Broadband changes everything. Or so we are told. But does it? There is only one way to find out — follow people who move from narrowband to broadband internet access and see what changes. This paper reports exactly this kind of analysis using data from a two wave European panel study (e-Living) and the lagged endogenous regression approach to see if switching to broadband increases the time spent online, the use of online communication services, the breadth of internet activities and the amount of online spend, and whether it decreases the time spent watching TV and the level of social leisure activities. The results suggest, in the main, that switching to broadband made little difference for this group of early broadband adopters who were already heavy internet users. There was no evidence of an online spend or social leisure substitution effect although there was evidence of a reduction in time spent watching television, and an increase in email in use, time spent online and breadth of internet use. In all cases however it was the previous levels of behaviour that were the most significant and switching to broadband was, in general, one of the least strong effects.

**Keywords** Broadband; social impact; social capital; e-commerce; longitudinal household panel

**Introduction**

At the time of writing there is an almost ceaseless stream of news flashes and marketing messages trumpeting the future social and economic (not to ignore profitable) opportunities of broadband internet access in the home. This has not gone unnoticed in policy circles since the early 1990s (Bangemann 1994; DTI 1994). More recently and as a natural progression from the Bangemann report, the eEurope 2005 Action plan¹ states:

broadband enabled communication, in combination with convergence, will bring social as well as economic benefits. It will contribute to e-inclusion, cohesion and cultural diversity. It offers the potential to
improve and simplify the life of all Europeans and to change the way people interact, not just at work, but also with friends, family, community, and institutions.

(CEC 2002, p. 8)

But is this happening and what evidence do we have of the difference that broadband makes to the domestic user? After providing a working definition of ‘broadband’ the paper summarises the literature to date, describes the e-Living data and then provides descriptive results on the uptake of household broadband internet access in the six countries of the e-Living survey (UK, Italy, Germany, Norway, Bulgaria, Israel) as background to the remainder of the paper. Rather than repeat previous analyses of indicators of uptake we use the unique longitudinal nature of the e-Living data to conduct new analysis of the routes households take into broadband and to develop models of the ‘impact’ of switching to broadband between wave one (2001) and wave two (2002) on time spent using the internet, online communication and other activities, social leisure, watching TV and e-commerce. We focus on these issues because they are germane to a number of sociological, policy and commercial preoccupations:

- Does broadband internet access lead to more time being spent online? Or is it that people can do more in the same amount of time that is available to them?
- Does broadband access lead to greater breadth of use as the flat rate and high speed support a wider range of services and activities? As a result do users become more sophisticated? Does broadband help to ‘up-skill’ internet users?
- Does broadband increase the use of communication services and therefore increase social interactions or relationships? We might expect that if it did there would be socially beneficial outcomes with respect to higher levels of social capital (Portes 1998; Putnam 2000; Licoppe & Smoreda 2006; Li et al. 2005). On the other hand, might broadband internet access lead to less out of home social engagement in a dystopian future as some might suggest (Nie & Hillygus 2002)?
- Might the usage of broadband either for content or for new forms of leisure lead to a reduction in TV viewing and an attendant switch in potential advertising revenues?
- To what extent does broadband enable more (or more valuable) e-commerce transactions by households?

The paper concludes with a summary of the results and a brief discussion of their implications.
What do we know already?

The processes of choosing a broadband connection, the characteristics of those who do so and the possible effects this has have been the focus of a number of studies (Hoag 1997; Madden & Simpson 1997; Kridel et al. 2002; Anderson et al. 2003; Lee et al. 2003; Paynter & Chung 2003; Ida & Kuroda 2006; Robertson et al. 2004; Choudrie & Dwivedi 2006) as well as many private and public market research surveys such as the Flash Eurobarometers funded by the European Commission (Gallup Europe 2002).

A number of these papers (such as Ida & Kuroda 2006) concentrate on econometric approaches to modelling and forecasting demand based on price and charging schemes and as such are of less interest here. Indeed of necessity early research was based on choice experiments; thus Madden and Simpson (1997) base their analysis of who would be likely to adopt broadband and what they would be prepared to pay on data from hypothetical statements.

Of the others, Hoag used a single cross-sectional survey of cable modem and narrowband users in the USA to establish that there were few sociodemographic differences between the two groups (confirmed by Anderson et al. 2003) but that broadband users tended to make more use of FTP and the Web than narrowband users and also to spend more time online. She also showed that they made more use of a wider range of applications and were more satisfied with their Internet experience.

