



**Broadband and i2010:  
The importance of dynamic competition  
to market growth**

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## 1 Executive Summary

- Viviane Reding, the new EU Commissioner of Information Society and Media, has recognised the importance of broadband competition to achieving her new i2010 agenda to promote competitiveness and productivity in Europe. She has said that she will be looking at the policy instruments available to her to promote broadband competition.
- In our earlier work we have examined the relationship between cable vs. DSL competition and broadband take-up. In this new paper we explore the dynamic relationship between competition in all forms of broadband supply and penetration. Specifically we look at how changing market structures and take-up are related.
- There is a clear, 40%, 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.
- However, there is a much stronger, 72%, relationship between the *rate of change* in the levels of market concentration and the *rate of change* in broadband take up as at June 2004.
- Taking this analysis one step further, and looking at the relationship over time, we see a stronger relationship still. 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 3% increase in broadband take-up.**
- Our model suggest that 71% 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.
- It is no surprise, therefore, that the fastest growing broadband markets, Luxembourg and the UK, have amongst the sharpest declines in market concentration nor that Sweden, where growth is slow, has seen a slight rise in concentration over the period Jan 2002 - June 2004.
- 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

The importance of ICT to the economic growth of Europe is well understood by the new European Commissioner for the Information Society and Media, Viviane Reding. Setting out her new i2010 programme during a speech in January she also 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.<sup>1</sup>*

Our own earlier analysis supports the relationship between competition and take-up. Using data for 13 EU countries for the ten quarters up to Q4 2003, we have found that 50% of the variation in broadband take-up can be explained by different intensities of competition between DSL and cable<sup>2</sup>. Other studies have also found that the level of inter-modal competition 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.

Using the same sample of 13 EU countries, in this new paper we go two steps further:

- First by exploring the relationship between all forms of competitive broadband supply and take-up. Five different forms of supply have been identified: the incumbent; resellers of the incumbent's wholesale bitstream service; providers based on unbundled local loops; cable operators and "others", principally wireless, satellite and fibre.
- Secondly, by examining the importance of dynamically changing market shares. Rather than simply examining the static, current position of market shares and take-up we examine how these have developed over the ten quarters up to Q2 2004 and the dynamic relationship between them.

We then go on to look at policy instruments that may be used by NRAs to promote competition in broadband markets.

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<sup>1</sup> Speech to Microsoft Government Leaders' Forum, Prague 31<sup>st</sup> January 2005.

<sup>2</sup> Cadman, R and Dineen, C, (March 2004) *The Impact of Inter-Modal Competition on Broadband Access Markets in Europe* available at [www.spcnetwork.co.uk](http://www.spcnetwork.co.uk)

## The European Broadband Market

The broadband landscape in the European Union is as varied as the continent's languages. Fewer than 0.1% of the population in Latvia and Cyprus are connected to broadband but in Denmark over 15% have high speed Internet access<sup>3</sup>. Similarly, the speed at which

	Subscribers per capita (%)
Denmark	15.1
Belgium	14.0
Netherlands	14.0
Sweden	11.1
Finland	9.0
Austria	8.7
Estonia	7.6
UK	7.5
France	7.0
Germany	6.7
Malta	6.6
Portugal	6.4
Italy	6.2
Spain	6.0
Luxembourg	5.3
Slovenia	3.8
Lithuania	2.5
Hungary	2.3
Ireland	1.6
Czech Rep.	0.6
Slovakia	0.4
Poland	0.3
Greece	0.2
Cyprus	<0.1
Latvia	<0.1

**Table 1 : Broadband Penetration**

consumers are buying broadband varies significantly. Luxembourg is in the fast lane: whereas just 0.4% of population were connected in Quarter 1 2002, 5.3% were in Q2 2004, an increase of over 1,000%. Surprisingly, the slow lane is occupied by Sweden which has seen only a 51% rise in broadband penetration over the same period. However, its relatively large initial base means that Sweden is still amongst the top five countries for broadband take-up.

Table 1 shows the level of broadband penetration rates for the 25 EU countries as at Q2 2004. Nordic states dominate the top of the table: all three EU members in the region are in the top five countries. Two Benelux countries are also in the top group. The bottom half of the table is dominated by new Member States where broadband has been introduced relatively recently.

The growth rates of 13<sup>4</sup> EU countries over the ten quarters to Q2 2004 are shown in Figure 1, overleaf. Starting from a low base of 0.4% and 0.8% of population respectively, Luxembourg the UK and have seen the fastest rise in broadband subscriptions. In contrast, Sweden has had modest growth though it started from the highest base, 7.3% of population, and has now dropped to fourth in the table.

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 inter-model competition to include competitive suppliers of DSL, based either on a wholesale bitstream product from the incumbent or on local loop unbundling.

<sup>3</sup> All data sourced from ECTA except population source Eurostat.

<sup>4</sup> Analysis over time is based on the 13 EU countries shown in Figure 1. Greece and Ireland are excluded due to data problems and the 10 new Member States have been excluded due to lack of time series data.

