**Broadband Markets in the EU:
The importance of dynamic competition
to market growth**

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1. Executive Summary

- This the fourth paper in our occasional series on the relationship between competition in EU broadband markets and market growth.

- In this latest study we have been able to widen the sample of countries in the model to include six of the New Member States which joined the EU in May 2004.

- Using the same sample of 13 Member States used in our previous papers, our model suggest that 59% of the variation between the rate of change in broadband subscribers in the EU13 can be explained by the rate of change in market concentration.

- We have calculated an elasticity of the relationship between change in market concentration and change in take-up for thirteen EU countries and found that *for every 1% decrease in market concentration there is a 2.86% increase in broadband take-up.*

- For the enlarged EU, there is a clear, 41%, correlation between the level of broadband take-up and competition between access modes, identified as: incumbent's own ISP; resellers of incumbent's bitstream; LLU; cable; and other modes.

- The elasticity for larger group of countries is –1.66: *for every 1% decrease in market concentration there is a 1.66% increase in broadband take-up.*

- Taking this elasticity coefficient and applying it to the decrease in the market concentration required for all countries to reach the low level found in Sweden, we find that an **additional 20 million subscribers could be achieved if all countries had the same intensity of competition.**

- Our model explains 82% of the variation in broadband take-up amongst this wider group.

- Based on this analysis we make four recommendations to policy makers:

  - Remove barriers to efficient market entry;
  - Promote infrastructure competition;
  - Reduce barriers to switching; and
  - Monitor collusion.

2.   Introduction

When the European Commissioner for the Information Society and Media, Viviane Reding launched the i2010 programme in January 2005, she recognised the importance of competition in broadband markets to faster take-up by consumers. She said:

> *The evidence we have today clearly shows that the Countries in Europe that have the most competition are also the areas that lead in broadband take-up. Thus my first priority will be to look carefully at the instruments that I have in the new regulatory package on electronic communications to see how we can provide competitiveness by promoting competition.[1]*

Our own earlier analysis strongly supported the relationship between competition and take-up. Using data for 13 EU countries for the ten quarters up to Q2 2004 we found that 71% of the variation in broadband take-up could be explained by different intensities of competition between DSL, bitstream, unbundled local loops, cable and other forms of broadband access[2]. Other studies have also found that the level of competition, both between and within platforms, plays an important, if not pivotal role in promoting take-up of broadband: those countries with the most intense competition also enjoy highest rates of take-up.

In this latest addition to our series of papers we expand our analysis to include the Member States[3] which joined the EU in May 2004. Some of the new Member States have the fastest growing economies in the EU and rapidly expanding telecommunications markets. In this paper we can see how broadband take up has responded to the intensity of competition. We have also calculated the potential for growth if all countries had the same level of competition as the most competitive market in Europe.

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[1] Speech to Microsoft Government Leaders' Forum, Prague 31st January 2005.
[2] Cadman, R and Dineen, C, _Broadband and i2010: The Importance of Dynamic Competition to Market Growth_ February 2005 available at www.spcnetwork.co.uk
[3] Excluding Cyprus, Czech Republic, Latvia and Poland for data quality reasons.

3. The European Broadband Market

The broadband landscape in the European Union is as varied as the continent's languages. Less than 1% of the population in Greece is connected to broadband but in Denmark nearly 23% have high speed Internet access[4]. Similarly, the speed at which consumers are buying broadband varies significantly. The growth rates of EU countries[5] over the seven quarters from Q1 2004 to Q3 2005 are shown in Figure 1, overleaf. Slovakia and Ireland have the fastest growth rates over the period, 341% and 237% respectively, whilst Sweden and the Netherlands have growth rates of just 34% and 46%, though these two countries began the period with a higher level of market penetration.

Table 1 shows the level of broadband penetration rates for the 25 EU countries as at Q3 2005. Nordic states dominate the top of the table: all three EU members in the region are in the top six countries. Two Benelux countries are also in the top group along with the UK. The bottom half of the table is dominated by new Member States and Greece, where broadband has been introduced relatively recently.

