-sector, an analysis by incumbent and new entrant operators is not appropriate, because there have not been true incumbent operators in the past.

2.6 Investment in the broadcasting sub-sector

The graphs in Figure 2.16 show changes in investments in terrestrial broadcasting for the countries grouped by population. Broadcasting investment patterns in terrestrial television vary noticeably among the three groups of countries. In particular, they are slightly decreasing for medium-size countries, decreasing until 2003 in large countries with an increase in 2004, and increasing after 2002 in small countries.

When looking at investment compared to the countries' GDP levels, it can be seen that expenditures are moderate, except for small countries that expend the highest fraction of their GDP on investments in terrestrial broadcasting.

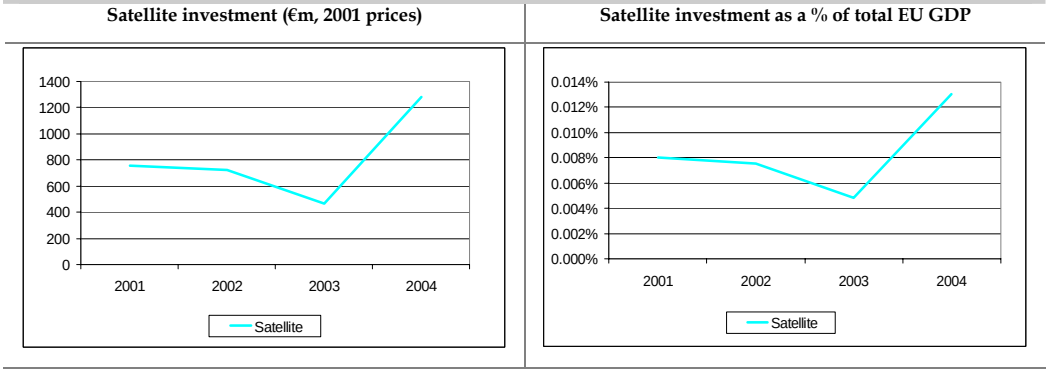
Figure 2.16: Total gross investment by country groups in the terrestrial broadcasting sub-sector



Source: Company Annual Reports and LE calculations.

In the case of satellite television, a sharp increase in investments can be observed in 2004 after a two-year decline. When taken compared to the GDP, it can be seen that satellite investments are of similar magnitude as the total terrestrial broadcasting investments in large countries (see Figure 2.16 and Figure 2.17). Detailed figures are provided in Table A.5 of Annex 1, with graphs by country (Figure A. and Figure A).

Figure 2.17: Total gross investment by country groups in the satellite broadcasting sub-sector



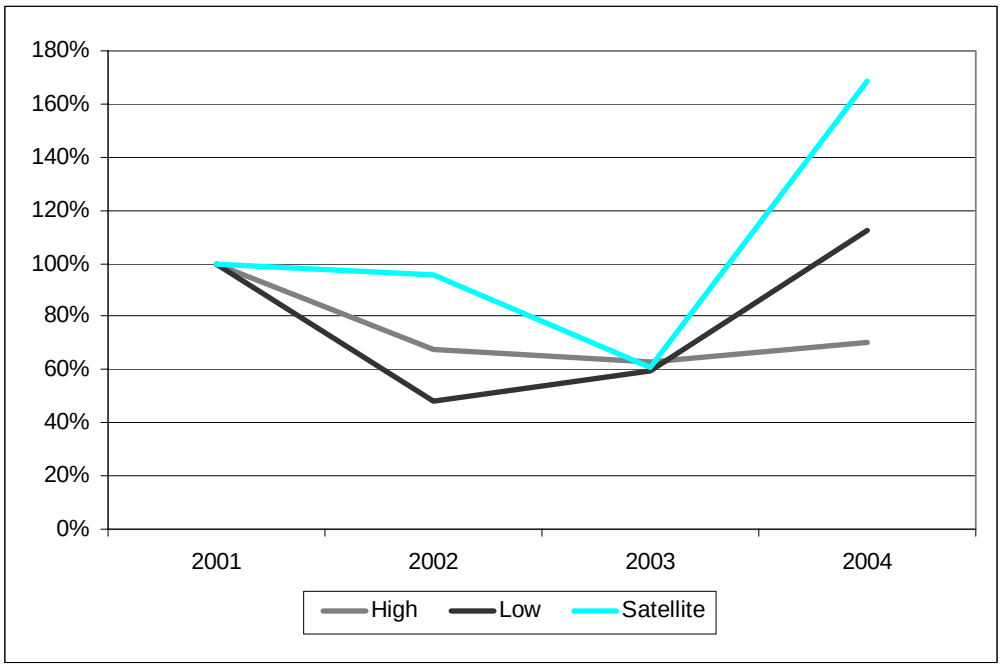
Source: Company Annual Reports and LE calculations.

Figure 2.18 shows the evolution of investments in the terrestrial and satellite broadcasting sub-sector between 2001 and 2004 compared to their original level in 2001. The three graphs show the corresponding change in

investments in terrestrial broadcasting in high- and low-income countries and the changes in aggregate investments in satellite broadcasting at the EU-level.

It can be seen from Figure 2.18 that following a sharper initial decline, investments in terrestrial broadcasting in low-income countries picked up earlier and showed a much stronger increase than investments in high-income countries.

Figure 2.18: Relative change in investments in the broadcasting sub-sector for countries with high and low levels of GDP/capita (terrestrial) and satellite



Source: Company Annual Reports and LE calculations.

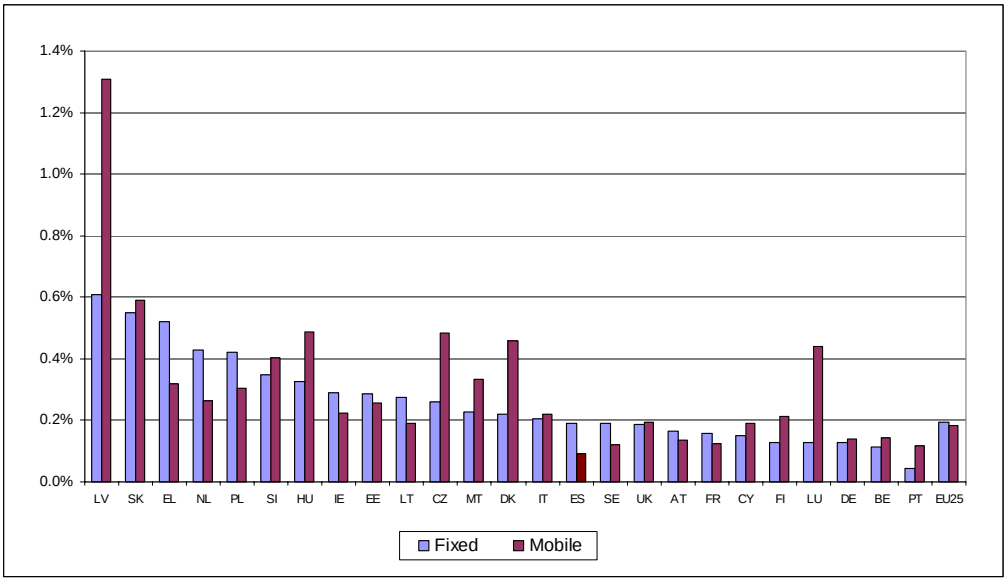
The increase in investments in 2004 compared to earlier years suggests that broadcasters are making efforts to invest in technology-supporting digital television. With digital television, an increased number of channels with increased quality can be transmitted using the same bandwidth, and this has encouraged new investment opportunities in complementary technological developments.

This can provide some explanation as to why cable television operators have not been increasing their investments (see Figure 2.15). With freely-available digital terrestrial television expanding in many countries (e.g. Freeview in the United Kingdom) future demand for cable television remains constrained and so does investment.

2.7 Synthesis of findings

Figure 2.19 below presents summary figures of investment in fixed and mobile telephony. Latvia, Hungary and the Czech Republic are clear outliers, with outstanding particularly high investment in mobile telephony relative to fixed telephony. This should not be surprising given the relatively low base of investment spending on which they are building, but it is interesting to note that Denmark and Luxembourg have also been investing more in mobile than in fixed telephony.

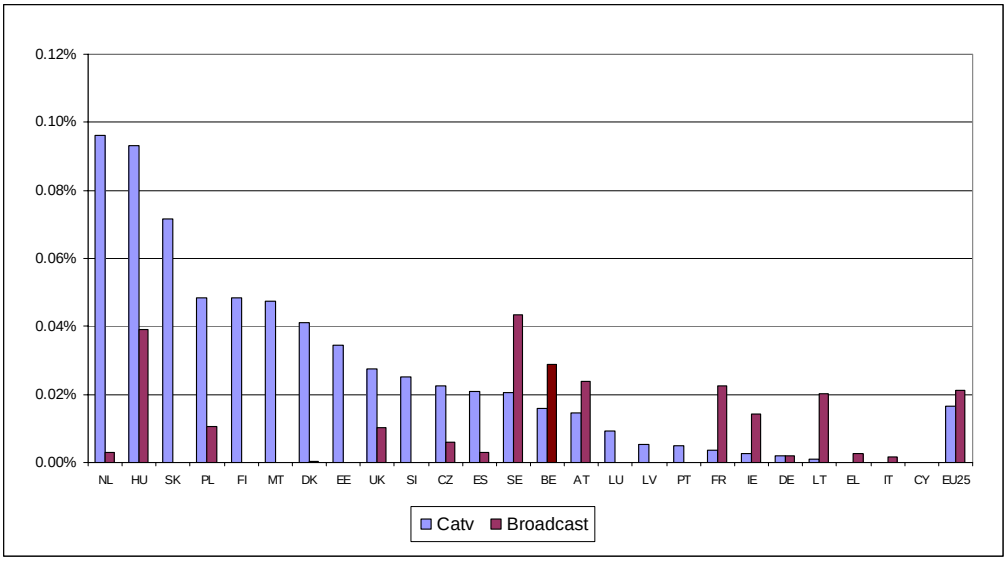
Figure 2.19: Investment (% of GDP) for fixed and mobile sub-sectors (total 2001-2004, 2001 prices)



Source: Company Annual Reports and LE calculations.

Figure 2.20 below is an equivalent summary figure of investment spending in the CaTV and broadcast sub-sectors. We see the Netherlands, Hungary, Slovakia and Poland investing the most in CaTV when expressed as a percentage of GDP. This is not surprising given the high penetration rate of CaTV in the Netherlands, and the previously low investment levels in the New Member States.

Figure 2.20: Investment (% of GDP) for CaTV and broadcast sub-sectors (Total 2001-2004, 2001 prices)

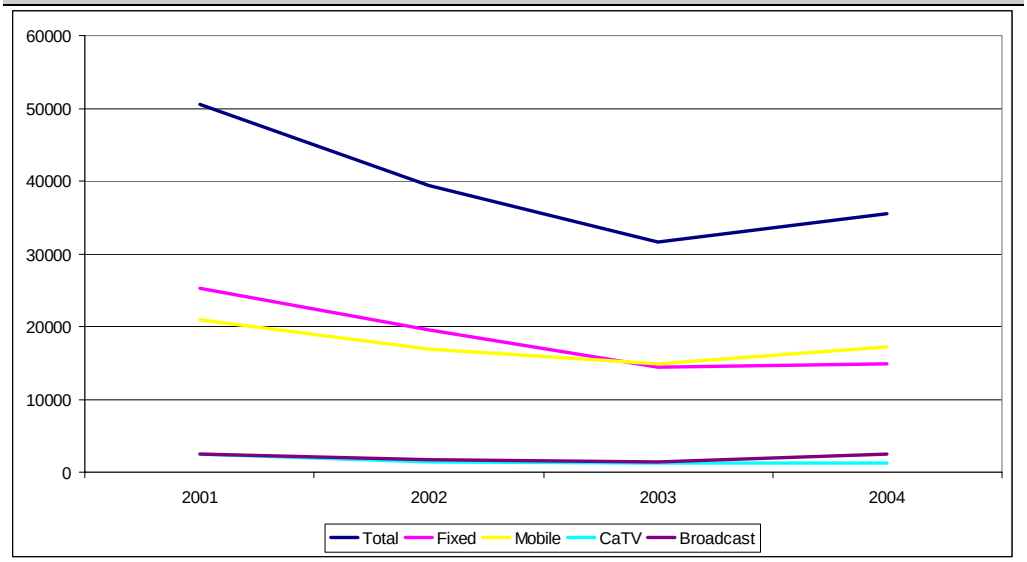


Note: There is no CaTV in some of the countries. EC sources state that Estonia receives some terrestrial broadcasting from Finland, Malta from Italy, Slovenia from Croatia, and Slovakia from Hungary and the Czech Republic.

Source: Company Annual Reports and LE calculations.

Figure 2.21 shows the evolution of investment by sub sector over the period 2001 to 2004 in constant prices. It illustrates the faster increase in investment between 2003 and 2004 experienced in the mobile sub-sector, compared to the fixed sub-sector. It also shows the relative low levels of total investment in the cable and broadcasting sectors, thought they follow a similar, though flatter, pattern over time with declines until 2003 followed by an upturn.

Figure 2.21: Evolution of EU25 investment by sub-sector (€m, 2001 prices)



Source: Company Annual Reports and LE calculations.

2.8 Explaining the differences in the investment patterns in the EU

As seen above, investments in e-communications show different patterns between Member States and submarkets. This subsection is devoted to analysing the differences in the observed investments during the period in question.

One of the market features that economic theory suggests could have an impact on investment spending is the regulatory environment. Firms must invest to remain efficient and to keep market shares and profits under regulatory regimes that foster competition and functioning of competitive markets.

To assess this link, we examine the relationship between investment and the regulatory environment in 2004. Firstly, we analyse the univariate

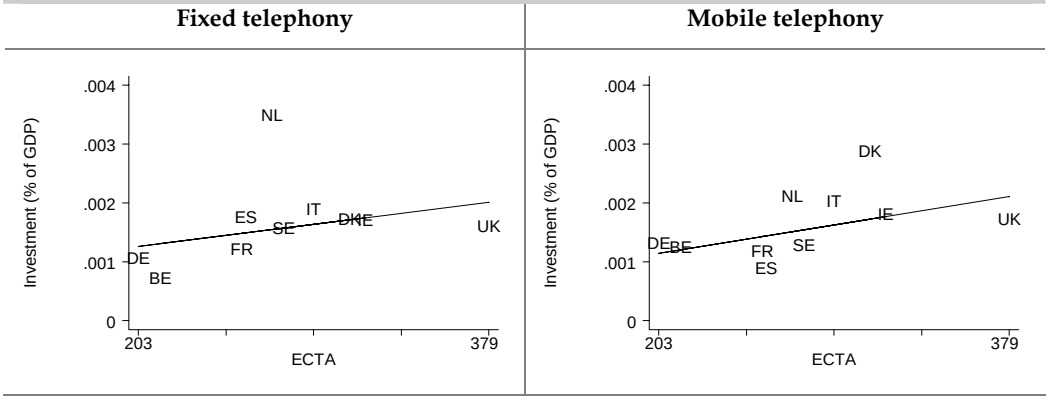
relationship between investment and regulation using two regulatory indices: ECTA's scorecard and the OECD's regulatory reform index for the Telecoms sector. In a second step we undertake a multivariate analysis including other potential explanatory factors of investment.

2.8.1 The effect of single variables on investment

In the univariate analysis, we use the investment data presented above, summed across companies within each sub-sector and country, and relate this investment figure to an index of the regulatory environment compiled by ECTA.[26] The index does not relate directly to the cable or broadcasting markets, and so is only relevant for fixed and mobile telephony.

Figure 2.22 below shows that as expected, a positive relationship exists between investment and the ECTA regulatory environment index in the fixed telephony sub-sector. A similar positive relationship exists between investment and regulation in the mobile sub-sector, confirming the correlation between higher investment and effective regulatory environment.

Figure 2.22: Relationship between investment and regulatory environment* (2004)



Note: * Regulatory index compiled by ECTA (2004).
Source: Company Annual Reports and LE calculations, ECTA.

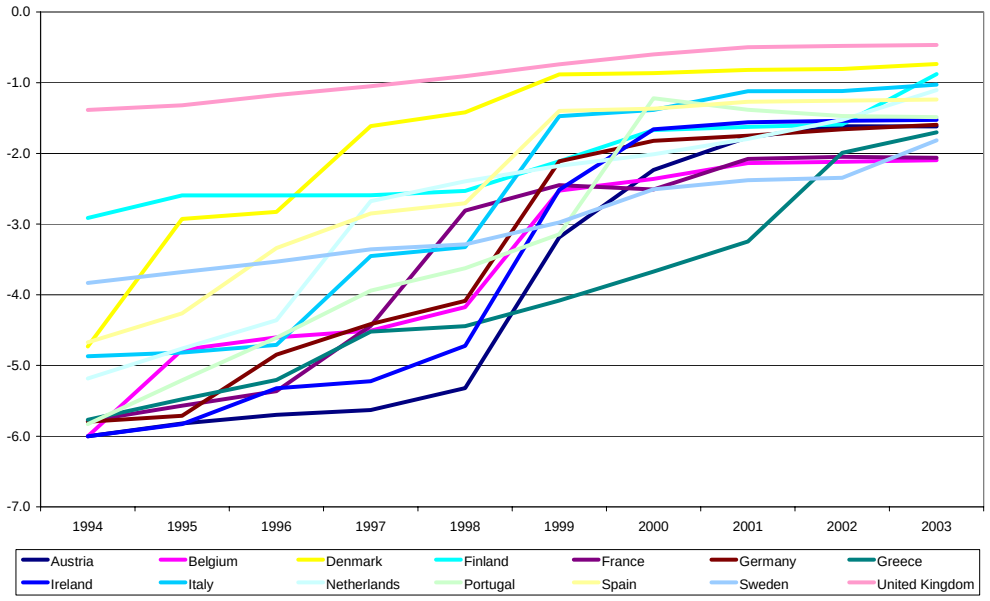
The historical evolution of the regulatory regimes in Member States can also be examined through a sector-specific regulatory reform index developed by

[26] The European Competitive Telecommunications Association (ECTA) regulatory scorecard assesses regulatory regimes in five categories: general NRA powers, the effectiveness of dispute settlement bodies, market access conditions, the availability of key access products and implementation of the new regulatory framework. Services covered by the index are fixed and mobile voice provision, business services and broadband. The scorecard is available from http://www.ectaportal.com/en/basic276.html

the OECD[27] as part of a wider exercise measuring regulatory reform in non-manufacturing product markets.[28]

There have been significant improvements in country performance against this index over the period 1994–2003 (a higher index number indicates an improved regulatory performance). It is interesting to note that the United Kingdom, which had the best indicator at the end of the period in 2003, had a better score in 1994 than several of the other countries did ten years later in 2003.

Figure 2.23: OECD Regulatory Reform Index for the Telecoms sector



Note: OECD Index has been inverted for comparison purposes. A higher number represents a regulatory regime that presents fewer impediments
Source: OECD.

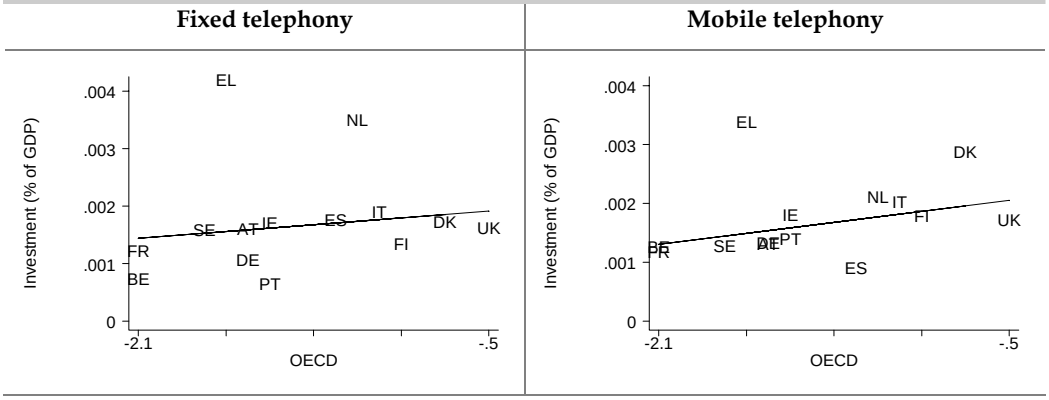
When looking at the relationship between investment and the OECD regulatory reform index (Figure 2.24) we find the same type of relationship as

[27] The composition of the sectoral indicator for telecoms is based on the response to three types of questions: (1) The extent to which there is free entry into the market (from a regulatory perspective); (2) The extent to which the largest firms in the fixed and mobile sectors are owned by the Government; and (3) The market structure, based on market shares.

[28] See Conway, P. and G. Nicoletti (2006), "Product market regulation in non-manufacturing sectors in OECD countries: measurement and highlights", OECD Economics Department Working Paper, forthcoming. Note that the index relates to the telecoms sector and so does not cover cable and broadcasting.

in Figure 2.22 for both fixed and mobile sub-sectors.[29] Countries with effective regulation have higher levels of investment.

Figure 2.24: Relationship between investment and regulatory environment* (2004)



Note: * Regulatory index compiled by OECD (2004).
Source: Company Annual Reports and LE calculations, OECD.

2.8.2 Drivers of investment in e-communications

A number of studies have investigated the determinants of telecommunications investment, focussing particularly on the effects of privatisation and regulation of the industry on investment.

Röller and Waverman (2001) examine the effects of telecommunications infrastructure on economic development at the aggregate level using a model of supply and demand for telecommunications investments. The authors find that GDP per capita has a positive and significant influence on the demand for telecommunications infrastructure, while prices of telephone service have a negative effect.

Li and Xu (2002) test the impact of privatisation and competition on investment, and find that privatisation has a positive effect on investment per capita, as does competition. Surprisingly, although competition is identified as a key complement to privatisation, stimulating performance, and investment in telecommunications, the authors do not find the effect to be significant.

Both Gutierrez (2003) and Wallsten (2003a) examine telecommunications investment in developing countries. Wallsten finds that GDP per capita has a positive and significant effect on investment, while 'exclusivity' arrangements

[29] We should note that for comparison purposes the OECD index has been inverted from its raw form so that a higher (more positive) number represents a regulatory regime that presents fewer impediments.

(whereby governments grant monopoly rights to the incumbent telecommunications provider in order to increase the firm's value to private investors) have a negative and significant effect on investment. This result is not surprising because incumbents need not invest heavily if there is no threat of more efficient new entrants stealing their market share and profits.

Wallsten (2003b) explores the relationship between telecommunications reforms and investment, finding that both population and GDP per capita have positive and significant effects on log investment.

Table 2.2: Description of models used in the literature

Authors	Study aim [countries covered]	Variables used in investment regressions	
		Dependent	Explanatory
Röller and Waverman (2001)	Investigates how telecommunications infrastructure affects economic growth [21 OECD countries]	Log real investment in telecoms infrastructure	Log geographic area, real government deficit, telephone service prices, country dummy variables
Wallsten (2003a)	Explores the costs and benefits of 'exclusivity' deals in privatisations of telecommunications firms. [27 developing countries]	Log telecom investment	Exclusivity, log population, log GDP per capita, country and year fixed effects
Wallsten (2003b)	Investigates the sequencing of reforms, and their effects on investment. [197 countries]	Log telecom investment	Regulation, log population, log GDP per capita, country and year fixed effects
Li and Xu (2002)	Tests the impact of privatisation and competition on investment. [166 countries]	Log investment per capita	Privatisation, non-state ownership, exclusivity, share issue privatisation, no. of fixed operators, no. of mobile operators, competition, GDP per capita, population, urbanisation.
Gutiérrez (2003)	Examines the effects of telecommunications reform on performance in Latin American. [22 Latin American countries]	Main lines per 100 population	GDP per capita, percentages of trade, value added and manufacturing to GDP, urbanisation, population density.
Byrne and Davis (2003)	Examines how investment is affected by exchange rate uncertainty. [UK, US, Germany, Japan, Canada, France, Italy]	Business investment	Output, exchange rates, Tobin's Q

Analysing the determinants of investment

To estimate the determinants of investment we have drawn on the reviewed literature and posit a model based on country- and market-specific characteristics for the fixed and mobile sub-sectors. Having data at the firm level, we depart from the reviewed models by also incorporating firm-specific characteristics.

Using the data we collected on investment at the firm level, together with data on a number of potential drivers of investment, we used statistical analysis to investigate which potential drivers were important influences on investment levels.

Proposed model

To estimate the determinants of investment we have drawn on the reviewed literature and posit a model based on country- and market-specific characteristics. Having data at the firm level, we depart from the reviewed models by also incorporating firm-specific characteristics.

Our proposed model for gross investment is expressed as follows:

$$\ln(I_{ijt}) = \alpha + \beta Z1_{jt} + \delta Z2_{jt} + \eta Z3_{ijt} + \varepsilon_{ijt},$$

where $\ln(I_{ijt})$ is the logarithm of gross investment in tangible assets for each firm *i* in country *j* and year *t*,

$Z1_{jt}$ are country-specific characteristics that change over time. We include real GDP per capita, land area and population density, and expect that those countries with higher GDP per capita and larger areas have higher levels of investment, whereas those countries with higher density will require lower levels of investment,

$Z2_{jt}$ are market-specific characteristics that change over time. In the model we include a regulatory index for telecommunications. Such an index is constant within a country but changes over time,

$Z3_{ijt}$ are firm specific characteristics that may or may not change over time. We use a measure of firms' total assets, a dummy variable to identify incumbent operators (versus new entrants), and dummy variables to control for whether a firm operates in more than one sub-sector, or more than one country, [30]

α, β, δ and θ are the model parameters to be estimated and ε is the error term.

[30] Since Jorgenson (1983) the importance of the cost of capital has been recognised as a determinant of a firm's investment. However, a measure of cost of capital could not be constructed for a significant number of companies in the sample. Consequently, the cost of capital is not included in our regressions. In preliminary estimations for a reduced number of companies we found that this variable was not statistically significant. This is probably due to its high correlation with some other variables included in the model.

As explained in Section 2.1, the data on investment refer to gross investment in tangible fixed assets, and have been deflated using the US telecommunications deflator to constant 2001 prices in order to make meaningful comparisons between years. In a similar manner, GDP per capita figures have been rebased to 2001 and deflated using the HICP (Harmonised Index of Consumer Prices) from Eurostat. Population data were also gathered from Eurostat.

The OECD Regulatory Reform Index has been used to measure regulatory performance in e-communications.[31] A higher index number indicates an improved regulatory performance.

Dummy variables include whether a firm is an incumbent (for fixed and mobile sub-sectors) and for firms operating in multiple sub-sectors and multiple countries.

Results

We developed a number of different model specifications. We discuss here our preferred model, which we call Model (3). A more detailed description of all the models we developed and of our statistical analysis is included in Annex 2.

The results of our estimation of Model (3) are presented in Table 2.3.

Model (3) includes:

- the log of the OECD regulatory index (lioecd);[32]
- country-specific variables (the logs of GDP per capita, area, and density, denoted as lgdpc, lland and ldensity, respectively);
- year fixed effects (d2003);
- dummy variables indicating whether:
    - the firm is an incumbent (dincum);
    - operates in the mobile subsector (dmobile);
    - operates in more than one sector (msec); or
    - operates multinationally (mnat).
- firms' total assets (to control for the fact that larger companies will have higher levels of investment). The variable is included in logs and lagged one period (lla), so that current levels of investment are not

[31] See Conway, P. and G. Nicoletti (2006), "Product market regulation in non-manufacturing sectors in OECD countries: measurement and highlights", OECD Economics Department Working Paper, forthcoming.

[32] The OECD Index measures regulatory performance in terms of the degree of free entry into the market; the extent of Governmnet ownerwhip of the major operators; and market structure, based on market shares.

correlated with the current size of the company but with its assets in the previous year.

Table 2.3: Regression results for determinants of investment (firm-level data)

Explanatory variable	Model (3)
lgdpc	0.722 (1.93)
lland	0.319 (1.93)
ldensity	0.192 (0.99)
lioecd	0.332 (1.52)
dmobile	1.237 (4.75)**
dinc	0.919 (2.18)*
mnat	0.176 (0.41)
msec	0.753 (2.14)*
d2003	-0.234 (0.94)
lla	0.275 (2.81)**
Constant	-6.143 (3.05)**
Observations	155
R-squared	0.55

Note: Robust t statistics in parentheses; * significant at 5%; ** significant at 1%

The results of the model predict that countries' GDP per capita has a positive impact on the levels of investment. In particular a 1% increase in GDP per capita would lead to a 0.7% increase in the level of investment.[33] The country's area has also a positive and significant impact, but not density (this is probably due to the correlation between density and other variables).

The dummy variable for the mobile sub-sector, dmobile, is statistically significant and means that on average investment in the mobile sub-sector is higher than investment in the fixed telephony sub-sector (which is the

[33] Using the relationship $dlnI = \beta\, dlngdpc$, we can see that $\beta = \frac{dI}{I} \Big/ \frac{dgdpc}{gdpc}$.

omitted dummy). Finally, the dummies for firms' multinational and multisector dimension show that those firms operating in more than one sector invest more than an equivalent firm that only works in one sub-sector, but not firms operating in more than one country.

The regulatory index variable is positive but significant only at the 13% level. The lower statistical significance (compared to other model specifications) is probably due to the smaller sample size (observations are lost because of lags in the firm's assets variable) and the collinearity of firms' assets with the regulatory index.

In general, Model (3) has good statistical properties, and an R^2 of 0.55.

Overall, we conclude from this analyis that a better performing regulatory regime, as measured by the OECD index, does contribute to higher levels of investment. Use of an alternative regulatory index, the ECTA index, suggests a similar contribution to investment levels. However, the magnitude of this effect may be low compared to some other factors.

Other factors that have an important positive influence on company investment levels are GDP per capita; the land area and population density of the country in which they operate; and the size of the company, as measured by total asset value of the company.[34]

In order to check the robustness of our results, alternative models have been used which aggregate investment data at the country level for each year and sub-sector, i.e. aggregating companies' investment by country and year. These additional models use both the OECD and ECTA regulatory index and confirm investment is higher in places with more efficient regulation.

[34] Other factors related to company size, such as status as an incumbent and investment across more than one sector, were also influential.

3 Comparative analysis of growth

In this section we provide a comparison of the market growth in the electronic communications sector relative to other sectors of the economy for the EU15 compared with the United States, Japan and South Korea.

We also compare market growth by looking at specific sectoral indicators for each of the sub-sectors (fixed and mobile telephony, CaTV and satellite TV and broadcast).

Finally, we examine price dynamics and its impact on the development of e-communications markets in the EU15.

Indicators are reported for the EU15 countries as a whole and compared against data for the United States, Japan and South Korea. A breakdown for individual European Union countries is provided in tabular form in the Annex 4 and noteworthy country-specific cases are explained in the text.

3.1 Economic indicators

The analysis of market growth focuses on Gross Value Added (GVA) at constant prices for the e-communications sector and other sectors of the economy.

In order to undertake the comparative analysis, we have used the OECD Structural Analysis (STAN) database which draws on national accounts data and presents them in a consistent form across OECD members.

One problem encountered in the STAN database is that it provides information on GVA for the "Post and Telecommunication" sector overall, and data is not split between "Post" and "Telecommunications".[35]

Therefore, to obtain data for the "Telecommunications" alone one needs to subtract value added of the postal sector from the data for the "Post and Telecommunications" sector. GVA for the postal sector has been estimated using information on operating expenditure and operating revenue from postal operators (See Annex 2 for details).

We should note that the STAN ISIC Rev.3 definition of telecommunications (group 64.2) matches the definition of electronic communications as it includes "transmission of sound, images, data or other information via cables, broadcasting relay or satellite: telephone, telegraph and telex communication; maintenance of the network; transmission (transport) of radio and television programmes".[36]

[35] According to STAN researchers, this is because few countries provide separate data for these activities in their national accounts.

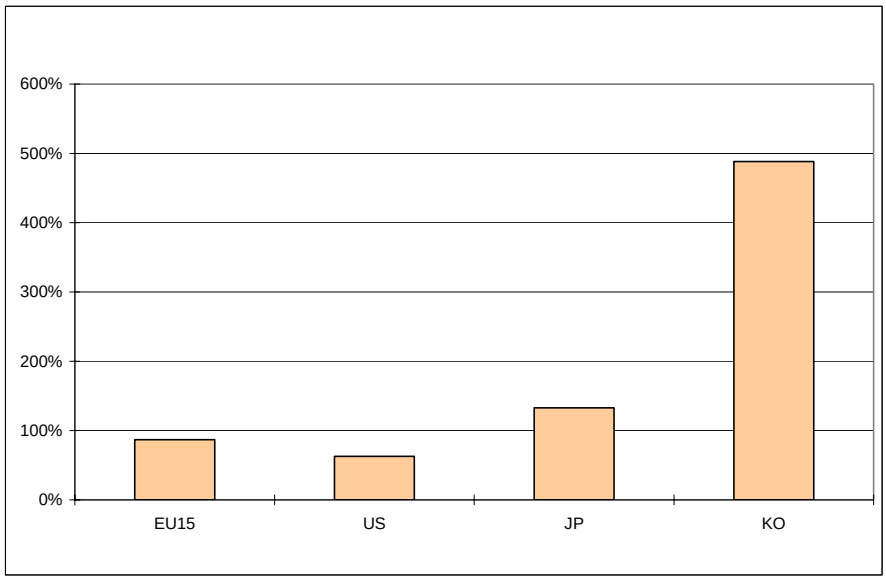
[36] This group excludes "telephone answering activities; and production of radio and television programmes even if in connection with broadcast".

Gross Value Added

Gross Value Added for a particular industry represents the contribution of that industry to national GDP (it is sometimes referred to as the industry's GDP).

E-communications GVA has experienced noticeable increases over recent years for the four analysed regions. All show an increase in GVA of more than 60% between 1995 and 2003. However, it is Japan and South Korea that experience the largest increase, with changes of 133% and 488%, respectively over the 1995-2003 period (Figure 3.1).

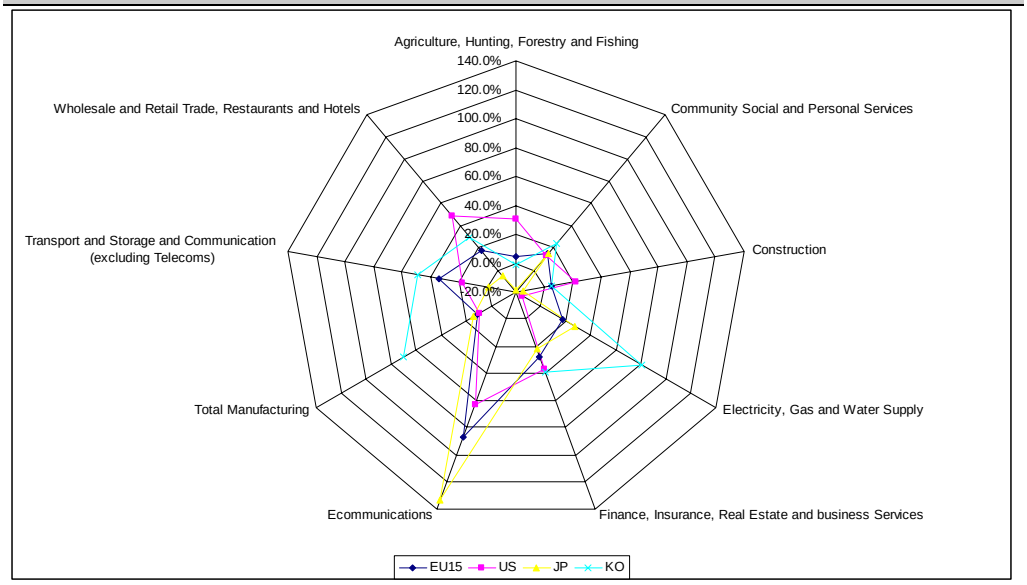
Figure 3.1: Gross Value Added in e-communications (% change 1995-2003, 2001 prices)*



Note: * 1995-2002 data used for the United States. EU15 excludes Ireland and Luxembourg due to missing data.
Source: London Economics calculations using STAN.

In all countries, growth in e-communications has outperformed the rest of sectors (Figure 3.2). For example, in the EU15, GVA in e-communications grew by 87% between 1995 and 2003, which is noticeably higher than the 30% growth experienced by the two sectors also showing high growth: "Finance, Insurance, Real Estate and Business Services" and "Transport and Storage and Communication (excluding Telecoms)".

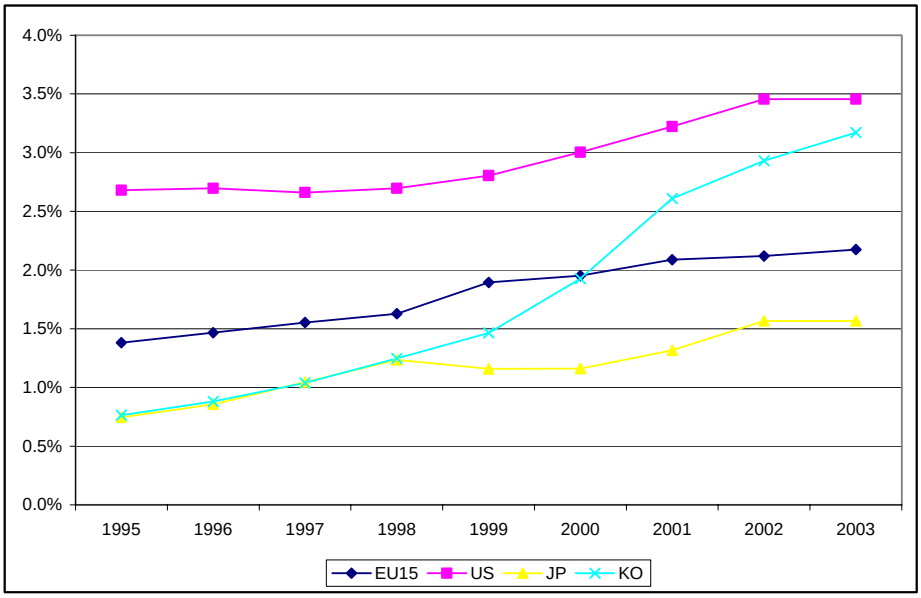
Figure 3.2: Change in real Gross Value Added for different sectors* (1995-2003)



Note: South Korea value for E-communications (488%) omitted to make countries comparable on the same scale.
Source: STAN.

