MPRA

e-Communications: Investment and the Regulatory Framework

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COMMUNICATIONS STRATEGIES

December 2006

e-Communications:
Investment and the Regulatory Framework

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Abstract: The EU regulatory framework for e-communications was adopted by the European Parliament and the Council in 2002, and became applicable from 2003. It has three primary objectives: (1) to promote competition; (2) to develop the single market; and (3) to promote citizens' rights. The European Commission's DG Information Society commissioned London Economics to estimate the level of e-communications investment in the EU and to examine its main drivers as part of a contribution to the Commission's 2006 review of the e-communications framework. This paper outlines some of the findings of that study. The paper provides a description of the process of collecting data on investment in physical infrastructure in the e-communciations sector by country and by sub-sector. It also presents the collected data, showing a decline in overall investment between 2001 and 2003 and a subsequent upturn in 2004. An econometric analysis of the drivers of investment over the period is undertaken, which suggests that better performing regulatory regimes, as measured by an OECD regulatory index, can contribute to higher levels of investment in the sector.
Key words: e-communications, investment, regulation.

The renewed Lisbon Agenda for Europe seeks to stimulate innovation, creativity and entrepreneurship in the ICT and media sectors. In this respect, e-communications play a key role as they have become increasingly instrumental to economic growth, innovation and creativity. The EU regulatory framework for e-communications was adopted by the European Parliament and the Council in 2002, and became applicable from 2003. It has three primary objectives: (1) to promote competition; (2) to develop the single market; and (3) to promote citizens' rights. The European Commission's DG Information Society commissioned London Economics to estimate the level of e-communications investment in the EU and to examine

its main drivers as part of a contribution to the Commission's 2006 review of the e-communications framework. This paper outlines some of the findings of that study (London Economics and PwC, 2006).

One of the key objectives for the study was the development of a dataset for investment in the e-communications sector across the EU that would enable the examination of investment both at the aggregate level and at the level of each member state and for a number of sub-sectors – fixed telecommunciations, mobile telecommunications, broadbcasting and cable. The focus was to be on investment in physical infrastructure, such as the communications networks and associated equipment. Investment data was collected for the period 2001-2004 and analysed to identify the patterns of investment over this period. In addition, an econometric analysis was undertaken to seek to determine the main drivers of investment and, in particular, the extent to which regulation may affect investment.

Previous studies have found a positive relationship between investment in telecommuncations and GDP (RÖLLER & WAVERMAN, 2001; WALLSTEN 2003a, 2003b) and also between investment and privatisation and competition (LI & XU, 2002). In the latter study, although competition is identified as a key complement to privatisation, stimulating investment in telecommunications, the authors do not find the effect to be significant. Wallsten (WALLSTEN, 2003a) also found that 'exclusivity' arrangements (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.

■ Collection of investment data

The primary source of investment data was company annual reports. Investment data was collected from the annual reports of over 200 market players. The aim was to identify sufficient market players to represent 90% of the overall market for these services.

Data for increases to tangible fixed assets were collected with the preferred source being cash flow statements or the 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.

Only additions to tangible fixed assets are included in the investment figures, as a sale of fixed assets does not represent a decrease in investment in the e-communications sub-sector. Hence all figures reported relate to gross and not net investment. In a minority of cases, data from company annual reports were not available. In those cases, alternative sources of information were used. For some companies, figures from the Amadeus database on the stock of tangible fixed assets (as reported in the balance sheet) were used and investment computed as the annual change in tangible fixed assets. Data from a survey of operators undertaken by the study team were also used. Where companies operate in more than one sub-sector and/or across more than one country, published annual reports do not always provide such a breakdown. Where this was the case, the shares of total capital expenditure, including intangibles, for individual sub-sectors were used as weights to disaggregate totals. Similarly, the share of the country's capital expenditure in total capital expenditure was used as the weight to disaggregate investment totals for relevant companies by country.
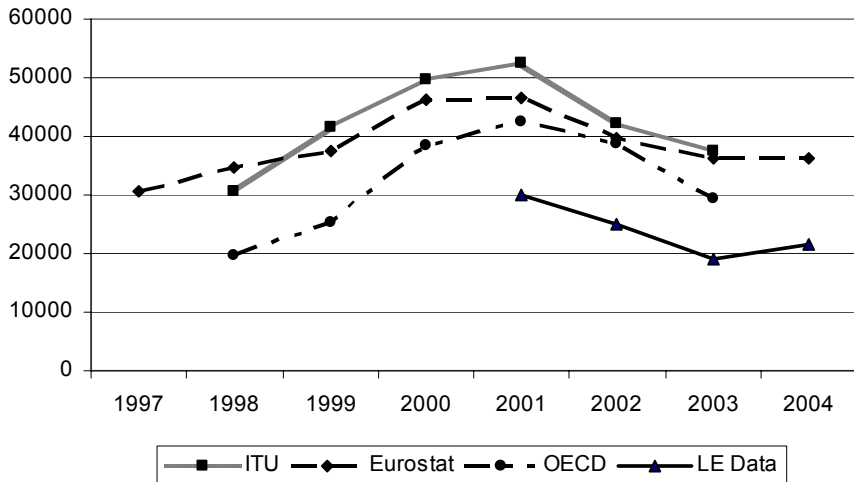
The adjustments made to the disaggregated data, and subsequent tests on the data, suggest that they contain some measurement error and should be treated with caution. At a more aggregated level, data is likely to be more reliable as it comes straight from the annual reports. Other sources of aggregate investment data were investigated for the purposes of comparison. These included investment data published by the International Telecommunications Union (ITU), the OECD and by Eurostat.