	Subscribers per capita (%) (Q3 2005)
Denmark	22.9
Netherlands	20.3
Finland	19.2
Belgium	17.8
UK	14.9
Sweden	14.9
Luxembourg	13.6
Austria	13.4
Estonia	12.0
Germany	11.7
France	11.4
Malta	11.2
Portugal	10.8
Italy	10.0
Spain	9.8
Slovenia	8.4
Lithuania	5.7
Ireland	5.3
Hungary	5.1
Slovakia	1.8
Greece	0.7

Table 1 : Broadband Penetration

Many factors might explain the varying rates of penetration and the speeds at which broadband has penetrated the various national markets. Price, the launch date of commercial broadband, alternative sources of premium content and government policy are four possibilities. In previous papers we have explored the relationship between levels of access mode (i.e. DSL vs. cable) concentration at a given point in time and broadband take-up and have found a strong relationship. In the remainder of this paper we take that analysis further by exploring the dynamic relationship between changing levels of market concentration and penetration. We have also extended our definition of competition to include competitive suppliers of DSL, based either on a wholesale bitstream product from the incumbent or on local loop unbundling.

As with the rate of take up, the structure of the broadband access market varies in each of the EU countries. Table 2 shows the proportion of the market held by the five access methods analysed in this article for the 21 Member States covered in this study.

In Slovakia, the market is almost exclusively based on DSL with 83% of lines retailed by the incumbent's ISP. By contrast, in the UK BT has just 25% of broadband subscribers, alternative ISPs based on a wholesale DSL product have 38% and the two cable companies 37% between them.

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[4] All data sourced from ECTA except population source Eurostat.
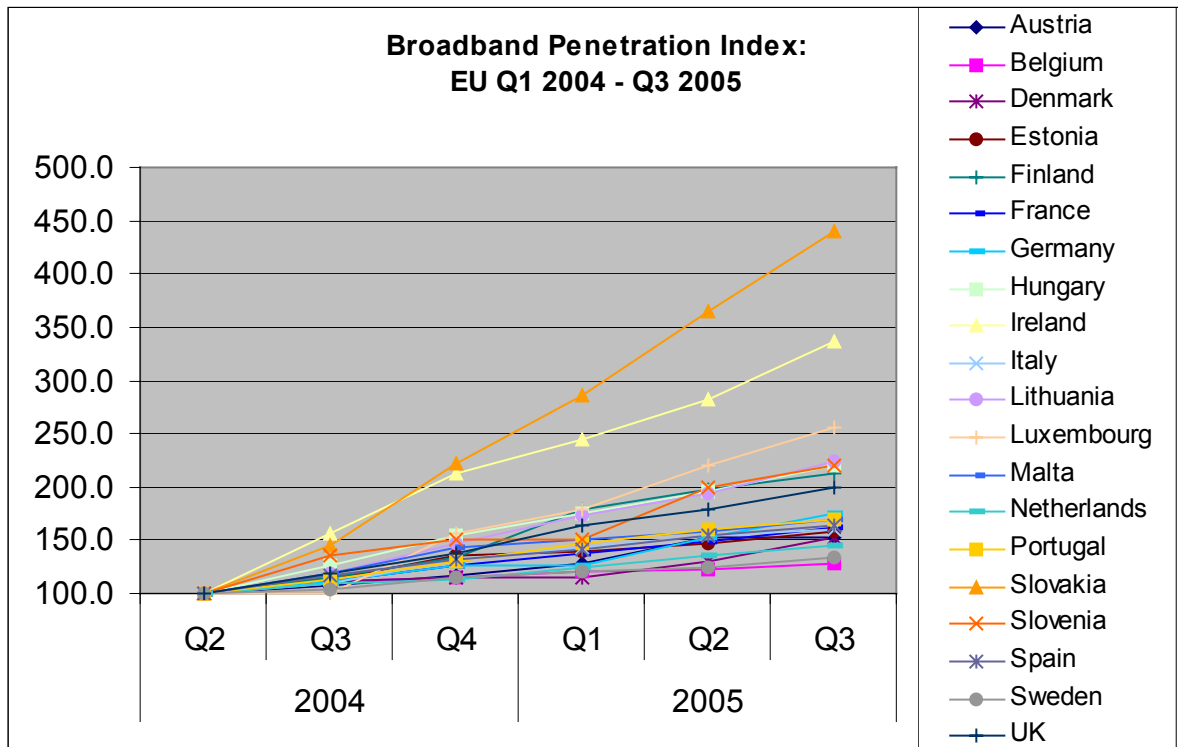[5] Excluding Cyprus, Czech Republic, Greece, Latvia and Poland.