It is interesting to see that the share of e-communications to total industry GDP has increased noticeably for the four analysed regions, although with huge disparities among them (Figure 3.3). In 2003 e-communications accounted for more than 2% of the industrial GDP in all regions except in Japan (where it was 1.5%).

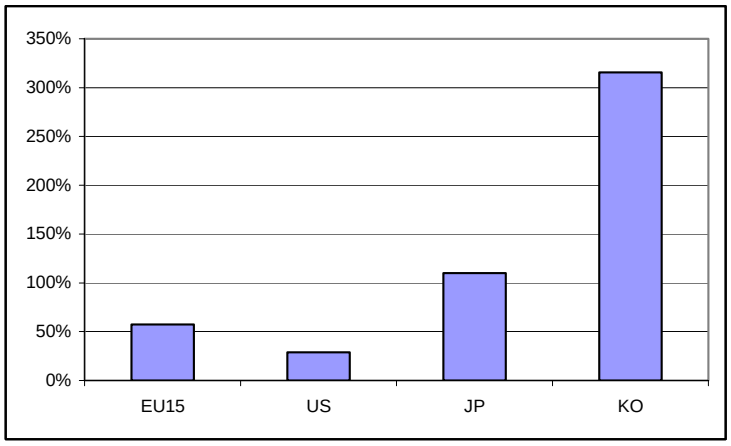
Figure 3.3: Evolution of the share of e-communications GVA in total economy (1995-2003)*



Note: * 1995-2002 data used for the United States. EU15 excludes Ireland and Luxembourg due to missing data.
Source: STAN.

Compared with their situation in 1995, all regions have seen a big increase in the share of e-communications GVA in total economy. South Korea increased its share 316% (from 0.8 to 3.2), Japan 110%, the EU15 58% and finally the United States increased only by 29% (Figure 3.4).

Figure 3.4: Change in the share of e-communications GVA in total economy (1995-2003)



Note: * 1995-2002 data used for the United States. EU15 excludes Ireland and Luxembourg due to missing data.

The overall increase in GDP between 1995 and 2003 differs markedly across the regions: GDP growth in EU15 was 19%, in the United States it was 26%, only 10% in Japan, but as much as 41% in South Korea.[37]

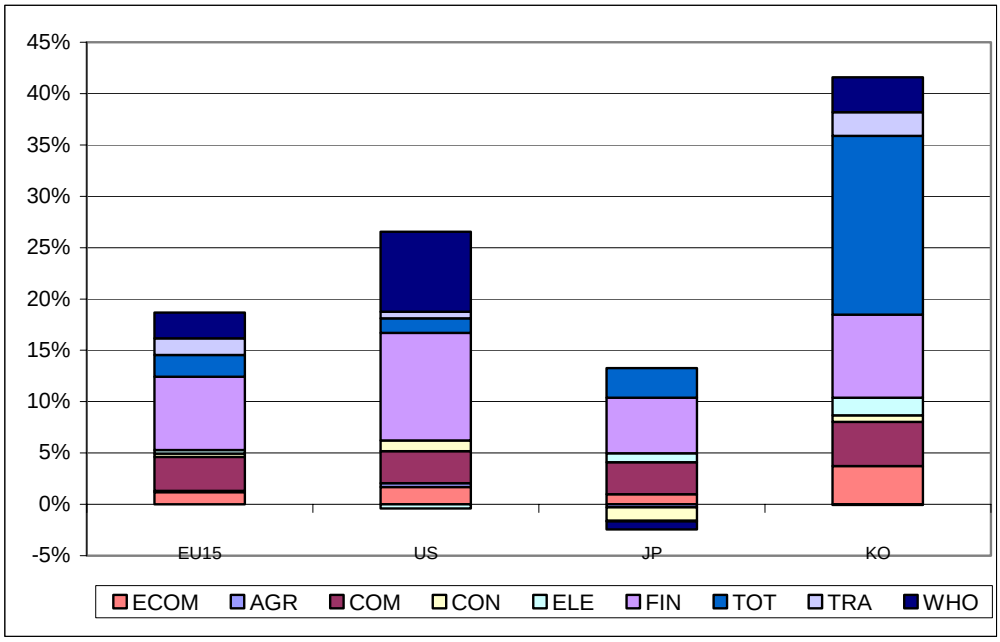
A decomposition of the growth in GDP between sectors shows that e-communications has had a contribution to growth of 6.4% (or 1.2% out of the 18.68% GDP growth) in the EU15 and 6.4% (or 1.68% out of the 26.17% GDP growth) in the United States, and around 9% in Japan and South Korea (or 1% of the 10% GDP growh in Japan and 3.7% out of 41% in South Korea).[38] In general "Finance, Insurance, Real Estate and Business Services" and "Community Social and Personal Services" show a large contribution to growth, mainly due to the large share they represent in the overall economy.

[37] Estimates exclude "Mining and Quarrying" due to missing data in some of the countries.

[38] Decomposition of growth between different sectors has been computed using sectors' share of 1995 GDP. For the EU15, for example, 18 percentage points of the 19% growth were contributed by non e-commnications sectors and one percentage point was contributed by the e-communications sector. Although the e-commnications sector in the EU15 experienced rapid, and above average, growth over this period, its share of economy wide GDP is small (around 2%) and so this limits its contribution to overall growth. Nevertheless it has made an important contribution to growth given its size in the economy.

The large contribution of "Total Manufacturing" in South Korea is also due to the importance of this sector in its economy (Figure 3.5).

Figure 3.5: Change in real Gross Value Added for different sectors (1995-2003)*



Note: * 1995-2002 data used for the United States. EU15 excludes Ireland and Luxembourg due to missing data. Estimates exclude the sector "Mining and Quarrying". ECOM: "E-communications"; AGR: "Agriculture, Hunting, Forestry and Fishing"; COM: "Community Social and Personal Services"; CON: "Construction"; ELE: "Electricity, Gas and Water Supply"; FIN: "Finance, Insurance, Real Estate and Business Services"; TOT: "Total Manufacturing"; TRA: "Transport and Storage and Communication (excluding Telecoms)"; WHO: "Wholesale and Retail Trade, Restaurants and Hotels".
Source: STAN.

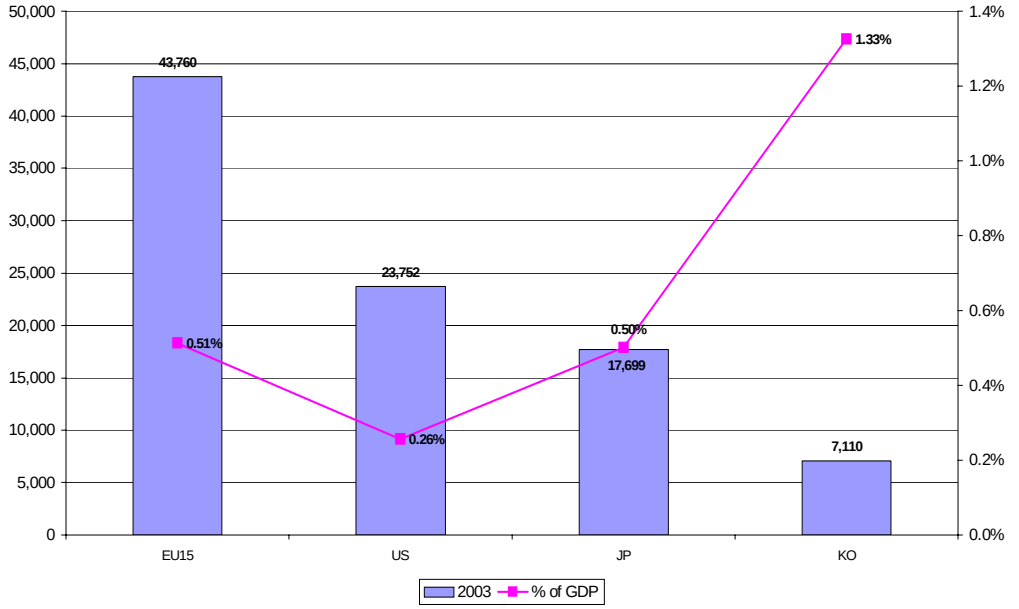
Investment

Investment data for the telecommunications sector has been obtained from the ITU World Telecommunications Indicator Database and the OECD.

Investment in total telecommunications represented a total of €92.3 billion for the EU15, the United States, Japan and South Korea, with major differences among countries. Investment is highest in the EU15 at €43.8 billion in 2003 (Figure 3.6), which is considerably greater than the equivalent in the United States (€23.8 billion), Japan (€17.7 billion) and South Korea (€7.1 billion).

To account for the size of the economy we also present investment in telecommunications as a percentage of GDP (Figure 3.6). We can observe that South Korea has the highest proportion at 1.33% of GDP, followed by the European Union (0.51% of GDP), Japan (0.50% of GDP) and the United States (0.26% of GDP).

**Figure 3.6: Annual telecommunication investment*
(€m and as a % of GDP, 2003)**



Note: * Data were not available for 2003 for a number of countries, 2002 data were used for Austria, Finland, France and the United Kingdom, while 2001 data were used for Ireland.
Source: Derived from International Telecommunications Union database.

Annex 1 presents comparative data for individual EU member States. The data suggest considerable variation across Member States in telecommunications investment. For example, investment ranges from 0.24% of GDP in Ireland to 0.95% of GDP in Greece. Other countries that exhibit low rates of investment include Germany (0.28% of GDP), France (0.38%) and Austria (0.44%). Countries showing relatively high rates of investment include the United Kingdom (0.86% of GDP), Spain (0.78%) and Italy (0.75%).

Similar results are gained from measuring annual telecommunication investment as a proportion of gross capital formation and expressed as per capita (Table 3.1). Investment as a proportion of gross capital formation is highest in South Korea at 4.5%, followed by the EU15 countries (2.8%), Japan (2.1%) and the United States (1.5%); whereas investment per capita is highest in South Korea (€149), followed by Japan (€139), the EU15 countries (€115) and the United States (€82).

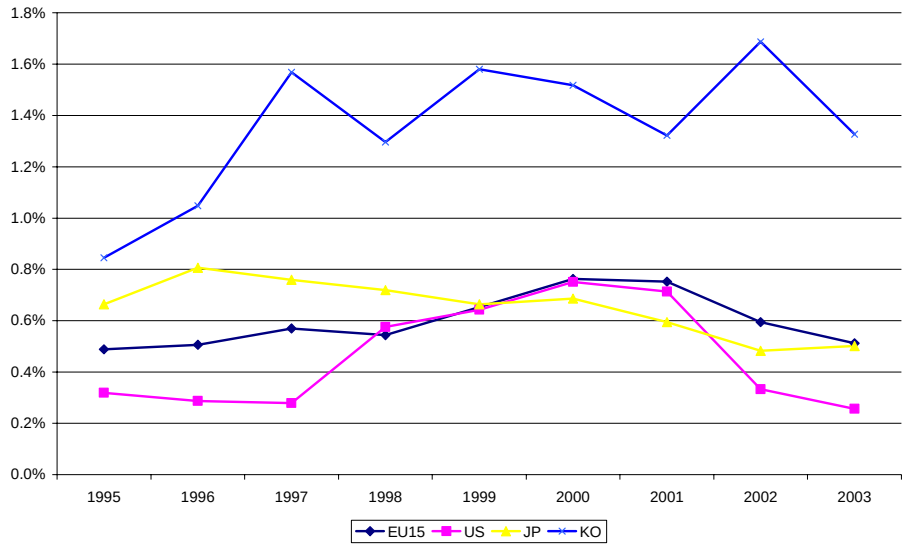
Table 3.1: Annual telecommunication investment (2003)

Country	% of GDP	% of gross fixed capital formation	per capita (€)
EU15	0.51	2.81	115
US	0.26	1.51	82
JP	0.50	2.08	139
KO	1.33	4.48	149

Note: * Data were not available for 2003 for a number of countries, 2002 data were used for Austria, Finland, France and the United Kingdom, while 2001 data were used for Ireland.
Source: Derived from International Telecommunications Union database.

The recent evolution of telecommunications investment has been different for the four regions. Data on annual telecommunication investment (relative to GDP) are presented in Figure 3.7 for 1995 to 2003. South Korea has had the highest investment (in relative terms) throughout the period, moving from an investment of less than 0.9% of GDP in 1995 to more than 1.3% in 2003. Relative investment has declined in Japan over the period, while in both the EU15 countries and the United States, annual telecommunications investment as a percentage of GDP rose in the middle of the period but has seen an important decline since 2001, reaching levels of below 0.6% for 2003.

Figure 3.7: Annual telecommunication investment (% of GDP, 1995 to 2003)



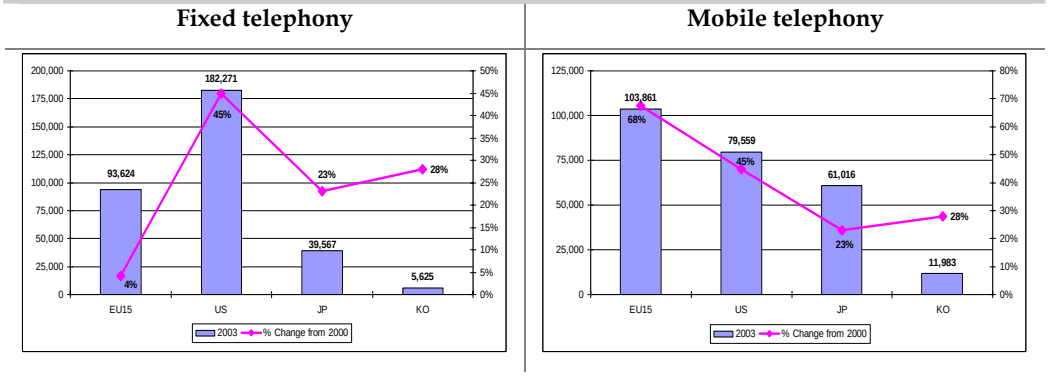
Source: Derived from International Telecommunications Union database.

Revenue

Data on fixed telephony service revenue are presented in Figure 3.8 (left panel). Revenues are highest in the United States at €182 billion. Although revenues increased over the period in all the regions, the increases ranged from only 4% in the EU15, to 45% in the United States.

Data on mobile communication revenue are presented in Figure 3.8 (right panel) and show that revenues are highest in the EU15 countries (€104 billion), followed by the United States (€80 billion), Japan (€61 billion) and South Korea (€12.0 billion). Individual country data are presented in Annex 4 (Table A.35).

Figure 3.8: Service revenues (€m, 2003)



Note: Data from earlier years were used for mobile communications and Member States with missing data for 2003.
Source: Derived from International Telecommunications Union database.

E-communications revenue data at country level for EU Member States are presented in Annex 4 (Table A.35). There is considerable variation across countries. Hence, for example, total telecommunication service revenues are highest in the United Kingdom (€64.5 billion), Germany (€62.9 billion), France (€35.1 billion) and lowest in Luxembourg (€0.4 billion), Ireland (€3.6 billion) and Finland (€4.6 billion). Growth rates in total revenues also show extensive variation across EU15 countries.

3.2 Sectoral indicators

This subsection reviews market growth in the electronic communications sector comparing grow rates for sector-based indicators across the EU15 countries, the United States, Japan and South Korea.

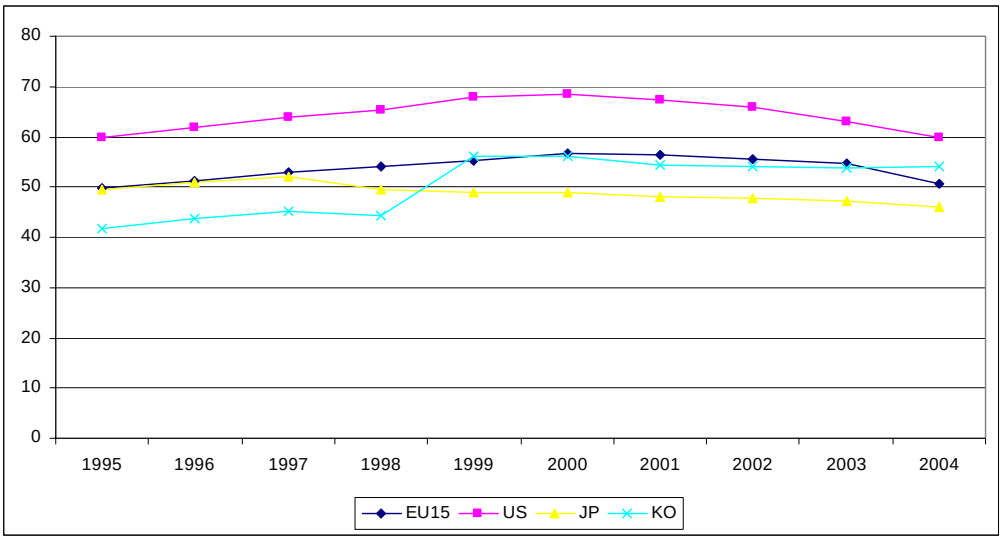
Data from the ITU World Telecommunications Indicator Database and the OECD are used. For some sub-sectors it was difficult or impossible to access consistent cross-country comparative data and in some instances the available data were either out of date or missing for a large number of countries.

We begin by considering a selection of indicators relating to fixed and mobile telephony sub-sectors. Data on the CaTV and satellite sub-sectors are considered next, followed by analysis of the internet and broadband.

Fixed telephony indicators

The evolution of fixed telephony subscribers (per 100 inhabitants) since 1995 is presented in Figure 3.9. All four jurisdictions show increases followed by declines in the number of fixed telephony subscribers. This can be explained by the rapid expansion of mobile telephony, which is examined in the next section.

Figure 3.9: Number of fixed line telephony subscribers per 100 inhabitants (1995 to 2004)

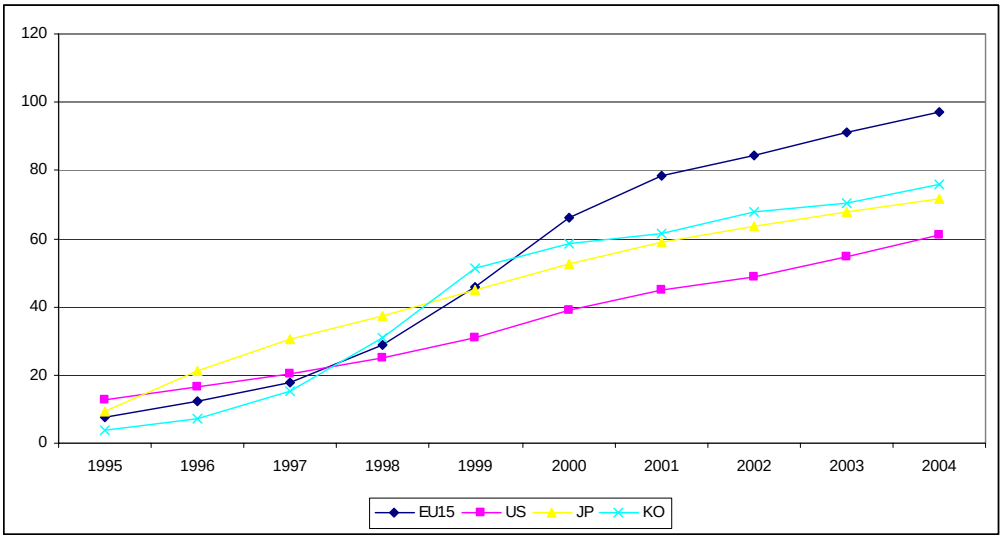


Source: International Telecommunications Union (2005).

Mobile telephony indicators

The evolution of mobile telephony subscriptions since 1995 is presented in Figure 3.10. The rapid growth of mobile telephony is clear, with increases in all four jurisdictions over the period from 1995 to 2004. The EU15 and South Korea showing the greatest proportionate increases.

Figure 3.10: Mobile telephony subscribers per 100 inhabitants (1995 to 2004)



Source: International Telecommunications Union (2005).

There is also evidence of cross-country differences in both subscription levels and growth rates across European Union countries as shown by the data in Annex 4. For example, subscription levels range from 73.7 subscribers in France to 119.4 subscribers per 100 inhabitants in Luxembourg, while growth rates in subscription range from 27.5% in Austria to 79.2% in Greece for the period from 2000 to 2003.

Cable TV, satellite and terrestrial indicators

Data on the percentage of households with a cable TV subscription in 2003 are presented in Figure 3.11. As shown, this varies markedly across the group of countries. Subscription to cable TV is highest in South Korea and the United States at 88.4% and 62.3%, respectively, and lowest in Japan (51.3%) and the EU15 (30.1%). Growth in cable TV subscriptions from 2000 to 2003 has been highest in South Korea and Japan.

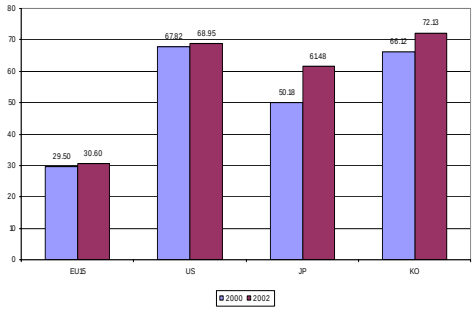
The percentage of households with a home satellite antenna is also presented in Figure 3.11. Ownership is higher among Japanese and European Union households (24.1% and 22.9% of households respectively) than in the United States (16.7%) and South Korea (only 3.4%). As cable TV and satellite TV are substitute goods it is not surprising that satellite antenna ownership is higher in the countries where cable TV subscriptions are lower.

The OECD provides data on a number of indicators relating to terrestrial broadcasting. A measure for 'terrestrial only' households has been calculated as the total television households (TVHH) less cable TVHH less home satellite TVHH.

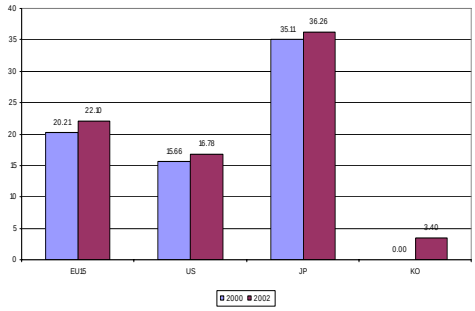
Figure 3.11 presents data on the number of 'terrestrial only' households as a proportion of total households. Overall, for 2002, 47% of European Union households receive 'terrestrial only' broadcast, compared to 24% of households in South Korea, 14% in the United States and 2% in Japan.

Figure 3.11: Television reception (percentage of total households)

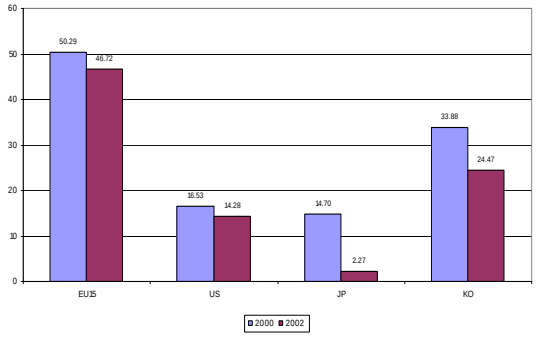
Cable television subscribers



Home satellite antenna



Terrestrial only households

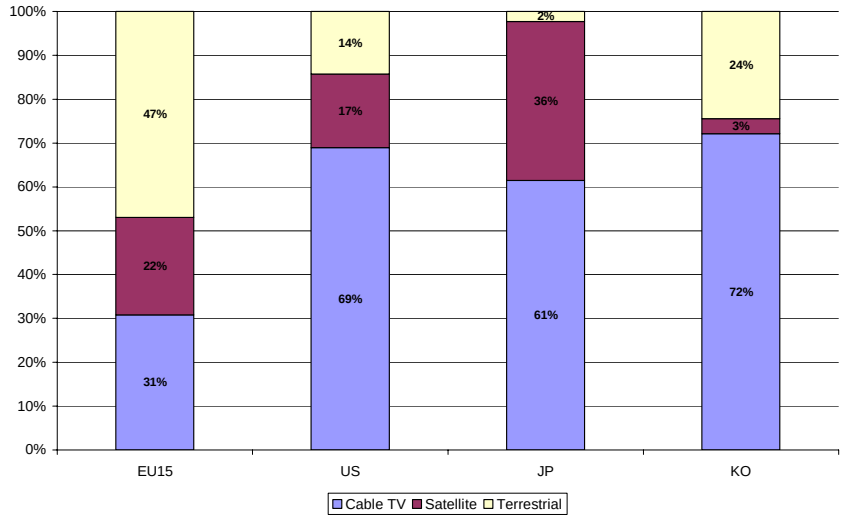


Source: ITU (2005) and OECD (2005).

Shares of 'terrestrial only', cable and satellite television are presented in Figure 3.12. The data show that cable television has the highest share in Korea (72%), the United States (69%) and Japan (61%), but is much less common in the EU 15 (31%).[39]

[39] These findings are consistent with the data presented in Figure 10 (which considers cable TV subscribers as a proportion of all households).

Figure 3.12: Cable television, home satellite and terrestrial reception (share of television-equipped households, 2002)



Source: OECD (2005).

Summary of key findings

Fixed telephone lines per 100 inhabitants stands at 54 in the EU15, a similar level to South Korea, but lower than in the United States. In all four regions the number of subscribers is falling.

The EU15 has the highest number of mobile telephony subscribers of the regions analysed, but both subscription levels and growth rates vary widely between the Member States.

Subscription to cable television is low in the EU15 relative to the United States, Japan and Korea, but ownership of satellite antennae is relatively high. The EU15 also has the largest proportion of homes that receive only terrestrial broadcasting (47%).

3.3 Trends in the Prices of Telecoms

In recent years, the European market for e-communications has witnessed major developments. Along with legislation, prices have changed significantly in a number of countries. In some Member States prices of telecoms have dropped and consumers are benefiting from increased competition in the sector. In other European countries, mainly New Member States, prices have increased considerably and moved towards the EU-25 average.

We will now analyse the changes in the PSTN (Public Switched Telephone Network) market, for both fixed and mobile services.

To compare the prices of fixed and mobile telecommunication services across countries we have used data provided by Teligen's reports (Teligen, 2004) for different OECD baskets of telecoms services.

For fixed services, we present figures for residential usage, following the OECD's classification. Figures for business usage are roughly similar to those for residential users, and are presented in the same format in Annex 5.

For each category there are two different available baskets:[40] the National Basket (Residential and Business) and the Composite Basket (Residential and Business[41]). Results in this section are reported for the new composite basket and for the incumbent operator in each country.

For mobile services we also report the results using the new composite baskets because they represent better the current mix of services.[42] There are three different baskets, based on low, medium and high usage levels: the low user makes 25 calls a month, the medium customer 75 per month and the high user makes 150 calls per month.[43] The two most prominent operators in each country are covered but, for simplicity, we present an average of the prices charged by the two main operators in each Member State. Data for the new basket prices for mobile services are available only for 2004.[44]

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[40] The new composite OECD baskets are built along the same lines as the "old" national baskets. Changes reflect the current usage patterns better, for example in that the baskets now take into account calls to mobiles and international calls. The main difference between the old and the new OECD baskets is that calls to mobile phones and international calls are now included. The old basket methodology used average call charges, while the new calculate accurate call charges based on any fixed price units applied. Installation charges are now an average of the charges for new installations and existing line takeover.

[41] The key distinction between the residential and the business basket lies in the different usage volume.

[42] As opposed to the "old" baskets, the new baskets contain an SMS element, include calls to several mobile networks and cover international calls. The "old" and "new" baskets are not comparable due to their inherent differences.

[43] Low usage basket includes 25 outgoing calls per month (42% of which are to fixed line phones and 58% to mobile phones) and 30 SMS messages. Medium usage basket includes 75 outgoing calls per month (36% of which are to fixed line phones and 64% to mobile phones) and 35 SMS messages. High usage basket includes 150 outgoing calls per month (40% of which are to fixed line phones, 60% to mobile phones) and 42 SMS messages. Only the cheapest package for each basket is presented; included minutes, messages and/or values are covered in the analysis.

[44] For Fixed Services Baskets, data refer to the national incumbent in every Member State. These are Austria, Mobilkom; Belgium, Mobistar; Cyprus, Cytamobile; Czech, Eurotel; Denmark, Sonofon; Estonia, EMT; Finland, Radiolinja; France, Orange; Germany, T-Mobile; Greece, Cosmote; Hungary, Pannon GSM; Ireland, O2; Italy, TIM; Latvia, LMT; Lithuania, Omnitel; Luxembourg, LuxGSM; Malta, Go Mobile; Netherlands, KPN; Poland, Centertel; Portugal, TMN; Slovakia, Eurotel; Slovenia, Mobitel; Spain, MoviStar; Sweden, Tele 2 Comviq; UK, Orange.For mobile Services Baskets the price average refers to the charges applied by the incumbent (see above) and by the most prominent competitor for each Member State. Austria, T-Mobile; Belgium, Proximus; Cyprus, Cytamobile; Czech, T-Mobile; Denmark, TDC Mobil; Estonia, Tele 2; Finland, Sonera IN; France, SFR; Germany, Vodafone; Greece, Vodafone; Hungary, T-Mobile; Ireland, Vodafone; Italy, Vodafone; Latvia, Tele 2; Lithuania, Tele 2; Luxembourg, Tango; Malta, Vodafone; Netherlands, Vodafone; Poland, Era; Portugal, Vodafone; Slovakia, Orange; Slovenia, Si.Mobil; Spain, Vodafone; Sweden, Teliamobile; UK, T-Mobile.

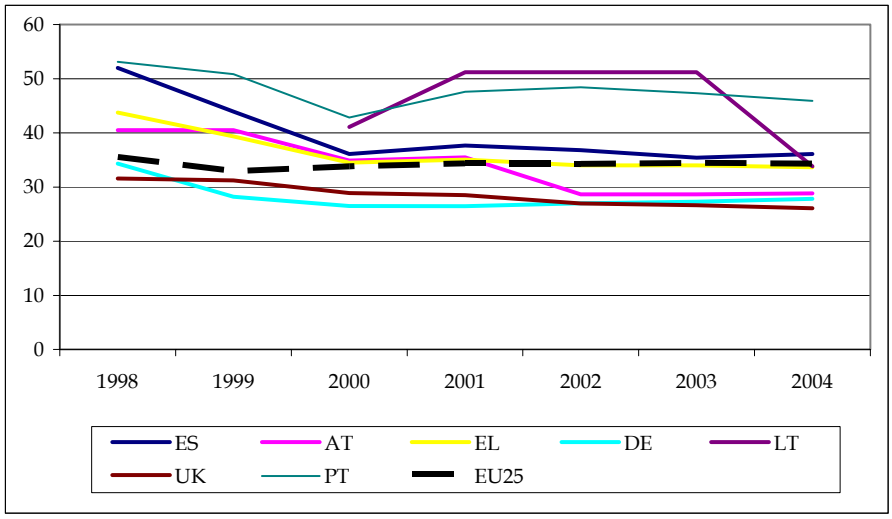
Fixed Residential Services

Thanks to the liberalisation processes which has become widespread since 1998, a number of EU countries, although not all of them, saw a sharp decline in the price of fixed telephony.

We will analyse price evolutions for three types of countries: countries that saw a noticeable price reduction, countries where prices did not change significantly, and countries where prices increased.

Figure 3.13 shows trends in countries where the national basket became more than 10% cheaper over the period. Given that the EU25 average performance settled at a 3% price decrease between 1998 and 2004, by showing such price decreases, the reduction in all of these countries has outperformed the EU25 as a whole. Spanish consumers have enjoyed the largest price cut in recent years (-30% since 2000); Austria and Greece follow, with decreases in basket prices of more than 20%. Germany, the UK, Portugal and Lithuania's consumers complete the list of countries enjoying a price reduction of more than 10%.

Figure 3.13: National Residential Basket Price (€)
(countries with more than 10% reductions, 1998-2004).

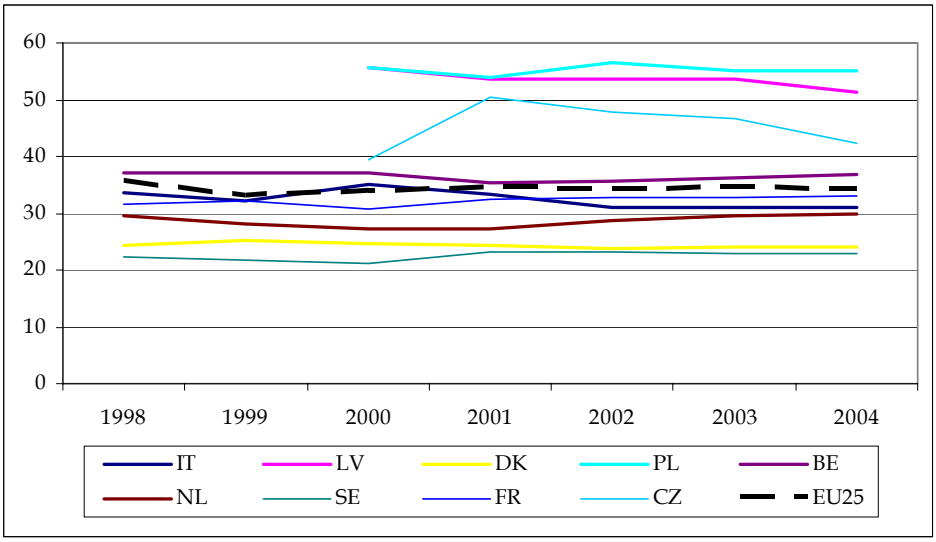


Note: * All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.
Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen.

Figure 3.14 identifies a number of countries in which price changes have been modest, i.e. less than 10% in either direction. France, Denmark, Poland, the Netherlands, Sweden and Belgium are the Member States where price changes have been the most limited (between -1% and 4%). Italian consumers

are the only ones within this group of countries benefiting from a price cut of noticeably more than that registered in the EU-25 as a whole (8% reduction against a 3% drop on average).

Figure 3.14 : National Residential Basket Price (€)
(countries with less than 10% basket price change, 1998-2004).



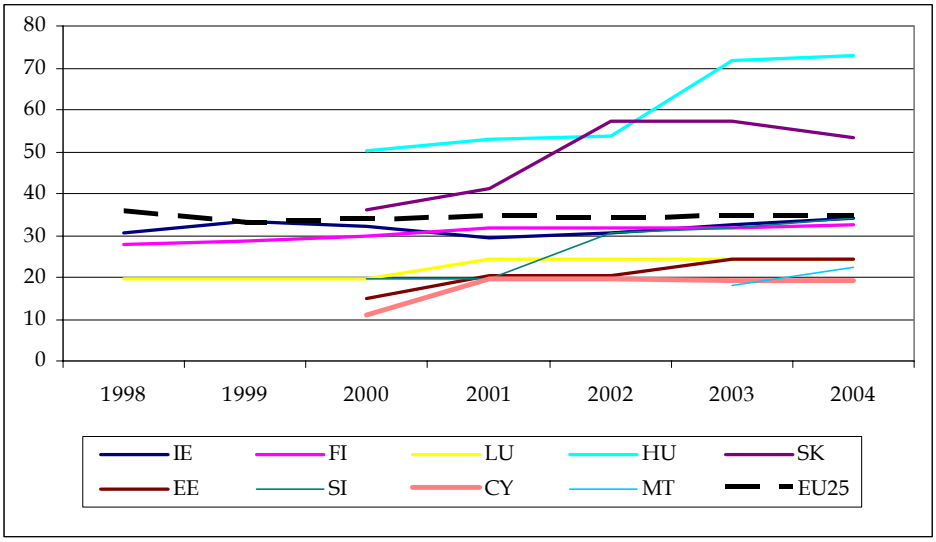
Note: * All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.
Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen

On the other hand, in nine EU countries the basket price has increased by more than 10% since 1998 (see Figure 3.15 below). Ireland has seen a rise in the price of residential fixed services by little more than 10% while Finland by about 17%.

In a number of New Member States, such as Cyprus, Estonia, Slovakia and Slovenia, the price of the basket of PSTN services for residential use has increased notably. Few of them started from much lower levels compared to old EU members. Cyprus's basket price, for instance, was almost a third of that shown by continental European countries and has increased by more than 70% in recent years. A similar situation can be observed in Estonia, where prices started at a level comparable to that of Cyprus and increased by more than 69%

Above all, Hungary's figure looks completely out of line, settling at more than twice the EU25 average and having increased by 50% between 2000 and 2004. Interestingly, the change was not spread evenly across the timeframe but the bulk of the variation happened in 2003.

Figure 3.15: National Residential Basket Price (€)
(countries with more than 10% basket increase, 1998-2004).



Note: * All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.
Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen.