Kridel and colleagues (2002) used a multinomial logit model to describe the broadband choice process of households in a cross-sectional survey conducted in the US in 2000. They found that age, income and education level, as well as price, are all highly significant predictors of choice in their model.

Lee et al. (2003) provide an analysis of the rapid take-up of broadband internet in South Korea between 1998 and 2001 by when up to 50 per cent of all households had adopted. They focus primarily on supply side issues such as market competition, national policies and infrastructure investment. However they also note that the mobilisation of demand through IT literacy activities particularly targeting housewives, the elderly, military personnel and farmers may have had a significant effect in driving up demand and thus uptake. Lee et al. also suggest that Asian cultures are more likely to use the Internet for inter-personal communication than non-Asian cultures and that the increased affordances for this aspect of usage may also have contributed to increased demand for broadband although, as we shall see, non-Asian cultures also make significant use of (broadband) internet services and applications for social communication.

Like Kridel et al., Paynter and Chung (2003) used cross-sectional survey data from New Zealand and a factor analysis technique to uncover clusters of service values of narrowband and broadband users and then to use these
loadings as the basis for the modelling of service satisfaction. They showed that cost is related to likelihood of future broadband usage and, unlike Hoag, that early broadband adopters in New Zealand were sociodemographically distinct from narrowband users. Thus men were more likely to adopt than women as were those with higher computer skills and those who used the internet more per day. Interestingly educational status, age and income made no difference.

In the UK Robertson and colleagues (2004) used a household survey to analyse the factors affecting narrowband and broadband choice in early 2003 whilst Choudrie and Dwivedi used a similar method in 2005 (Choudrie & Dwivedi 2006). Both Robertson et al. and Choudrie and Dwivedi found that educational attainment, disposable income and the presence of children were all indicators of internet adoption. Robertson et al. found that there was a marginally stronger effect for broadband as opposed to narrowband at this time and they also suggest that downward shifts in broadband price will lead to many more narrowband users switching to broadband as the prices equalise and that this would be concentrated in higher income and ICT acceptance groups.

Pew Internet data for the USA have been used to analyse the differences between broadband and narrowband users (Horrigan & Rainie 2002). These data suggested that broadband users spent more time online, did more things and did them more often than narrowband users. They also suggested that home broadband users were ‘typical early technology adopters’ being disproportionately well educated, wealthy and male.

However such studies of difference tell us nothing at all about broadband related outcomes. Indeed recent authors have noted that few academic publications focus on the impact of broadband on the kinds of social and personal issues discussed in the introduction in contrast to the developmental and macro-economic issues (Firth & Mellor 2005). Firth and Mellor note that the results of even these economic analyses tend to provide more rhetoric than empirical analysis and call for a diverse analysis of the outcomes of broadband internet access. This paper therefore provides a timely contribution of exactly this kind of analysis.

Definitions

What do we mean by ‘broadband’? According to the ITU (2003) ‘Broadband is commonly used to describe recent Internet connections that are significantly faster than today’s dial-up technologies, but it is not a specific speed or service’. Recommendation I.113 of the ITU Standardization Sector defines broadband as a transmission capacity that is faster than primary rate ISDN, at 1.5 or 2.0 Mbit/s. Elsewhere, broadband is considered to correspond to
transmission speeds equal to or greater than 256 kbit/s, and some operators
even label basic rate ISDN (at 144 kbit/s) as a ‘type of broadband’. In this
paper, while not defining broadband specifically, 256 kbit/s is generally
taken as the minimum speed and so we use the following definitions:
- analogue = narrowband Internet access (does not include ISDN)
- broadband = cable modem/ADSL

We should note that in Wave 1 the e-Living survey item asking about Internet
access mode had one merged category for ISDN, cable modem and ADSL. As a
result it was not possible to distinguish ISDN equipped households from
ADSL/cable modem equipped households in the Wave 1 data. This was recti-
fied at Wave 2. Where Wave 1 data are used and this distinction matters to the
analysis, this problem is noted. However Wave 1 data can be used for longitu-
dinal analysis which examines those who had analogue modem access at Wave 1
but had adopted broadband Internet at home by Wave 2 (for example).