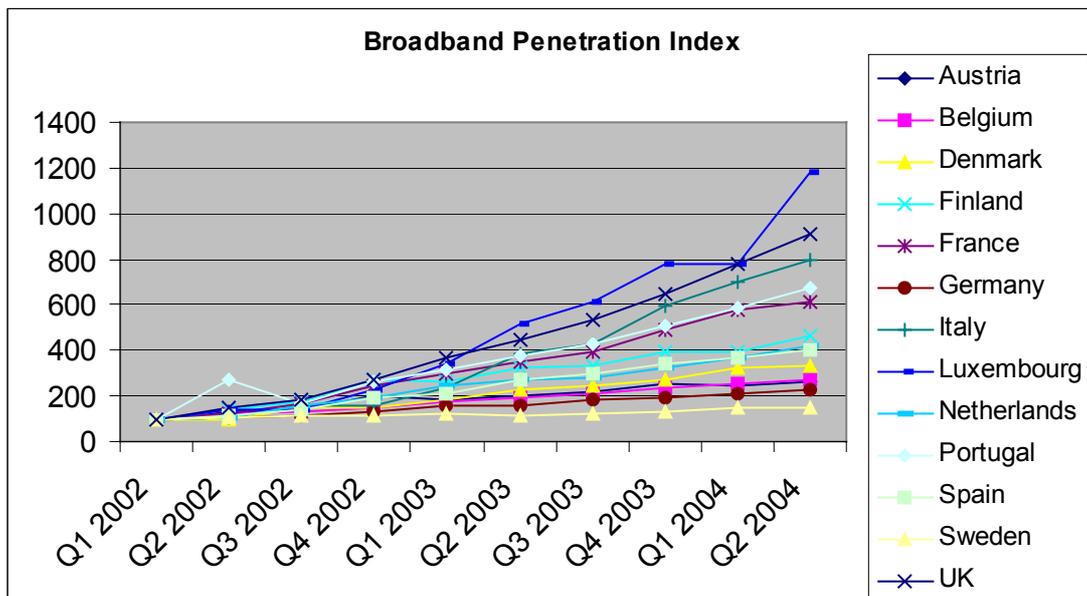


Figure 1: Broadband Growth Rates

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.

	Incumbent DSL	Wholesale DSL	LLU	Cable	Other	HHI
Germany	86%	0%	12%	2%	1%	7,457
Luxembourg	76%	7%	3%	13%	1%	6,048
Italy	68%	15%	9%	0%	8%	5,007
Spain	62%	20%	2%	16%	0%	4,490
Finland	59%	6%	13%	21%	1%	4,123
France	54%	35%	0%	10%	0%	4,287
Denmark	53%	7%	6%	31%	3%	3,823
Belgium	52%	11%	0%	37%	0%	4,156
Netherlands	48%	0%	1%	50%	0%	4,849
Sweden	44%	15%	1%	21%	19%	2,941
Portugal	39%	5%	1%	55%	0%	4,612
Austria	35%	10%	5%	50%	0%	3,835
UK	25%	38%	0%	37%	0%	3,404

Table 2 : Broadband Market Structures

In Germany, the market is almost exclusively based on DSL with 86% of lines retailed by the incumbent's ISP and 12% by LLU based operators. 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. The Netherlands, Portugal and Austria all have 50% of more customers based on cable.

Using these data we have analysed the degree of market concentration amongst these five access modes 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<sup>5</sup>. 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.

Germany (7,457) and Luxembourg (6,048) have the highest concentration, and so the highest HHI, whilst Sweden (2,941) and the UK (3,404) 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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<sup>5</sup> 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.

### 3 Analysis

Our hypothesis is that the less concentrated the market, the higher the rate of broadband penetration. We have tested this using the data set out above. If our hypothesis is correct, we would expect Germany and Luxembourg, as the least competitive markets, to have a low penetration and Sweden and the UK, with low market concentration, to have a high penetration.

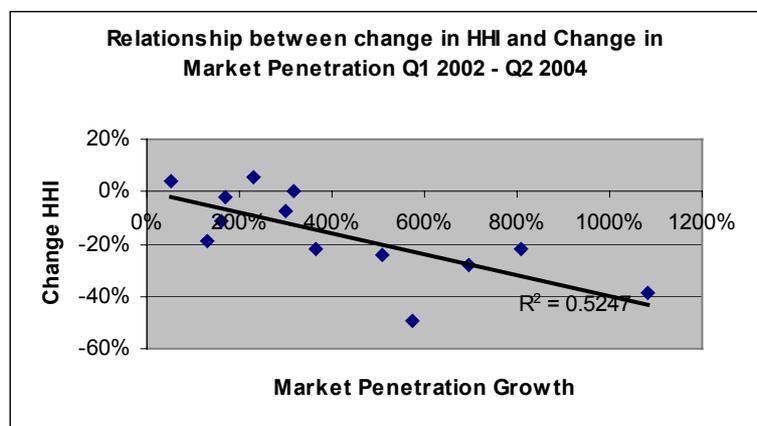
The first test was a simple correlation between HHI and broadband penetration at Q2 2004. We find a moderate correlation coefficient of  $-0.4$ , which is encouraging but does not suggest a particularly strong relationship. We expect a negative relationship because as market concentration measured by the HHI falls, broadband take-up rises.