In summary, some countries have seen significant decreases in the prices of both residential and business fixed services; Spain is the Member State where price have decreased the most, followed by Greece, Austria and Portugal.

On the other hand, in several New Member States, such services have become much more expensive: Estonia and Slovenia lead the list of these countries. Hungary and Slovakia have shown as well major increases in the prices of both residential and business fixed services; the former of the two combines a very high starting price level as well as a huge variation across the period

Mobile Services

In the mobile telephony sub-sector, we observe large variation in the price of the OECD baskets across the EU25. The following chart refers to mobile services prices, at different usage volumes.

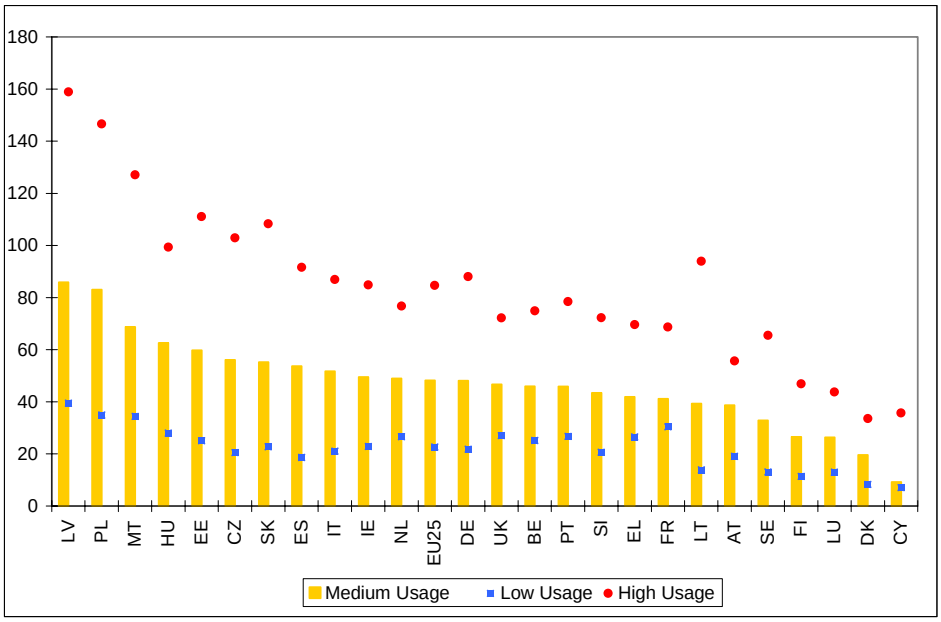
Figure 3.16 compares prices for low usage customers (i.e. customers who make, on average, 25 calls and write 30 text messages per month), medium usage users, (i.e. an average of 75 outgoing calls per month and 35 SMS messages a month), and high usage customers, (i.e. customers making, on average, 150 outgoing calls and 42 SMS messages).

For low usage customers, Latvia is the country with the highest prices, whereas in Cyprus low usage mobile services are the cheapest. The EU25 average expense for such low usage services was €23 in 2004 and a number of countries (Germany, Italy, Ireland, Slovakia and the Czech Republic) show prices very close to such average. Among big EU countries, France is the most expensive (its national basket costs €30), followed by the United Kingdom (€27). Within old Member States, Scandinavian countries (Denmark, Sweden and Finland) are those with most affordable mobile services for low usage customers.

For medium usage baskets the EU average price settled at €48; the cheapest services can be found again in Cyprus (€9), while the most expensive in Latvia (€85). The distribution of countries around the average remains roughly unchanged when compared to the low usage basket, with Scandinavian countries generally providing cheap mobile services.

For high volumes users, once again, Latvia is the most expensive country (€158). The EU25 average is now at €84 but Denmark outperforms Cyprus, settling as the Member State where high usage mobile services are the cheapest (€35). The distribution around the average does not appear to change significantly and there is no clear distinction between Old Member States and New Member States.

Figure 3.16: National Mobile Basket Price (€) (low, medium and high usage, 2004).



Note: *All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.
Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen.

To conclude, mobile services are the most expensive, for any volume of usage, in Latvia, Poland and Malta. Denmark and Cyprus are the countries were such services are less costly. In general, the Scandinavian region is the cheapest zone for mobile services. No clear pattern can be identified to separate New and Old Member States.

3.4 The relationship between prices and investment

In this subsection we analyse the relationship between prices and investment in the fixed and mobile sub-sectors.

Although a relationship between prices and investment seems intuitively likely, the interaction between the variables can be subject to different explanations.

On the one hand, we might expect to see a negative relationship between investment and prices. This could be caused by increased competition in the market or technological changes that foster both increased investment and price reductions.

On the other hand, a positive relationship could be also found if higher prices and revenues are required to allow increased investment.

In Figure 3.17 we observe the relationship between investments and prices for the fixed and mobile sub-sectors and for Old (EU15) and New Member States (NMS). Investment includes the total 2001-2004 investment for each country and it is expressed as a percentage of the aggregated GDP. Composite price baskets for fixed and mobile services for 2004 have been used. [45]

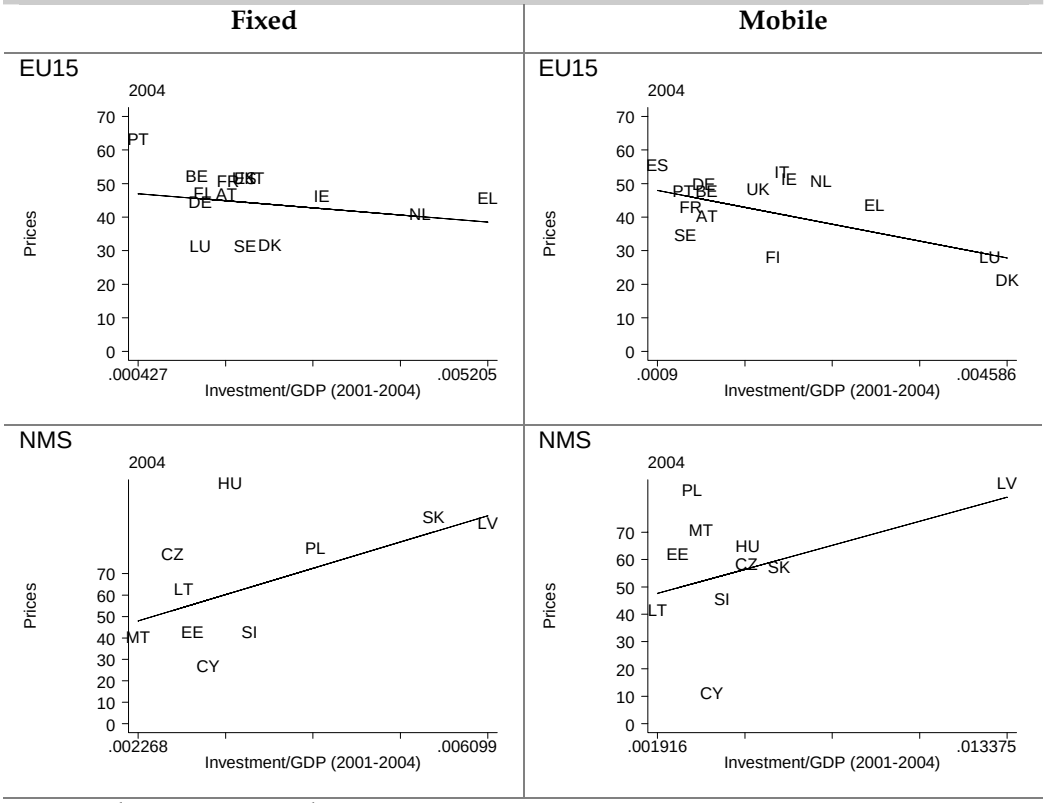
For the Old Member States there seems to be an inverse relationship between prices and investment. The relationship is less evident for fixed services than for mobile, although the results for mobile services are heavily influenced by two countries (Luxembourg and Denmark).

The graphs for New Member States reflect a positive relationship between investment and 2004 prices. In the fixed sub-sector there is some disparity in the plot with result being influenced mainly by Latvia and Slovakia. Observing the mobile sub-sector scatter plot it can be seen that the positive relationship is again heavily influenced by Latvia, and if this country were removed from the analysis a negative correlation could be observed.

So despite evidence for the hypothesis that price and investment are positively related from the NMS, the result is weak and heavily influenced by outlying observations. However, the evidence from the EU15 countries for a negative relationship also needs to be read with caution. In the mobile sub-sector the result is again driven by outliers, and the fixed sub-sector shows only a weakly negative relationship.

[45] Analyses using yearly investment lead to similar results. Using prices for previous years for fixed services did not change significantly the results.

Figure 3.17: Investment/GDP (aggregated over 2001-2004) and 2004 prices



Source: Teligen, Eurostat, London Economics' estimates.

4 Investment and the Regulatory Framework

4.1 Introduction

Following the terms of reference, in this section we identify the main factors affecting investments in the electronic communications sector.

We have used a number of approaches to investigate the links between investment and the regulatory framework. These include the analysis of investment data and the factors which may drive investment (undertaken in Section 3) and the collation of the views of market players.

In collating the views of market players, we have taken three approaches:

- A desk-based study;
- Structured telephone interviews of 135 operators across five EU member states;
- Semi-structured telephone interviews with 11 market players.

4.2 Factors that drive investment levels

The primary drivers of investment are the level of expected returns and the risk and uncertainty associated with those returns (see Table 4.1).

When a decision to invest is being made, the cost of that investment is weighed against the returns that it is expected to generate. Naturally, the greater the expected returns are, the more willing the firm will be to invest in that programme.

It is important to note that the returns are not certain, and usually bear some sort of risk. The more uncertain the expected future returns are, the less willing the firm will be to invest, ceteris paribus.

Investment returns and risk are associated with a range other secondary factors that can influence them. These include economy-wide, sectoral (or specific to the e-communications market), and company-specific factors (see Table 4.1).

Table 4.1: Analysis of investment drivers

Primary Drivers	Level of expected returns Risk and uncertainty associated with expected returns		
Secondary Drivers	**Economy-wide**	**Industry-specific**	**Company-specific**
	GDP per capita Demographic/geographic characteristics Economic cycle (financial bubble) General regulation (not sector-specific)	Regulation by NRA Competition Technological progress Demand for E-communications services	Cost of capital Credit rating & debt levels Take-overs and mergers Company performance

We review each of these factors in turn.

4.2.1 Economy-wide factors

The factors that affect investment at an economy-wide level have been split into four categories. These are: GDP per capita, demographic and geographical characteristics, the economic cycle and economic regulation.

GDP per capita

The idea that increases in income lead to increases in investment is known as the accelerator effect. As GDP per capita rises due to economic growth, company sales, cash flows and profits rise too. Expectations of higher future profits and increased business confidence encourage companies to increase output and increase investment in property, plant and equipment.

Modelling the supply and demand of telecommunications infrastructure, Röller and Waverman (2001) find that GDP per capita has a positive and significant effect on the demand for investment.

On the other hand, an increase in the GDP per capita may be inversely related with investments, in some circumstances. Generally, countries with high GDP per capita grow at a much lower rate than economies with emerging markets. Therefore, the rate of return on investments in emerging markets is higher, and investments (per capita) in those countries should also be higher.

Demographic/geographic characteristics

Demography, structure and distribution of human populations also have an effect on investment at the economy-wide level. An increase in population may require corresponding increases in investment in network infrastructure, while migration to urban areas may reduce the necessity to invest in rural

ones for example. Low population density may also give rise to the need for high levels of investment per capita.

In a similar manner, geography can also be thought of as a driver of e-communications investment. Put simply, countries with greater land masses will naturally require greater lengths of network infrastructure, and more or more powerful transmitters to ensure coverage. The existence of geographic features such as mountains or islands in a country may also mean higher investment levels are needed.

Economic cycle

Economic cycles or fluctuations are associated with increases and decreases in investment in property, plant and equipment. The cycle consists of alternating periods of economic contraction and expansion. In a phase of economic contraction, productivity, consumer confidence, aggregate demand and prices stagnate or decline, only recovering in a phase of expansion and economic prosperity.

The 'dot-com' bubble of 1997-2000 was characterised by increases in stock prices, market speculation, freely available capital and the dismissal of standard business models. With the bursting of the telecoms bubble in 2000 investment fell.

General regulation (not sector-specific)

As well as regulation that is specific to the e-communications industry (which is examined below) investments by all companies in an economy will be affected to some extent by other types of regulation.

Companies are burdened by regulation to carry out a wide range of tasks for government, such as collecting pay-as-you-earn taxes and paying benefits for maternity leave for example.

Institutional regulation provides protection for companies, for example through the protection of property, and intellectual property (patents). Countries with more protection may benefit from more investment, if future returns are seen as being more secure.

Finally, specific labour, environment, and real estate regulation can also have some effect on investment.

4.2.2 Industry-specific factors

There are a range of factors that are specific to the industry that can also influence investment decisions. Some of these factors are linked to regulation by the NRA; the level of competition; the demand for e-communications services or market opportunities; and finally some of the factors are linked to technological progress or the availability of new innovations.

We will review the factors grouped in these four categories. However, it should be noted that important interactions exist between the different factors (such as how the NRA can work to open competition, or how innovation can make new products available that will foster demand for e-communications).

Regulation by NRA

Access regulation is one of the key aspects of regulation in the sector. It relates to the obligation for incumbents to supply network services (e.g. interconnection) to new entrants and to share with them network elements (e.g. unbundled local loops).[46] Access regulation is viewed as a pro-competitive measure because it opens the way to infrastructure-based competition (and hence will produce different incentives for incumbents and new entrants).

The way access is regulated can have different implications for new investment.

An initial low-access price may increase opportunities for later investment if entrants need an early phase of service-based competition to get acquainted with the market, before engaging in facility-based competition.

If access conditions are too narrow (narrow eligibility rules) this will deter entry but at the same time it would encourage entrants to invest in their own network (Cave and Vogelsang, 2003).

It has often been argued that access prices should be set low in order to counteract the anticompetitive attitude of the incumbent and to encourage competitors to 'climb the ladder' of infrastructure investment, by installing progressively less replicable assets. However, if the access price is set too low, inefficient entry may occur.

Moreover, if fixed costs are involved in the bottleneck, the regulator needs to determine how much the entrants should contribute to repay the fixed cost of a service that they use in order to supply their customers.

Finally, unbundling regulation might have a contrary effect on entrants if they feel that especially favourable conditions will induce extensive entry. In this sense, particularly favourable conditions could erode the value of first-mover advantage (Jorde et al, 2000) and might delay investment by new entrants (Pindyck, 2004).

While access regulation may increase entry, it can also work against the incentives for incumbents. Some authors (Jorde et al., 2000) are opposed to mandatory unbundling at long-run incremental costs because the incumbent's obligation to unbundle the network assets works in favour of new entrants and depresses any incentives for the incumbent to upgrade the

[46] In both cases, the NRA may prescribe the accounting rule for wholesale access prices and may intervene directly to determine the price if incumbent and entrants fail to negotiate access conditions on a commercial basis.

network and to deploy new systems. Investments aimed at the provision of new services are highly risky, and in case of success rivals will share benefits at cost, while, in case of failure, the incumbent will bear the full costs. Any cost-reduction would be reflected in a downward variation of rivals' access price, thus immediately eroding the market leadership gained.

Competition

Investment in infrastructure confers a first-mover advantage to the facility owner. Whether the incumbent or entrants are more likely to reap larger gains from such an advantage is a question known as *innovation race*. In the context of first-mover advantage, a monopolist may have higher incentives than an entrant to invest in innovative facilities, since this allows the monopoly profits to be perpetuated; on the other hand, an existing monopolist may have smaller incentives, since profits from innovation would limit or replace former profits.

Alternatively, if second-mover advantage is more prevalent, firms may delay their own investments to extract information from the early innovator (first mover).

Alesina et al. (2002) argue that if regulation is effective in removing entry barriers, competition will drive retail prices down and the market enlargement will imply that new capacity needs to be installed. In addition, investment adjustment costs will be lowered by liberalisation. Under general conditions the authors show that aggregate network investment will increase with greater competition.

Empirical evidence has shown mixed results (see Bohln, Garrone and Andersson, 2004, for a good review). At the industry and country levels, entry liberalisation is shown to have spurred investments in the OECD countries (Alesina et al., 2002). At the firm level Greenstein et al. (1995) do not find any positive effects from the removal of entry barriers.

Technological progress

As seen, firms' investments can be subject to strategic decisions in an innovation race context where investment in advanced infrastructure confers a first- or second-mover advantage to the facility owner.

Whether the incumbent or entrants are more likely to reap larger gains from such an advantage is not clear and will depend on which of the two factors prevails.

However, in an industry with high levels of innovation, and uncertainty around the success of some of the innovative products, it is possible that companies will delay their investment decisions until the risk of investment is understood.

Demand for E-communications services

Market conditions are also an important driver of investment (which is closely related to technological progress). This is particularly true in a sector that has been liberalised and is open to competition, and most companies have to invest to keep the pace with competitors' new investments.

4.2.3 Company-specific factors

There are a range of drivers that are specific to the company. Such factors are usually idiosyncratic to each firm, are often related to managerial decisions, and can bear little relationship with economic or sectoral variables.

Cost of capital

The minimum rate at which firms can finance their operations is known as the cost of capital.[47] The cost of capital is usually different across firms due to differences in their financial structure or incurred risk.

The cost of capital plays an important role in firms' investing decisions. The return on capital of an investment must be greater than the cost of capital in order to be worthwhile for its shareholders. This means that the higher the cost of capital of a firm, the smaller the number of investment projects it can undertake.

Takeovers and mergers

Takeovers and mergers are usually motivated by efficiency gains realised from the joint operation of separated companies. These efficiencies can take the form of economies of scale or scope, saving on management costs, improving conditions for access to liquidity, etc.

Sometimes the investment programs of a firm can be stopped after being merged with another firm. For example, this could happen if existing equipment can be more efficiently utilised by the two previously-separated companies when operating together. Investment is also sometimes delayed when a take-over or merger is anticipated.

In other circumstances, increases in size from the merger will make it possible to undertake investments that the two separate companies would not have been able to undertake individually.

Company performance, debt levels and credit rating

Financial performance and debt levels affect the conditions of gaining access to capital. In particular, a firm with a high debt level will be able to raise

[47] Firms finance their operations through two external sources: issuing stock (equity), and issuing debt (or borrowing from a bank). The cost of capital for a firm is a weighted sum of the cost of equity and the cost of debt.

funds under less favourable conditions. Problems of asymmetric information in debt markets affect financially unhealthy firms' ability to obtain outside finance and, consequently, their allocation of real investment expenditure over time (see Whited, 1992).

As a result, a firm with higher debt levels can gain access to a capital only at a higher price, which in turn increases both the total and marginal cost of investment opportunities, resulting in a lower level of overall investments.

Credit rating is crucial for a firm's opportunities to gain access to capital. In particular, a company with a good credit rating is one that functions reliably, and can have better access to capital (at lower cost). This means that a company with a good credit rating will have access to capital at a lower price than a company with bad credit rating, and, as a result, it will be able to undertake a wider range of investments.

4.3 Evidence

The review of the literature has shown different potential investment drivers and has explained the ways in which they operate.

In this subsection we see how these factors have influenced investment decisions in the e-communications sector, and their relative importance.

The analysis is based on a mixture of different sources:

- Investment data from Section 3. This is complemented with information from the annual reports of major operators.
- A desk-based exercise reviewed the statements made by market players, in response to public consultations.
- A survey undertaken by PricewaterhouseCoopers in five member States.
- Interview programme with market players and representative bodies carried out by London Economics.

4.3.1 Results of stage 1

Decline observed since 2001 for all four sub-sectors

Our results from stage 1 show that the vast majority of EU e-communications investment is in the fixed and mobile sub-sectors (accounting for 44% and 49%, respectively, of total EU investment). In addition, we have seen that total EU investments are lower in 2004 than in 2001, having fallen from 2001 to 2003, picking up slightly in 2004.

Explaining the downturn

Investment in e-communications networks had peaked in 2000, having been driven by investment in infrastructure to support 2G mobile telephony, investment by new entrants into the fixed telephony market due to local loop unbundling, and investment by both incumbents and entrants in national and international backbone networks. The peak also coincided with the auctions for 3G mobile telephony licences.

There is not a single reason for the decline in investment from 2001. The most common explanation attributes the decline to the collapse of the financial telecoms bubble in 2000. The immediate consequences of this were economic contraction and low confidence of investors.

Other significant effects followed. The high debt incurred by some companies in their financial effort to acquire new 3G licenses or investment by new entrants in backbone networks meant that companies had difficulties in accessing capital. One interesting finding is that the decline in investment is observed in all four sub-sectors, suggesting significant interlinks between the sub-sectors. Although this is obviously related to the overall economic cycle, it also reflects the degree of substitutability and complementarity between different services. The only sub-sector that seems to follow a different pattern is the satellite industry. Its investments did not decrease immediately in 2002, but in 2003, to pick up rapidly in 2004.

Although much of the explanation has focused on the telecoms financial bubble, another argument attributes some of this decline to a "natural" reduction as part of the investment cycle. Following liberalisation in 1998, there was a lot of infrastructure investment to enable entry into the market. In subsequent periods, investment was less needed as much of it had already been put in place.

Observed patterns for incumbents and new entrants

Investment by incumbent fixed operators was eight times as high as new entrant investment in 2004, although it fell by half over the period 2000-2004. However, when expressed as a percentage of revenues the situation is reversed, with entrants' investments falling by more than half, and falling from four to three times more than incumbent investments over the period. The high absolute figure by incumbents illustrates their larger size and their need to invest in refurbishing and replacing the network. When looked at relative to their revenues, it becomes apparent that new entrants have been investing more than incumbents.

It is clear from the figures for incumbents and new entrants that both types of firms have been affected by the change in the cycle that took place after 2001.

The importance of the regulatory environment

In our regression model we have seen the importance of the regulatory environment in investment decisions. Better-performing regulatory regimes, as measured by the OECD index, contribute to higher levels of investment. Our findings were also corroborated by using the ECTA scorecard index.

Other important factors

Other factors that have an important positive influence on company investment levels in our model are GDP per capita, the land area and population density of the country in which they operate, the size of the company, incumbent status and whether the firm operates in more than one sector.

Evidence from companies' annual reports

Our main findings can be complemented with information extracted from companies' annual reports. According to company sources, investment patterns in physical infrastructure are mostly driven by three factors:

- Technological change: investments in a given market are influenced both by technological improvements in that particular market or in related/complementary markets;
- Nature of competition in the market: strong competitive pressure fosters innovation and associated investment;
- Corporate principles: the principles underlying a particular corporate strategy have an impact on how the board of directors interprets economic factors (technological change and nature of competition) when setting the company's business strategy.

A number of companies have linked their investment decisions with the path of technological development. For example, BT started investing in broadband technologies following a new strategy to recover previous years' losses[48] and its strategy for the future is the creation of an intelligent, flexible and customer-focused network for the 21st century.

In Germany, Deutsche Telekom incurred high investment levels in 2002, which were linked to building the new synchronous digital hierarchy (SDH) platform and the T-DSL platform by the T-Com branch. Liberty Global had higher investments in 2005 compared to 2004 because of its new plan to invest more aggressively in digital television in certain locations and its VoIP roll-out in its major markets in Europe and Chile.[49]

[48] In 2001 more than 1100 exchanges were upgraded and following the strong demand for broadband, BT upgraded another 1128 exchanges by 2005, which made broadband available for 99.6% of UK homes.

[49] Other investment included improvements in its master telecom centre in Europe, information technology upgrades and expenditures for its general support system.

Terracom's (Sweden) high level of investments in 2001 was attributed to investments related to the build-out of digital TV.[50] The rapidly changing nature of the underlying technology as well as competitive pressure from other type of broadcasters made Kabel Deutschland invest heavily in new or enhanced technology.

As seen, another important factor that influences investments in fixed tangible assets is competition. In particular, many of the large multinational firms (mainly fixed line incumbents in their home market) report heavy debts incurred in the period between 1998 and 2002 which would not have occurred without competitive pressure or anticipation of competition.

For example, the most important investments in fixed tangible assets of Tiscali in 2004 were incurred during the development of infrastructure necessary to support the unbundled local loop offers in France, the Netherlands and Italy. These investments were motivated by the migration of ADSL users from wholesale to unbundled services.

France Telecom (FT) engaged in massive investments between 1999 and 2002 in order to develop new services and reach critical mass in high growth markets on the European level (particularly in the wireless and Internet markets). The Vodafone Group made substantial investments in the acquisition of 3G licenses and in its mobile networks (including the rollout of 3G networks). The Group continued to make significant investments in its mobile networks due to increased usage and the need to offer new services.

Corporate decisions have also been reported as important drivers. For example, different company reports suggest that acquisitions of other companies and the sales of subsidiaries are an important factor explaining certain shifts in investment patterns. However, changes attributed to these events are hard to evaluate from rigorous economic perspective as they are the result of discretionary managerial decisions.

Additionally, some corporate decisions are linked to rationalisation plans. For example, France Telecom introduced a plan to rationalise the company's investment policy to be able to fight the huge accumulated debts.[51] Finally, some companies (like Orange) also mention that their investment decreased because of the termination of operations in certain countries (Sweden).

4.3.2 Analysis of investment and regulatory actions

In this section we consider whether it is possible to elicit a relationship between specific regulatory actions/practices and levels of investment.

[50] As that has been completed, investments level fell in 2002 and 2003. They rose again in 2004 as a consequence of a sharp increase in investments in broadband networks.

[51] As a result, investments sharply decreased from €7,421 million in 2002 to €5,009 million in 2003 and only continued with the same intensity in areas with strong growth potential, including broadband services, business services and inter-operability and convergence between its fixed, wireless and Internet activities.

First, we examine the links between investment data and measures of regulatory practice based on the ECTA Scorecard. Second, we examine changes in investment in the fixed telecommunications sub-sector in each of four countries to consider whether it is possible to explain differences in investment levels on the basis of what we know about the application of regulation.

Data analysis

The ECTA Regulatory Scorecard for 2004 analyses five areas of assessment.[52] The first two areas pertain to the regulator and the dispute settlement body, their modus operandi and effectiveness. The third area deals with the manner in which access rules and regulations are applied. The fourth relates to the availability and quality of access products. The fifth and final criterion is based on the timely and effective implementation of the new regulatory framework.

The ECTA scorecard 2004 indices are not available for all 25 Member States – they are available for ten of the EU15 countries. We have used the ECTA scorecard for 2004 in our analysis, rather than the more up to date scorecard for 2005 because our latest investment data is for 2004.[53]

The levels of investment (2004 fixed telephony) and different regulatory areas (as measured by the ECTA 2004 Scorecard) are presented in Figure 4.1 to Figure 4.5.[54] These are scatter diagrams that show, for each country, the relationship between the level of investment in fixed telecommunications (as a percentage of GDP) on the vertical access and the scores for the various criteria in the ECTA Scorecard.

[52] The chosen areas of assessment reflect the main principles set out in the 1996 WTO Reference Paper on Telecommunications.

[53] We also tested the links between investment data for 2004 and the ECTA Scorecard for 2005, but found that it was difficult to discern any clear relationships.

[54] The Netherlands has a particularly high level of investment in terms of GDP in 2004 and so has been excluded from the analysis.

Figure 4.1: Fixed investment (2004)/GDP and different regulatory criteria (Regulator general functions)

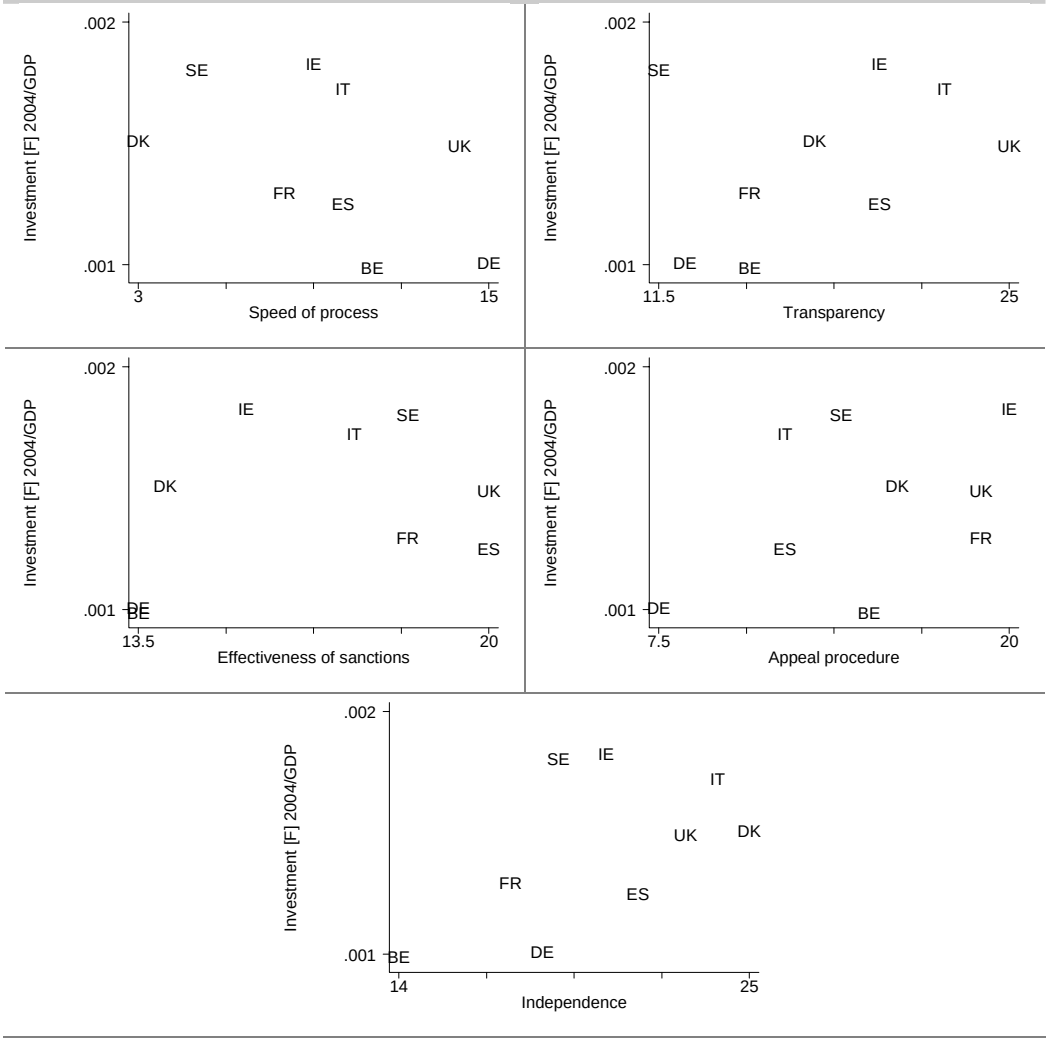


Figure 4.2: Fixed investment (2004)/GDP and different regulatory criteria (Regulator dispute settlement)

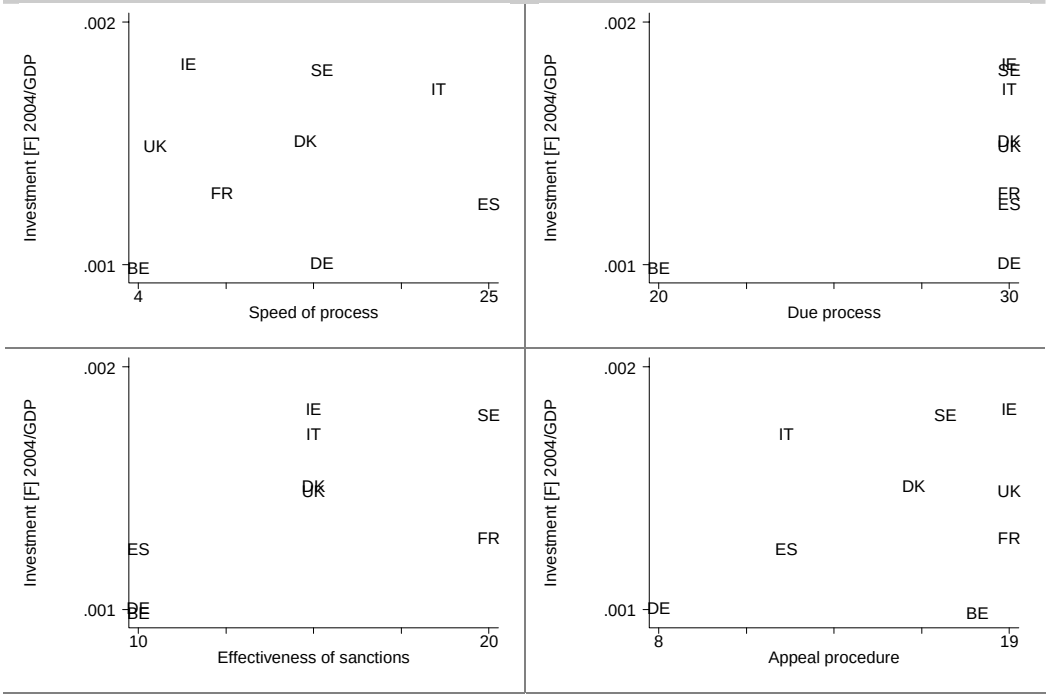


Figure 4.3: Fixed investment (2004)/GDP and different regulatory criteria (Application of access regulation)

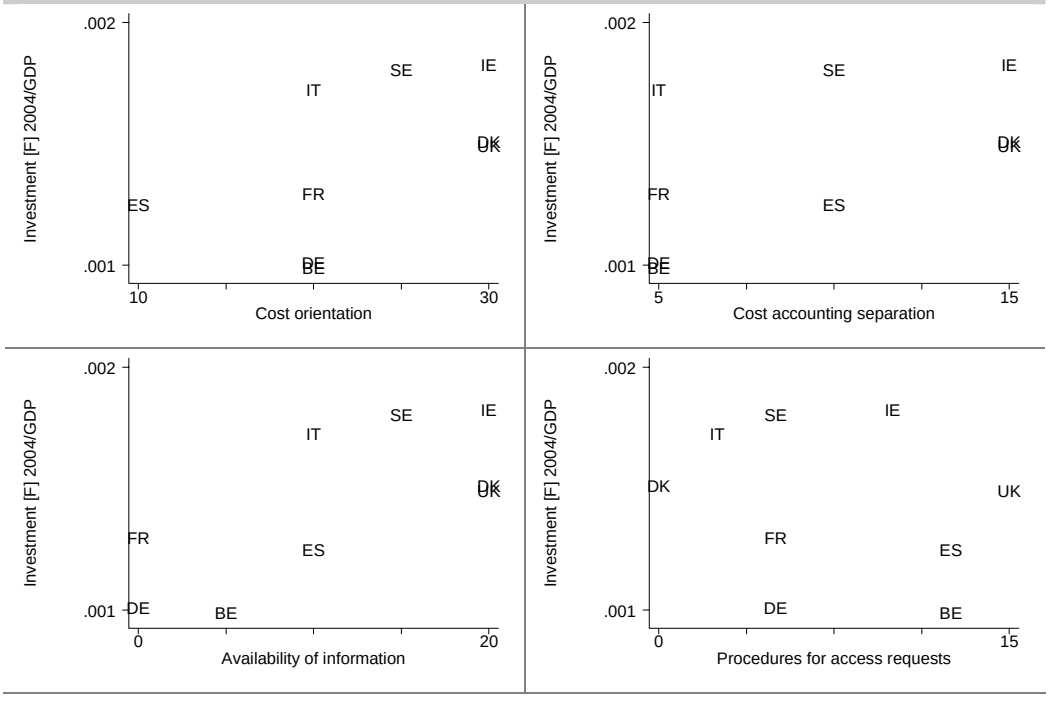


Figure 4.3: Fixed investment (2004)/GDP and different regulatory criteria (Application of access regulation)

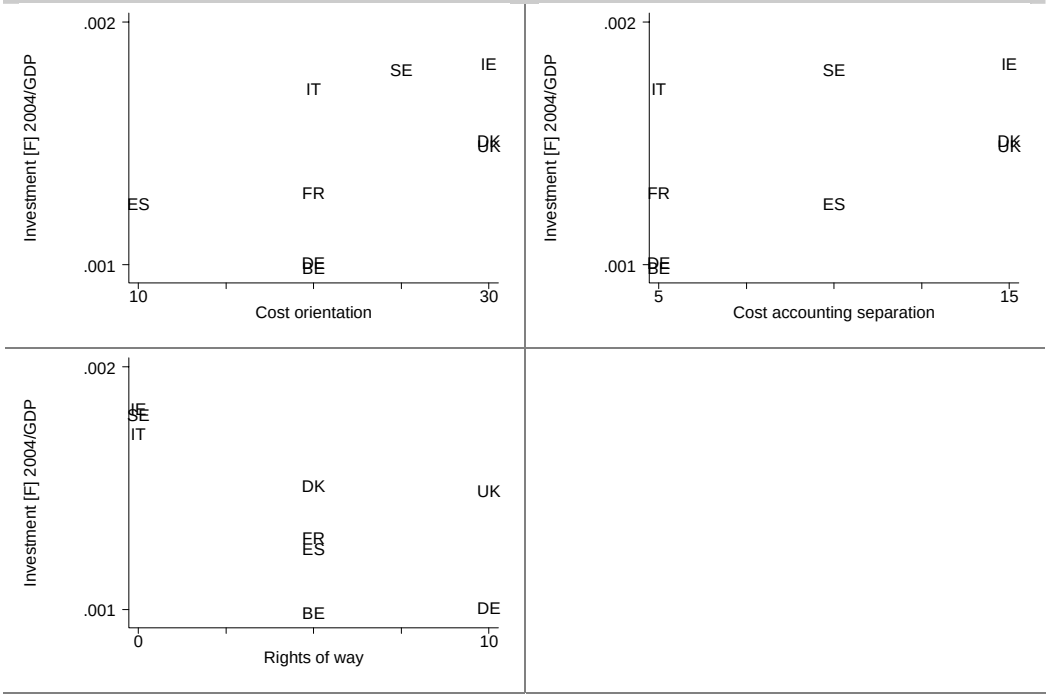


Figure 4.4: Fixed investment (2004)/GDP and different regulatory criteria (Key access products)