The e-living survey data

e-Living was a two wave panel conducted in six ‘European’ countries (UK,
Norway, Germany, Italy, Bulgaria, Israel) in 2001 and 2002 (Raban 2004). The
survey carried extensive items on ICT ownership and use as well as
labour market activity, education and skills, social networks (social
capital), attitudes and well-being as well as standard sociodemographic vari-
ables such as income, age, gender, household type, housing tenure and so
forth. The data are now in the public domain via the UK’s Social Science
Data Archive.2

Wave 1 of the e-living survey collected data on a single individual in some
1750 households in each of the six surveyed countries in late 2001. These
households were selected using a form of stratified random sampling in con-
junction with the first-birthday rule to achieve a sample that was representa-
tive of the national populations. Computer Aided Telephone Interviewing
(CATI) was used in all countries except Bulgaria where the low penetration
of fixed-line telephony mean that face-to-face (PAPI) interviewing was used.
This is reflected in the overall Wave 1 response rates.

The e-Living Wave 2 survey attempted to re-interview these respondents
in late 2002 using the same methods (CATI in all but Bulgaria) even if they had
moved and it also sought to interview their partners if present. In addition an
extra survey instrument was introduced at Wave 2. This was a 24 hour time
use diary derived from a method developed by Kestnbaum et al. (2002) which
asked the respondent to recall his/her sequential activities starting from 0:01
the previous morning through to 11:59 the previous evening (see (e-Living
consortium 2002)). Overall response rates for Waves 1 and 2 are given in
Table 1. As we can see, between 60 per cent (Israel) and 83 per cent (Bulgaria) of Wave 1 respondents were re-interviewed at Wave 2 of whom nearly all completed the 24 hour time use diary except in Israel. A reasonable sample of partners was also achieved of whom most also completed the time-use diary again with the notable exception of Israel.

As we can see from Table 2, in the e-Living countries in 2002 Internet households with broadband were most prevalent in Israel, Norway and Italy with the UK and Germany lagging behind. Bulgaria may appear to have had a broadband penetration rate similar to that of other countries but this in fact represents five households. Given our per country longitudinal sample size of around 1,100 we can see that the number of households in each country that switched from narrowband to broadband internet access between Waves 1 and 2 is small. This restricts some of the analyses that are possible and, in particular, forces us to pool the households from all countries and exclude Bulgaria as we discuss below.

### Analytic approaches

We might hypothesise that moving to broadband would increase the amount of money individuals spend online due to the always-on nature of access

| TABLE 1 | e-Living response rates wave 1–2. |
|---------|---------------------------------|
|         | UK    | Italy | Germany | Norway | Bulgaria | Israel |
| W1 achieved | 1760   | 1762  | 1756    | 1753   | 1750     | 1751   |
| W1 response rate | 36%    | 42%   | 43%     | 35%    | 77%      | 39%    |
| W2 achieved | 1153   | 1153  | 1160    | 1216   | 1457     | 1061   |
| W2 response as % of wave 1 achieved | 66%    | 65%   | 66%     | 69%    | 83%      | 60%    |
| W2 respondents' diary completed | 1137   | 1149  | 1159    | 1215   | 1454     | 1052   |
| W2 partners in household | 445    | 335   | 433     | 511    | 870      | 630    |
| W2 partners interviewed | 373    | 316   | 400     | 438    | 870      | 311    |
| W2 partner response rate | 84%    | 94%   | 92%     | 86%    | 100%     | 49%    |
| W2 partners’ diary completed | 363    | 317   | 400     | 438    | 868      | 310    |
supporting ‘ad-hoc’ e-commerce and to the higher speed access supporting a more efficient interaction with e-commerce websites.

As a simple way to analyse this, Figure 1 compares the mean euros spent online in the last three months by narrowband users who did not move to broadband with those who did. We can see that those who moved to broadband were already heavier online spenders before they switched and that after switching their spending increased although not substantially (and not significantly) so. Indeed those who did not switch to broadband increased their spend by, on average, 217 per cent whilst switchers increased by 197 per cent. In other words the general trend to spend more online eclipsed the supposed ‘broadband effect’.

But of course this is still a relatively simple picture. We do not know the influence of internet experience, age, gender or education, all of which may be mediators of internet use as may changes in life stage or lifestyle such as getting (or losing) a job, becoming a parent or retiring. To do this we need to use multivariate techniques which aim to predict current (Wave 2) behaviour on the basis of historical (Wave 1) behaviour and changes between Waves 1 and 2 such as adopting broadband or losing a job. It is to this that we now turn.