Figure 1: Broadband Growth Rates

Using these data we have calculated the degree of market concentration amongst these five access methods using the Herfindahl-Hirschmann Index (HHI) which calculates a score between 0 and 10,000 by summing the squares of the percentage market share of each access mode[6]. The higher the HHI score, the more concentrated the market. The HHI score for each country is shown in the right hand column of Table 2.

Slovakia (7,142) and Luxembourg (5,857) have the highest concentration, and so the highest HHI, whilst Sweden (3,109) and Denmark (3,202) have the lowest. Sweden has a particularly low concentration due largely to the presence of fibre in Stockholm.

Normally, the HHI is used to calculate market concentration amongst competing firms and so requires data for the market share of each retailer of broadband access. This information is not available on a consistent basis over the time period so our analysis is based only on the degree of competition between access modes.

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[6] Formally the HHI is shown as $HHI = \sum_{i=1}^{f} S_i^2$ Where f = number of technologies in the market, Si = each technology's market share and i = technology in a given industry. Normally the HHI is used to measure the concentration amongst supplier firms rather than access modes.

	Market Share					
	Incumbent	OLO	LLU	Cable	Other	HHI
Austria	39%	9%	9%	41%	2%	3,377
Belgium	51%	14%	0%	34%	0%	3,996
Denmark	45%	7%	5%	31%	12%	3,202
Estonia	47%	0%	1%	28%	24%	3,549
Finland	57%	8%	13%	14%	9%	3,730
France	59%	28%	5%	8%	0%	4,325
Germany	64%	11%	21%	3%	1%	4,663
Greece	63%	29%	5%	0%	2%	4,904
Hungary	48%	17%	0%	31%	3%	3,631
Ireland	60%	17%	1%	9%	13%	4,173
Italy	71%	15%	9%	0%	6%	5,317
Lithuania	42%	1%	0%	22%	35%	3,444
Luxembourg	75%	11%	3%	10%	0%	5,857
Malta	27%	31%	0%	42%	0%	3,449
Netherlands	51%	0%	2%	47%	0%	4,786
Portugal	49%	4%	4%	43%	0%	4,269
Slovakia	83%	0%	0%	17%	0%	7,142
Slovenia	60%	2%	0%	36%	1%	4,904
Spain	57%	19%	1%	22%	0%	4,125
Sweden	48%	12%	3%	18%	19%	3,109
UK	25%	47%	0%	28%	0%	3,582

**Table 2 : Broadband Market Structures**

4.   Analysis

In our previous paper we tested the hypothesis that, within the pre-May 2004 EU Member States[7], there was a strong relationship between the rate of change in market concentration of different forms of broadband access and the growth of broadband penetration. We tested this hypothesis using a pooled time-series/cross-section model and indeed found such a relationship.

In this paper we again have again set the same hypothesis, but are able to test the hypothesis using a larger data set comprising 21 of the 25 Member States, although we have had to exclude Cyprus, Czech Republic, Latvia and Poland due to data problems. We have also re-run the model for the 13 pre-May 2004 Member States that we used in the previous model

4.1   EU 13

Our first level of analysis was to calculate a simple correlation between the change in HHI over the period Quarter 1 2002 to Quarter 3 2005 with the change in market take-up over the same period. We find a medium correlation of –0.44. The sign is negative, as we would expect as a lower HHI number indicates greater competition. This correlation is shown graphically in Figure 2, though here we have inverted the HHI for presentational purposes, so that the trend line slopes upwards.