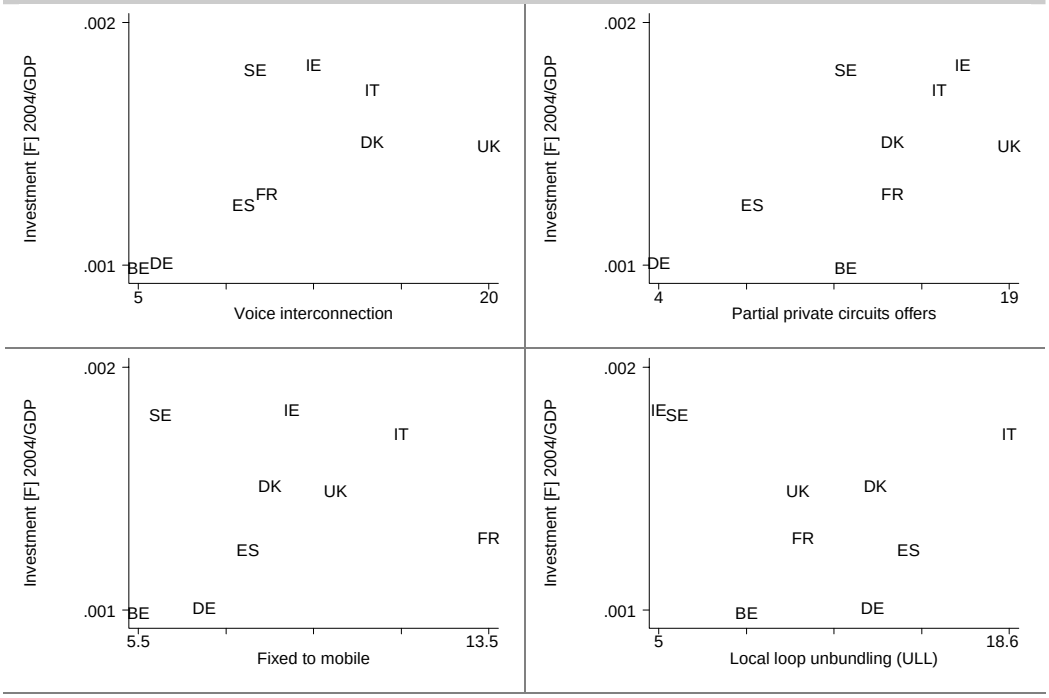


Figure 4.4: Fixed investment (2004)/GDP and different regulatory criteria (Key access products)

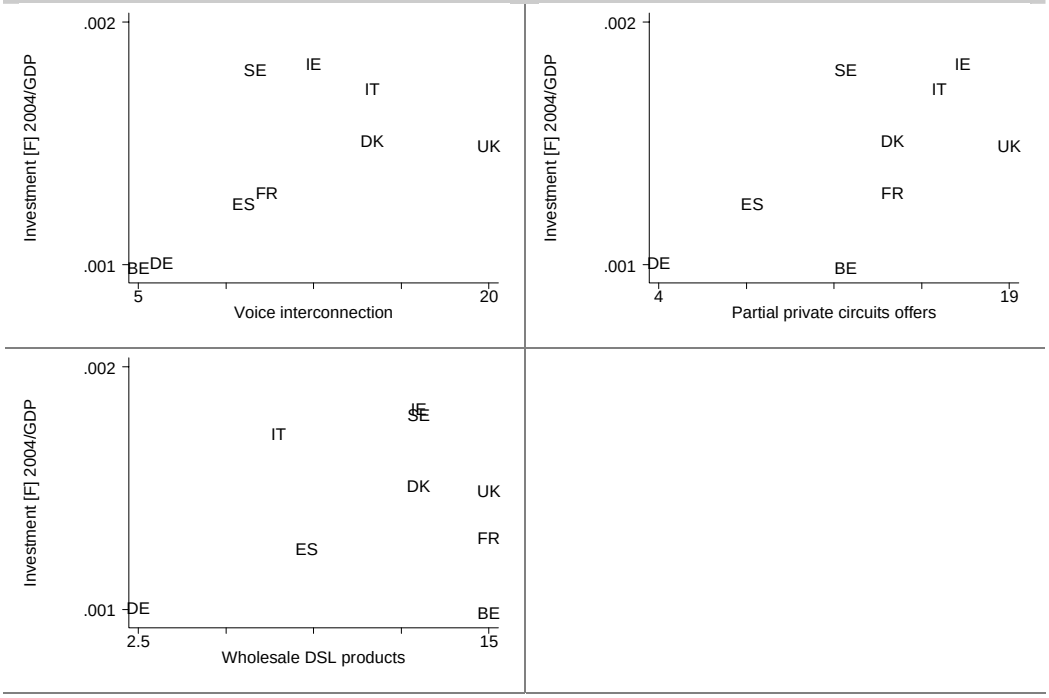
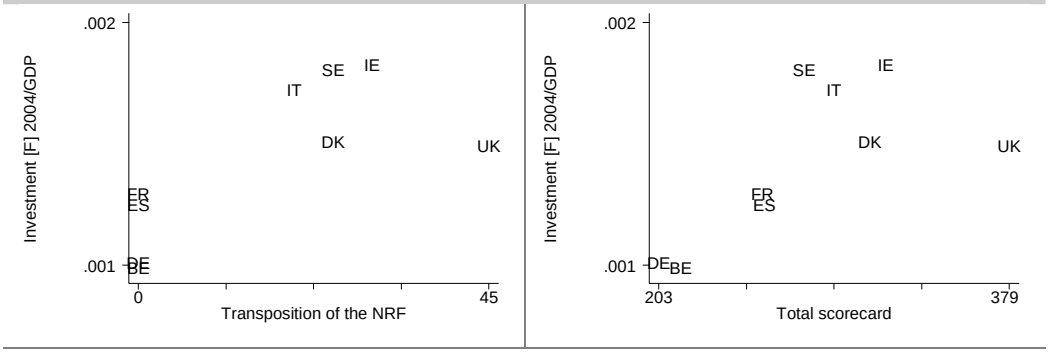


Figure 4.5: Fixed investment (2004)/GDP and different regulatory criteria (Transposition of NRF and Overall index)



A review of these scatter diagrams suggests that in many cases there does appear to be a relationship between the regulatory criteria and the levels of investment for some countries. These are the countries that tend have relatively high levels of investment and those that tend to have relatively low levels of investment. That is, the low levels of investment observed for ES, DE and BE correspond to low values in the regulatory index, whereas the high investment levels observed for IE, SE and IT are usually associated with

high regulatory indices. For many countries in an intermediate position with respect to the regulatory index, a clear pattern is more difficult to discern.

These relationships appear to be stronger for the following criteria:

- "Transparency" and "Independence" of the regulator;
- "Effectiveness of sanctions" in disputes and settlements;
- "Availability of information" in the application of access regulation;
- "Voice interconnection" and "Partial private circuits offers and leased lines" when accessing products; and
- "Transposition of the NRF by the NRAs".

This view is largely corroborated by undertaking a correlation analysis of the different indices and the 2004 level of investment in fixed telephony adjusted for GDP. The outcome of this analysis is shown in Table 4.2.

The correlation coefficients (in bold) in the table suggest that the most important factors are:

- "Effectiveness of sanctions" in disputes and settlements;
- "Availability of information" in the application of access regulation;
- "Voice interconnection" and "Partial private circuits offers and leased lines" when accessing products; and
- "Transposition of the NRF by the NRAs".

There is a relatively low correlation coefficient for "transparency" of the regulator.

It is important to emphasise the limitations of this analysis. As we have already indicated, there a number of factors that influence investment, of which regulation is only one. It is also dependent on the quality of the inputs, particularly the ECTA scorecard.

In developing any regulatory index, inevitably a range of simplifying assumptions need to be made and it is hard both to develop a clear and objective assessment of what the concept of regulatory quality should mean and also how it should best be measured. In the case of the ECTA scorecard, it should be borne in mind that the underlying data is based on the opinions of ECTA members. In addition, better scores sometimes appear to be allocated on the basis of *more* regulation rather than *better* regulation necessarily. As the regulatory framework makes clear, sometimes (generally where there is competition) the best regulation is no regulation, or less regulation.

Table 4.2: Correlation coefficients indices and 2004 investment per GDP (fixed telephony)

Area of assessment	Index	Coef.
Regulator general functions	Speed of process	-0.49
	Transparency	0.32
	Effectiveness of sanctions and scale of resources	0.34
	Effectiveness of appeal procedure	0.40
	Independence	0.55
Dispute settlement body	Speed of process	0.11
	Due process	0.52
	Effectiveness of sanctions	**0.64***
	Effectiveness of appeal procedure	0.33
Application of access regulation	Cost orientation	0.53
	Cost accounting separation	0.52
	Availability of information	**0.71***
	Procedures satisfying access requests and interconnection in an effective and timely fashion	-0.25
	Rights of way	-0.71*
Key access products	Voice interconnection	**0.61***
	Partial private circuits offers and leased lines	**0.64***
	Fixed to mobile	0.24
	Local loop unbundling (ULL)	-0.21
	Wholesale DSL products	0.20
Implementation of the NRF	Transposition of the NRF by	**0.73***
Overall	Overall Index	**0.68***

Note: * denotes significant coefficient at 10% level or better. The analysis excludes the Netherlands due to outlying value in investment.

Country analysis

We have supplemented the above analysis with a brief review of regulation and investment in the fixed telecommunications sub-sector in four Member States – Germany, France, Greece and the Netherlands.

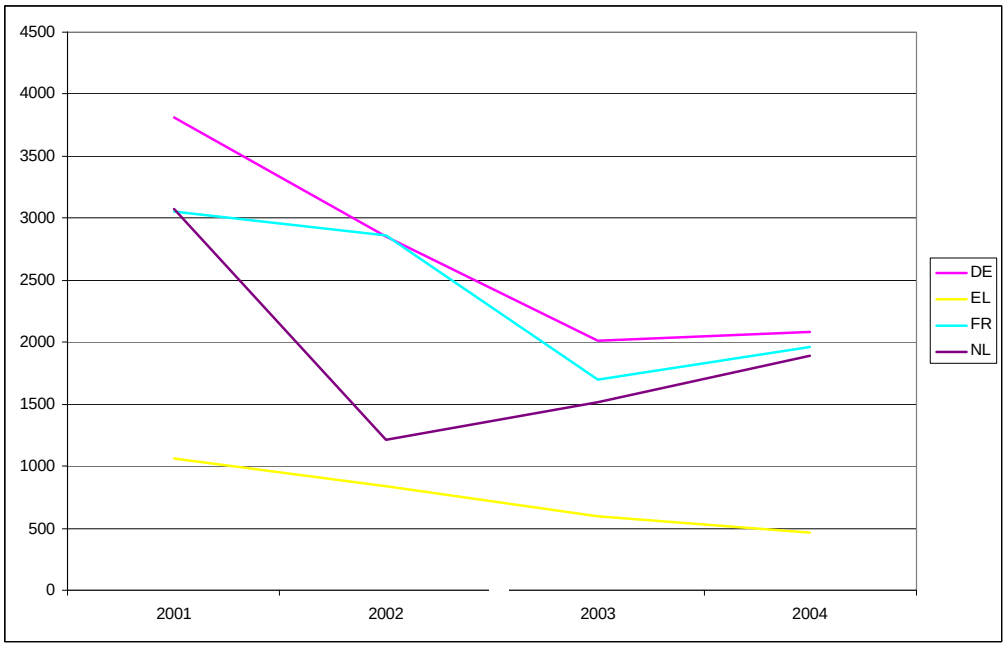
Figure 4.6 shows the path of investment in fixed telephony as a percentage of GDP in the EU25 and in four Member States. Across the EU25 investment declines in the period 2001 to 2003 and then stabilises in 2004. In the largest Member State, Germany investment follows the same pattern, but at a slightly lower percentage of GDP. The pattern in France is similar again, but investment increases in 2004.

The path for investment is very different in the Netherlands and in Greece. In the Netherlands a sharp decline in investment is seen between 2001 and 2002, followed by relatively rapid increases between 2002 and 2004. In Greece, there are high levels of investment as a percentage of GDP, but there is also a rapid decline over the whole period.

Figure 4.6: Investment in Fixed Telephony as % of GDP

On possible explanation of these differences is that changes in gross investment were similar in the countries, but the pattern of GDP growth was very different, causing the pattern of change in investment as a percentage of GDP to be different. However Figure 4.7 shows the path of gross investment in these countries. This indicates that the patterns of change for each country were similar to those for investment as a percentage of GDP, though the relative positions of countries differ.

Figure 4.7: Investment in Fixed Telephony (€m, 2001 prices)



In the remainder of this section we discuss possible regulatory factors that may have influenced these different paths for investment, using investment as a percentage of GDP, as shown in Figure 4.6, as the basis for our comparison.

It is important to bear in mind that regulatory factors are only one of a number of important factors that influence the path of investment, as the rest of our analysis illustrates. This means that it is difficult to be sure about the relationships between specific regulatory actions and the path of investment.

A further complicating factor is the dynamic relationship between regulatory action and investment. Companies may take investment decisions based on the anticipation of future regulatory actions, or they may wait until after a regulatory action has been taken. There is also a delay between taking an investment decision and seeing the results of that decision reflected in company accounts. This makes is difficult to link the timing of a regulatory action and the timing of a change in investment.

Germany and France

The path of investment (as a percentage of GDP) was similar in Germany to the path for the EU25, though at a slightly lower level of investment. Investment declined to 2003 and then did not change between 2003 and 2004. The pattern in France was similar, though investment increased between 2003

and 2004. ECTA's Regulatory Scorecard for 2004[55] showed Germany having the lowest overall regulatory score of 10 EU15 countries. France was two places above this.

The breakdown of the ECTA scorecard index into its constituent components suggests that for many criteria the scores for France and Germany were similar. The main differences were in appeals procedures, where Germany also scored relatively poorly, and in the characteristics of key access products where Germany scored poorly.[56] The difference in scores was particularly notable for wholesale DSL products.

The 10th Implementation Report[57] notes that in 2003 the market share of the incumbent operator in the German market for retail broadband access was the highest in the EU15. It attributes this, in part, to the lack of bitstream access in Germany and also notes the presence of a presumed margin squeeze in relation to broadband access.

In France, by contrast, the 10th Implementation Report notes positive developments during 2004 in respect of broadband competition. It reports rapid growth in the number of DSL connections and strong market penetration from entrants. There has also been success in the development of partially unbundled lines. The report commends the contribution of ART, the French NRA,[58] to this success through the maintaining of sufficient margins between the resale, bitstream and unbundled products, though notes that this position may have changed in December 2003 following an ART decision to allow the incumbent to reduce retail prices.

It is possible that these differences between the regulatory position in these two countries in the broadband market may have been a contributory factor to the increase in investment between 2003 and 2004 in the fixed sub-sector in France, whilst it remained the same in Germany.

Greece

In Greece, there are high levels of investment as a percentage of GDP, but there is also a rapid decline in investment over the whole period.

Greece is not one of the countries covered by the ECTA Regulatory Scorecard in 2004. It is, however, a constituent of the OECD regulatory index. That index suggests that Greece's regulatory regime performed poorly in 2001 but that it has made progress in catching up with other countries since then. This

[55] Jones Day/SPC Network, 2004, ECTA Regulatory Scorecard.

[56] Except for unbundled local loops.

[57] 10th Report on the implementation of the EU telecommunications regulatory package – 2004, COM(2004) 759.

[58] Now ARCEP.

suggests that factors other than regulatory factors may be driving the decline in the investment as a percentage of GDP in Greece.

OTE, the fixed incumbent, contributes most of the capital investment in the fixed sector in Greece. Over the period 2001 – 2004 OTE was losing market share in the fixed sector and was focussed on a cost cutting exercise in order to meet the competitive threat. This position may well have contributed to the reductions in capital investment over the period.

Netherlands

For the Netherlands a sharp decline in investment is shown in Figure 3.16 between 2001 and 2002, followed by relatively rapid increases between 2002 and 2004.

Of the ten countries covered by the 2004 ECTA Regulatory Scorecard, the Netherlands is placed in 6th position overall – above both France and Germany. The OECD Regulatory Index suggests improvements in regulatory conditions throughout the period 2001 to 2003, followed by a stabilisation in 2004.

Towards the end of 2002, OPTA, the Dutch NRA was designated with responsibility for implementing the EU regulation on access to the unbundled local loop. This decision, which followed earlier delays, enabled OPTA to take rapid action to speed up competition in the local access market. OPTA also required KPN (the fixed incumbent) to re-introduce a wholesale bitstream access product towards the end of 2002.

In addition to improvements in the regulatory situation, the following factors may have also contributed to the upturn in investment in 2003. There was a rapid growth in take up of broadband in 2003, perhaps following the regulatory actions in 2002; KPN made its first profit since 2000; and there was also a large increase in the number of business customers taking IP VPN services.

4.3.3 Collation of operator views

To complement our views, we also reviewed statements made by market players in response to public consultations about the impacts that various regulatory measures have had on investment decisions.

We reviewed statements made by industry associations as well as statements made by individual companies. Our key source has been the responses to the DG InfSo Call for input on the forthcoming review of the EU regulatory framework for electronic communications and services.[59]

[59] The call for input includes a number of questions relevant for this study, most specifically the question on competition and access regulation: *"The current framework requires national regulatory authorities to promote competition in networks and services, and to encourage efficient investment in infrastructure. Should there be any changes in the provisions of the Directives that deal with access and related regulation, in order to achieve these objectives?"*

The responses submitted by different parties reveal that there is a consensus among respondents that competition provides right incentives to invest in innovation and infrastructure.

The main difference in responses is coming from the respondents' views on how to achieve efficient competition. Three main approaches can be identified:

1. *Call for fast deregulation/no regulation*: no regulation or a fast deregulation is needed because ex-ante regulation hinders competition, and consequently, hinders innovation.
2. *Improve the path of existing gradual deregulation*: ex-ante regulation is useful in many cases and has to be relaxed once competition in the market develops. However, the steps of the deregulation process have to be designed carefully.
3. *Improve selection rule of which market to regulate*: the choice of which market should be susceptible to ex-ante regulation is often not trivial, therefore, this decision makes a real difference when one wants to develop competition in the long run.

4.3.4 Results of the sector survey

To corroborate our views, we have undertaken a telephone survey of companies in five EU Member States: Germany, France, United Kingdom, Poland and Portugal.

Representatives of 136 companies operating in e-communications markets across the five selected countries have been interviewed.[60] Companies were selected on the basis of SIC codes that corresponded to the e-communications sector. Respondents represent both operators who provide e-communications services and a range of other companies including equipment suppliers, providers of value added services for businesses and content providers. The structure of the sample achieved, by country and by sector, is indicated in Table 4.3 below.

[60] Introductory letters were sent to around 450 companies across these five countries. The letters were then followed up with telephone calls by the survey team in order to arrange interview times.

Table 4.3: Structure of the sample by country and sub-sector Whole Sample[61]

Country	Fixed	Mobile	Cable	Broadcasting	Other
France	9%	4%	3%	5%	0%
Germany	6%	1%	2%	4%	0%
Poland	7%	5%	1%	8%	0%
Portugal	6%	7%	5%	4%	0%
UK	10%	7%	1%	2%	1%
Total	39%	25%	11%	24%	2%

Of these 136 respondents 47 (35%) were operators providing e-communications services.[62] The structure of the sample for these operators, by sector and by country, is provided in Table 4.4 below. As can be seen, the structure of this sub-sample, in terms of the % of responses in each sector in total is very similar to the overall sample. For each of the sector-country combinations, the differences in structure between the two samples are generally small, mostly in the range of 1 to 3 percentage points. In a small number of cells it is 5 or 6 percentage points.

[61] This breakdown is based on responses made by interviewees to Question 1. Note that interviewees were able to indicate that they operated in more than one sector, hence the figures are percentages of the total number of sector responses and not of the total number of interviewees.

[62] In other words these companies are providing services such that they would need to be authorised under the regulatory framework. In order to make this judgement we have drawn on lists of authorised operators published by NRAs, where available, and we have used our own judgment based on material provided on operator websites.

Table 4.4: Structure of the sample by country and sub-sector Operators Only[63]

Country	Fixed	Mobile	Cable	Broadcasting	Other
France	12%	5%	1%	1%	0%
Germany	8%	1%	3%	3%	0%
Poland	12%	10%	3%	9%	0%
Portugal	3%	3%	3%	4%	0%
UK	6%	9%	0%	1%	4%
Total	40%	29%	9%	18%	4%

Note: interviewees were able to indicate that they operated in more than one sector, hence the figures are percentages of the total number of sector responses and not of the total number of interviewees. Where operators indicated that they were actve in more than one sector, they may not be active as providers of e-communications service in each sector. We were not able to remove this effect from the figures in the Table.

In our summary of responses in the remainder of this section, we provide an indication both of responses from the whole sample and of responses from the sub-sample of operators.

The aim of this questionnaire was to achieve an understanding of company views on a number of issues, focussing on:

- The main factors that have driven changes in investment levels generally in the sector in recent years;
- The main factors that have driven changes in investment by individual company respondents;
- The way in which the regulatory framework affects investment levels; and
- Potential changes to the regulatory framework, and its implementation, that would raise investment levels.

A copy of the interview questionnaire is included in Annex 7.

Economic factors and competition explain the decline of investment

Four main explanations for the decline in e-communications investment over the period 2000-2003 were cited.[64] Economic factors were named by 40% of companies,[65] and comprise the end of the financial bubble, the economic cycle

[63] As before, This breakdown is based on responses made by interviewees to Question 1. Note that interviewees were able to indicate that they operated in more than one sector, hence the figures are percentages of the total number of sector responses and not of the total number of interviewees.

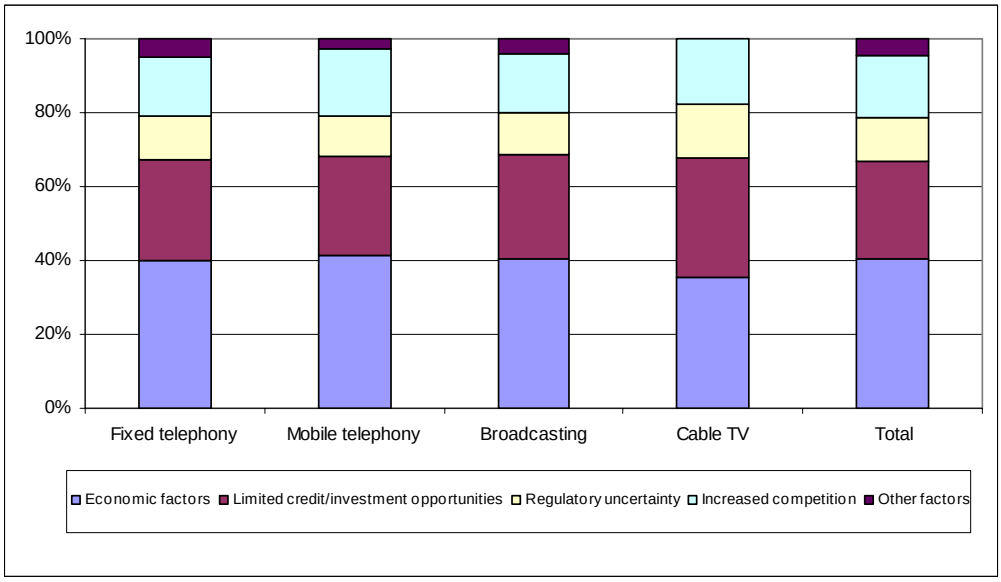
[64] Qu.4a of the questionnaire.

[65] In the charts throughout this section figures are expressed as a percentage of respondents who expressed a view. Small numbers of respodents – generally in the range 1% to 4% - responded "don't know" to

and the decline in macroeconomic conditions. Limited credit and investment opportunities were named by 26% of respondents, while 17% cited increased competition as an explanation for the decline, and 12% pointed to regulatory uncertainty.

Figure 4.8 below shows a breakdown of the results by sub-sector and type of factor. The responses did not vary significantly from the total when looking at the breakdown of different sub-sectors or countries.

Figure 4.8: Important explanatory factors for the decline of investment Whole sample

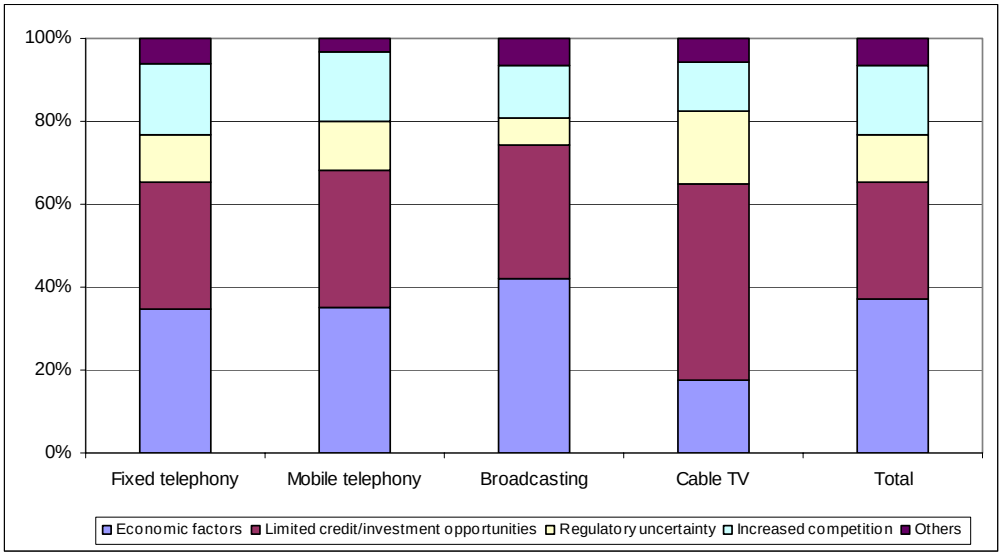


Note: * Economic factors include: "the end of the financial bubble", "the economic cycle", and "the decline in macroeconomic conditions".
Source: PwC survey and LE calculations.

Figure 4.9 shows the response to the same question from operators. They tended to view economic factors as less important and limited credit and investment opportunities as more important, particularly in the cable sector. They placed the same emphasis on regulatory uncertainty, with 12% of respondents indicating that this was a factor.

some questions.

Figure 4.9: Important explanatory factors for the decline of investment Operators only



Note: * Economic factors include: "the end of the financial bubble", "the economic cycle", and "the decline in macroeconomic conditions".
Source: PwC survey and LE calculations.

When asked which one factor was the most important in explaining the decline in investment between 2001 and 2003, economic factors were the most popular with 44% of companies picking this factor. Regulatory uncertainty was mentioned as the most important factor by 11% of all respondents. Operators placed less emphasis on economic factors (30%) and slightly more on limited credit and investment opportunities and on regulatory uncertainty (15%).

New market opportunities increased investment since 2003

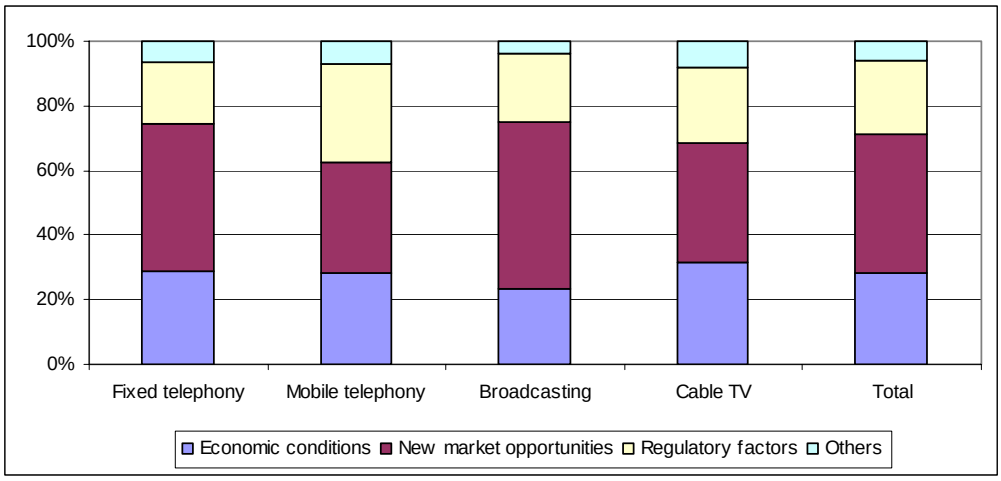
New market opportunities was the most important factor explaining the decision to increase investment since 2003, being mentioned by 43% of total responses.[66] Economic conditions were named by 28% of companies, while 23% mentioned regulatory factors (including "changes in the regulatory framework", "changes in the implementation or enforcement of the regulatory framework" and "more regulatory certainty").

Figure 4.10 below shows that the results do not differ significantly across the sub-sectors, but for mobile telephony and CaTV companies, new market

[66] Qu. 6a of the questionnaire.

opportunities were less of a factor in the increase in investment than for companies in the fixed and broadcasting sectors.

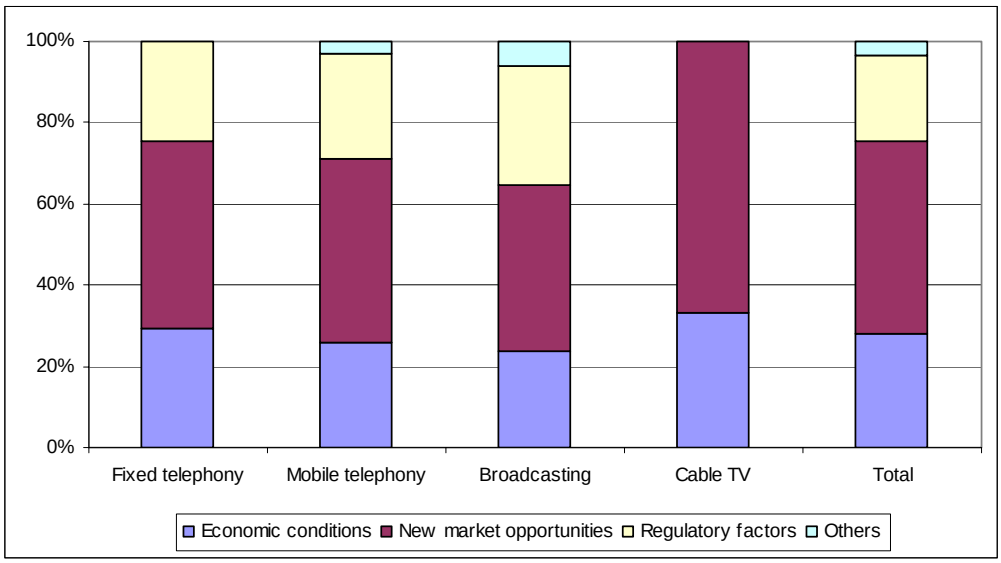
Figure 4.10: Factors in companies' decisions to increase investment in e-communications sector since 2003. Whole sample



Note: *Economic conditions includes: "the investment cycle" and "macroeconomic conditions"; regulatory factors includes: "changes in the regulatory framework", "changes in the implementation or enforcement of the regulatory framework" and "more regulatory certainty".
Source: PwC survey and LE calculations

Figure 4.11 shows the responses from operators. They tended to place a higher weight on new market opportunities (47%) - especially in the cable sector (67%). Whilst the ranging of regulatory factors is similar overall (21%), they were not raised as an issue by cable operators and in other sectors more emphasis tended to be placed on them.

Figure 4.11: Factors in companies' decisions to increase investment in e-communications sector since 2003. Operators only



Note: *Economic conditions includes: "the investment cycle" and "macroeconomic conditions"; regulatory factors includes: "changes in the regulatory framework", "changes in the implementation or enforcement of the regulatory framework" and "more regulatory certainty".
Source: PwC survey and LE calculations

The existence of new market opportunities was named as the most important factor driving the increase in investment since 2003 by 60% of all respondents. Economic conditions were named as the most important factor by 22% of all respondents, while only 8% cited regulatory factors as the most important factor. Only 3% of operators cited regulatory factors as the most important.

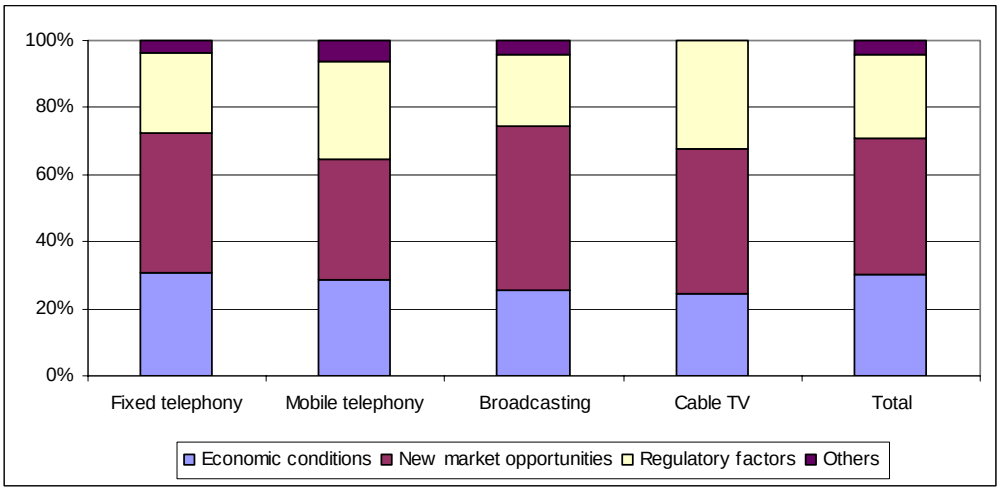
New market opportunities and economic conditions main causes of the increase in investment

Responses to this question were about the factors that drive increases in investment generally, rather than those which specifically drove the increases that have been experience since 2003.[67] Not surprisingly the results are very similar to those outlined above. As illustrated in Figure 4.12, 41% of

[67] Qu. 7a of the questionnaire.

companies responded that new market opportunities were a cause of the increase in investments, while 30% and 25% responded that economic conditions and regulatory factors respectively were causes.

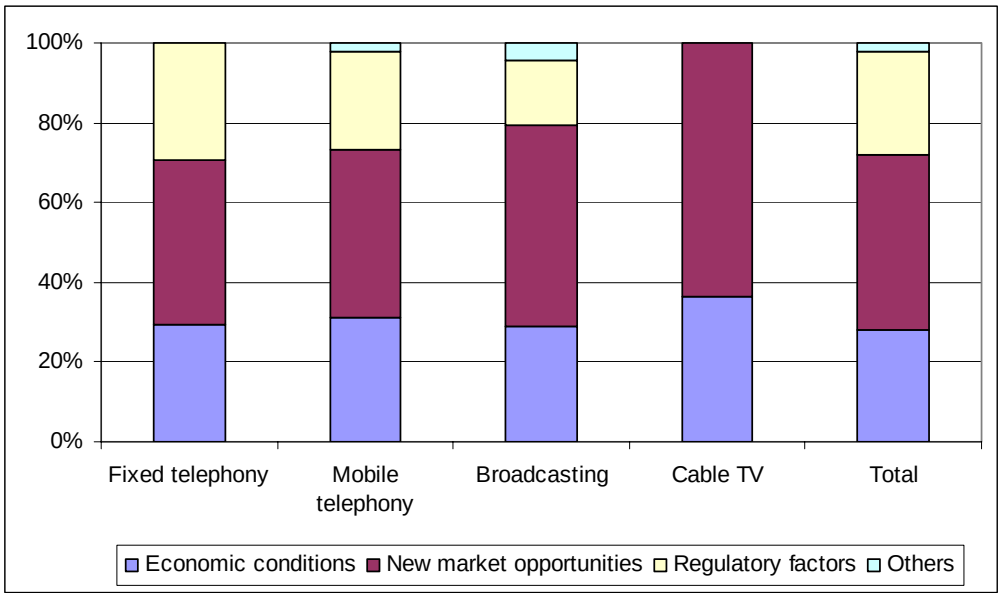
Figure 4.12: Causes of the increase in investment in e-communications sector. Whole Sample



Note: Economic conditions includes the investment cycle and macroeconomic conditions, regulatory factors includes changes in the regulatory framework, changes in the implementation or enforcement of the regulatory framework and more regulatory certainty.
Source: PwC survey and LE calculations.

Responses to this question by operators (shown in Figure 4.13) were similar though, again, cable operators did not mention regulatory factors. Overall 26% of operators mentioned regulatory factors.