In order to analyse the change in behaviour that can be attributed to switching from narrowband to broadband we use a lagged endogenous regression model3 which has the advantage of controlling for Wave 1’s value of Y in predicting the value at Wave 2. If we want to know how a

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**TABLE 2** Broadband uptake in e-Living survey countries in 2002.

| % of households | % of internet households with | % of internet households with at least ISDN | % of internet households with broadband | Switching from narrowband to broadband 2001–2002 |
|----------------|-------------------------------|--------------------------------------------|----------------------------------------|-----------------------------------------------|
|                | internet access               | with analogue modems only                  | with analogue modems only              | switching from narrowband                      |
| UK             | 47.0%                         | 87.0%                                      | 3.2%                                   | 9.7%                                          | 39                                           |
| Italy          | 31.1%                         | 77.3%                                      | 8.2%                                   | 13.0%                                         | 50                                           |
| Germany        | 41.5%                         | 49.8%                                      | 39.8%                                  | 8.7%                                          | 21                                           |
| Norway         | 57.3%                         | 30.0%                                      | 55.5%                                  | 15.0%                                         | 32                                           |
| Bulgaria       | 4.6%                          | 90.9%                                      | 1.5%                                   | 7.6%                                          | 0                                            |
| Israel         | 43.5%                         | 71.2%                                      | 6.1%                                   | 22.5%                                         | 68                                           |

*aDefined as ‘at least cable modem or ADSL’ – may also include other such as WIFI, Ethernet etc.*
change in X has changed Y then we need to take this out. Controlling for the effect of the lagged value of Y on current values of Y is argued to be the most powerful way to ascertain causality (Finkel 1995) and such is its suppressing effect on the variation to be explained by the other independent variables that a significant effect is likely to be reliable.

In the remainder of the paper we present the results of multivariate models we have developed to test the effects of adopting broadband on internet time, aspects of online communication (emailing), the range of internet activities carried out, TV watching time, online spending, satisfaction with social communication and social leisure activities as representative of the range of potential ‘impacts’ of broadband. In each case we have pooled all internet users at Waves 1 and 2 in five countries (Bulgaria is excluded) in order to achieve a reasonable sample size but have included dummy variables for the countries as controls to try to negate inter-country differences.

In the case of Internet time we want to know if moving from narrow to broadband is associated with an increase or decrease in time spent online whilst controlling for previous internet usage and other transitions. We
also include a set of internet behaviour change variables and a measure of change in TV watching.

This model uses the survey estimates of minutes spent online at Wave 1 and Wave 2. Since this variable is skewed, in order to ensure an approximation to the normal distribution of the dependent variable we have transformed it by taking the natural log. Note that this excludes 10 cases where the original value was 0 since \( \ln(0) \) is undefined.

In the case of emailing friends and relatives we want to understand the impact of switching to broadband on online social interaction and we use the frequency of emailing friends and relatives as an indicator of social capital. This model uses the survey estimate of the frequency of emailing friends and relatives which was recorded on a scale as follows:

- 7 = most days
- 6 = 2–3 times a week
- 5 = about once a week
- 4 = about once a fortnight
- 3 = about once a month
- 2 = several times a year
- 1 = less often
- 0 = never

This variable approximates to a normal distribution and is therefore not transformed.

In the case of the number of different internet activities we want to understand the impact that switching to broadband might have on the breadth of internet use as a proxy for sophistication of use. This model uses an aggregate of the number of different internet activities carried out by the respondent in the last three months out of the following list of ten:

- shopped online
- used banking services
- used library or similar services
- used travel or holiday information services
- used educational services
- obtained medical assistance
- obtained information about the environment
- downloaded music
- applied for a job or got job information
- anything else that we have not already talked about

This variable approximates to a normal distribution and is therefore not transformed.

In the case of TV minutes per day we want to know if moving from narrow to broadband is associated with an increase or decrease in time spent watching...
TV whilst controlling for previous TV usage. This model uses the survey estimate of the number of minutes spent watching television per day. This variable approximates to a normal distribution and is therefore not transformed. We have also retained the longitudinal ICT usage variables from the internet time model to see if changes in online activity have any effect on TV time.

For online spending we want to know if moving from narrow to broadband is associated with an increase or decrease in overall online spending. This model is again broadly similar to the previous two but includes the Wave 1 and Wave 2 spend variables and leaves out the ICT behaviour variables relating to email as we have no a priori reason to suppose that this will be linked to online spending. However we include internet experience at Wave 1 as it is known to correlate with online spending and the change in time spent online between Waves 1 and 2.