Figure 1 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). The estimates of total investment in fixed and mobile telephony vary between the four sources.

There are several factors that contribute to this difference. All three of the other sources include intangible assets (except spectrum licence fees), whilst the data collected from company reports excludes intangible assets. Interestingly, although the investment definitions used by the ITU and Eurostat appear to be very similar (except that the Eurostat data includes satellite investment and the ITU does not), the ITU provides higher estimates of investment. One further factor is that London Economics data has not

been collected from every company in the sector (though the data collected is expected to have captured a large part of physical infrastructure investment).

Figure 1 - Comparison of investment data in fixed and mobile telephony from different sources (€m, 2001 prices)

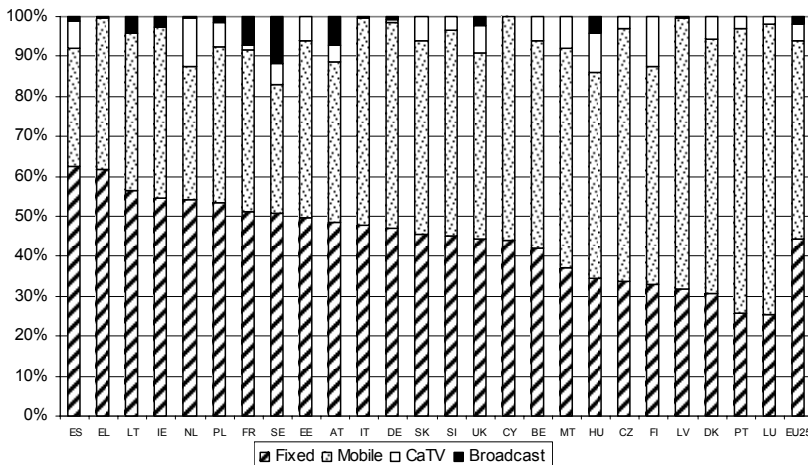Note: Fixed and mobile telephony investment for Germany, Spain, France, Italy and the United Kingdom.

Sources: Eurostat, OECD Communications Outlook 2005, ITU World Telecommunications Indicators Database 2005, annual reports and LE calculations.

■ Patterns of investment

The LE data in figure 1 shows a decline in investment over the period 2001-2003 followed by an upturn in 2004. Discussions with market operators, undertaken as part of the study, suggested a general view that the decline from the peak in investment in 2001 was a part of the normal investment cycle, with the collapse of the financial bubble contributing to the decline. Following a period of high investment in the late 1990s, many operators were consolidating their positions and focussing on increasing revenues from their new infrastructure. Other factors that were cited as contributing to the decline to 2003 were limited availability of credit and investment opportunities; increased competition and regulatory uncertainty. New market opportunities, improving economic conditions and regulatory developments were viewed as factors that contributed to the upturn.

From an examination of the sub-sectoral breakdown of e-communications investments in the European Union we observe that most investments were in fixed and mobile telephony (see figure 2) [1]. This can be explained by the large investments needed to support the uptake of new technological developments in those sectors, such as fixed 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.