Figure 4.13: Causes of the increase in investment in e-communications sector. Operators only



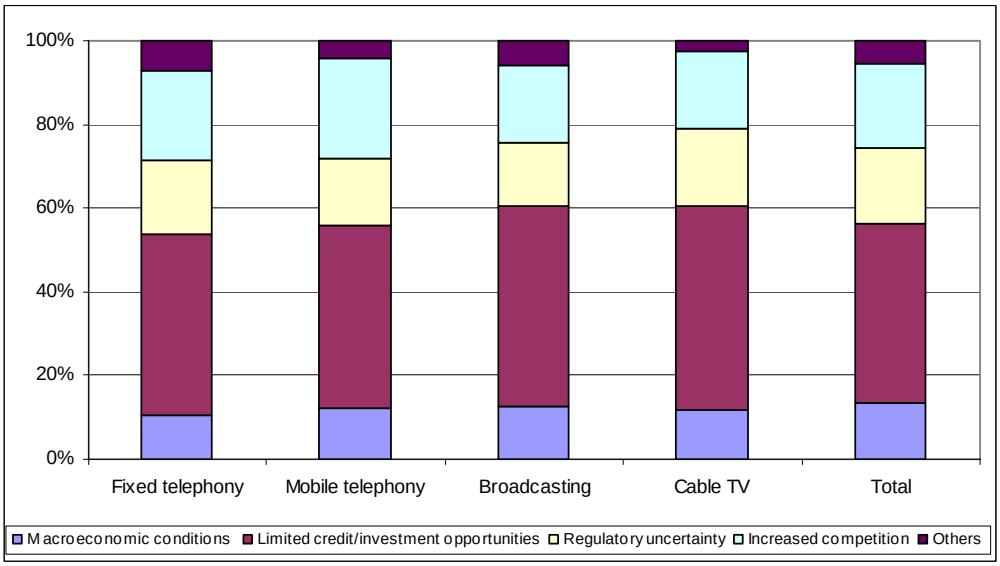
Note: Economic conditions includes the investment cycle and macroeconomic conditions, regulatory factors includes changes in the regulatory framework, changes in the implementation or enforcement of the regulatory framework and more regulatory certainty.
Source: PwC survey and LE calculations.

New market opportunities were clearly singled out as the most important cause by 62% of respondents. 18% of companies named economic conditions as the most important cause and regulatory factors were mentioned in 10% of cases as the most important cause of increased investment. Only 7% of operators cited regulatory factors as the most important.

Increased competition can hinder investment

Four main factors were identified as hindering companies' investment strategies.[68] The limited availability of credit and profitable investment opportunities was the most common with 43% of responses. 20% named increased competition as a factor, while 18% cited regulatory uncertainty as hindering investment, and 13% were worried about macroeconomic conditions.

Figure 4.14: Major factors hindering companies' investment strategies Whole sample

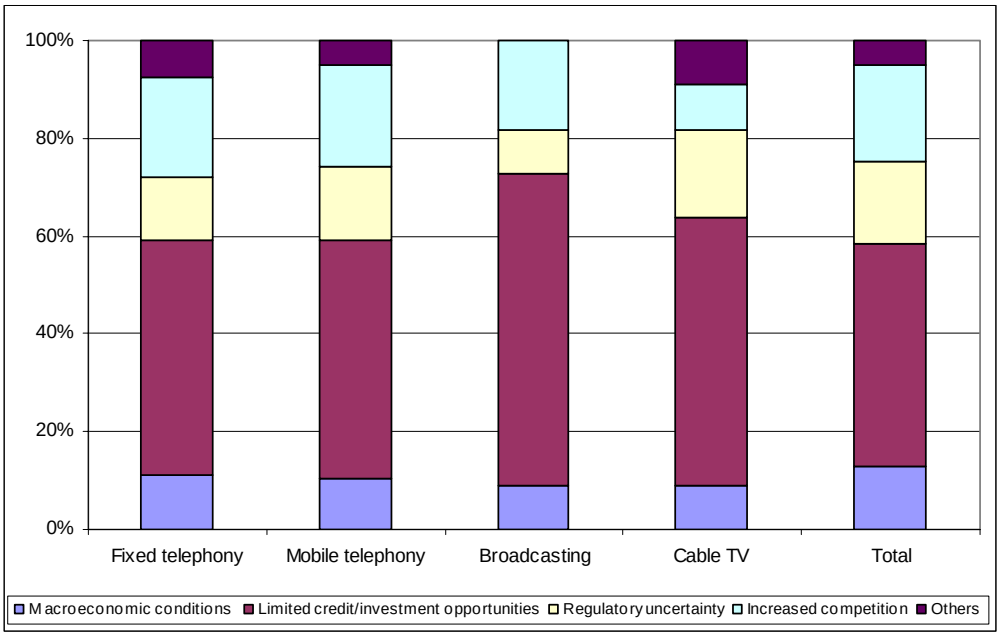


Source: PwC survey and LE calculations.

[68] Qu. 8a of the questionnaire.

Figure 4.15 shows the responses by operators to this question. Responses were very similar overall, though with operators in the broadcasting sector placing a higher emphasis on limited credit and investment opportunities.

Figure 4.15: Major factors hindering companies' investment strategies Operators only



Source: PwC survey and LE calculations.

Limited credit and investment opportunities was named by 38% of companies as the most important factor hindering investment, while 22% and 17% respectively chose competition and regulatory uncertainty as the main hindrance. 12% cited macroeconomic conditions as the most important factor. Responses from operators were very similar with, again, 17% choosing regulatory uncertainty as the most important factor.

High disparity in factors for investing in non-EU countries

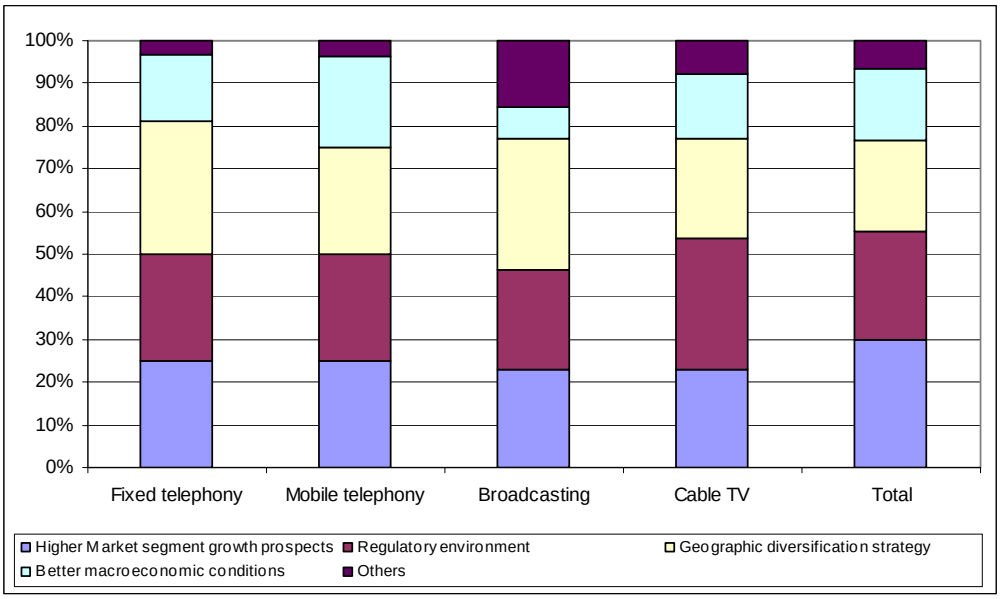
Only 26 companies are investing in non-EU countries.[69] There are no specific factors that seem to stand out in terms of the number of times they were cited (see Figure 4.16).

When asked which of these factors was the most important, "higher market segment growth prospects" and "regulatory environment" were chosen as

[69] Only 8 operators in the sample said they were investing in non-EU countries and we have not provided a separate chart to show these responses to Qu. 10.

the most important factors, each with 30% of responses. Operators placed more emphasis on the higher market segment growth prospects, with 50% of respondents citing that as the most important factor.

Figure 4.16: Explanatory factors for investing in non-EU countries Whole sample

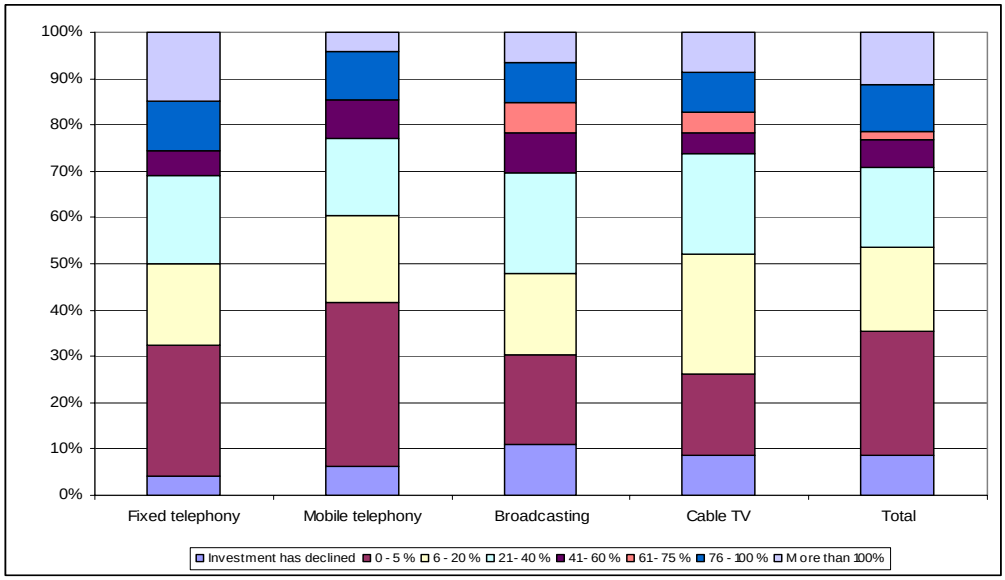


Source: PwC survey and LE calculations.

Investment increased between 2003 and 2005

As can be seen from Figure 4.17 over 90% of respondening companies indicated that they had increased investment over the period 2003 to 2005.[70] Almost half of them said that they had increased investment by more than 20%.

Figure 4.17: Increase in investment 2003 – 2005
Whole sample

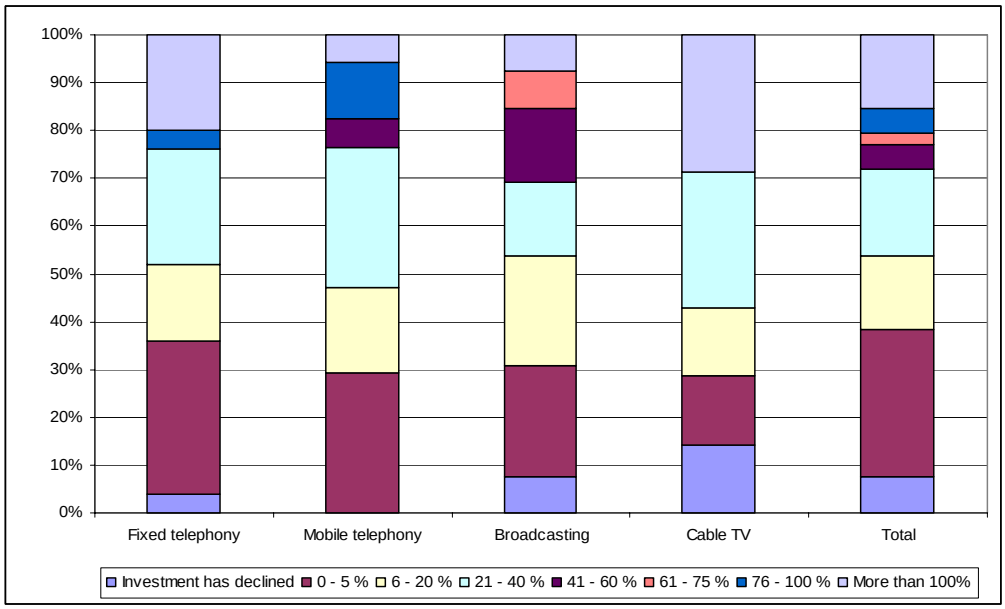


Source: PwC survey and LE calculations.

[70] In response to Qu. 5 of the questionnaire.

Figure 4.18 shows the equivalent responses for operators only. The figures are very similar, showing operators also making significant increases in investment over the period.

Figure 4.18: Increase in investment 2003 – 2005
Operators only



Source: PwC survey and LE calculations.

The link between regulaion and investment – survey responses

In the survey, respondents were asked to provide their level of agreement with some important statements related to the new regulatory framework. Responses from the sub-sample of operators have been ranked for each sector and are provided in Table 4.5. A ranking of 1 indicates most agreement with a statement and a ranking of 9 means least agreement with a statement.

Overall, there is most agreement from operators with the statement:

"*More retail competition would lead to more network investment*".

For the two sub-sectors with the highest levels of investment (fixed and mobile) this statement was also the one with which there was most agreement in the fixed sub-sector and it was placed second by operators in the mobile sub-sector. The statement with which mobile operators agreed most was:

"*Access regulation, as currently applied by the regulators, does generally allow SMP operators to earn a sufficient return on their investments.*"

This statement was also placed second by fixed operators, and third overall across operators in all sub-sectors.

The statement which was placed second overall was:

"*The regulatory framework deters investment in new technological developments*".

This statement was placed first by operators in the broadcast sector but only fourth and sixth, respectively, by fixed and mobile operators.

There is least agreement among operators with the statement:

"*Uncertainty about the terms of access discourages the entry of new companies into e-communications markets*"

followed by:

"*In order to encourage more network investment, fundamental changes should be made to the regulatory framework within the next two years*"

and

"*There is insufficient network competition*".

Table 4.6 shows how the same statements are ranked by the whole sample of all respondents.

The statement that was ranked 1 overall in the sub-sample of operators is now ranked 4. The statement that is ranked 1 by the whole sample (ranked 2 by the sub-sample of operators) is now:

"*The regulatory framework deters investment in new technological developments*".

As before the ranking for this statement in the fixed sector is lower at 4, though this time it has a ranking of 1 in the mobile sector. The two other most significant changes in ranking are that the statement that was previously ranked fifth is now ranked second, whilst the statement that was previously ranked seventh is now ranked third. The overall rankings for most of the other statements have not changed by more than one or two places.

Table 4.5: Investment and the regulatory framework rankings for operators

Statement:	Fixed	Mobile	Terrestrial broadcast	Satellite broadcast	CaTV	Overall rank
The principles that underpin the new regulatory framework are improving the conditions for investment in the sector	5	3	3	5	8	4
The way in which the new regulatory framework is being implemented is improving the conditions for investment in the sector	2	4	3	9	7	5
Allowing competing operators access to SMP operator networks will encourage more investment in networks in the long run	8	5	5	1	5	6
There is insufficient network competition	7	7	7	7	2	7
More retail competition would lead to more network investment	1	2	2	3	3	1
The regulatory framework deters investment in new technological developments	4	6	1	1	4	2
In order to encourage more network investment, fundamental changes should be made to the regulatory framework within the next two years	6	8	8	7	6	8
Access regulation, as currently applied by the regulators, does generally allow SMP operators to earn a sufficient return on their investments	2	1	6	4	1	3
Uncertainty about the terms of access discourages the entry of new companies into e-communications markets	9	9	9	6	9	9

Note: A ranking of 1 indicates most agreement with a statement and a ranking of 9 means least agreement with a statement.
Source: PwC Survey

Table 4.6: Investment and the regulatory framework rankings Whole Sample

Statement:	Fixed	Mobile	Terrestrial broadcast	Satellite broadcast	CaTV	Overall rank
The principles that underpin the new regulatory framework are improving the conditions for investment in the sector	6	3	4	6	6	6
The way in which the new regulatory framework is being implemented is improving the conditions for investment in the sector	1	2	2	2	5	2
Allowing competing operators access to SMP operator networks will encourage more investment in networks in the long run	9	6	9	8	7	9
There is insufficient network competition	3	5	6	3	2	3
More retail competition would lead to more network investment	5	7	5	4	4	4
The regulatory framework deters investment in new technological developments	4	1	1	1	1	1
In order to encourage more network investment, fundamental changes should be made to the regulatory framework within the next two years	7	9	8	9	9	7
Access regulation, as currently applied by the regulators, does generally allow SMP operators to earn a sufficient return on their investments	2	4	3	5	3	4
Uncertainty about the terms of access discourages the entry of new companies into e-communications markets	8	8	7	7	8	7

Note: A ranking of 1 indicates most agreement with a statement and a ranking of 9 means least agreement with a statement.
Source: PwC Survey

Table 4.7 below shows respondents' opinions on the impact of the new regulatory framework on incentives to invest. In fixed and mobile markets, both wholesale and retail, more respondents felt that the new regulatory framework had improved incentives than had damaged or had no impact on incentives. For broadcasting and cable market the picture is slightly less clear, though more respondents think that the regulatory framework has improved incentives than think that it has damaged incentives. In some of the retail markets respondents are more likely to believe that it has had no impact.

Table 4.7: The effect of the new regulatory framework on incentives to invest – Whole sample

	Impact on:	Improve incentives	Damage incentives	No impact on incentives	DK / No opinion
Wholesale market	Fixed	49%	15%	29%	6%
	Mobile	57%	12%	24%	7%
	Terrestrial broadcasting	43%	14%	32%	11%
	Satellite broadcasting	38%	10%	39%	14%
	Cable TV	43%	10%	35%	12%
Retail market	Fixed	40%	14%	35%	10%
	Mobile	62%	11%	16%	11%
	Terrestrial broadcasting	36%	12%	36%	16%
	Satellite broadcasting	36%	7%	40%	16%
	Cable TV	38%	7%	40%	16%

Source: PwC Survey.

Table 4.8 shows the results for operators only and gives similar overall results.

Table 4.8: The effect of the new regulatory framework on incentives to invest – Operators only

	Impact on:	Improve incentives	Damage incentives	No impact on incentives	DK / No opinion
Wholesale market	Fixed	47%	17%	30%	6%
	Mobile	49%	15%	26%	11%
	Terrestrial broadcasting	40%	11%	36%	13%
	Satellite broadcasting	28%	4%	51%	17%
	Cable TV	34%	11%	38%	17%
	Others	33%	0%	67%	0%
Retail market	Fixed	36%	15%	36%	13%
	Mobile	53%	13%	17%	17%
	Terrestrial broadcasting	36%	9%	34%	21%
	Satellite broadcasting	26%	9%	45%	21%
	Cable TV	36%	2%	36%	26%
	Others	0%	0%	67%	33%

Source: PwC Survey.

Interviewees were also asked what changes to the regulatory framework, or changes to the implementation of the framework they thought would most encourage investment in the sector.[71] We have summarised here the responses to these questions from the sub-sample of operators. Responses from the whole sample were similar – the main difference was that there was a lower % of responses in the main sample making specific proposals for changes to improve the regulatory framework and a higher percentage that were calling for less VAT and lower social charges.

About 9% of responses from operators suggested, in very general terms, that measures to promote competition and more liberalisation of markets would encourage investment.[72] A further 8% suggested less regulation, often for similar reasons. Most of the latter responses were general in nature, though

[71] Questions 14 and 15 of the questionnaire.

[72] Each respondent was able to make up to three suggestions. The figures in this section refer to percentages of the total number of suggestions ("responses") rather than to percentages of the number of respondents.

there were calls for less regulation in the mobile sector, in retail markets (especially for business services) and for less regulation of new infrastructure.

There were calls for stronger regulation in 15% of responses. In many cases this was a general call for prevention of monopoly power, but there were also more specific suggestions, such the break up of fixed incumbents; stronger powers for NRAs; and better enforcement. A number of responses from Poland also suggested that the NRA needed to speed up the process of implementing the legal framework.

There were a number of responses that indicated the need to improve regulation through more simplification, consistency, harmonisation and transparency. These amounted to 16% of responses and also included specific calls for more regulatory certainty. Again, most responses were general in nature, but there were specific suggestions to simplify regulations relating to access to mobile networks. There were also several calls from respondents in the telecommunications sector in France for more information and communication. Of all the operator responses, 6% related specifically to calls for more harmonisation across the EU.

There were other suggestions that regulation should be improved from 19% of responses. These were varied in nature and included only general suggestions for improving regulation. Others were more specific and included the following: regulation should allow for higher profit margins; mobile number portability should be available; there should be more pro-active encouragement of infrastructure development; regulation should be more effective in relation to wholesale international roaming; it should take more account of accepted legal economic theory; and regulatory processes should be speeded up.

6% of responses were calls for lower VAT and social charges, most from respondents in France, and the remainder (28%) were a mix of responses that were difficult to interpret or seemed unrelated to the regulatory framework.

4.3.5 Results of the interview programme

In addition to the survey exercise described above, we undertook a second, smaller scale, interview programme in order to validate the conclusions we drew from the above analysis. This interview programme involved interviews with eleven market players and representative bodies. Those interviewed represented a range of countries and sub-sectors (fixed, mobile, cable, broadcasting and satellite) and both new entrants and incumbents. The telephone interviews were semi-structured in nature allowing a wide ranging discussion of relevant issues. Interviewees were asked to focus on the following general issues:

- The main factors that drive levels of investment in network infrastructure (e.g. economy wide factors, industry-specific factors, company-specific factors etc.).

- The main reasons for the decline in investment in e-communications infrastructure across the EU between 2000 and 2003 and the subsequent upturn in investment levels.
- The extent to which the regulatory framework influences investment levels and the aspects of the framework that are particularly important.
- Potential changes to the underlying regulatory framework that would encourage more network investment.
- Potential changes to the way in which NRAs are implementing the regulatory framework that would encourage more network investment.

Factors that influence investment

Interviewees suggested that the most important investment drivers are: the economic cycle and the consequences of the financial bubble; availability of capital; technological developments; and regulatory uncertainty. Other factors mentioned included demographic factors and firm size.

In most of the responses the investment cycle was mentioned as a reason for the 2000-2003 decline in investment, together with a lack of confidence on the part of investors as the financial bubble collapsed. Some incumbents felt that they had not been affected by the financial bubble and that this factor was more important for entrants.

Some interviewees also pointed to the lack of capital available for undertaking investments after the huge amounts being spent on 3G licences and network upgrades, suggesting that investment in the mobile sub-sector had been crowding out investment in other sub-sectors.

The decline in investment can also be explained by a phased entry strategy to a new market. Following liberalisation in 1998 there was a lot of network rollout by new entrants. Once that alternative infrastructure was in place it is natural to expect a decline in new infrastructure investment as operators seek to consolidate their positsion and grow revenues before undertaking a further round of investment where they have been successful in developing their market positions. It was also suggested that there had been over-investment in backbone networks in the late 1990s and that this may have dampened futher investment in this infrastructure in later years.

One interviewee also noted that nominal investments can be falling simply because there has been a decline in the prices of investment goods.[73]

Technological change was also proposed as an important factor for investment generally. Some interviewees felt that technological developments, combined with competition, forced them to keep investing in

[73] This does not affect our results, as all our figures have been deflated and are expressed in real terms.

order that they could keep up with the services offered by competitors. It was also seen as contributing to cost reduction. One new entrant said that the current developments in new generation networks had led them to take a prudent investment stance as they did not know yet which technologies were going to be successful in the market.

In some cases, technological progress can foster network investment in an indirect way. One incumbent surveyed by LE mentioned that they were upgrading their network mainly because equipment suppliers were stopping their support of old equipment (otherwise they would have delayed their network upgrade for longer).

Some players linked their investment strategy to changes in demographics. As the population grows, particularly in urban areas, and as average household size declines, operators need to invest to be able to supply the higher number of customers. These investment costs are higher per customer where the population is more dispersed.

Firm size is also driving some of the investments. Incumbents operate larger networks and need to invest for the purposes of refurbishment and replacement of existing infrastructure.

It was also suggested that the development of public sector investment in infrastructure, particularly broadband infrastructure in recent years was having a negative effect on private sector investment.

The regulatory framework and investment – results form the interview programme

A number of themes arose from our discussions with operators and trade associations about the links between the regulatory framework and investment, and on possible changes to the framework and/or its implementation. We discuss each of those themes in the remainder of this section.

Regulatory uncertainty

Evidence from the survey of companies across five Member States suggested that regulatory certainty was one of the important drivers of investment. In the interview programme, regulatory uncertainty was also raised as a major issue for the regulatory framework by many of the interviewees. It also seemed to be an underlying factor in many of the other themes that arose in the course of discussions.

One very common comment made to us in the interview programme was that operators agreed with the general approach of the overall regulatory framework and many of the principles enshrined in it, but that in implementing the framework insufficient regard was taken of the core underlying principles.

Several explanations were made for this including: lack of clarity and central guidance as to how they should be implemented; NRAs preferring to pursue national aims; NRAs not having sufficient knowledge and expertise; and insufficient monitoring and enforcement action taken by the European Commission.

Application of sector-specific regulation

Some of the larger market players called for the removal of ex-ante sector-specific regulation and for reliance on competition law alone. Others called for the withdrawal of regulation in certain markets (e.g. retail markets), or at least the removal of certain markets from the EC Recommendation on relevant markets.

Some market players believe that competition law is an appropriate replacement for sector-specific regulation now, pointing to the successful opening up of e-communications markets to competition in the EU and to the success that light touch regulation elsewhere, such as the United States, has had in providing incentives to invest in new infrastructure. Others believe that in many e-communications markets the main reason for the inappropriateness of competition law is the time it takes for cases to be completed, particularly where appeals are made.

Objectives for the regulatory framework

Some market players argued in favour of raising the profile of investment in the objectives, perhaps by introducing an objective for ensuring sustainable investment which would have equal status with the objective for promoting competition. Others argued in favour of reinforcing the promotion of competition as the main objective, arguing that strong competition is the best way of promoting investment.

Market players in smaller Member States have also argued that NRAs seek to promote competition by applying obligations in a way that is not proportional to the benefits to be derived from the obligations. For example, one operator pointed out that the costs of developing a product such as LLU or wholesale line rental for operators in small Member States are similar to the costs for operators in much large Member States, but that the benefits in terms of potential to increase competition were very much lower. Ignoring wider impacts could lead to a misallocation of investment expenditures.

It was suggested that a requirement for a regulatory impact assessment (RIA) should be introduced into the regulatory framework and that NRAs should be required to apply this to justify their choice of remedies. The UK approach to RIAs was cited as an example of good practice.

The ladder of investment

Whilst many market players accept the principle of the ladder of investment[74], some argue that it has not been implemented properly. This is particularly relevant in relation to the encouragement of moves to the higher rungs of the ladder. Suggestions included plans to increase access prices over time.

It was also suggested to us that where services provided over cable networks are competing with services provided over fixed telecoms networks, service-level mandated access to the fixed telecoms networks reduces the returns on cable networks and so can reduce incentives to invest in alternative infrastructure. It was argued that as convergence continues, this problem is likely to be become more important.

Some examples of good practice in implementing the investment ladder were also given to us. These include where NRAs had applied different remedies in different geographical areas of a product market. An example is where intermediate access products (such as bitstream and wholesale line rental) are only mandated in areas where there is no business case for access through unbundled local loops (these tend to be in areas of low access density such as rural areas). It was argued that this approach encourages the development of more infrastructures by competitors, particularly in urban areas, whilst still providing the level of access they need to compete in areas where access density is lower.

Application of remedies

Some market players indicated to us that they believe that the European Commission itself should play a stronger role in determining the way in which remedies are applied. They argued that this could increase the level of consistency across NRAs in the application of remedies and, as a consequence, reduce uncertainty.

It was suggested to us that the European Commission was better placed than ERG to fulfil this role because it had a good track record in ensuring consistency across the internal market; it was highly competent in this area; and it was able to act more speedily (as agreement is not needed across 25 organisations, each with their own national interests). ERG was still seen as an important forum for disseminating good practice.

A general comment from several market players that we interviewed was that they agreed with the principles set out in the regulatory framework but that in practice NRAs did not follow them closely enough in the application

[74] The ladder of investment principle suggests that new entrants find it easier to compete initially in services that require relatively little infrastructure investment (e.g. CPS services for retail customers in the fixed telecoms sub-market) and that over time as they become successful in the provision of those services they begin to invest in infrastructure (e.g. more switches, lines etc) that enables them to compete more effectively with the incumbent over a wider range of services and reduces their reliance on the incumbent's network.

of remedies. There was a feeling that the introduction of formal guidance on remedies from the European Commission would encourage the application of remedies that are more consistent with the framework and that this would contribute to reducing uncertainty. Some market players also proposed that the Article 7 procedures should also apply to remedies so that the European Commission has a veto in relation to remedies as it does in relation to market definition and SMP assessment.

Market Analysis

The Framework Directive notes that an operator with SMP in one market can be deemed to have SMP in a closely-related market where the links between the two markets are sufficient in order to leverage market power from one market into the other.[75] Some market players suggested such links between markets were very important for understanding market dynamics and competitive pressures and that more clarity was needed on how and when these links should be taken into account. They argued that this is particularly the case where markets and services are converging, with different platforms providing similar services.

One related suggestion was that given the existence of close links between many of the analysed markets, it would provide more transparency if NRAs undertook and presented their market analysis for each separate market in clusters of related markets.

Process and NRA powers

Several of the market players pointed out that the long-time delays in many Member States between finalisation of the regulatory framework in 2002 and transposition into national laws and then market analysis, and imposition of remedies by NRAs, have contributed considerably to regulatory uncertainty in the sector. Market players were of the opinion that this has delayed some investment decisions as operators await outcomes. Some suggested that the regulatory framework should include procedural timetables for market analysis and the imposition of remedies by the NRAs.

Concern was also expressed about the limits on the enforcement powers held by the NRAs and the limited sanctions that they were able to impose. It was felt that these factors often led to considerable delays in regulatory decisions and to a position of sometimes considerable legal uncertainty. It was suggested that both these factors contributed to inhibiting investment. One suggestion was that a requirement to use specialised bodies for appeals would contribute to reducing the legal uncertainty.

[75] Article 14(3).

5 Conclusions

This report has investigated the levels of investment, and investment drivers, for e-communications in the European Union. Four different aspects have been examined:

- The investment in e-communications in the EU15 in relation to the international context (Section 3);
- Investment figures gathered for EU25 Member States and four different sub-sectors (Section 2);
- The factors explaining the decline and recovery of investment in recent years (Section 4); and
- Regulatory factors that have been driving changes in investment levels in the sector (Section 4).

We review each of them in turn.

5.1 E-communications in the international context

Gross Value Added (GVA) in the e-communications sector has increased significantly over recent years in the EU, United States, Japan and South Korea. All regions show an increase in GVA of more than 60% between 1995 and 2003. In all countries, growth in e-communications has outperformed other sectors.

A decomposition of the growth in GDP between sectors shows that e-communications has had a contribution to growth of between 6% and 7% in the EU15 and the United States, and around 9% in Japan and South Korea.

5.2 Investment levels in the EU

Total e-communications investment rose from 1998 to a peak in 2001 and then sharply declined to 2003.[76] Analyses of company financial statements and survey responses suggest an increase from 2003 onwards.

In the EU25, 93% of investment in e-communications is in the fixed and mobile telecommunications sub-sectors. A general U-shaped pattern (decline since 2001 followed by an upturn from 2003) has been seen across the four sub-sectors, though fixed telecommunications saw a stabilisation of investment between 2003 and 2004, rather than an increase.

[76] Our analysis of company reports shows the decline from 2001 to 2003 and a subsequent upturn. Other sources (e.g. OECD and ITU) show the increase from 1998 to 2001 as well as the subsequent decline. Analysis of questionnaire responses from five EU Member States shows increases between 2003 and 2005. Other operators interviewed also believed that there had been an increase in investment in the sector since 2003.

The upturn is not observed in each of the sub-sectors in all EU25 countries. Large countries and countries with higher GDP per capita have tended to see a more pronounced upturn since 2003, though in the CaTV sector it is small and medium-sized countries that have experienced a more significant upturn.

Over the period, total investment by incumbent operators in the fixed telecommunications sub-sector has been significantly higher than investment by entrants, though the gap has narrowed. The picture for investment expressed as a percentage of revenue is different. Entrants have invested much more relative to their size than incumbents. This gap also narrowed over the period. Expressed as a percentage of revenue, entrants were investing three times as much as incumbents in 2004. Expressed in monetary terms, incumbents were investing about eight times as much as entrants in 2004.

Results of the regression model show that better-performing regulatory regimes (as measured by the OECD regulatory index) contribute to higher investment levels. Use of an alternative regulatory index (the ECTA index) suggests a similar contribution to investment levels. However, the magnitude of this effect may be low compared to some other factors.

Our modelling suggests that the other factors that have an important positive influence on company investment levels are GDP per capita; the land area and population density of the country in which they operate; and the size of the company, as measured by total asset value of the company. It has also been suggested that competition is an important factor - data limitations meant that we were unable to test this proposition in our model.

It has not been possible to identify a clear pattern for separate pricing trends in the EU15 and the EU10 based on the data available, and we did not find any clear evidence of a relationship between prices and investment.

5.3 Factors explaining the evolution of investment

To validate the correlations between regulation and investment, a literature review was undertaken, together with a telephone survey by PwC and interviews with market players.

Explaining the decline and recovery of investment

There are many factors that influence investment decisions. Regulatory factors are one important category, though they are not necessarily the most important. Other general factors that contribute to investment decisions are new market opportunities; economic conditions (including the investment cycle); and technological change.

There is a view that the increase in investment prior to 2001 was a part of the normal investment cycle, and that this responded to an increase in network rollout by new entrants following liberalisation in 1998 and the financial bubble in the sector.

It is also argued that the subsequent decline in investment was a part of the investment cycle following the collapse of the financial bubble. After the period of high investment in the late 1990s, many operators were consolidating their positions and focussing on increasing revenues from their new infrastructure. In survey responses, the following factors were noted as the main causes of the decline: economic factors such as the economic cycle and the end of the financial bubble; limited availability of credit and investment opportunities; increased competition; and regulatory uncertainty.

Survey respondents indicated that the main factors driving the upturn in investment since 2003 were new market opportunities; economic conditions; and regulatory factors, including improved regulatory certainty.

How the impact of the regulatory framework is perceived

Our study suggests that regulatory uncertainty is one important aspect of regulation that affects investment decisions. There are a number of factors that influence the level of uncertainty. Changes to these factors may contribute to improving the climate for investment. In this context it should be borne in mind that the comparative analysis of investment in telecommunications between the EU15, United States, Japan and South Korea suggests an already strong investment performance in the EU15.

The factors that can contribute to more regulatory certainty include:

- clear legislation
- timely implementation of legislation
- comprehensive guidance on the interpretation of legislative requirements
- harmonisation between Member States
- clear communication from NRAs
- adequate appeals processes
- adequate NRA enforcement powers

Whilst many companies have suggested specific improvements to the regulatory framework and its implementation in these respects, many also expressed the view that the current framework was a welcome and significant improvement on the previous regulatory framework. Some also argued that the development of competition meant that there was now no further need for regulation in some or all markets.

5.4 The relationship between investment and regulation

Our analysis of the correlation between specific aspects of regulatory performance[77] and investment levels in the fixed telecommunications sub-sector in a number of Member States highlighted the aspects of regulatory regimes, and their implementation by NRAs, that may be the most important in their influence on investment levels. These are the following:

- "Effectiveness of sanctions" in disputes and settlements;
- "Availability of information" in the application of access regulation;
- "Voice interconnection" and "Partial private circuits offers and leased lines" when accessing products; and
- "Transposition of the NRF by the NRAs".

These factors seem to be consistent with the factors listed as being important in the context of regulatory uncertainty.

It is also clear from our analysis and discussions with operators that NRAs' actions in relation to developing access obligations that encourage entrants to develop their own infrastructures is also an important factor. Suggestions for good practice included the maintaining of adequate margins between the products at different levels in the vertical supply chain (e.g. in fixed telecoms markets between unbundled local loops, intermediate access products and resale products); and the mandating of intermediate access products (such as wholesale bitstream or wholesale line rental) only where it is clear that there would be no business case for the development of downstream competition through the use of unbundled local loops. This may mean differential obligations within national markets.

In our analysis of the correlation between regulatory actions and investment, referenced at the beginning of this section, we noted the limitations of the analysis, including its dependence on the ECTA scorecard as an indicator of regulatory quality. There may be benefits for the European Commission to develop its own independent index, or set of indicators, for regulatory quality for the purposes of monitoring and comparing regulatory regimes and assessing their impacts, including the impact on investment.

[77] Based on measures in the ECTA Regulatory Scorecard for 2004.

Annex 1 Investment data and Methodology

Total investment by sub-sector

Investment data can be found below in Table A.1 to Table A.5 for total, fixed, mobile, CaTV and broadcasting investment respectively.

Figure A.1 to Figure A. show investments in individual EU10 countries, and Figure A. to Figure A do the same for the EU15 countries.

Detailed explanations of the methodology used in the case of each company follow in Table A.6 to Table A.30 for all the EU25 countries.

Table A.1: Total gross investment by country in the e-communications sector† (€m, 2001 prices)

Country	2001	2002	2003	2004
Belgium	1088	873	608	637
Czech Republic	896	574	426	433
Denmark	1509	1393	904	1439
Germany	7318	5891	4688	4942
Estonia	61	40	33	39
Greece	1493	1250	1065	965
Spain	2901	2078	1893	1851
France	5710	4766	3648	4669
Ireland	1092	523	416	592
Italy	6010	5735	4788	5118
Cyprus	0	0	73	75
Latvia	209	210	161	160
Lithuania	132	82	37	57
Luxembourg	147	122	143	141
Hungary	780	635	530	521
Malta	29	28	24	16
Netherlands	5716	2496	2698	3277
Austria	961	689	662	640
Poland	2260	1543	1201	1246
Portugal	253	167	246	187
Slovenia	210	129	150	196
Slovak Republic	341	355	266	268
Finland	642	487	484	491
Sweden	1274	738	734	1080
United Kingdom	8773	7827	5344	5213
Satellite	758	723	464	1280
Total (annual reports)*	50563 (50618)	39354 (39030)	31686 (31417)	35533 (34279)

Note: * Includes data from annual reports only (and not LE survey). † Including satellite broadcasting data.
Source: Company Annual Reports and LE calculations.