This model uses the survey estimate of the total amount spent online in euros over the previous three months. This variable is highly skewed and, like internet time, we could use the natural log. However this would result in the exclusion of 1,327 cases compared with the other models and would merely tell us if switching to broadband had an effect on the amount spent for those who were spenders. Automatically excluded would be the effect of those for whom switching to broadband made no difference to their (zero) spending. We would therefore produce an overestimation of the ‘population level’ effect of switching to broadband and our analysis (not reported here) shows this to be the case.

As a solution we have chosen to recode online spending into two categories – high (being in the top 20 per cent of spenders) and low (the rest) and use a logistic regression model to analyse the impact of switching to broadband on the probability of being a high online spender at Wave 2 (after switching) whilst controlling for online spend at Wave 1. Whilst perhaps sub-optimal from an analytic point of view the nature of the data dictates this more robust approach.

For social leisure we want to know if moving from narrow to broadband is associated with an increase or decrease in out of home social activity.4 This model is similar to the previous three but instead of the online spend variable we use an index of social leisure constructed from the sum of the frequency of undertaking the following social leisure activities (coded as 0 = Never, 1 = Several times a year, 2 = About once a month, 3 = About once a fortnight, 4 = About once a week, 5 = 2–3 times a week, 6 = most days):

- meet with friends
- attend activity groups
- have a meal in a restaurant or café, or go for a drink to a bar
- go to the cinema, a concert, theatre or watch live sport
- play sport, keep fit or go walking
This variable approximates to a normal distribution and is therefore not transformed.

Finally in each model we include a dummy for switching from narrowband to broadband internet. Those who stayed with narrowband are coded as 0 whilst those who switched are coded as 1. All other cases, such as adopting broadband without having previously had narrowband which happened in a very small number of households, are excluded. We also include age, gender and educational level as well as a number of transition variables such as retiring, losing a job or changing work hours as well as dummy variables for each country. Internet experience is measured in number of years since the respondent first started using the internet.

**Results**

Table 3 reports the results of estimating these models and presents beta (standardised coefficients) for the OLS models and odds ratios for the logistic model. This enables us to compare the relative strength of the effects within each model and shows that, as expected, in each model the lagged endogenous (Wave 1, denoted ‘W1:’) variable was an excellent predictor of the Wave 2 value and partly as a result the performance of the models was reasonable.

Overall, we can see that switching to broadband had a significant positive effect on time spent online, the frequency of emailing friends and family and the range of internet activities but a significant negative effect on time spent watching television. It had no effect on the probability of being a high online spender or on the frequency of social leisure. However in each case where an effect is seen switching to broadband is not the strongest effect, as we discuss below.

It is hardly surprising that the strongest predictor of current internet time by a considerable margin was the amount of time spent online last year. People’s habits do not change that quickly. Switching to broadband was less important than the frequency of emailing friends and relatives (positive) and also less important than the structural effect of being female and or aged 45–64 compared with being aged 18–24 (both negative). Both internet experience and the number of internet activities were also significant.