Figure 2: Relationship between Competition and Growth: EU13
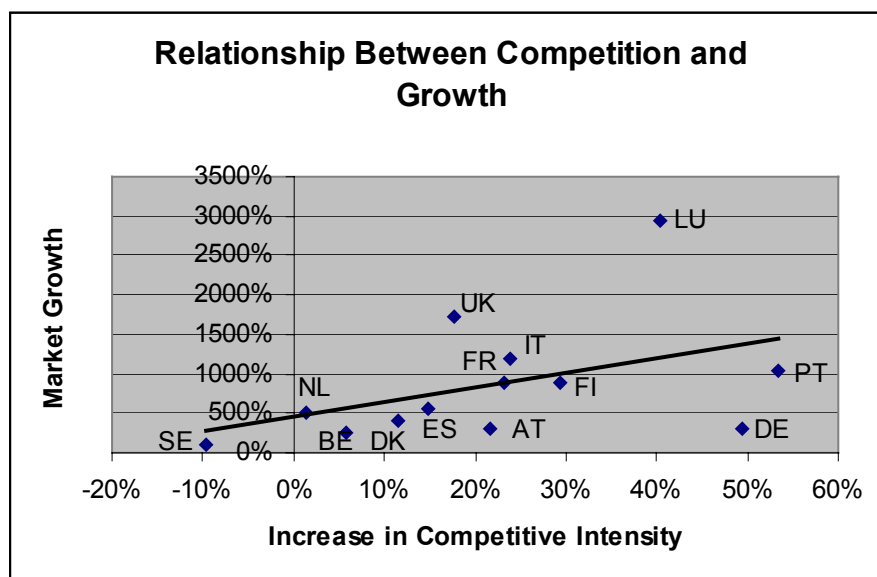
We then developed a pooled time-series/cross-sectional econometric model using penetration and market concentration data for 13 countries over 15 quarters for each of the five access models (195 data points). The model had the coefficient on HHI constrained to be identical, and the constant terms different, across the countries. A double log model was found to produce a better fit than a linear model. Iterative Generalised Least Squares (GLS) with cross section weights was used to estimate the model.

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[7] Excluding Greece and Ireland for data reasons.

The resultant equation is:

$$\text{Log}(\text{Subs}_i) = C_i - 2.86 \cdot \log(\text{HHI}_i)$$

where the subscript, i, indicates country i and C is the constant term. Subs is broadband subscribers per 100 population and HHI is calculated as explained above.

The result of the model was robust and suggests a strong and relationship between change in HHI and change in broadband penetration. The t-statistic on the coefficient of HHI is – 13.18 indicating a very strong statistical significance of greater than 99%. The adjusted R^2 is 0.59.

If, as is common when using the double log model form, we consider the coefficient to be an elasticity, it indicates that a 1% decrease in market concentration will lead to a 2.86% increase in market penetration. The R^2 of 0.59 suggests that 59% of the variation in the rate of change of broadband penetration in the 13 countries can be explained by the rate of change in the HHI.

The equation is, to all intents and purposes, identical to the previous time we ran the model. The coefficient is now 2.86 compared with 2.83, and with a stronger t-statistic (13.18 compared with 10.24). However, the R^2 is rather less: 0.59 compared with 0.71. So, 13% less of the variation between rates of change in penetration can be explain by the current model compared to our previous version.

The most likely explanation for this is that over the intervening five quarters, the HHI for the 13 countries has converged. At Q2 2004, the level of the HHI ran from 7,457 in Germany to 3,404 in the UK whereas at Q3 2005 the difference was between 5,857 in Luxembourg to 3,109 in Sweden. With a narrower range of HHI scores, we would expect this variable to explain less of the variation in rates of change in broadband penetration.

4.2   EU 21

To examine the relationship between market concentration and broadband take up we first ran a simple bi-variate correlation for Q3 2005. The resulting coefficient was moderately strong at –0.41. As expected we found a negative correlation: as the HHI decreases, so take-up increases.

We then used the same econometric technique as above to examine the relationship over time, but for 21 of the current 25 Member States. The resultant equation is:

$$\text{Log}(\text{Subs}_i) = C_i - 1.66 \cdot \log(\text{HHI}_i)$$

The t-statistic was 8.03, again giving us confidence in excess of 99% and the R^2 was 0.82.

So, for the EU21, we can say that a 1% decrease in HHI will lead to a 1.66% increase, a rather lower elasticity than we find for the EU 13. However, given the much greater range in HHI scores, we can see that this model explains some 82% of the variation in broadband penetration across the sample.

4.3 Elasticity

Taking the elasticity coefficient of 1.66 for the EU21, we have calculated the potential for broadband take-up if all Member States in the sample had the same level of competitive intensity as Sweden. We have calculated the difference between the current HHI for each country and Sweden as a proportion of each country's current HHI. We have then applied the our elasticity coefficient to the proportionate difference to calculate the growth for each country if the same levels of competition were achieved as in Sweden and calculated the resulting penetration levels. By summing the additional subscribers in each country we find that over 20 million subscribers would be added to the European broadband market if all countries were as competitive as Sweden. We expect this number to be conservative as two of the larger new Member States (Czech Republic and Poland) have had to be excluded from the model. The calculation is shown in Table 3.