Table A.2: Total gross investment by country in the Fixed Telephony sub-sector (€m, 2001 prices)

Country	2001	2002	2003	2004
Belgium	508	283	168	264
Czech Republic	334	231	125	110
Denmark	537	494	295	278
Germany	3815	2849	2016	2088
Estonia	35	20	15	16
Greece	1058	837	593	465
Spain	1942	1369	1206	931
France	3056	2867	1704	1966
Ireland	735	270	204	240
Italy	2830	3076	2277	2189
Cyprus	0	0	34	31
Latvia	83	67	36	50
Lithuania	90	54	11	20
Luxembourg	38	27	29	28
Hungary	289	250	163	151
Malta	5	17	13	4
Netherlands	3069	1210	1519	1888
Austria	417	366	331	323
Poland	1381	853	551	564
Portugal	93	25	70	33
Slovenia	115	56	67	70
Slovak Republic	193	128	104	133
Finland	171	209	172	166
Sweden	654	431	382	476
United Kingdom	3773	3542	2351	2417
Total (annual reports)*	25220 (25782)	19530 (19602)	14434 (14486)	14899 (14901)

Note: * Includes data from annual reports only (and not LE survey).
Source: Company Annual Reports and LE calculations.

Table A.3: Total gross investment by country in the Mobile Telephony sub-sector (€m, 2001 prices)

Country	2001	2002	2003	2004
Belgium	441	466	308	291
Czech Republic	502	358	319	310
Denmark	940	869	504	1027
Germany	3470	3004	2591	2671
Estonia	24	19	16	18
Greece	430	413	477	490
Spain	764	511	581	730
France	2117	1486	1643	2373
Ireland	313	249	218	349
Italy	3179	2661	2441	2916
Cyprus	0	0	39	43
Latvia	126	144	125	108
Lithuania	41	24	24	32
Luxembourg	106	93	112	111
Hungary	347	315	305	301
Malta	16	16	12	12
Netherlands	1839	948	904	1024
Austria	413	252	266	248
Poland	725	622	477	608
Portugal	150	140	167	150
Slovenia	92	69	75	119
Slovak Republic	111	214	150	124
Finland	435	280	234	233
Sweden	320	234	304	367
United Kingdom	4049	3564	2525	2504
Total (annual reports)*	20949 (21001)	16953 (17027)	14816 (14871)	17161 (17161)

Note: * Includes data from annual reports only (and not LE survey).
Source: Company Annual Reports and LE calculations.

Table A.4: Total gross investment by country in the CaTV sub-sector (€m, 2001 prices)

Country	2001	2002	2003	2004
Belgium	61	45	57	6
Czech Republic	42	7	7	14
Denmark	32	30	103	134
Germany	0	13	49	97
Estonia	3	1	2	5
Greece	0	0	0	0
Spain	195	198	80	129
France	145	35	1	36
Ireland	14	0	0	0
Italy	0	0	0	0
Cyprus	0	0	0	0
Latvia	1	0	0	2
Lithuania	0	0	0	0
Luxembourg	2	2	3	2
Hungary	100	49	45	48
Malta	8	0	0	0
Netherlands	793	318	269	351
Austria	62	21	21	25
Poland	123	46	158	58
Portugal	10	2	9	3
Slovenia	3	4	8	7
Slovak Republic	37	12	11	12
Finland	48	18	101	104
Sweden	95	44	24	49
United Kingdom	651	565	326	228
Total (annual reports)*	2424 (2586)	1410 (1571)	1275 (1296)	1310 (1311)

Note: * Includes data from annual reports only (and not LE survey). IDC (2002) reports that 'there is very little CATV in Italy, and what exists is provided by Stream'. Stream merged with Telepiu in July 2003, forming SKY Italia, which then closed down the cable network in February 2004 (Screen Digest, http://www.screendigest.com/reports/edptvp0 4/italy/edptvp04_12_2/view .

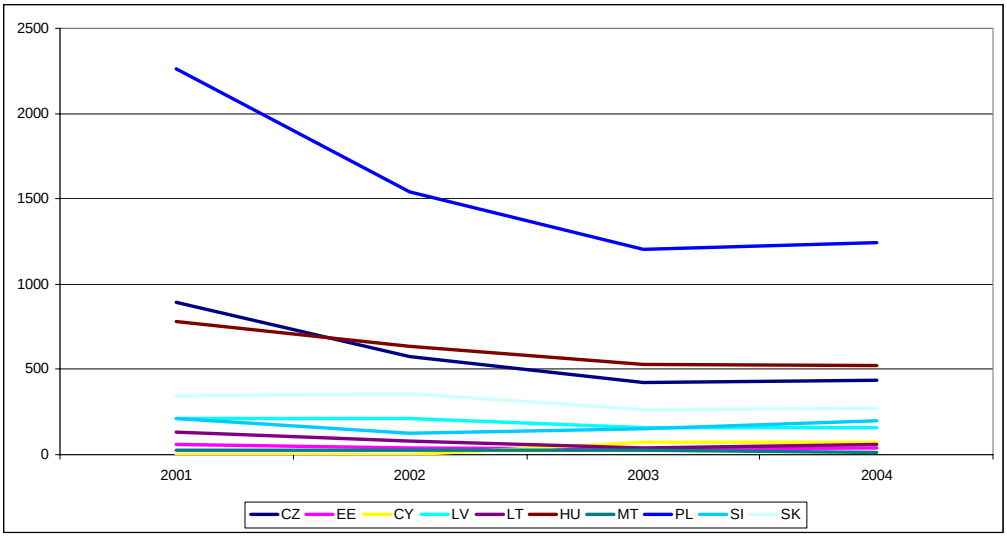
Source: Company Annual Reports and LE calculations.

Table A.5: Total gross investment by country in the Broadcast† sub-sector (€m, 2001 prices)

Country	2001	2002	2003	2004
Belgium	79	79	75	75
Czech Republic	18	0	0	0
Denmark	0	0	1	1
Germany	32	25	31	86
Estonia	0	0	0	0
Greece	5	0	0	9
Spain	0	0	26	61
France	392	379	300	295
Ireland	30	20	9	12
Italy	1	0	71	13
Cyprus	0	0	0	0
Latvia	0	0	0	0
Lithuania	2	5	2	4
Luxembourg	0	0	0	0
Hungary	44	21	16	21
Malta	0	0	0	0
Netherlands	14	19	6	14
Austria	70	49	45	45
Poland	31	22	15	17
Portugal	0	0	0	0
Slovenia	0	0	0	0
Slovak Republic	0	0	0	0
Finland	0	0	0	0
Sweden	205	29	24	188
United Kingdom	301	156	142	64
Satellite	758	723	464	1280
Total (annual reports)*	2465 (1250)	1753 (831)	1415 (766)	2556 (908)

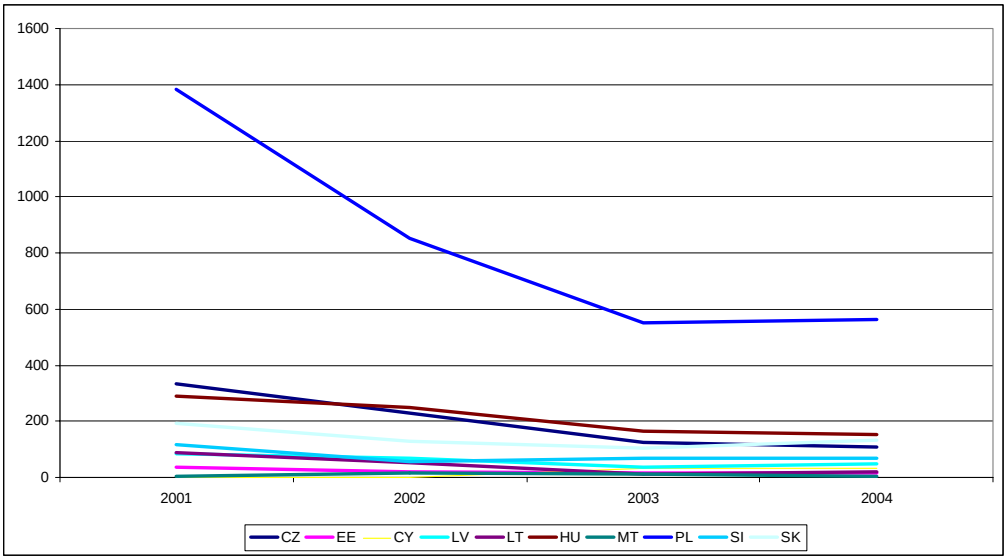
Note: * Includes data from annual reports only (and not LE survey). EC sources state that Estonia receives some terrestrial broadcasting from Finland, Malta from Italy, Slovenia from Croatia, and Slovakia from Hungary and the Czech Republic. † Including satellite broadcasting data.
Source: Company Annual Reports and LE calculations.

Figure A.1: Total gross investment by NMS in the e-communications sector (€m, 2001 prices)



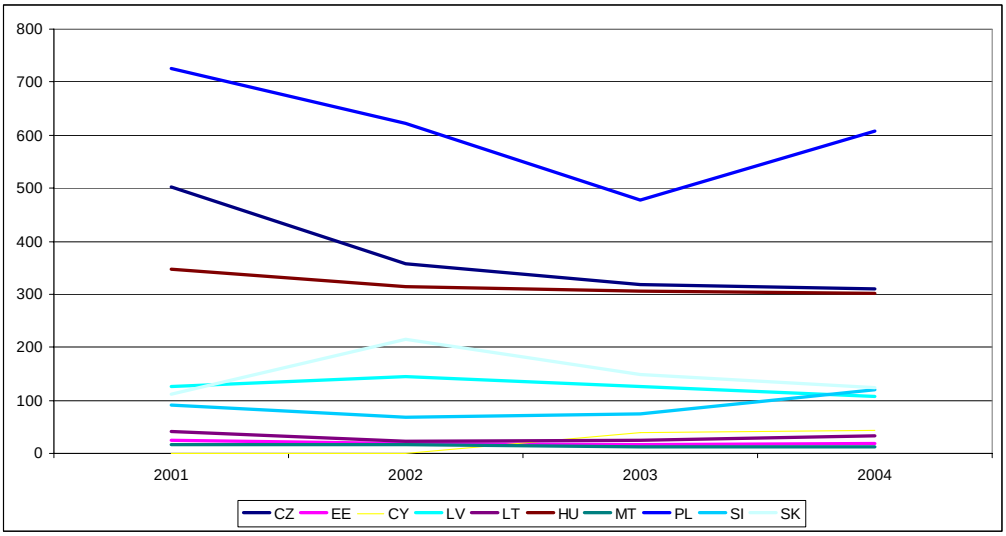
Source: Company Annual Reports and LE calculations.

Figure A.2: Total gross investment by NMS in the fixed telephony sub-sector (€m, 2001 prices)



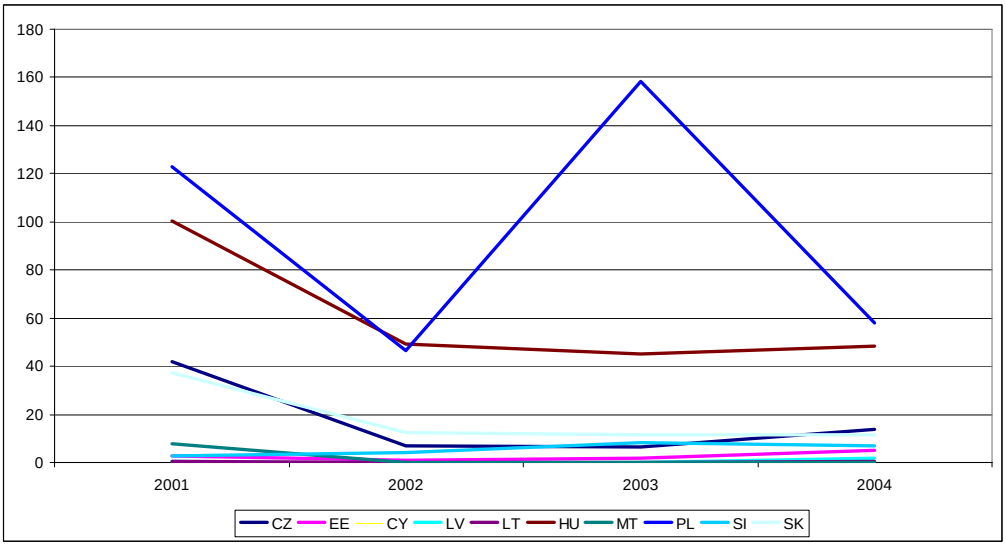
Source: Company Annual Reports and LE calculations.

Figure A.3: Total gross investment by NMS in the mobile telephony sub-sector (€m, 2001 prices)



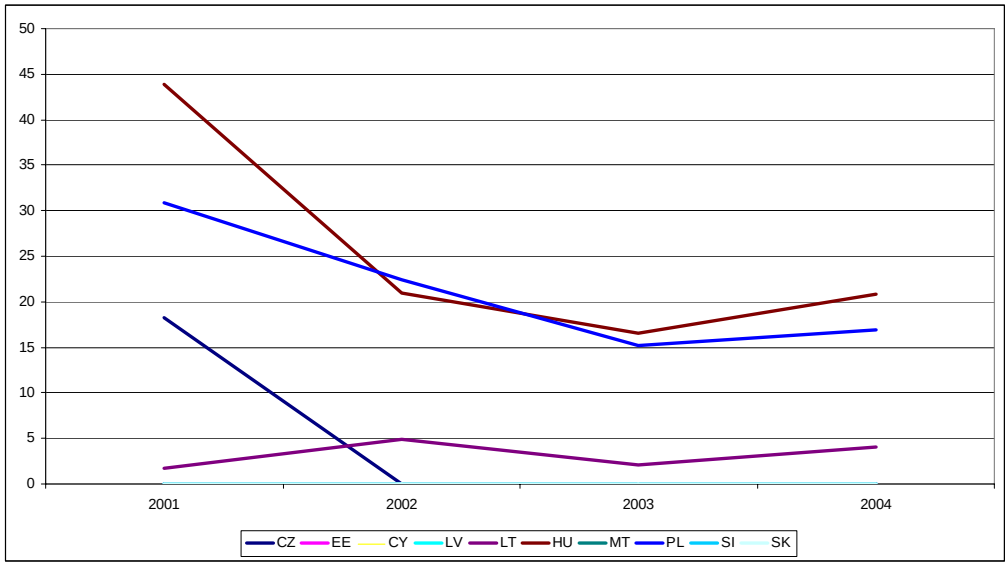
Source: Company Annual Reports and LE calculations.

Figure A.4: Total gross investment by NMS in the CaTV sub-sector (€m, 2001 prices)



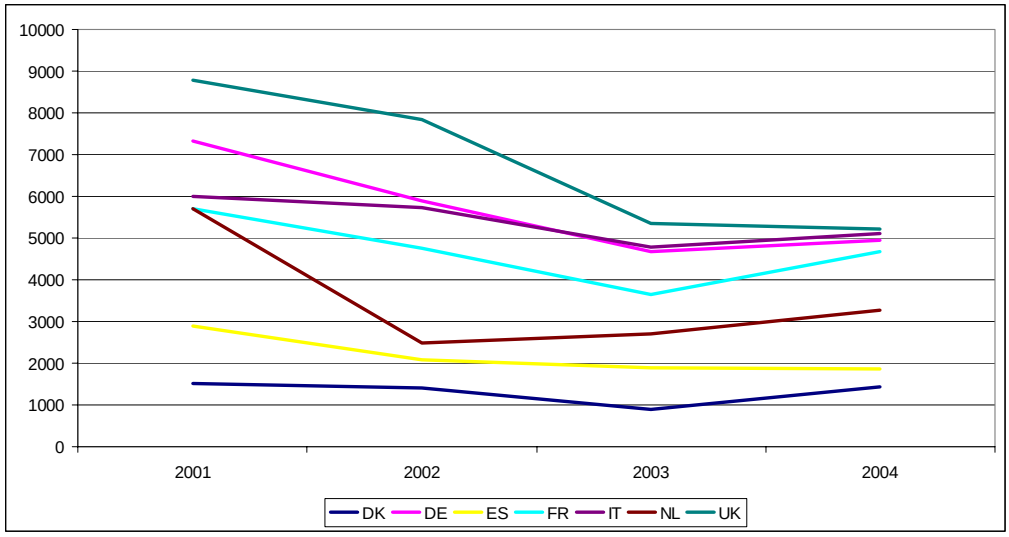
Source: Company Annual Reports and LE calculations.

Figure A.5: Total gross investment by NMS in the broadcast sub-sector (€m, 2001 prices)



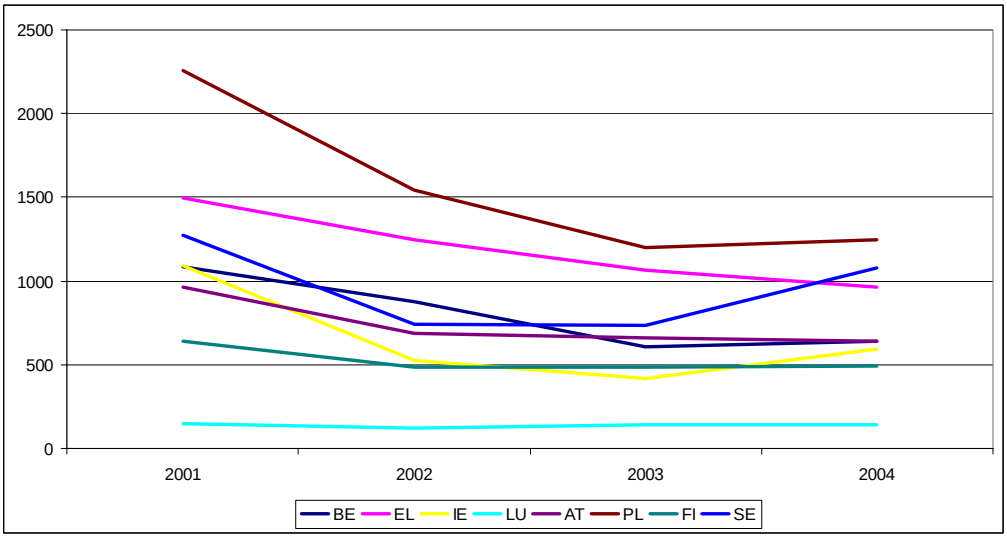
Source: Company Annual Reports and LE calculations.

Figure A.6: Total gross investment by EU15 in the e-communications sector. High investment countries (€m, 2001 prices)



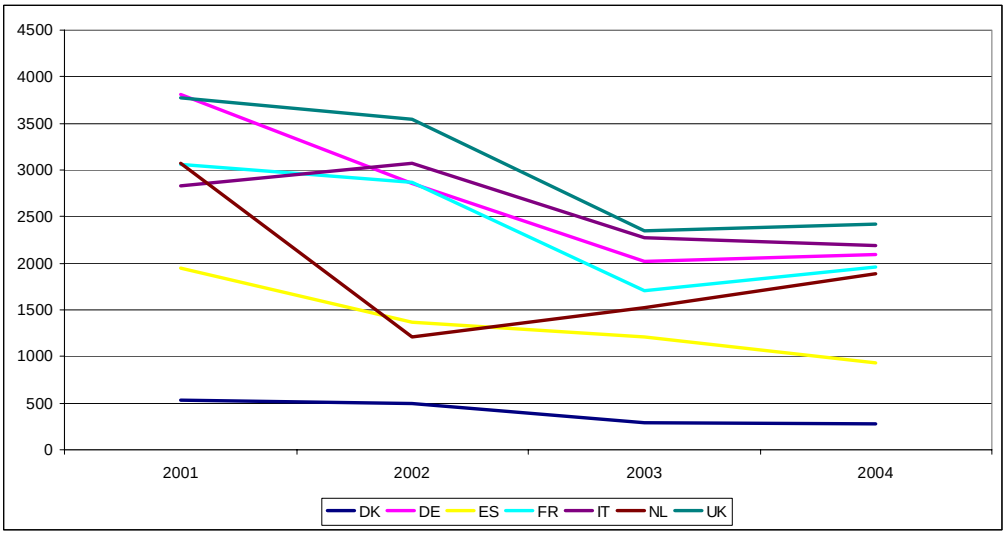
Source: Company Annual Reports and LE calculations.

Figure A.7: Total gross investment by EU15 in the e-communications sector. Low investment countries (€m, 2001 prices)



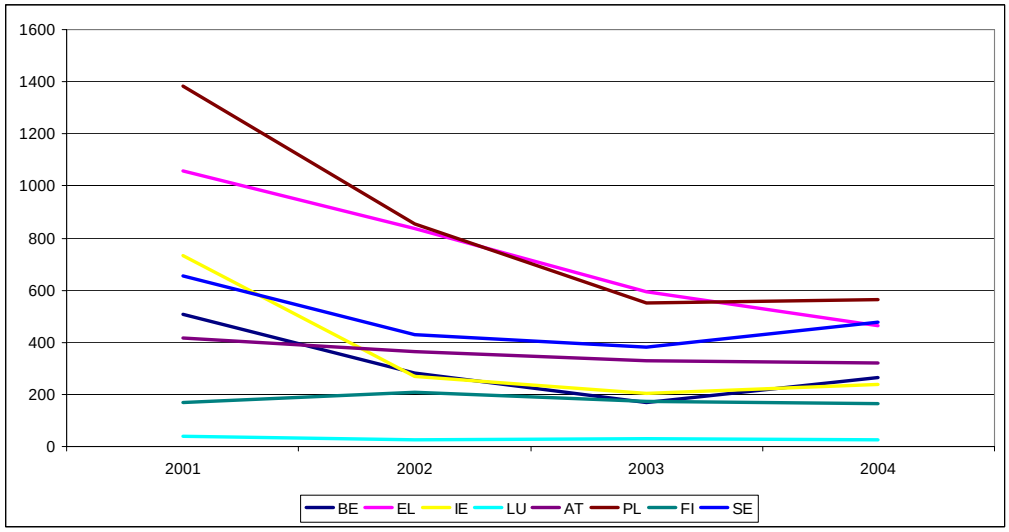
Source: Company Annual Reports and LE calculations.

Figure A.8: Total gross investment by EU15 countries in the fixed telephony sub-sector. High investment countries (€m, 2001 prices)



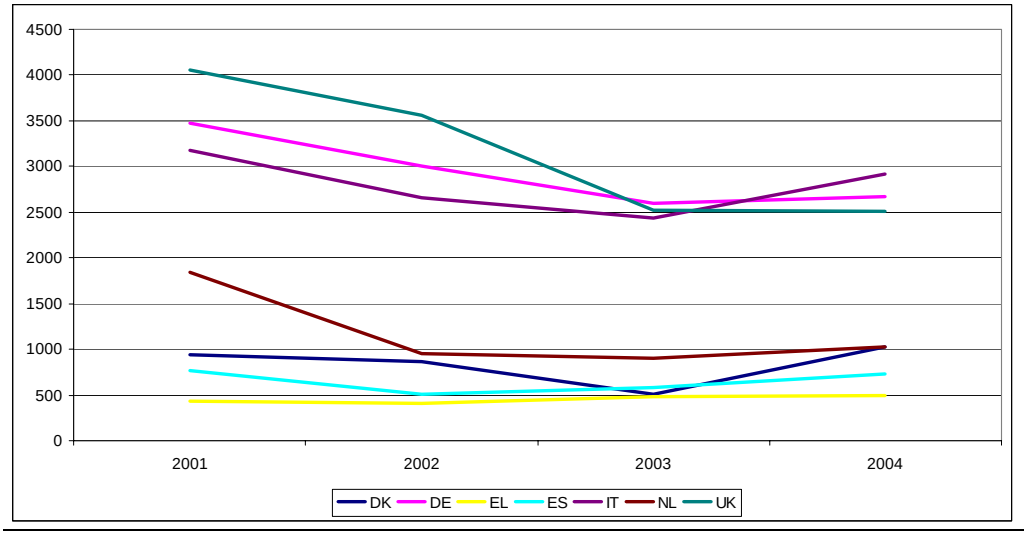
Source: Company Annual Reports and LE calculations.

Figure A.9: Total gross investment by EU15 countries in the fixed telephony sub-sector. Low investment countries (€m, 2001 prices)



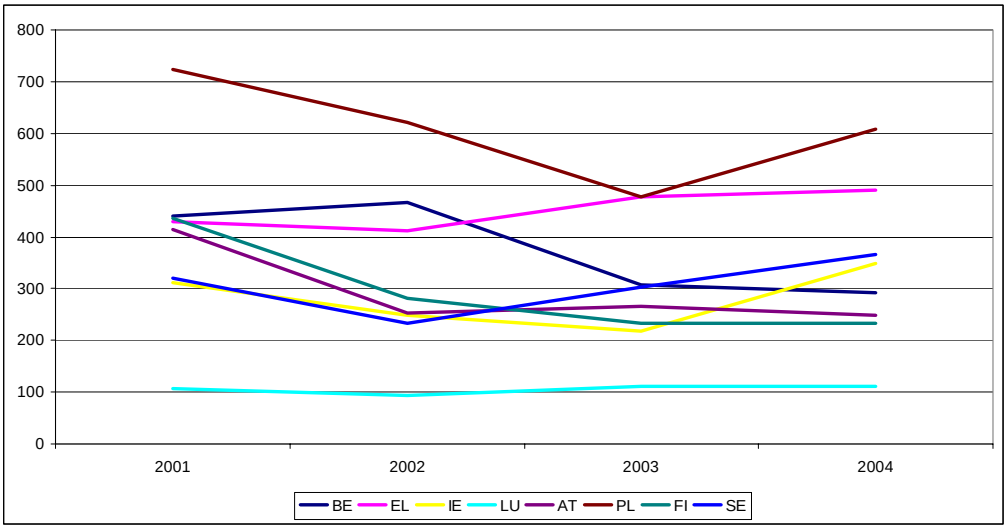
Source: Company Annual Reports and LE calculations.

Figure A.10: Total gross investment by EU15 countries in the mobile telephony sub-sector. High investment countries (€m, 2001 prices)



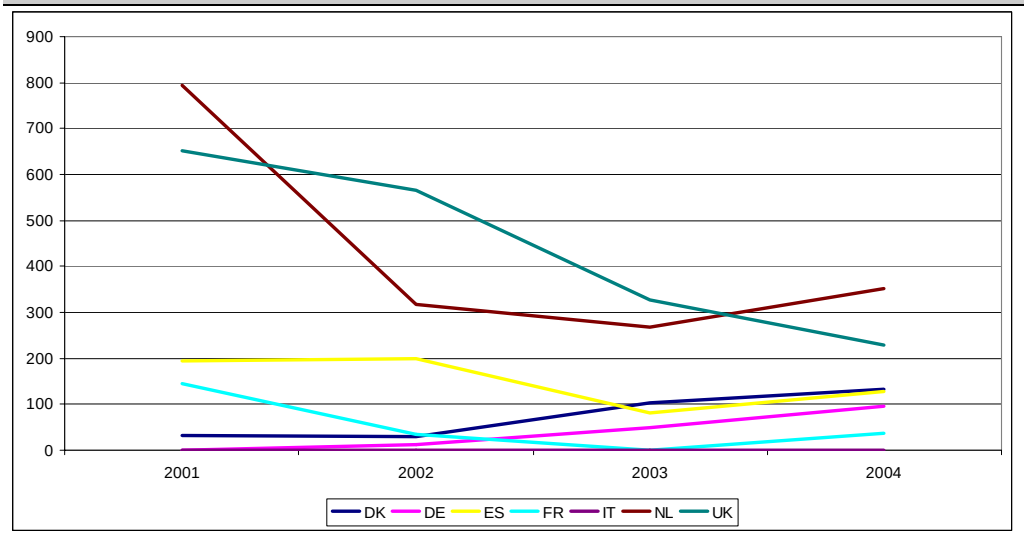
Source: Company Annual Reports and LE calculations.

Figure A.11: Total gross investment by EU15 countries in the mobile telephony sub-sector. Low investment countries (€m, 2001 prices)



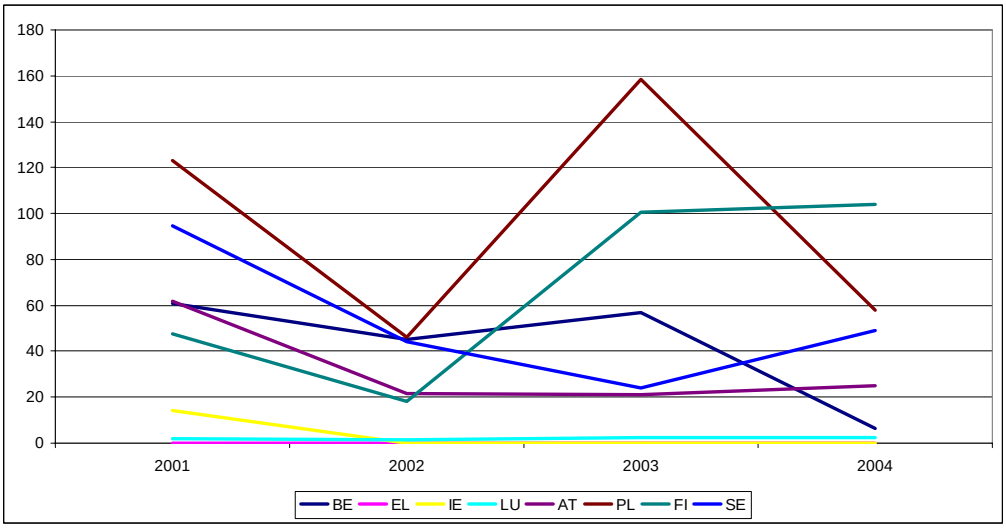
Source: Company Annual Reports and LE calculations.

Figure A.12: Total gross investment by EU15 countries in the CaTV sub-sector. High investment countries (€m, 2001 prices)



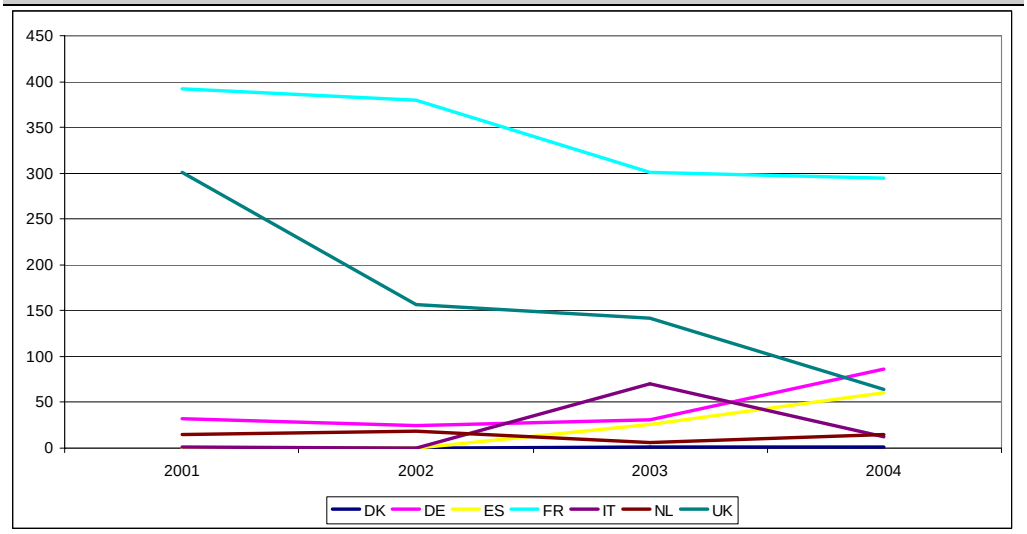
Source: Company Annual Reports and LE calculations.

Figure A.13: Total gross investment by EU15 countries in the CaTV sub-sector. Low investment countries (€m, 2001 prices)



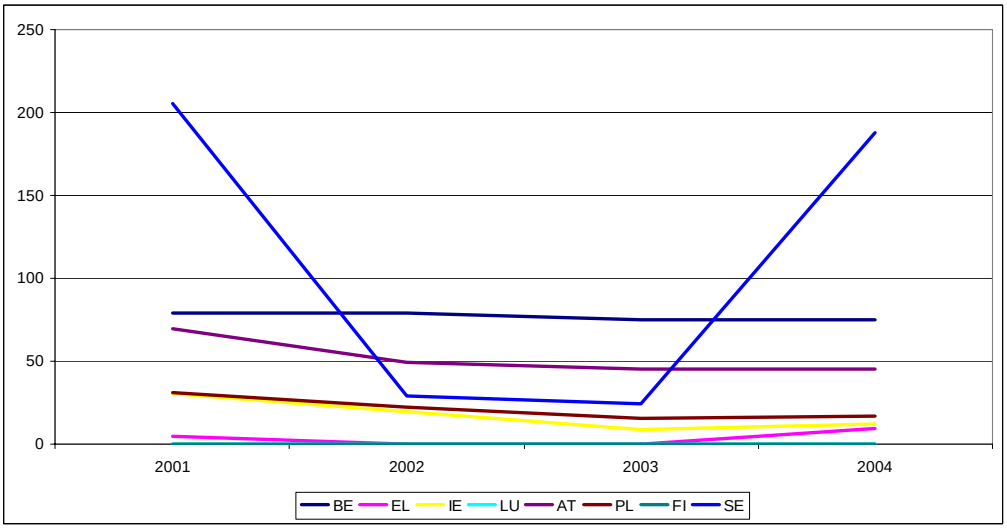
Source: Company Annual Reports and LE calculations.

Figure A.14: Total gross investment by EU15 countries in the broadcast sub-sector. High investment countries (€m, 2001 prices)



Source: Company Annual Reports and LE calculations.

Figure A.15: Total gross investment by EU15 countries in the broadcast sub-sector. Low investment countries (€m, 2001 prices)



Source: Company Annual Reports and LE calculations.

Belgium

In Belgium, data collected in the survey have been used for the incumbent fixed operator, Belgacom, and the three mobile operators: BASE, Mobistar and Vodafone. Figures for fixed telephony operator Scarlet have been calculated by weighting investment figures for the group using shares of net sales in each area of business. Likewise for fixed operator Versatel, additions to tangible fixed assets in all of the countries in which the company operates have been weighted by shares of revenue to give data for individual countries. Figures for UPC's fixed and cable operations have been calculated by weighting cash flow capital expenditures by subscriber numbers[78], a method used for all UPC data presented here. Data for the remaining market players have been collected from Amadeus.[79]

[78] It should be noted that UPC operates in many of the EU25 countries, and is owned by the US company Liberty Global. Liberty Global don't disaggregate investments in tangible and intangible assets, so data include investments in intangible fixed assets.

[79] No data were reported for CaTV operator Telenet in 2003 and 2004, and similarly for broadcaster RTBF in 2001 and 2002. These values have been extrapolated.

Table A.6: Detailed methodology of data collection for Belgium

Country	Sub-sector	Company	Methodology	Comments
BE	Fixed	Belgacom	Additions to tangible fixed assets.	Survey data.
BE	Fixed	Colt Telecom	Change in balance sheet tangible fixed assets.	Data from Amadeus.
BE	Fixed	Scarlet (KPN)	Additions to property, plant and equipment, weighted by shares of net sales in each business area.	
BE	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
BE	Fixed	Telenet	Change in balance sheet tangible fixed assets.	Data from Amadeus.
BE	Fixed	Versatel	Additions to tangible assets, weighted by shares of revenue in each country.	
BE	Mobile	BASE (KPN)	Additions to tangible fixed assets.	Survey data.
BE	Mobile	Mobistar (Orange)	Additions to tangible fixed assets.	Survey data.
BE	Mobile	Vodafone (Proximus)	Additions to tangible fixed assets.	Survey data.
BE	CaTV	Coditel	Change in balance sheet tangible fixed assets.	Data from Amadeus.
BE	CaTV	Telenet	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2003 and 2004.
BE	CaTV	UPC Belgium	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
BE	CaTV	Interelectra	Additions to tangible fixed assets.	Survey data.
BE	Broadcast	VRT	Additions to tangible fixed assets.	Survey data.
BE	Broadcast	RTBF	Change in balance sheet tangible fixed assets.	Data from Amadeus. Publicly funded. No data for 2001 and 2002.

Czech Republic

In the Czech Republic, data for the fixed telephony incumbent, Cesky Telecom have been calculated from total group purchases of property, plant and equipment, and split up by weighting using shares of revenue from different business areas. Similarly for T-Mobile, current asset additions have been weighted by the share of total capital expenditure in each country and sub-sector. No data for GTS were available in 2004, survey data were used for mobile operator Eurotel, and of the data collected from Amadeus, figures for 2004 were not yet available and have been extrapolated on the basis of previous values.

Table A.7: Detailed methodology of data collection for Czech Republic

Country	Sub-sector	Company	Methodology	Comments
CZ	Fixed	Cesky Telecom	Purchases of property, plant and equipment, weighted by shares of revenue from sub-sectors.	
CZ	Fixed	eTel	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2004.
CZ	Fixed	GTS	Cash outflows from capital expenditure on tangible fixed assets.	No data for 2004.
CZ	Fixed	Contactel	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2004.
CZ	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
CZ	Mobile	T-Mobile	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
CZ	Mobile	Eurotel	Additions to tangible fixed assets.	Survey data.
CZ	Mobile	Oskar Vodafone	Additions to tangible fixed assets.	
CZ	CaTV	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
CZ	CaTV	Karneval	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2004.
CZ	Broadcast	České radiokom unikace	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2004.
CZ	Broadcast	Ceska Televize	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2004.