Thus the more email one sends and the more activities one does, the more time one spends online and it is interesting to note that the effect for email is marginally stronger. Internet experience also has a positive effect as does the break-down in a relationship whilst being in a couple at Wave 1 and being female have a negative effect. These suggest that in general, and controlling for the other effects, those in a couple and especially women do not use the internet as much as others.
| method:          | internet minutes | frequency of emailing | internet activities | television minutes | being a high online spender | social leisure |
|------------------|------------------|-----------------------|---------------------|--------------------|-----------------------------|----------------|
| cells report:    | OLS              | OLS                   | OLS                 | OLS                | Logistic                    | OLS            |
| country (UK)     | beta             | beta                  | beta                | beta               | odds ratio                  | beta           |
| Italy            | 0.045            | -0.023                | -0.045              | -0.128***          | 0.106***                    | 0.027          |
| Germany          | -0.007           | 0.037                 | 0.075*              | -0.052             | 0.377***                    | -0.061*        |
| Norway           | -0.205***        | -0.095**              | -0.017              | -0.031             | 0.307***                    | -0.02          |
| Israel           | 0.04             | -0.032                | 0.018               | -0.041             | 0.217***                    | -0.033         |
| female           | -0.110***        | -0.004                | -0.004              | 0.002              | 0.702*                      | -0.022         |
| got married      | 0.029            | 0.067*                | -0.015              | 0.025              | 1.723                       | -0.009         |
| became couple    | -0.015           | -0.013                | -0.035*             | 0.005              | 1.909                       | -0.018         |
| got a job        | 0.02             | 0.014                 | 0.029               | -0.026             | 1.093                       | -0.050*        |
| retired          | -0.013           | 0.029                 | -0.032              | 0.014              | 0.289                       | -0.026         |
| became unemployed| 0.012            | 0.02                  | -0.017              | 0.039              | 0.640                       | -0.035         |
| couple split     | 0.013            | -0.01                 | -0.001              | 0.014              | 0.689                       | -0.01          |
| acquired children| -0.008           | 0.017                 | -0.021              | -0.013             | 1.238                       | 0.005          |
| education (no. 16+ qualifications) |                   |                       |                     |                    |                             |                |
| GCSEs or equivalent | -0.027          | 0.012                 | 0.080**             | -0.042             | 1.628                       | 0.041          |
| A levels or equivalent | 0.013           | 0.033                 | 0.075***            | -0.002             | 5.206*                      | 0.023          |
| degree +         | -0.042           | 0.03                  | 0.046*              | -0.034             | 1.001                       | 0              |
| age at wave 1 (18–24) |                   |                       |                     |                    |                             |                |
| 25–34            | -0.077           | -0.004                | -0.039              | -0.025             | 1.143                       | -0.096**       |
| 35–44            | -0.058           | -0.051                | -0.085*             | -0.054             | 1.169                       | -0.132***      |
| Age Group | change in work hours | moved from PSTN internet to broadband | change in frequency of email sent to family and friends | change in number of online activities | change in minutes per day using TV | change in minutes per day spent online | W1: Internet experience | W1: internet minutes | W1: email family and friends | W1: number of internet activities | W1: TV minutes | W1: euros spent online |
|-----------|----------------------|-------------------------------------|-------------------------------------------------------|-------------------------------------|-----------------------------------|----------------------------------------|-------------------------|-------------------|--------------------------|-------------------------------|----------------|------------------------|
| 45–54     | -0.088*              | -0.043                              | -0.103**                                              | -0.024                              | 0.782                             | -0.128***                              |                         |                   |                          |                                |                |                        |
| 55–64     | -0.096*              | -0.036                              | -0.112***                                             | 0.021                               | 0.718                             | -0.081*                                |                         |                   |                          |                                |                |                        |
| 65–74     | -0.001               | 0.016                               | -0.053                                               | -0.012                              | 0.851                             | -0.082*                                |                         |                   |                          |                                |                |                        |
| 75 +      | -0.066               | 0.007                               | -0.076***                                             | 0.006                               | 0.134*                            | -0.008                                 |                         |                   |                          |                                |                |                        |
| change in work hours | -0.005               | 0.006                               | 0.016                                               | 0.011                               | 1.016                             | -0.067**                               |                         |                   |                          |                                |                |                        |

moved from PSTN internet to broadband

| change in frequency of email sent to family and friends | 0.084* | 0.072* | 0.089** | -0.062* | 1.172 | -0.005 |
|---------------------------------------------------------|--------|--------|---------|---------|-------|--------|

change in number of online activities

| change in minutes per day using TV | 0.017 |
|-----------------------------------|-------|

change in minutes per day spent online

| W1: Internet experience | 0.069* | 0.068* | 0.131*** | 1.171*** |
|-------------------------|--------|--------|-----------|-----------|
| W1: internet minutes    | 0.355*** |
| W1: email family and friends | 0.434*** |
| W1: number of internet activities | 0.415*** |
| W1: TV minutes           | 0.592*** |
| W1: euros spent online   | 1.002*  |

(Table continued)
Table 3  Continued.

|                     | internet minutes | frequency of emailing | internet activities | television minutes | being a high online spender | social leisure |
|---------------------|------------------|-----------------------|---------------------|--------------------|-----------------------------|----------------|
| W1: social leisure  | 0.300            | 0.237                 | 0.291               | 0.397              | 0.610***                    |
| R square            |                  |                       |                     |                    | 0.457                       |
| N                   | 1025             | 1149                  | 1249                | 1032               | 1218                        | 1030           |
| F                   | 6.569            | 8.922                 | 17.531              | 9.094              | 5.257                       | 23.682         |
| Prob > F            | 0.000            | 0.000                 | 0.000               | 0.000              | 0.000                       | 0.000          |

Contrast categories shown in parentheses. *=p < 0.05, **=p < 0.01, ***=p < 0.001
Following on from this we can see that the score in the previous year overwhelmingly affects the frequency of emailing friends and relatives followed by the broadband effect, the level of internet experience and, interestingly, getting married.