If we look at the data over the time series, we see some interesting anomalies. Sweden has the least concentrated market, yet its market growth is a sluggish 50% over 2½ years. By contrast, Luxembourg has enjoyed extremely fast growth, but has the second most concentrated market in the sample. Our initial hypothesis would suggest that Sweden should be growing faster than Luxembourg.

We have, therefore, looked at the relationship between the *change* in HHI over the ten quarters from Q1 2002 to Q2 2004 and the *change* in market penetration over the same period. Table 3 shows the sample countries ranked by percentage growth in broadband take-up together with their change in market concentration. Note that Denmark and Sweden have seen a small *increase* in market concentration. The relationship between these data are presented graphically in Figure 2.

	% growth	Change HHI
Luxembourg	1084%	-38%
UK	808%	-22%
Italy	698%	-28%
Portugal	573%	-50%
France	510%	-24%
Finland	364%	-22%
Netherlands	316%	0%
Spain	299%	-7%
Denmark	232%	6%
Belgium	169%	-2%
Austria	161%	-11%
Germany	130%	-19%
Sweden	51%	4%

**Table 3: Market Changes**



**Figure 2: Market Change Relationship**

There is a considerably stronger correlation, of  $-0.72$ , between *change* in penetration and *change* in HHI. The implication is that the rate of change in the market concentration is more important at explaining the take up of broadband than the actual level of market concentration. Again, we expect a negative coefficient as a lower HHI indicates a less concentrated market: so as HHI decreases, market penetration increases.

Finally, we have calculated the market concentration elasticity of demand for broadband using data for each of the 13 countries for ten quarters. We found an elasticity of  $-2.83$ , i.e. for each 1% fall in market concentration (HHI), there is a 2.83% increase in broadband take-

up with a very high level of probability. This model also found that 71% of the variation in the change of broadband take-up can be explained by changes in market concentration.

Our hypothesis that market penetration is closely linked to market concentration is therefore strongly confirmed. However, the important finding is that it is not the absolute level of market concentration, but the change in concentration over time which appears to drive broadband growth. The model we used to calculate the elasticity is described in the box below.

We developed a pooled time-series/cross-sectional econometric model using penetration and market concentration data for 13 countries over 10 quarters. 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.

The resultant equation is:

$$\text{Log}(\text{Subs}_i) = C_i - 2.83 \cdot \text{log}(\text{HHI}_i)$$

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 relationship between change in HHI and change in broadband penetration. The  $t$ -statistic on the coefficient of HHI is -10.24 indicating a strong statistical significance. The adjusted  $R^2$  is 0.71.

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 2.83% increase in market penetration. The  $R^2$  of 0.71 suggests that 71% 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.

To extend the sample to the whole EU, we also ran a different model based on data for as many member states as possible. Time series data were not available so we ran a cross-sectional model using 2004 Q2 data for 21 Member States (excluding Greece, Ireland, Cyprus and Latvia, for which the data are not reliable). To account for differences in national income, which may also explain variations in broadband take-up, we added gross domestic product (GDP) as an additional variable.

The model yielded the following equation:

$$\text{log}(\text{Subs}) = 0.48 - 1.86 \cdot \text{log}(\text{HHI}) + 1.69 \cdot \text{log}(\text{GDP})$$

The  $t$ -statistic on the coefficient of  $\text{log}(\text{HHI})$  is -3.70 and on  $\text{log}(\text{GDP})$  is 4.36 so both are statistically significant. The adjusted  $R^2$  is 0.64. The simple correlation between Subs and HHI is -0.47.

GDP is forecast 2004 Gross Domestic Product per inhabitant in PPP at current market prices from the Eurostat Yearbook 2004.

Again, we find a similar strong relationship across the Member States between broadband take-up and market concentration, allowing for variations in national income.

#### 4 Conclusion and Policy Implications

Static market shares and a highly concentrated market are the enemies of rapidly increasing broadband take-up. 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** – In all but three countries (Austria, Portugal and the UK) the incumbent's ISP has more than a 40% share of the retail market, the level at which competition authorities presume dominance. In some countries this number has remained stubbornly consistent or even increased. There is much that regulators can do to encourage efficient market entry: for example mandating wholesale DSL and promoting LLU. The former has been effectively executed in the UK resulting in 38% of broadband connections via retailers of BT's wholesale products. France has recently seen a three-fold increase in the number of unbundled lines, providing a new competitive dynamic.
- **Promote efficient entry of new infrastructure** - The broadband access market remains dominated by two technologies: cable and DSL. Only in 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. We propose that this can be done by basing cost-based access to incumbents' facilities on the costs of an efficient entrant so that entrants can make make-buy decisions on a comparison of their costs rather than the incumbent's.
- **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. .