Denmark

In Denmark, survey data have been used for the fixed incumbent, TDC, and its operations in the mobile and CaTV sub-sectors, as well as for Telia and Orange in the mobile sub-sector. Figures on additions to tangible assets for Sonofon required weighting by the share of group revenues generated in the mobile sub-sector, as did those for Telia in the CaTV market. Data for Tele2 and Broadcast Service Denmark have been gathered from Amadeus, although no data were available for Broadcast Service Denmark in 2001.

Table A.8: Detailed methodology of data collection for Denmark

Country	Sub-sector	Company	Methodology	Comments
DK	Fixed	TDC	Additions to tangible fixed assets.	Survey data.
DK	Fixed	Tele2	Change in balance sheet tangible fixed assets.	Data from Amadeus.
DK	Fixed	Telia Denmark	Investment in PPE.	
DK	Mobile	Orange	Additions to tangible fixed assets.	Survey data.
DK	Mobile	Sonofon	Additions to PPE weighted by share of revenues from mobile sub-sector.	
DK	Mobile	TDC Mobile	Additions to tangible fixed assets.	Survey data.
DK	Mobile	Telia	Additions to tangible fixed assets.	Survey data.
DK	CaTV	TDC Kabel	Additions to tangible fixed assets.	Survey data.
DK	CaTV	Telia Stofa	Investment in PPE weighted by country and sub-sector share of revenues.	No investment figures for 2001 and 2002.
DK	Broadcast	Broadcast Service Denmark	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2001.

Germany

In Germany, only data on total current asset additions are available for the Deutsche Telecom group. Country and sub-sector figures have been calculated using the share of capital expenditure in each sub-sector and country relative to the total capital expenditure. [80] In a similar manner, figures for E-Plus have been extracted from the accounts of the KPN group using sales figures to weight the shares of total additions[81], and likewise for Versatel using shares of revenue. Investment figures for O2 have been disaggregated by weighting by the shares of turnover in different countries[82]. Survey data have been used for Arcor, Vodafone, and T-Systems in the fixed, mobile and broadcast sub-sectors respectively. Amadeus provided figures for the fixed operators Freenet and Envia Tel. No data were available for Kabel Deutschland in 2001 and 2002 because no annual reports were available, or for Unity Media in 2001.[83]

[80] This method was not possible for 2001 due to a lack of data, so 2002 figures are used to weight.

[81] Again, this method was not possible for 2001 due to a lack of data, so 2002 figures are used to weight.

[82] O2 data for 2001 have been taken from the BT annual report. BT demerged its mobile arm in May 2002.

[83] In addition, no data were available for Kabel BW, which is owned by the private equity firm Blackstone

Table A.9: Detailed methodology of data collection for Germany

Country	Sub-sector	Company	Methodology	Comments
DE	Fixed	Deutsche Telekom	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
DE	Fixed	Arcor	Additions to tangible fixed assets.	Survey data.
DE	Fixed	Versatel	Additions to tangible assets, weighted by revenues in each country.	
DE	Fixed	Freenet	Change in balance sheet tangible fixed assets.	Data from Amadeus.
DE	Fixed	Envia Tel	Change in balance sheet tangible fixed assets.	Data from Amadeus.
DE	Mobile	T-Mobile	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
DE	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
DE	Mobile	E-Plus	Additions to property, plant and equipment, weighted by shares of net sales in each business area.	
DE	Mobile	O2	Purchases of tangible fixed assets, weighted by share of turnover in countries of operation.	2001 figure taken from BT Annual Report (BT demerged its wireless business in May 2002).
DE	CaTV	Kabel BW	No data.	Owned by private equity firm Blackstone Group, no reports published.
DE	CaTV	Kabel Deutschland	Cash paid for investments in property and equipment.	No data for 2001 or 2002 (reports not available).
DE	CaTV	Unity Media	Additions to tangible assets.	No data for 2001.
DE	Broadcast	T-Systems	Additions to tangible fixed assets.	Survey data.

Estonia

In Estonia the total purchases of property, plant and equipment of the Eesti Telecom group are split by shares of revenue to represent investment by Elion in the fixed sub-sector and EMT in the mobile sub-sector. No data are available for Tele2, because the data are not available from annual reports, and although data are available on Amadeus, no reliable method can be used to split the investment figures between sub-sectors. Amadeus does provide

Group, and doesn't publish reports.

data for Elisa and Starman, but no figures are available for STC Cable or Levira.

Table A.10: Detailed methodology of data collection for Estonia

Country	Sub-sector	Company	Methodology	Comments
EE	Fixed	Elion	Purchases of property, plant and equipment weighted by shares of revenue.	
EE	Fixed	Tele2	No data.	No way to split Amadeus data between sub-sectors.
EE	Mobile	EMT	Purchases of property, plant and equipment weighted by shares of revenue.	
EE	Mobile	Tele2	No data.	No way to split Amadeus data between sub-sectors.
EE	Mobile	Elisa	Change in balance sheet tangible fixed assets.	Data from Amadeus.
EE	CaTV	Starman	Change in balance sheet tangible fixed assets.	Data from Amadeus.
EE	CaTV	STC Cable	No data.	Can't find on Amadeus.
EE	CaTV	Tele2	No data.	No way to split Amadeus data between sub-sectors.
EE	Broadcast	Levira	No data.	Part public owned, no reports, not on Amadeus.

Greece

In Greece data for the fixed incumbent OTE and its mobile subsidiary Cosmote have been separated by weighting capital expenditures on tangible fixed assets using the share of revenues from each firm. The same method has also been applied to data for fixed entrant Lan Net. Amadeus provided data for Forthnet and Hellas On Line in the fixed sub-sector, and for the broadcaster ERT. Vodafone-Panafon provided survey data, but no figures are available for Q-Telecom, which was recently bought by TIM.

Table A.11: Detailed methodology of data collection for Greece

Country	Sub-sector	Company	Methodology	Comments
EL	Fixed	OTE	Capital expenditures on tangible assets, weighted by shares of revenues in each sub-sector.	Part state owned.
EL	Fixed	Forthnet	Change in balance sheet tangible fixed assets.	Data from Amadeus.
EL	Fixed	Hellas On Line	Change in balance sheet tangible fixed assets.	Data from Amadeus.
EL	Fixed	Lan Net	Purchases of tangible fixed assets, weighted by share of revenue.	
EL	Fixed	Newspho ne	Cash outflows from expenditure on tangible fixed assets.	
EL	Mobile	Cosmote	Capital expenditures on tangible assets, weighted by shares of revenues in each sub-sector.	Part state owned.
EL	Mobile	Q-Telecom	No data.	Bought by TIM in Oct 2005, no reports available. Not on Amadeus.
EL	Mobile	TIM	Cash flows used on tangible capital expenditure.	
EL	Mobile	Vodafone-Panafon	Additions to tangible fixed assets.	Survey data.
EL	CaTV			
EL	Broadcast	ERT	Change in balance sheet tangible fixed assets.	Data from Amadeus. Publicly funded.

Spain

Survey data have been used for Spain's Telefónica in the fixed and mobile sub-sectors, and Vodafone in the mobile sub-sector. Splitting aggregate figures using weights was necessary for Auna in the fixed sub-sector, where shares of customer numbers are used, and ONO in the CaTV sub-sector, where shares of revenues are used. No data were available either for Amena or Aunacable, which have both been subject to recent takeovers, or for Abertis in 2001 or 2002 for the same reason. Data for Euskaltel, Jazztel and Tenaria have been collected from Amadeus, but no figures were available for Axion.[84]

[84] Axion is owned by TDF, which is in turn owned by private equity firms.

Table A.12: Detailed methodology of data collection for Spain

Country	Sub-sector	Company	Methodology	Comments
ES	Fixed	Telefónica	Additions to tangible fixed assets.	Survey data.
ES	Fixed	Auna (Ono)	Additions to tangible fixed assets weighted by share of customer numbers.	
ES	Fixed	Euskaltel	Change in balance sheet tangible fixed assets.	Data from Amadeus.
ES	Fixed	Jazztel	Change in balance sheet tangible fixed assets.	Data from Amadeus.
ES	Fixed	Tenaria	Change in balance sheet tangible fixed assets.	Data from Amadeus.
ES	Mobile	Telefónica	Additions to tangible fixed assets.	Survey data.
ES	Mobile	Amena	No data.	Bought by France Telecom in July 2005, no Annual Reports available.
ES	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
ES	CaTV	Aunacable	No data.	Auna bought by ONO in Nov 2005, no reports.
ES	CaTV	ONO	Additions to tangible assets, weighted by shares of revenues from each sub-sector.	
ES	CaTV	Mundo-R	Change in stock of accumulated investment.	
ES	Broadcast	Abertis	Increase in fixed assets (excluding highways), weighted by revenues from each area of business.	No data for 2001 and 2002 (Abertis bought Retevision in April 2003).
ES	Broadcast	Axion		Part of TDF, see below TDF.

France

Survey data have been used in France for France Telecom in the fixed sub-sector, and Orange and Bouygues in the mobile sub-sector. Splitting up group investment data by weighting is necessary for Tiscali (using shares of revenues), Vodafone SFR (also using shares of revenues), NC Numericable (using shares of revenue and subscriber numbers) and Towercast (using shares of turnover). Data from Amadeus have been used for Neuf Telecom and Colt Telecom in the fixed sub-sector, and Est Video, Valvision and Paris Cable in the CaTV sub-sector. No data are available for TDF, which is owned by private equity firms.

Table A.13: Detailed methodology of data collection for France

Country	Sub-sector	Company	Methodology	Comments
FR	Fixed	France Telecom	Additions to tangible fixed assets.	Survey data.
FR	Fixed	Neuf Telecom	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FR	Fixed	Iliad	Cash flows used by investing activities.	
FR	Fixed	Colt Telecom	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FR	Fixed	Tiscali	Additions to tangible fixed assets, weighted by share of revenues in France.	
FR	Mobile	Orange	Additions to tangible fixed assets.	Survey data.
FR	Mobile	Bouygues	Additions to tangible fixed assets.	Survey data.
FR	Mobile	Vodafone (SFR)	Additions to tangible fixed assets, weighted by shares of revenue from each area of business.	
FR	CaTV	Est Video	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FR	CaTV	NC Numericable	Additions to property, plant and equipment weighted by shares of cable revenue, then subscriber numbers.	No 2001 revenue data, 2002 used.
FR	CaTV	Noos (UPC)	Cash flow capital expenditures	Includes intangibles, UPC is part of Liberty Global.
FR	CaTV	Valvision	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FR	CaTV	Paris Cable	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FR	Broadcast	TDF	No data.	Owned by private equity firms, no reports available.
FR	Broadcast	Towercast	Purchase of fixed assets, weighted by share of turnover from broadcasting sub-sector.	

Ireland

In Ireland, data for the fixed incumbent, Eircom, are missing for 2003, so an average of additions to tangible fixed assets in 2002 and 2004 has been used. Amadeus data have been used in the cases of Esat, Colt Telecom, Energis, Meteor and NTL[85]. In the mobile sub-sector, survey data have been used for Vodafone, and for O2 tangible fixed asset additions for the group have been

[85] Data for NTL include some investments in fixed and broadband networks.

weighted by the share of group revenues generated in Ireland[86]. Data for CaTV operators Chorus and Crossan Cable are not available.

Table A.14: Detailed methodology of data collection for Ireland

Country	Sub-sector	Company	Methodology	Comments
IE	Fixed	Eircom	Additions to tangible assets.	2003 data missing, average of 2002 and 2004 used.
IE	Fixed	Esat	Change in balance sheet tangible fixed assets.	Data from Amadeus.
IE	Fixed	Colt Telecom	Change in balance sheet tangible fixed assets.	Data from Amadeus.
IE	Fixed	Energis	Change in balance sheet tangible fixed assets.	Data from Amadeus.
IE	Mobile	Meteor	Change in balance sheet tangible fixed assets.	Data from Amadeus.
IE	Mobile	O2	Tangible fixed asset additions, weighted by share of group revenue.	No capital expenditure data available for 2001, so 2002 used.
IE	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
IE	CaTV	NTL	Change in balance sheet tangible fixed assets.	Data from Amadeus. Includes fixed and broadband operations.
IE	CaTV	Chorus	No data.	Reports not available on Amadeus.
IE	CaTV	Crossan Cable	No data.	Reports not available on Amadeus.
IE	Broadcast	RTE	Additions to tangible fixed assets.	Publicly owned.

Italy

Telecom Italia total group additions to tangible fixed assets are weighted by the share of industrial investments in their fixed and mobile operations to get figures at a sub-sector level. Similarly, Wind sub-sector figures are calculated using total investments in tangible fixed assets and weighting them by revenues shares generated in fixed and mobile telephony.[87] Figures for broadcaster RAI Way are presented grouped for the total of the company's broadcasting operations. Figures for increases in tangible fixed assets in broadcasting are separated from their other operations using shares of total capital expenditure on broadcasting as weights.[88] Data from Amadeus have

[86] No capital expenditure data were available for 2001, so 2002 data have been used.

[87] No revenue figures were available for 2001, so 2002 numbers are used to construct the weights.

[88] Data for RAI Way in 2001 were not available and have been extrapolated.

been used for Tele2 and Elettronica Industriale, and survey data used for Vodafone. No data are available for 3, part of the Hutchinson Whampoa group, which provides no way to break down total investment figures.

Table A.15: Detailed methodology of data collection for Italy

Country	Sub-sector	Company	Methodology	Comments
IT	Fixed	Telecom Italia	Additions to fixed assets weighted by shares of industrial investments in sub-sectors.	
IT	Fixed	Wind	Investments and capitalisation of tangible fixed assets, weighted by share of revenues from sub-sectors.	No revenues data for 2001, so 2002 figures used.
IT	Fixed	Tiscali	Additions to tangible fixed assets, weighted by share of revenues in Italy	
IT	Fixed	Tele2	Change in balance sheet tangible fixed assets.	Data from Amadeus.
IT	Fixed	Fastweb	Cash flows used in investing activities.	
IT	Mobile	TIM	Additions to fixed assets weighted by shares of industrial investments in sub-sectors.	
IT	Mobile	Wind	Investments and capitalisation of tangible fixed assets, weighted by share of revenues from sub-sectors.	No revenues data for 2001, so 2002 figures used.
IT	Mobile	3	No data.	3 is owned by Hutchinson Whampoa, no weightings available.
IT	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data
IT	CaTV*	-	-	See note below.
IT	Broadcast	RAI Way	Additions to tangible fixed assets, weighted by share of capital expenditure in broadcasting sub-sector.	No 2001 data.
IT	Broadcast	Elettronica Industriale	Change in balance sheet tangible fixed assets.	Data from Amadeus.

Note: * IDC (2002) reports that 'there is very little CATV in Italy, and what exists is provided by Stream'. Stream merged with Telepiu in July 2003, forming SKY Italia, which then closed down the cable network in February 2004 (Screen Digest, http://www.screendigest.com/reports/edptvp04/italy/edptvp04_12_2/view).

Cyprus

Investment data for the fixed and mobile incumbent CYTA in Cyprus have been separated using weights constructed from the shares of operating revenues in each sub-sector. No data are available for Areeba, which is owned by Investcom Holdings, and, similarly it has not been possible to get

data either from annual reports or Amadeus for Lumiere TV, TV O Logos or Sigma TV in the CaTV sub-sector, or the Cyprus Broadcasting Corporation.

Table A.16: Detailed methodology of data collection for Cyprus

Country	Sub-sector	Company	Methodology	Comments
CY	Fixed	CYTA	Additions to fixed assets, weighted by shares of operating revenues.	No data for 2001 or 2002.
CY	Mobile	CYTA	Additions to fixed assets, weighted by shares of operating revenues.	No data for 2001 or 2002.
CY	Mobile	Areeba	No data.	Owned by Investcom holdings, not on Amadeus.
CY	CaTV	Lumiere TV	No data.	Reports not available on Amadeus.
CY	CaTV	TV O Logos	No data.	Part of Greek group Mega Channel.
CY	CaTV	Sigma TV	No data.	Reports not available on Amadeus.
CY	Broadcast	Cyprus Broadcasting Corporation	No data.	Reports not available on Amadeus.

Latvia

Data for the Latvian fixed telephony incumbent, Lattelecom, have been calculated by weighting purchases of property, plant and equipment by the share of revenues generated in the fixed sub-sector. Amadeus has provided data for Telekom Baltija, Telekomunikaciju grupa, Tele2, Baltkom and FAO, while survey data are used in the case of mobile operator LMT. It has not proven possible to source data for Telia Multkom or the broadcaster LVRTC.

Table A.17: Detailed methodology of data collection for Latvia

Country	Sub-sector	Company	Methodology	Comments
LV	Fixed	Latteleko m	Purchases of property, plant and equipment, weighted by shares of revenues.	
LV	Fixed	Telekom Baltija	Change in balance sheet tangible fixed assets.	Data from Amadeus.
LV	Fixed	Telekomu nikaciju grupa	Change in balance sheet tangible fixed assets.	Data from Amadeus.
LV	Fixed	CSC Telekom	No data.	Reports not available on Amadeus.
LV	Mobile	Tele2	Change in balance sheet tangible fixed assets	Data from Amadeus.
LV	Mobile	LMT	Additions to tangible fixed assets.	Survey data.
LV	Mobile	Bite	Investments into mobile network	
LV	CaTV	Telia Multcom	No data.	Reports not available on Amadeus.
LV	CaTV	Baltkom	Change in balance sheet tangible fixed assets.	Data from Amadeus.
LV	CaTV	FAO	Change in balance sheet tangible fixed assets.	Data from Amadeus.
LV	Broadcast	LVRTC	No data.	Reports not available on Amadeus.

Lithuania

Survey data have been used in Lithuania for Lietuvos Telekomas, Balticum TV and LRTC. For mobile operator Omnitel a figure has been reached by weighting total investment in property, plant and equipment by the share of total revenues generated in that business area. Reports for fellow mobile operator Bite are not available, and nor were data present on Amadeus.

Table A.18: Detailed methodology of data collection for Lithuania

Country	Sub-sector	Company	Methodology	Comments
LT	Fixed	Lietuvos Telekomas	Additions to tangible fixed assets.	Survey data.
LT	Mobile	Bite	No data.	Reports not available on Amadeus.
LT	Mobile	Omnitel	Total PPE investment, weighted by shares of revenues.	No weights available for 2001, so 2002 used.
LT	Mobile	Tele2	No data.	Reports not available on Amadeus.
LT	CaTV	Balticum TV	Additions to tangible fixed assets.	Survey data.
LT	Broadcast	LRTC	Additions to tangible fixed assets.	Survey data

Luxembourg

In Luxembourg, figures for the fixed incumbent, EPT, have been disaggregated by weighting additions to fixed capital by the shares of revenues generated in telecommunications, and then the number of customers in the fixed and mobile sub-sectors[89]. Similarly, data for Tele2 in the fixed sub-sector and Tango in the mobile sub-sector have been calculated using weights constructed from shares of revenues. In both these cases, no data were available for 2004, and figures have been extrapolated. Survey data have been used for Cegecom, but no data have been available for Codenet, Voxmobile, Coditel or Siemens.

[89] No investment data are available for 2003, so an average of the values in 2002 and 2004 has been used. No customer numbers are available for 2003 and 2004, so 2002 numbers have been used.

Table A.19: Detailed methodology of data collection for Luxembourg

Country	Sub-sector	Company	Methodology	Comments
LU	Fixed	EPT	Additions to fixed capital, weighted by shares of revenues in telecommunications and customer numbers in each sub-sector.	No investment data for 2003 available, so average of 2002 and 2004 used. No customer numbers for 2003 and 2004 available, so 2002 data used to weight.
LU	Fixed	Cegecom	Additions to tangible fixed assets.	Survey data.
LU	Fixed	Codenet	No data.	Reports not available on Amadeus.
LU	Fixed	Tele2	Investments in tangible assets weighted by revenues.	No data for 2004.
LU	Mobile	LuxGSM	Additions to fixed capital, weighted by shares of revenues in telecommunications and customer numbers in each sub-sector.	No investment data for 2003 available, so average of 2002 and 2004 used. No customer numbers for 2003 and 2004 available, so 2002 data used to weight.
LU	Mobile	Tango	Investments in tangible assets weighted by revenues.	No data for 2004.
LU	Mobile	Voxmobile	No data.	Reports not available on Amadeus.
LU	CaTV	Coditel	No data.	Reports not available on Amadeus.
LU	CaTV	Eltrona	Additions to tangible fixed assets.	Survey data.
LU	CaTV	Siemens	No data.	Reports not available on Amadeus.
LU	Broadcast			

Hungary

Magyar Telecom report their investment in tangible fixed assets at the group level, so revenue shares have been used to weight investment between their fixed and mobile divisions. Figures for Invitel[90], Hungarotel, Pannon[91] and broadcaster Antena Hungaria[92] are simple additions to tangible fixed assets, as these companies operate in only one sub-sector and country. No data were available for cable operators EMKTV or Fibernet. Data for Deutsche Telekom subsidiaries T-Mobile and T-Kabel have been constructed by weighting group additions to fixed assets by the share of capital expenditure in each country and sub-sector.

[90] Includes intangibles

[91] Includes intangibles and disposals

[92] Includes intangibles

Table A.20: Detailed methodology of data collection for Hungary

Country	Sub-sector	Company	Methodology	Comments
HU	Fixed	Magyar Telekom	Investment in tangible fixed assets, weighted by share of revenue.	
HU	Fixed	Invitel	Additions to fixed assets.	Includes intangibles.
HU	Fixed	Hungarotel	Additions to fixed tangible assets.	
HU	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles, UPC is part of Liberty Global.
HU	Mobile	T-Mobile	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
HU	Mobile	Pannon	Net cashflows from investment activities.	Includes disposals and intangibles.
HU	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
HU	CaTV	UPC	Cash flow capital expenditures.	Includes intangibles, UPC is part of Liberty Global.
HU	CaTV	EMKTV	No data.	Reports not available on Amadeus.
HU	CaTV	T-Kabel	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
HU	CaTV	FiberNet	No data.	
HU	Broadcast	Antenna Hungaria	Additions to fixed assets.	Includes intangibles.

Malta

In Malta it has not been possible to separate investments by the fixed and mobile incumbent operator Maltacom to represent investments in the sub-sectors. Data for Vodafone have been gathered from the survey, and the figures for cable provider Melita are from Amadeus.[93]

[93] No data are available for 2003 or 2004.

Table A.21: Detailed methodology of data collection for Malta

Country	Sub-sector	Company	Methodology	Comments
MT	Fixed	Maltacom	Additions to tangible assets. Includes Go Mobile as data are not separated.	
MT	Mobile	Go Mobile	Part of Maltacom, included in fixed data, see above.	
MT	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
MT	CaTV	Melita	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2003 or 2004.
MT	Broadcast			

Netherlands

The Dutch fixed and mobile operator, KPN, reports its figures at the group level, so shares of revenue from its operations in the different sub-sectors have been used to weight investments in tangible fixed assets. Figures for fixed operator Versatel are not available from annual reports, so changes in balance sheet assets from Amadeus are used instead. Survey data have been used for Orange, Vodafone, Essent, Casema, and Cai Westland.

Table A.22: Detailed methodology of data collection for the Netherlands

Country	Sub-sector	Company	Methodology	Comments
NL	Fixed	KPN	Investment in tangible fixed assets weighted by shares of revenue.	
NL	Fixed	Versatel	Change in balance sheet tangible fixed assets.	Data from Amadeus.
NL	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles, UPC is part of Liberty Global.
NL	Mobile	KPN Mobile	Investment in tangible fixed assets weighted by shares of revenue.	
NL	Mobile	Orange	Additions to tangible fixed assets.	Survey data.
NL	Mobile	T-Mobile	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
NL	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
NL	CaTV	UPC	Cash flow capital expenditures.	Includes intangibles, UPC is part of Liberty Global.
NL	CaTV	Essent	Additions to tangible fixed assets.	Survey data.
NL	CaTV	Casema	Additions to tangible fixed assets.	Survey data.
NL	CaTV	Cai Westland	Additions to tangible fixed assets.	Survey data.
NL	Broadcast	Nozema	Additions to tangible fixed assets.	

Austria

Figures for the Austrian fixed incumbent, Telekom Austria, have been calculated by weighting capital expenditures on property, plant and equipment by shares of revenue. Priority has been treated in the same way, while survey data have been used for T-Mobile, Mobikom and ORF. It has not been possible to obtain data in the fixed sub-sector for Cybertron or RSLCom, for ONE and 3 in the mobile sub-sector, or BKF, Kabelsignal, Liwest or Salzburg AG in the CaTV sub-sector. Data from Amadeus have been used for Tele Ring, although figures for 2001 and 2004 have been extrapolated.

Table A.23: Detailed methodology of data collection for Austria

Country	Sub-sector	Company	Methodology	Comments
AT	Fixed	Telekom Austria	Capital expenditure on PPE, weighted by shares of revenue.	
AT	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
AT	Fixed	Priority	Additions to tangible assets, weighted by revenues in Austria.	
AT	Fixed	Cybertron	No data.	Reports not available on Amadeus.
AT	Fixed	RSLCom	No data.	Reports not available on Amadeus.
AT	Mobile	T-Mobile	Additions to tangible fixed assets.	Survey data.
AT	Mobile	Mobikom	Additions to tangible fixed assets.	Survey data.
AT	Mobile	ONE	No data.	Reports not available on Amadeus.
AT	Mobile	Tele Ring	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2001 or 2004.
AT	Mobile	3	No data.	3 is owned by Hutchinson Whampoa, no weightings available.
AT	CaTV	BKF	No data.	Reports not available on Amadeus.
AT	CaTV	Kabelsignal	No data.	Reports not available on Amadeus.
AT	CaTV	Liwest	No data.	Reports not available on Amadeus.
AT	CaTV	Salzburg AG	No data.	Reports not available on Amadeus.
AT	CaTV	UPC Telekabel	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
AT	Broadcast	ORF	Additions to tangible fixed assets.	Survey data.

Poland

Poland's TPSA group figures for additions to fixed assets are separated to represent their fixed, mobile and broadcasting activities using the shares of the revenues generated by these divisions. Survey data have been used for PTK Centertel and Emitel, while Amadeus was utilised for Polkomtel, Grupa Vectra, Aster City Cable and Multimedia Polska[94]

[94] Figures for Multimedia Polska have been extrapolated for 2001 and 2004 due to missing data.

Table A.24: Detailed methodology of data collection for Poland

Country	Sub-sector	Company	Methodology	Comments
PL	Fixed	TPSA	Total additions to tangible fixed assets, weighted by shares of revenues in each sub-sector.	
PL	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
PL	Mobile	Polska Telefonia (ERA)	Purchases of tangible fixed assets.	
PL	Mobile	PTK Centertel	Additions to tangible fixed assets.	Survey data.
PL	Mobile	Polkomtel (Plus GSM)	Change in balance sheet tangible fixed assets.	Data from Amadeus.
PL	CaTV	UPC Poland	Cash flow capital expenditures.	Includes intangibles, UPC is part of Liberty Global.
PL	CaTV	Grupa Vectra	Change in balance sheet tangible fixed assets.	Data from Amadeus.
PL	CaTV	Multimedia Polska	Change in balance sheet tangible fixed assets.	Data from Amadeus, no data for 2001 and 2004.
PL	CaTV	Aster City Cable	Change in balance sheet tangible fixed assets.	Data from Amadeus.
PL	Broadcast	Emitel	Additions to tangible fixed assets.	Survey data.

Portugal

In Portugal, investments by the fixed incumbent have been separated to represent additions to tangible fixed assets in the fixed and mobile sub-sectors by weighting using shares of revenue. Data from the survey has been used for Vodafone, while figures for Novis, OniTelecom and Bragatel[95] come from Amadeus. Data are also available on Amadeus for Cabovisao, but there is no means to split this investment between the fixed and cable sub-sectors. It has not been possible to find data for ONO Portugal or Jazztel.

[95] No data are available for 2001 and 2002.

Table A.25: Detailed methodology of data collection for Portugal

Country	Sub-sector	Company	Methodology	Comments
PT	Fixed	PT Group	Cash receipts resulting from investments in tangible fixed assets, weighted by shares of revenue in each sub-sector.	
PT	Fixed	Cabovisão	No data.	Figures from Amadeus, but no way to split between fixed and cable.
PT	Fixed	Novis	Change in balance sheet tangible fixed assets.	Data from Amadeus.
PT	Fixed	OniTelecom	Change in balance sheet tangible fixed assets.	Data from Amadeus.
PT	Fixed	Jazztel	No data.	Reports not available on Amadeus.
PT	Mobile	Optimus	Only 2004 data available on Amadeus.	
PT	Mobile	TMN	Cash receipts resulting from investments in tangible fixed assets, weighted by shares of revenue in each sub-sector.	
PT	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
PT	CaTV	Bragatel	Change in balance sheet tangible fixed assets.	Data from Amadeus. No data for 2001 and 2002.
PT	CaTV	Cabovisão	No data.	Figures from Amadeus, but no way to split between fixed and cable.
PT	CaTV	ONO Portugal		Reports not available on Amadeus.
PT	CaTV	TV Cabo	Cash receipts resulting from investments in tangible fixed assets, weighted by shares of revenue in each sub-sector.	
PT	Broadcast	RTP		Reports not available on Amadeus.

Slovenia

Data for Slovenia's fixed incumbent have been calculated by weighting cash outflows from increases in tangible fixed assets by the share of revenues generated in that sub-sector. Survey data have been used in the cases of Mobitel and Telemach, while Amadeus provides figures for Ljubljanski kabel. It has not been possible to find data for Vega in the mobile sub-sector or Triera or G Kabel in the CaTV sub-sector.

Table A.26: Detailed methodology of data collection for Slovenia

Country	Sub-sector	Company	Methodology	Comments
SI	Fixed	Telekom Slovenije	Cash outflows from increases in tangible fixed assets, weighted by shares of revenues.	
SI	Mobile	Mobitel	Additions to tangible fixed assets.	Survey data.
SI	Mobile	Sl.Mobil	Capital expenditure on PPE, weighted by shares of revenue.	
SI	Mobile	Vega (Western Wireless)	No data.	Reports not available on Amadeus.
SI	CaTV	Telemach	Additions to tangible fixed assets.	Survey data.
SI	CaTV	Ljubljansk i kabel	Change in balance sheet tangible fixed assets.	Data from Amadeus.
SI	CaTV	Triera	No data.	Reports not available on Amadeus.
SI	CaTV	G Kabel	No data.	Reports not available on Amadeus.
SI	Broadcast			

Slovak Republic

Slovak Telecom figures are constructed using weights from capital expenditure in each sub-sector and country to separate additions to fixed assets. Survey data is used for T-Mobile.

Table A.27: Detailed methodology of data collection for Slovak Republic

Country	Sub-sector	Company	Methodology	Comments
SK	Fixed	Slovak Telecom	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country revenues.	No 2001 investment weights, so 2002 used; no 2004 revenues shares, so 2003 used.
SK	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
SK	Mobile	T-Mobile	Additions to tangible fixed assets.	Survey data.
SK	Mobile	Orange	Capital expenditures on PPE.	
SK	CaTV	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
SK	Broadcast			

Finland

Finnish incumbent Elisa's capital expenditure on fixed assets has been disaggregated to represent investments in the fixed and mobile sub-sectors

using weights constructed of shares of revenue. Amadeus provided data for Alands Mobile, Helsinki Televisio, Jyrasiestinta Oy, Koklan Puhelin Oy, Mariekamns, Digita Oy, and the Finnet Group. [96]

Table A.28: Detailed methodology of data collection for Finland

Country	Sub-sector	Company	Methodology	Comments
FI	Fixed	Elisa	Capital expenditure on fixed assets, weighted by share of revenue.	
FI	Fixed	Sonera	Additions to PPE.	
FI	Fixed	Finnet	No data.	Increase in tangible fixed assets for 2003 & 4, no way to split between sub-sectors.
FI	Mobile	Alands Mobile	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FI	Mobile	Finnet Group	No data.	Increase in tangible fixed assets for 2003 & 4, no way to split between sub-sectors.
FI	Mobile	Elisa	Capital expenditure on fixed assets, weighted by share of revenue.	
FI	Mobile	Sonera	Total additions to tangible fixed assets, weighted by shares of revenues in each sub-sector.	
FI	CaTV	Helsinki Televisio	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FI	CaTV	Jyrasiestinta Oy	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FI	CaTV	Koklan Puhelin Oy	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FI	CaTV	Kotkan Tietoruutu Oy	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FI	CaTV	Mariekamns	Change in balance sheet tangible fixed assets.	Data from Amadeus.
FI	Broadcast	Digita Oy	Change in balance sheet tangible fixed assets.	Data from Amadeus.

Sweden

In Sweden, Telia's fixed and mobile investments have been separated by weighting using shares of revenues in each sub-sector. The same method has

[96] It has not been possible to separate Finnet investments between the fixed and mobile sub-sectors.

also been applied to Telenordia, Canal Digital and Terracom. Survey data have been used in the cases of Vodafone and Com Hem. Amadeus has data for Tele2, but provides no way to break it down between sub-sectors, and only has data for SpringMobil in 2004.

Table A.29: Detailed methodology of data collection for Sweden

Country	Sub-sector	Company	Methodology	Comments
SE	Fixed	Telia	Total additions to tangible fixed assets, weighted by shares of revenues in each sub-sector and country.	
SE	Fixed	Tele2	No data.	No way to split Amadeus data between sub-sectors.
SE	Fixed	Telenordia	Additions to tangible assets, weighted by share of revenues in each sub-sector.	
SE	Fixed	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
SE	Mobile	SpringMobil (Swefour)	No data.	Only 2004 data available on Amadeus
SE	Mobile	Tele2	No data.	No way to split Amadeus data between sub-sectors.
SE	Mobile	Telia	Total additions to tangible fixed assets, weighted by shares of revenues in each sub-sector and country.	
SE	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
SE	Mobile	3	No data.	3 is owned by Hutchinson Whampoa, no weightings available.
SE	CaTV	UPC	Cash flow capital expenditures.	Includes intangibles. UPC is part of Liberty Global.
SE	CaTV	Comhem	Additions to tangible fixed assets.	Survey data.
SE	CaTV	Tele2	No data.	No way to split Amadeus data between sub-sectors.
	CaTV	Canal Digital	Broadcasting capital expenditures on fixed assets, weighted by share of revenue from cable.	
SE	Broadcast	Terracom	Acquisitions of tangible fixed assets, weighted by share of revenues.	

United Kingdom

BT data have been calculated using expenditure on property plant and equipment, and weighting by the share of total capital expenditure in each area of operation. The figures constructed for NTL use purchases of tangible

fixed assets and are weighted by the share of the number of 'revenue generating units'.[97] Arqiva was owned by NTL until recently, and investment figures have been extracted from the 2003 NTL Annual Report.[98] The Telewest data are taken from total purchases of fixed assets, which are weighted by the share of number of subscribers in each sub-sector. Figures for National Grid Wireless (formerly Crown Castle) are disaggregated from the group data using weights constructed from capital expenditure shares in different areas of operation[99]. No capital expenditure figures were available for 2001. In the mobile sub-sector, survey data have been used for Orange and Vodafone, while O2's group purchases of tangible fixed assets have been split by weighting with shares of turnover[100].

[97] The 2004 report is used for consistency, because NTL underwent restructuring following bankruptcy in 2002 and the figures have since been recalculated. This also means that 2001 figures are not available, and have been extrapolated.

[98] Figures do not appear in the 2004 report due to the sale of NTL's broadcast division.

[99] This was not possible for 2004, so 2003 weights are used in their place.

[100] The figure for 2001 has been taken from the 2001 BT annual report, before BT demerged its mobile telephony business.

Table A.30: Detailed methodology of data collection for the UK

Country	Sub-sector	Company	Methodology	Comments
UK	Fixed	BT	Capital expenditure on property, plant and equipment additions, weighted by share of capital expenditure in each sub-sector.	No capital expenditure data available for 2001, so 2002 figures used.
UK	Fixed	NTL	Additions to net fixed asset figures used, weighted by shares of revenue in sub-sectors.	Figures all taken from 2004 Annual Report (Figures from earlier reports are not comparable due to restructuring).
UK	Fixed	Telewest	Cash paid for property and equipment, weighted by shares of revenue from each sub-sector.	
UK	Fixed	Kingston	Additions to tangible fixed assets.	
UK	Mobile	T-Mobile	Current asset additions to fixed assets, weighted by share of capital expenditure in each sub-sector and country.	
UK	Mobile	Orange	Additions to tangible fixed assets.	Survey data.
UK	Mobile	O2	Purchases of tangible fixed assets, weighted by share of turnover in countries of operation.	2001 figure taken from BT Annual Report (BT demerged its wireless business in May 2002).
UK	Mobile	Vodafone	Additions to tangible fixed assets.	Survey data.
UK	Mobile	3	No data.	3 is owned by Hutchinson Whampoa, no weightings available.
UK	CaTV	NTL	Purchases of tangible fixed assets, weighted by shares of 'revenue generating units' in each sub-sector.	
UK	CaTV	Telewest	Total purchases of fixed assets, weighted by the shares of subscribers in each sub-sector.	
UK	Broadcast	Crown Castle	Payments for fixed assets, weighted by share of capital expenditure in broadcasting sub-sector.	No capital expenditure data for 2004, so 2003 used, no investment figure for 2001, so 2002 used.
UK	Broadcast	Arqiva	Purchases of fixed assets. Weighted by broadcast sub-sector revenues.	Data from ntl 2003 annual report. NTL sold its broadcast division to Macquarie in 2004.