In the case of Internet activities again the level of activity in Wave 1 was an overwhelmingly strong predictor of the level at Wave 2 and, as we might expect, internet experience was also significant. However whilst switching to broadband was significant, the structural effects of being aged 45–64 were stronger as was found for internet time. So not only does this middle-aged group spend less time online, they have a smaller range of activities as well. Interestingly those aged 75+ had much a much smaller range of activities than the 18–24 even though, as we saw above, they did not spend significantly less time online. We should also note that there were strong educational effects such that compared with those with no 16+ qualifications, those with at least 16+ qualifications had a wider repertoire of online activities. Given that the model already controls for age (some older Europeans left school at 14) and internet experience this educational effect needs further examination.

Although the TV time model explains some 40 per cent of the variance in the time spent watching television at Wave 2 \( r^2 = 0.397 \) the only variables that proved statistically significant were the amount of time spent watching TV at Wave 1 \( \beta = 0.592 \) and switching to broadband \( \beta = -0.062 \).

As discussed above, switching to broadband has no significant effect on the likelihood of being a high online spender. Instead being female reduces the chances of being a high online spender by 30 per cent \( \text{odds ratio} = 0.702 \) whilst being aged 75+ reduces it by 84 per cent. Having 18+ education (A levels or equivalent) increases the chances significantly as does increasing the number of online activities and having greater internet experience.

This suggests that the ‘broadband effect’ on online spending discussed earlier is actually caused by differences between narrowband and broadband users at this stage in the uptake curve. We find no ‘broadband effect’ in these data. We find that the best predictors of the amount spent online are related to internet experience, usage and, perhaps, competence. Simply moving from narrow to broadband makes no difference.

Switching to broadband also has no significant effect on the indicator of social leisure and nor did the other internet related variables tested. These data do not support the view that increased time spent online automatically reduces social participation. For this sub-group of the population (internet users at each wave) getting a job decreases social leisure as does being aged 25–74 (and especially 35–54) compared with 18–24. Increasing work hours also reduces social leisure as does, independently, getting a job.
We have repeated this analysis for each component part of the social leisure index (not reported here) and the patterns were identical but with one exception. Increasing the range of internet activities had a positive effect on frequency of meals out (item 3). Quite why this should be the case is unclear but it is possible, albeit tenuous, that increased social leisure opportunities of this kind are discovered through broader internet use.

**Discussion and conclusions**

In part this paper is inevitably a history lesson. The penetration of broadband Internet was still at an early stage in 2001 and 2002. Israel ranked with the UK, Germany and Norway in terms of households with PCs but the UK had proportionately more narrowband (analogue modem) Internet households than any other country. ISDN dominated in Norway and to some extent in Germany. Some households had multiple modes of access, the most frequent in the UK being analogue modem and cable modem/ADSL and ISDN with analogue modem/cable in Germany and Norway. This reinforces a finding from earlier research, which suggested that new cable modem and ADSL users were retaining their analogue modem access in case of broadband service failure (Anderson *et al.* 2003).

Responding to our initial research questions, the six models that we have presented in this paper have used unique longitudinal data to examine the effect of moving to broadband on six ‘representative’ activities of interest primarily to the ICT industry but also to policy-makers — internet time, social communication, internet usage breadth, television time, amount of money spent online and out of home social leisure activities.

As we noted in the introduction to this paper a range of authors from market research consultancies to academics have proclaimed the ‘impact’ of broadband on these aspects of life. It turns out that such ‘impacts’ are rather weak when we have ‘before’ and ‘after’ data on the same individuals and can control for previous behaviour and a range of other simultaneous life changes.

We have seen that the greatest effect in all cases was not moving to broadband, although this was significant in four out of six, but the previous behaviour of an individual. We have seen also the strong positive effect on time online of the frequency of emailing friends and relatives thus confirming Kraut *et al.*’s similar finding for the USA (2000) and highlighting that it is not only Asian internet users who are driven to a great extent by social communication. This should remind us that those looking for ‘killer apps’ may need to further investigate services to support social communication rather than content consumption.