Table 3: Potential Market Size

	A	B	C	D	E	F	G
	Current Penetration (percent)	Current HHI	Difference From Lowest (Sweden)	Difference as %age	Growth potential	Penetration % if HHI ≡ Sweden	Additional Users ('000)
			B - HHI Sweden	C / B	D * 1.66	A + (A * E)	Population * F
Austria	13.4	3,377	267	7.9%	13%	15.2	142
Belgium	17.8	3,996	887	22.2%	37%	24.3	678
Denmark	22.9	3,202	92	2.9%	5%	24.0	59
Estonia	12.0	3,549	440	12.4%	21%	14.4	33
Finland	19.2	3,730	621	16.6%	28%	24.5	277
France	11.4	4,325	1,216	28.1%	47%	16.7	3,170
Germany	11.7	4,663	1,553	33.3%	55%	18.1	5,325
Greece	0.7	4,904	1,795	36.6%	61%	1.1	48
Hungary	5.1	3,631	522	14.4%	24%	6.3	123
Ireland	5.3	4,173	1,064	25.5%	42%	7.6	89
Italy	10.0	5,317	2,207	41.5%	69%	16.8	3,940
Lithuania	5.7	3,444	335	9.7%	16%	6.6	32
Luxembourg	13.6	5,857	2,748	46.9%	78%	24.1	47
Malta	11.2	3,449	340	9.9%	16%	13.1	7
Netherlands	20.3	4,786	1,677	35.0%	58%	32.1	1,914
Portugal	10.8	4,269	1,160	27.2%	45%	15.7	508
Slovakia	1.8	7,142	4,033	56.5%	94%	3.5	91
Slovenia	8.4	4,904	1,795	36.6%	61%	13.5	102
Spain	9.8	4,125	1,016	24.6%	41%	13.9	1,671
Sweden	14.9	3,109	0	0.0%	0%	14.9	-
UK	14.9	3,582	473	13.2%	22%	18.2	1,942

Germany, Italy and France have the greatest potential for growth in absolute numbers if they are able to achieve more intense levels of competition whilst Slovakia, Luxembourg and Lithuania have the greatest proportional potential.

5. **Conclusion and Policy Implications**

As with our previous analysis, we once again conclude that the rate of change in broadband penetration is strongly and negatively correlated with the rate of change in the level of market concentration between different forms of broadband access: the faster the HHI falls, the faster broadband is taken up by consumers.

So what can policy makers do to promote dynamic competition? Below we set out four steps regulators and governments should consider:

- **Remove barriers to efficient market entry –** There is much that regulators can do to encourage efficient market entry: for example mandating wholesale DSL and promoting LLU. The former has been most effectively executed in the UK resulting in 47% of broadband connections via retailers of BT's wholesale products. France has seen the market share of LLU increase by a factor of 17 since Q2 2004 (when we last undertook this analysis) creating new dynamic competition.

- **Promote efficient entry of new infrastructure -** The broadband access market remains dominated by two technologies: cable and DSL. Only in the Baltic States, Denmark, Italy and Sweden do alternative infrastructures have any real foothold. Yet alternative technologies represent a potential source of dynamic competition. Regulators should ensure that, in promoting wholesale access to incumbent facilities, they do not damage the potential for entry by, for example, wireless and fibre, or even the upgrading of existing cable assets to support 2-way broadband. The "ladder of investment" should encourage firms to step all the way up to infrastructure competition.

- **Reduce barriers to switching –** Regulators cannot directly affect the market shares of firms, but they can make it easier for consumers to switch suppliers by, for example, ensuring that switching costs are kept low. Charges levied by an incumbent operator for switching a wholesale DSL line from itself to a competitor must be reasonable and there should be no unnecessary, anti-competitive delays in the process.

- **Closely monitor market collusion -** static market shares are often taken as an indicator of tacit collusion between competitors. Where market shares have not changed much over time, regulators should ensure that firms are not acting in a concerted manner reducing the level of dynamic competition.