Annex 2 Modelling the determinants of investment

Proposed model

To estimate the determinants of investment we have drawn on the reviewed literature and posit a model based on country- and market-specific characteristics. Having data at the firm level, we depart from the reviewed models by also incorporating firm-specific characteristics.

Our proposed model for gross investment is expressed as follows:

$\ln(I_{ijt}) = \alpha + \beta Z1_{jt} + \delta Z2_{jt} + \eta Z3_{ijt} + \varepsilon_{ijt}$,

where $\ln(I_{ijt})$ is the logarithm of gross investment in tangible assets for each firm *i* in country *j* and year *t*,

$Z1_{jt}$ are country-specific characteristics that change over time. We include real GDP per capita, land area and population density, and expect that those countries with higher GDP per capita and larger areas have higher levels of investment, whereas those countries with higher density will require lower levels of investment,

$Z2_{jt}$ are market-specific characteristics that change over time. In the model we include a regulatory index for telecommunications. Such an index is constant within a country but changes over time,

$Z3_{ijt}$ are firm specific characteristics that may or may not change over time. We use a measure of firms' total assets, a dummy variable to identify incumbent operators (versus new entrants), and dummy variables to control for whether a firm operates in more than one sub-sector, or more than one country, [101]

α, β, δ and θ are the model parameters to be estimated and ε is the error term.

As explained in Section 2.1, the data on investment refer to gross investment in tangible fixed assets, and have been deflated using the US telecommunications deflator to constant 2001 prices in order to make meaningful comparisons between years. In a similar manner, GDP per capita figures have been rebased to 2001 and deflated using the HICP (Harmonised Index of Consumer Prices) from Eurostat. Population data were also gathered from Eurostat.

[101] Since Jorgenson (1983) the importance of the cost of capital has been recognised as a determinant of a firm's investment. However, a measure of cost of capital could not be constructed for a significant number of companies in the sample. Consequently, the cost of capital is not included in our regressions. In preliminary estimations for a reduced number of companies we found that this variable was not statistically significant. This is probably due to its high correlation with some other variables included in the model.

The OECD Regulatory Reform Index has been used to measure regulatory performance in e-communications.[102] A higher index number indicates an improved regulatory performance.

Dummy variables include whether a firm is an incumbent (for fixed and mobile sub-sectors) and for firms operating in multiple sub-sectors and multiple countries.

Table A.31 reports the correlation matrix of the explanatory variables. The table shows very low correlation coefficients.

Table A.31: Correlation matrix (observations = 292)

	li	lgdpc	lland	ldensity	lioecd	dmobile	dinc	mnat	msec	d2002	d2003
li	1										
lgdpc	0.13	1									
lland	0.10	-0.10	1								
ldensity	0.16	0.09	-0.39	1							
lioecd	0.21	0.30	0.04	0.17	1						
dmobile	0.30	0.03	-0.05	-0.04	0.05	1					
dinc	0.43	-0.03	0.03	-0.16	-0.01	0.02	1				
mnat	0.34	0.27	-0.13	0.09	0.16	0.33	0.16	1			
msec	0.30	0.16	-0.09	0.07	0.25	-0.08	0.43	0.26	1		
d2002	-0.04	-0.09	-0.01	-0.01	0.01	-0.01	-0.01	0.00	0.01	1	
d2003	-0.05	0.15	0.03	0.01	0.18	-0.01	-0.01	0.02	0.01	-0.49	1

To correct for heteroskedasticity, we use the Huber-White sandwich estimator of variance[103] in place of the traditional calculation to ensure that our standard errors are robust.

Results

The results of different model specifications are presented in Table A.32. Model (1) shows a model including only the log of the OECD regulatory index (lioecd), country-specific variables (the logs of GDP per capita, area, and density, denoted as lgdpc, lland and ldensity, respectively) and year fixed effects (d2002, d2003). It is interesting to note that in its simplest form, the model already shows that the regulatory index is statistically significant

[102] See Conway, P. and G. Nicoletti (2006), "Product market regulation in non-manufacturing sectors in OECD countries: measurement and highlights", OECD Economics Department Working Paper, forthcoming.

[103] See Huber, P. J. 1967. The behavior of maximum likelihood estimates under nonstandard conditions. In *Proceedings of the Fifth Berkeley Symposium on Mathematical Statistics and Probability*. Berkeley, CA: University of California Press, vol. 1, 221–223. Also White, H. 1980. A heteroskedasticity-consistent covariance matrix estimator and a direct test for heteroskedasticity. *Econometrica* 48: 817–830.

and with a positive sign, indicating that those countries with a lower regulatory performance have less investment.[104]

Model (2) of Table A.32 shows a model adding dummy variables indicating whether the firm: is an incumbent (dincum), operates in the mobile subsector (dmobile), operates in more than one sector (msec), or operates multinationally (mnat).

The coefficient for lland and ldensity are statistically significant, meaning that those countries with larger area and higher density have higher levels of investment. GDP per capita, however is not significant in this model. The coefficient for the regulatory index shows again a positive and significant sign. The coefficient indicating the firms' incumbent status is significant and positive illustrating a higher investment for those firms compared with new entrants.

In Model (3) we have included firms' total assets (to control for the fact that larger companies will have higher levels of investment). The variable is included in logs and lagged one period (lla), so that current levels of investment are not correlated with the current size of the company but with its assets in the previous year.

The results of the model predict that countries' GDP per capita has an impact on the levels of investment. In particular a 1% increase in GDP per capita would lead to a 0.7% increase in the level of investment.[105] The country's area has also a positive and significant impact, but not density (this is probably due to the correlation between density and other variables).

The dummy variable for the mobile sub-sector, dmobile, is statistically significant and means that on average investment in the mobile sub-sector is higher than investment in the fixed telephony sub-sector (which is the omitted dummy). Finally, the dummies for firms' multinational and multisector dimension show that those firms operating in more than one sector invest more than an equivalent firm that only works in one sub-sector, but not firms operating in more than one country.

The regulatory index variable is still positive but significant only at the 13% level. The lower statistical significance is probably due to the collinearity of firms' assets with the regulatory index. However, it should be noted that Model (2) and Model (3) are not strictly comparable because they have different numbers of observations. Observations are excluded from Model (3) due to missing values in the total assets variable. For these reasons, the precise estimate of the coefficient for regulatory index is difficult to obtain but

[104] The OECD Index measures regulatory performance in terms of the degree of free entry into the market; the extent of Governmnet ownerwhip of the major operators; and market structure, based on market shares.

[105] Using the relationship dlnI = βdlngdpc, we can see that $\frac{dI}{I} = \beta \frac{d\text{gdpc}}{\text{gdpc}} \Leftrightarrow \beta$

it is likely to lie in the range 0.57 to 0.33. What is important to note is that the performance of the regulatory regime does seem to be an important determinant of investment (as indicated by the consistent positive sign) but the magnitude of this effect may be low compared to some other factors such as GDP per capita.

Overall, the model has good statistical properties, and an R^2 of 0.55 in Model (3).

Table A.32: Regression results for determinants of investment (firm-level data)

Explanatory variable	Model (1)	Model (2)	Model (3)
lgdpc	0.481 -1.71	0.33 (1.35)	0.722 (1.93)
lland	0.416 (2.79)**	0.55 (4.57)**	0.319 (1.93)
ldensity	0.545 (2.76)**	0.808 (4.96)**	0.192 (0.99)
lioecd	0.908 (3.20)**	0.573 (2.65)**	0.332 (1.52)
dmobile	--	1.202 (5.17)**	1.237 (4.75)**
dinc	--	2.062 (8.91)**	0.919 (2.18)*
mnat	--	0.677 (2.05)*	0.176 (0.41)
msec	--	0.332 -1.26	0.753 (2.14)*
d2002	-0.514 -1.67	-0.431 -1.73	--
d2003	-0.781 (2.41)*	-0.656 (2.53)*	-0.234 (0.94)
lla	--	--	0.275 (2.81)**
Constant	-0.071 (0.03)	-2.705 (1.69)	-6.143 (3.05)**
Observations	292	292	155
R-squared	0.09	0.44	0.55

Note: Robust t statistics in parentheses; * significant at 5%; ** significant at 1%

As a robustness check we have estimated two additional models, Model (4) and Model (5), which use similar model specifications but aggregate investment data at the country level (for each year and sector). Model (4) uses the log of the OECD index, whereas Model (5) uses the log of the ECTA regulatory index.

Model (4) has been estimated for 2002-2003 and shows a positive significant coefficient for the OECD index with an estimated value of 0.65. Model (5) has been estimated for 2004 and shows that the ECTA scorecard measure of regulation corroborates the results from the OECD index. Its coefficient is significant at the 7% level and has a value of 1.3 showing that efficient regulation leads to higher levels of investment.

Table A.33: Regression results for determinants of investment (country-level data)

Explanatory variable	Model (4)	Model (5)
lgdpc	0.957 (3.86)**	1.424 (2.81)*
lland	1.165 (7.16)**	1.01 (6.12)**
ldensity	1.293 (7.73)**	1.175 (5.25)**
lioecd	0.65 (4.06)**	--
lr	--	1.294 (1.94)
dmobile	-0.163 (1.40)	0.039 (0.19)
lla	-0.241 (2.43)*	-0.118 (0.97)
d2002	0.255 (2.08)*	--
Constant	-3.571 (3.41)**	-12.906 (2.62)*
Observations	60	20
R-squared	0.81	0.85

Note: Robust t statistics in parentheses; * significant at 5%; ** significant at 1%.

Conclusions

Overall, we conclude from this analyis that a better performing regulatory regime, as measured by the OECD index, does contribute to higher levels of investment. Use of an alternative regulatory index, the ECTA index, also suggests a contribution to investment levels.

Other factors that have an important positive influence on company investment levels are GDP per capita; the land area and population density of

the country in which they operate; and the size of the company, as measured by total asset value of the company.[106]

In more detail, we note that:

- Due to the reduced number of observations for which complete data are available, the models are quite sensitive to small changes in the specification.
- The OECD regulatory index is in general statistically significant in all our specifications, with a negative sign and with an estimated value in the range of 0.57 to 0.33.
- GDP per capita and the country's area are both statistically significant variables and are directly related to the levels of investment in our sample.
- Firms' total assets also show that those firms with larger stocks of assets are likely to invest more in the next period (illustrating the fact that such companies need to undertake more investment to replace their current network or that those companies have the financial muscle to undertake larger level of investments).
- On average, investment in the mobile sub-sector is higher than investment in the fixed telephony sub-sector
- Firms operating in more than one sub-sector invest more in a single sub-sector than an equivalent firm operating only in that sub-sector, but not firms operating in more than one country.
- The coefficient indicating the firms' incumbent status is significant and positive, confirming our findings in previous charts that illustrate a higher investment for those firms compared with new entrants.

[106] Other factors related to company size, such as status as an incumbent and investment across more than one sector, were also influential.

Annex 3 Computation of Gross Value Added for the Telecommunications sector

As suggested in Section 3, one problem encountered in the STAN database is that it provides information for the sector "Post and Telecommunication". To get a measure Gross Value Added for "Telecommunications" only we have subtracted the value added of the postal sector.

Gross Value Added is not available in the UPU but has been estimated in the following way. Gross Value Added for a particular industry represents its contribution to national GDP (and it is sometimes referred to as GDP by industry). Gross value added includes labour costs, consumption of fixed capital, taxes less subsidies and net operating surplus and mixed income and is usually calculated as the difference between production and intermediate inputs.

Using total Operating revenue and Operating expenditure for the postal sector we have constructed a measure of Gross Value Added for the postal sector by applying the following formula.

GVA = Labour costs + Consumption of fixed capital + (Taxes – Subsidies) +Net operating surplus and mixed income

= Production – Other expenses (i.e. inputs different from labour, capital, etc.) ,

where Other expenses = θ * (Operating expenditure) and

Production = Operating revenue.

The share of other expenses to total operating expenditure (θ) has been estimated from data extracted from the annual reports of the main postal service companies in the different countries.

Table A.34: Shares of other expenses to total operating expenditure (θ)

Country	θ	Country	θ
BE	0.22	SE	0.41
DK	0.29	DE	0.63
EL	*0.34*	ES	0.25
IE	*0.34*	FR	0.32
LU	*0.34*	IT	0.27
NL	0.61	UK	0.31
AT	0.31	JP	0.34
PT	0.25	KO	*0.34*
FI	*0.34*	US	0.21

Note: Entries in *italics* are estimates computed as the average of remaining countries.

Annex 4 Sectoral Indicators at EU Member State Level

Table A.35: Fixed and mobile telephony investment and service revenues (2003)

Country	Investment		Service revenue (€m)	
	Fixed and mobile (€m)	Fixed and mobile as a % of GDP	Fixed	Mobile
AT	801	0.36%	1,821	2,913
BE	1,572	0.59%	4,188	3,547
DK	753	0.40%	1,808	1,565
FI	646	0.45%	1,003	2,516
FR	4,843	0.38%	13,194	9,749
DE	4,972	0.23%	26,292	24,991
EL	1,114	0.73%	1,762	3,583
IE	256	0.19%	1,816	1,358
IT	7,843	0.61%	15,843	1,106
LU	128	0.54%	163	15,812
NL	2,330	0.63%	5,276	165
PT	784	0.60%	1,921	3,702
ES	4,517	0.78%	9,274	3,251
SE	1,311	0.49%	3,019	13,945
UK	11,889	0.86%	18,361	1,886

Source: Derived from International Telecommunications Union database.

Table A.36: Telephone subscribers per 100 inhabitants

Country	Fixed telephony		Mobile telephony	
	2004	**% change since 2000**	**2004**	**% change since 2000**
AT	45.85	-8.04%	97.36	27.52%
BE	46.01	-6.25%	88.32	61.04%
DK	64.65	-10.15%	96.10	52.29%
FI	45.40	-17.51%	95.63	32.75%
FR	56.04	-2.89%	73.72	49.44%
DE	66.10	8.27%	86.42	47.47%
EL	46.98	-12.29%	100.61	79.18%
IE	50.49	4.37%	94.52	45.45%
IT	44.75	-5.56%	108.19	46.74%
LU	79.75	5.65%	119.38	72.61%
NL	48.44	-21.68%	91.34	35.77%
PT	42.07	-0.21%	102.26	53.79%
ES	43.16	1.25%	93.91	55.28%
SE	76.57	1.07%	103.22	43.86%
UK	56.71	-3.79%	102.81	41.41%

Source: Derived from International Telecommunications Union database.

Table A.37: CaTV and Satellite subscribers per 100 inhabitants

Country	CaTV		Satellite	
	2003	**% change since 2000**	**2003**	**% change since 2000**
AT	15.56	23.08%	19.25	6.38%
BE	37.77	2.31%	1.53	10.27%
DK	23.67	21.25%	13.53	17.43%
FI	21.06	14.73%	7.36	11.00%
FR	5.88	16.47%	8.40	15.06%
DE	25.08	1.24%	16.84	21.68%
EL	n/a	n/a	3.80	81.80%
IE	13.40	-24.29%	7.28	83.68%
IT	0.31	154.52%	4.52	10.11%
LU	33.44	18.27%	7.40	8.15%
NL	39.24	1.18%	2.22	7.69%
PT	12.82	38.88%	4.08	-2.08%
ES	2.33	214.15%	4.86	15.64%
SE	27.54	11.17%	12.19	3.08%
UK	5.69	-4.61%	11.59	30.71%

Source: Derived from International Telecommunications Union database.

Table A.38: Internet use (% of population)

Country	Internet users (estimated)		Internet subscribers		DSL subscribers
	2004	% change since 2000	2003	% change since 2000	2003
AT	47.52	41.01%	15.97	21.85%	5.36
BE	40.62	38.98%	18.41	64.23%	9.63
DK	70.00	78.52%	50.36	59.36%	11.79
FI	63.00	69.22%	25.26	112.26%	13.13
FR	41.37	187.97%	17.71	91.52%	10.42
DE	50.00	65.85%	27.87	146.50%	8.12
EL	17.81	88.16%	4.90	90.70%	0.42
IE	27.00	50.58%	30.16	107.65%	2.85
IT	49.78	116.06%	29.37	190.12%	7.30
LU	59.00	158.72%	23.83	326.52%	2.90
NL	61.63	40.74%	30.70	-16.96%	11.56
PT	29.30	74.78%	47.50	125.56%	4.18
ES	34.85	154.87%	11.50	43.18%	6.33
SE	75.46	65.54%	35.77	39.26%	6.33
UK	63.27	139.33%	26.33	31.12%	7.07

Source: Derived from International Telecommunications Union database.

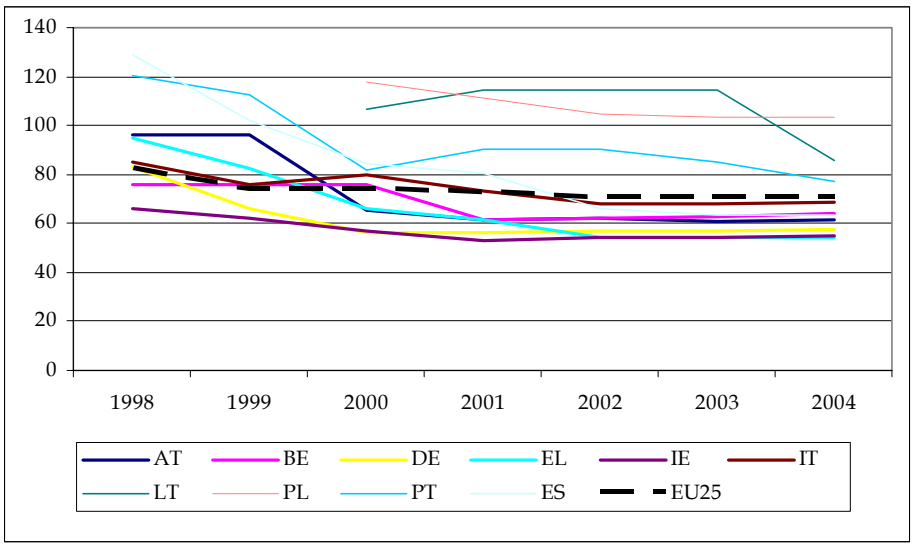
Annex 5 Business fixed telephony price trends

In this Annex we examine trends in business fixed line telephony using the same framework as Section 3.3 uses for residential fixed line telephony. The trends are very similar in residential and business fixed telephony.

Figure A shows price trends in countries that have enjoyed significant price reductions, i.e. more than 10%. On average, within the EU-25, the business basket price has dropped by 14% between 1998 and 2004. As for residential fixed telephony, Spain is the country where prices have decreased the most, with a 50% price reduction; Greece follows having seen a cut in the price of 40%

Germany, Austria and Portugal continue the list of EU Members States where national baskets became more than 30% cheaper between 1998 and 2004; Lithuania, Italy, Ireland and Belgium have benefited from price cuts of between 15-20%. Within countries where the price decrease has been more than 10%, only Poland did not outrank the EU-25 as a whole.

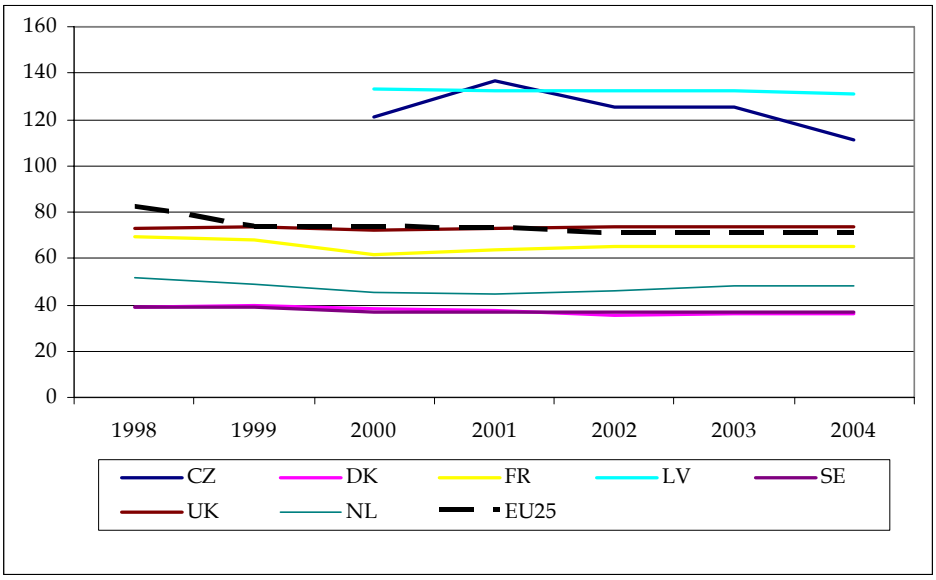
Figure A.16: National Business Basket Price (countries with more than 10% reductions, 1998-2004).



Note: * All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.
Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen.

Again, some countries have not seen major changes in the price of the selected basket, as presented in Figure A. France, Denmark, the Netherlands, the Czech Republic and Sweden's price variations have been relatively modest (less than 10%). Yet for all of these countries prices have dropped, although by less than the reduction in the EU-25 as a whole, where the average has been -14%. Over the period, prices have remained roughly constant in Latvia and in the United Kingdom, having moved by little more than 1% (downwards in Latvia and upwards in the United Kingdom).

Figure A.17: National Business Basket Price
(countries with less than 10% basket price change, 1998-2004).



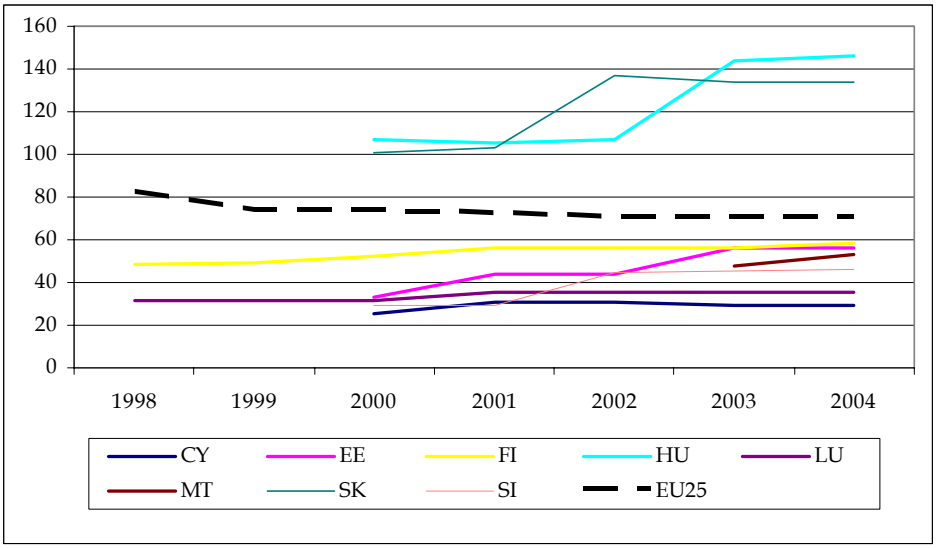
Note: * All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.
Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen.

On the other hand, as we can see from Figure A, in eight countries the basket price has increased more than 10% since 1998. Ireland has seen a rise in the price of residential fixed services by little more than 10%, while Finland by about 17%. In several New Member States, such as Cyprus, Estonia, Slovakia and Slovenia, the price of the basket of PSTN services for residential use has increased sensibly.

Once again, many New Member States started with much lower prices if compared to those prevailing in Old Member States. Cyprus's basket price, for instance, was almost a third of that showed by major European countries and increased by more than 70% in recent years. In a similar vein, Estonia's basket increased by more than 60%.

Hungarian business prices for telecoms dramatically increased in 2003, settling at more than twice the EU-25 average and having increased by 50% between 2000 and 2004 (closely matching residential services).

Figure A.18: National Business Basket Price (countries with more than 10% basket increase, 1998-2004).



Note: All values in euro/PPP per month, including VAT. Values shown are total values, i.e. include both the fixed and usage components of the basket. The average value is a weighted average across EU Member States using population as weight.

Source: European Commission, Directorate General for Information Society, Report on Telecoms Price Developments, prepared in October 2004 by Teligen.

Annex 6 Survey Questionnaires

This Annex contains examples of the survey questionnaires sent to e-communications companies in the EU25 in order to corroborate the data already gathered from annual reports.

Three types of questionnaire have been sent, one to fixed and mobile telephony operators, one to cable operators, and the other to broadcasters.

The letter and questionnaire sent to fixed and mobile operators is below.

London Economics
11-15 Betterton Street
London WC2H 9BP
United Kingdom
Tel: +44 207 446 8400 / 207 866 8185
Fax: +44 207 464 8677 / 207 866 8186

24th of February 2006

[Company name]
[Individual name]
[Position]
[Address]
[City]
[Postcode]
[Country]

Dear Sir or Madam,

London Economics is currently working for the European Commission DG Information Society and Media in a study to assess the regulatory framework for electronic communications as well as its growth and investment. In the context of this project it is necessary to gather data on investment in physical infrastructure of different e-communications companies. Please find attached the letter from the director of DG Information Society introducing the study.

[Company name] has been selected by the Commission as part of a sample of telecom companies to provide details of its past investment in physical e-communications infrastructure in the EU. We would appreciate if you could provide data for each of the countries in which your company operates, and separately for fixed and mobile telephony, where relevant. We would also appreciate if you could provide investment by property, plant and equipment, or the total if the breakdown is not available.

Please fill the table overleaf and return it to us by fax no later than March 17, 2006 at: ++44 207 446 8499 or alternatively by post at the above address.

Thank you very much for your time. Your response is very important for the study.

Sincerely,

Mr. Patrice Muller

Partner

London Economics

Mobile Telephony Gross Current Tangible Asset Additions [Company name] (millions of € at market prices)					
EU Country		**2001**	**2002**	**2003**	**2004**
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
Contact details* **Name:** **Email:**					

Note: * To be used only in case of any clarification required. Please add rows if necessary.

Fixed Telephony Gross Current Tangible Asset Additions [Company name] (millions of € at market prices)					
EU Country		**2001**	**2002**	**2003**	**2004**
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
Contact details* **Name:** **Email:**					

The letter and questionnaire sent to cable operators is below:

London Economics
11-15 Betterton Street
London WC2H 9BP
United Kingdom
Tel: +44 207 446 8400 / 207 866 8185
Fax: +44 207 464 8677 / 207 866 8186

24th of February 2006

[Company name]
[Individual name]
[Position]
[Address]
[City]
[Postcode]
[Country]

Dear Sir or Madam,

London Economics is currently working for the European Commission DG Information Society and Media in a study to assess the regulatory framework for electronic communications as well as its growth and investment. In the context of this project it is necessary to gather data on investment in physical infrastructure of different e-communications companies. Please find attached the letter from the director of DG Information Society introducing the study.

[Company name] has been selected by the Commission as part of a sample of Cable companies to provide details of its past investment in physical e-communications infrastructure in the EU. We would appreciate if you could provide data for each of the countries in which your company operates, and provide investment by property, plant and equipment, or the total if the breakdown is not available.

Please fill the table overleaf and return it to us by fax no later than March 17, 2006 at: ++44 207 446 8499 or alternatively by post at the above address.

Thank you very much for your time. Your response is very important for the study.

Sincerely,

Mr. Patrice Muller

Partner

London Economics

Cable Gross Current Tangible Asset Additions [Company name] (millions of € at market prices)					
EU Country		**2001**	**2002**	**2003**	**2004**
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
Contact details* **Name:** **Email:**					

Note: * To be used only in case of any clarification required. Please add rows if necessary.

The letter and questionnaire sent to broadcast operators is below:

London Economics
11-15 Betterton Street
London WC2H 9BP
United Kingdom
Tel: +44 207 446 8400 / 207 866 8185
Fax: +44 207 464 8677 / 207 866 8186

24th of February 2006

[Company name]
[Individual name]
[Position]
[Address]
[City]
[Postcode]
[Country]

Dear Sir or Madam,

London Economics is currently working for the European Commission DG Information Society and Media in a study to assess the regulatory framework for electronic communications as well as its growth and investment. In the context of this project it is necessary to gather data on investment in physical infrastructure of different e-communications companies. Please find attached the letter from the director of DG Information Society introducing the study.

[Company name] has been selected by the Commission as part of a sample of Broadcast companies to provide details of its past investment in physical e-communications infrastructure in the EU. We would appreciate if you could provide data for each of the countries in which your company operates, and provide investment by property, plant and equipment, or the total if the breakdown is not available.

Please fill the table overleaf and return it to us by fax no later than March 17, 2006 at: ++44 207 446 8499 or alternatively by post at the above address.

Thank you very much for your time. Your response is very important for the study.

Sincerely,

Mr. Patrice Muller

Partner

London Economics

Broadcast Gross Current Tangible Asset Additions [Company name] (millions of € at market prices)					
EU Country		**2001**	**2002**	**2003**	**2004**
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
	Property (land and buildings)				
	Plant and equipment				
	Total				
Contact details* **Name:** **Email:**					

Note: * To be used only in case of any clarification required. Please add rows if necessary

Annex 7 PwC Survey

London Economics

Investment in e-communications sector questionnaire

Good morning/afternoon, my name is …… calling from PricewaterhouseCoopers International survey Unit. We recently sent you a letter inviting you to participate in an important piece of research we are conducting for London Economics on behalf of the European Commission. The purpose of the research is to assess the determinants of investment in the European Union (EU) and how investment decisions are being made in the e-communications sector.

One element of this study is a survey of companies in the e-communications sector. The main aims of the survey are to understand the views of operators on the way in which different elements of the regulatory framework affect investment decisions and to elicit proposals for encouraging investment in infrastructure.

The survey will take approximately 15 minutes to complete, would you have time to answer some questions now or would you prefer we call back at a time more suitable to you?

Section 1 - Company Information

Respondent name	
Respondent position	
Name of company*	
Brief description of main business activity	
Company address & telephone no.	

** Respondents should be clear about whether they are answering questions on behalf of a Group company or a specified subsidiary.*

Q1. From the following list could you please tell me which sectors your company operates in? ***Code all that apply***

Fixed telephony	1
Mobile telephony	2
Terrestrial broadcast	3
Satellite broadcast	4
Cable TV	5
Other – Please specify	6

Q2. Could you please tell me which other countries in the EU does you company operate? ***Please code all that apply***

Belgium	1	Italy	10	Poland	19
Czech Republic	2	Cyprus	11	Portugal	20
Denmark	3	Latvia	12	Slovenia	21
Germany	4	Lithuania	13	Slovakia	22
Estonia	5	Luxembourg	14	Finland	23
Greece	6	Hungary	15	Sweden	24
Spain	7	Malta	16	United Kingdom	25
France	8	Netherlands	17		
Ireland	9	Austria	18		

Q3. What is your most recent turnover (in millions of Euros). Please could you specify the year? ***Please record turnover in millions of Euros and year turnover is specified***

Euros (millions)	
Year	

Section 2 - Investment Drivers

By "investment in e-communications" we mean investment in the physical infrastructure necessary for the provision of electronic communications services.

This may include investment in networks and equipment necessary for the provision of fixed telephony services, mobile telephony services, cable networks and terrestrial and satellite broadcasting networks.

Q4a. Investment in the e-communications sector declined in the EU25 between 2000 and 2003. In your opinion, which of the following factors do you think were important causes of the decline in the sector? ***Please code all that apply***

Q4b. And which factor do you think was the most important? ***Please code one only***

	(a)	**(b)**
Financial bubble (deflation of the financial bubble in the sector during this period)	1	1
Economic cycle (part of the normal investment cycle following high levels of investment early on in this period)	2	2
Decline in macroeconomic conditions (such as changes in GDP and exchange rate movements)	3	3
Limited availability of credit and other sources of finance	4	4
Limited profitable investment opportunities in the sector	5	5
Regulatory uncertainty	6	6
Increased competition	7	7
Other – Please specify	8	8

Q5. Approximately, by how much has your company increased its investment in e-communications between 2003 and 2005? ***Please code one only***

0 – 5 %	1	Continue to Q6a
6 – 20 %	2	

21 – 40 %	3	
41 – 60 %	4	
61 – 75 %	5	
76 – 100 %	6	
More than 100%	7	
Investment has declined	8	Skip to Q7a
Not applicable	9	

Q6a. Which of the following factors have been important in your company's decision to increase it's investment in e-communications? ***Please code all that apply***

Q6b. And, which factor was the most important? ***Please code one only***

	(a)	(b)
Investment cycle (following low levels of investment early on in this period)	1	1
Macroeconomic conditions (changes in GDP and demand)	2	2
New market opportunities	3	3
Changes in the regulatory framework	4	4
Changes in the implementation or enforcement of the regulatory framework	5	5
More regulatory certainty	6	6
Other – Please specify	7	7

Q7a. There are signs that across much of the EU, investment in the e-communications sector is now increasing. Which of the following factors do you think are important causes of this increase? ***Please code all that apply***

Q7b. And which factor was the most important? ***Please code one only***

	(a)	(b)
Investment cycle (following low levels of investment early on in this period)	1	1
Macroeconomic conditions (changes in GDP and demand)	2	2
New market opportunities	3	3
Changes in the regulatory framework	4	4
Changes in the implementation or enforcement of the regulatory framework	5	5
More regulatory certainty	6	6
Other – Please specify	7	7

Q8a. In the current context, what are the major factors hindering your investment strategy in the electronic communications sector in the EU? ***Please code all that apply***

Q8b. And what is the most important factor? ***Please code one only***

	(a)	(b)
Macroeconomic conditions (changes in GDP and demand)	1	1
Limited availability of credit and other sources of finance	2	2
Limited profitable investment opportunities in the sector	3	3
Regulatory uncertainty	4	4
Increased competition	5	5
Other – Please specify	6	6

Q9. Approximately what percentage of current investment made by your company is in non-EU countries? ***Please record % in the box below.***

%	**Continue to Q10a**
None	**Skip to Q11**

Q10a. What factors are important for the decision to invest in non-EU countries? ***Please code all that apply***

Q10b. And which factor was the most important? ***Please code one only***

	(a)	**(b)**
Geographic diversification strategy	1	1
Better macro-economic conditions	2	2
Higher Market segment growth perspective	3	3
Economic and social regulatory environment more favourable to growth (e.g. more flexible labour market regulation)	4	4
Financial incentives from local or national authorities	5	5
Sector specific regulatory conditions more favourable to investment	6	6
Other – Please specify	7	7

Q11. What measurable indicators do you think would best reflect the nature of long run investment conditions in the e-communications sector? ***Please record verbatim***

Section 3 - Investment and the Regulatory Framework

A new regulatory framework for the e-communications sector across the EU was introduced into EU law in 2002. Since then, Member States have been transposing the legislation into nation law and national regulatory authorities have been taking action to implement the framework. This process is still underway in most Member States.

Q12. Using the scale of agree strongly, agree slightly, neither agree nor disagree, disagree slightly and disagree strongly could you please state your agreement/disagreement with the following statements (EU market overall)? ***Please code one only on each row***

	Agree strongly	Agree slightly	Neither/ nor	Disagree slightly	Disagree strongly	DK/No opinion
The principles that underpin the new regulatory framework are improving the conditions for investment in the sector	1	2	3	4	5	6
The way in which the new regulatory framework is being implemented is improving the conditions for investment in the sector	1	2	3	4	5	6
Allowing competing operators access to SMP operator networks will encourage more investment in networks in the long run [*Note: SMP operator networks are the networks of operators which have been designated with Significant Market Power by the regulator*]	1	2	3	4	5	6
There is insufficient network competition	1	2	3	4	5	6
More retail competition would lead to more network investment	1	2	3	4	5	6

The regulatory framework deters investment in new technological developments	1	2	3	4	5	6
In order to encourage more network investment, fundamental changes should be made to the regulatory framework within the next two years	1	2	3	4	5	6
Access regulation, as currently applied by the regulators, does generally allow SMP operators to earn a sufficient return on their investments	1	2	3	4	5	6
Uncertainty about the terms of access discourages the entry of new companies into e-communications markets	1	2	3	4	5	6

Q13. In each of the following areas do you think that overall the new regulatory framework is, or is likely to, improve or damage incentives to invest?

	Improve incentives	**Damage incentives**	**No impact on incentives**
Wholesale markets			
Fixed	1	2	3
Mobile	1	2	3
Terrestrial broadcasting	1	2	3
Satellite broadcasting	1	2	3
Cable TV	1	2	3
Other as per Q1 – Please specify	1	2	3

	Improve incentives	Damage incentives	No impact on incentives
Retail markets			
Fixed	1	2	3
Mobile	1	2	3
Terrestrial broadcasting	1	2	3
Satellite broadcasting	1	2	3
Cable TV	1	2	3
Other as per Q1 – Please specify	1	2	3

Q14. In your opinion, what three changes to the underlying regulatory framework would most encourage more investment in the sector? ***Please record verbatim below***

1.
2.
3.

Q15. In your opinion, what three changes to the behaviour of national regulatory authorities would most encourage more investment in the sector ***Please record verbatim below***

1.
2.
3.

CLOSE INTERVIEW:

Thank you for taking the time to answer our questions.

Sign and date survey below:

I declare that this interview was conducted within the Market Research Society's Code of Conduct and according to instruction and that the respondent was unknown to me. I understand that all information given to me must be kept confidential.

Date: / / Signed: _____