Figure 2 - Composition of gross investment by sub-sector (2001-2004, 2001 prices)
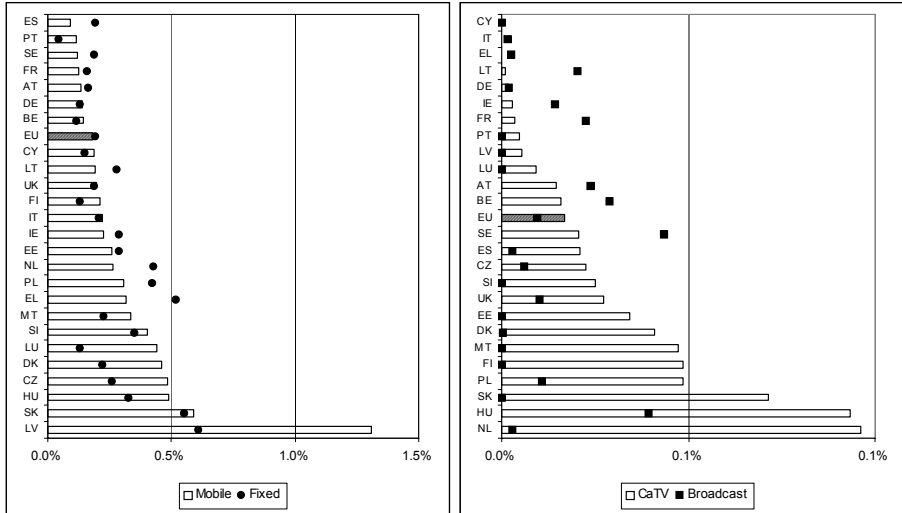

Sources: Annual reports and LE calculations

Many of the EU15 member states show very low investment figures in the fixed sub-sector, and to a lesser extent in the mobile sub-sector. This is particularly relevant for Portugal, France, Austria, Germany and Belgium (see figure 3). Although new member states have investment figures above the EU average for the mobile industry, many EU15 countries have also been investing heavily in this new technology; and in some instances more so than the new member states.

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[1] Fixed telephony also includes broadband services.

Figure 3 - Investment 2001-2004 by sub-sectors (% of GDP)

Sources: Annual reports and LE calculations

■ The model

To estimate the determinants of investment we posit a general model based on country- and market-specific characteristics. Having data at the firm level, we depart from previous studies 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 [2] 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

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[2] Deflated using the U.S. telecommunications deflator to constant 2001 prices. GDP per capita figures have been rebased to 2001 and deflated using the HICP (Harmonised Index of Consumer Prices) from Eurostat.

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 an index of regulatory reform developed by the OECD (CONWAY & NICOLETTI, 2006). This measures regulatory performance in each country and changes over time [3],

$Z3_{ijt}$ 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 [4],

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

■ Results

The results of different model specifications are presented in table 1. Model [1] includes only the log of the OECD regulatory index [5] (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). In this simple form, the model already shows that the regulatory index is statistically significant and with a positive sign, indicating that those countries with a lower regulatory performance have less investment.

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[3] The OECD index measures regulatory performance in terms of the degree of free entry into the market; the extent of government ownership of the major operators; and market structure, based on market shares. Following an inversion of the index by London Economics, a higher index number indicates an improved regulatory performance.

[4] The importance of the cost of capital has been recognised elsewhere as a determinant of a firm's investment (JORGENSON, 1983). 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 may be due to its high correlation with some other variables included in the model.

[5] Measured in terms of the degree of free entry into the market; the extent of government ownership of the major operators; and market structure, based on market shares.

Table 1 - 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%.

For model [2], 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) have been added. The coefficients 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.

Model [3] also includes firms' total assets (to control for the fact that larger companies 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. The country's area has also a positive and significant impact, but not density (this is due to the correlation between density and the land area variable).

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 dimensions 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 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 R2 of 0.55 in model [3]. Correlation coefficients are generally low and we use the Huber-White sandwich estimator of variance (HUBER, 1967; WHITE, 1980) to correct for heteroskedasticity and to ensure that our standard errors are robust.

As a robustness check we also estimate two additional models, which use similar model specifications, but aggregate investment data at the country level (for each year and sector). One of these models used the OECD index as the measure of regulatory effectiveness and the other used the ECTA scorecard (ECTA, 2004). Both models show that efficient regulation is a significant explanatory factor and leads to higher levels of investment.

■ **Conclusions**

Overall, we conclude from this analysis that there are a number of important factors that contribute to determining investment levels.

A better performing regulatory regime does appear to be one of those factors. We used an OECD index as our main measure of regulatory effectiveness, though similar results were also obtained when the ECTA index was used. The OECD Index measures regulatory performance in terms of the degree of free entry into the market; the extent of government ownership of the major operators; and market structure, based on market shares. The market entry and market structure elements of the index mean that this measure is quite similar to a measure of the degree of competition or, perhaps, the extent to which the regulatory regime is allowing or encouraging competition to take place.

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. Factors related to company size, such as status as an incumbent and investment across more than one sector, were also influential. 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.

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