The results confirm previous findings using longitudinal data that getting household internet access had a negative effect on television use (Gershuny
since this result also holds for switching from narrowband to broadband internet at home. That said our results also demonstrate the resilience of time spent watching TV to a range of life transitions. As the delivery of ‘TV like’ services over broadband emerges we might expect further erosion of time spent watching television delivered through traditional means. This does not, of course, mean that people will watch ‘less TV’ but simply that the mode of delivery and potentially the focus of advertising expenditure will change.

Perhaps the result which will cause the most disbelief in the ICT sector is that we have no evidence that switching to broadband will have any effect on the likelihood that individuals will become high online spenders. As with time online we can instead see a steady progression of online spend driven largely by experience not only in terms of years spent online but in terms of breadth of internet use. We can also see an effect for successful previous e-commerce – since being a high spender this year is predicted by being one last year.

Of course this picture may have changed – those adopting broadband in 2002 were very early adopters and more recent adopters may exhibit different behavioural change. We must also be cautious because our sample sizes are relatively small and the number of switchers from narrow to broadband is low. We only have 12 months of data so at most people had been using broadband for 12 months and any changes we see here may be a novelty effect. On the other hand it may be that significant behavioural change has yet to come about in these households. But we have argued, and hopefully demonstrated, that we require longitudinal data to find out.

Overall the effects we see are largely caused by experienced/heavy users moving to broadband. In the future and possibly quite soon in some countries, as recent UK survey data suggest, less experienced ‘average net users’ and indeed new users will move to broadband. In this case we may see more substantial broadband-related change although the constraints of everyday life suggest that it is only a small group of people in any cohort who are able to absorb significant behavioural change. There is simply not that much slack in most people’s lives for major shifts in behaviour in the short term.

On the other hand our results lead us to express some concerns about the potential social benefits of broadband. We have seen in the case of the internet time, internet repertoire and online spend models that it is those who have the most experience and greatest breadth of use who are doing and spending more. If this pattern continues then broadband access will not change the structural problems already found in narrowband – those who have the knowledge and experience gain the most benefit whilst those who lack the skills, knowledge and perhaps self-confidence are left further behind as others have shown (Selwyn 2005). This is not an issue that will be solved by technology or by policies that focus on penetration and access as opposed to utility, value and social outcomes.
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Notes

1 http://europa.eu.int/information_society/eeurope/2005/index_en.htm
2 www.data-archive.ac.uk
3 This model takes the form:

\[ Y(t) = f(\beta Y(t-1) + \Delta X + \beta Z(t-1)) \]

Where

- \(Y(t)\) is the value of \(Y\) at Wave 2,
- \(Y(t-1)\) is the value of \(Y\) at Wave 1,
- \(\Delta X\) is the difference between the value of \(X\) at Wave 1 and Wave 2 (\(X(t) - X(t-1)\)).

This may include a transition variable such as whether or not a household switched to broadband,
- \(Z(t-1)\) is the value of \(Z\) at Wave 1.

This approach allows us to see more clearly the relationship between \(X\) and \(Y\) because we are removing the effect of previous values of \(Y\). A good example is that if \(Y\) is time spent online then its value at time \(t\) is likely to be very strongly related to its value at \(t-1\).

4 Unfortunately within this dataset we have no measures of intra-household social activity with which to test the hypothesis that heavier internet usage may lead to less intra-household communication.

References

Anderson, B., Gale, C., Jones, M.L.R. & McWilliam, A. (2003) ‘Domesticating Broadband – what really matters to consumers’, in Broadband Applications and the Digital Home, ed. J. G. Turnbull, IEE, London, pp. 153–176.

Bangemann, M. (ed.) (1994) Europe and the Global Information Society: Recommendations to the European Council, HLEG INFO-SOC, Brussels.

CEC (2002) eEurope 2005: An information society for all – An Action Plan, Commission of the European Communities, Brussels.

Choudrie, J. H. & Dwivedi, Y. K. (2006) ‘Examining the socio-economic determinants of broadband adopters and non-adopters in the United Kingdom’,
in Proceedings of the 39th Annual Hawaii International Conference on System Sciences, 2006, IEEE Computer Society.

DTI (1994) Creating the Superhighways of The Future: Developing Broadband Communications in the UK, HMSO, London.

e-Living consortium (2002) D8: Finalised e-Living Survey Wave 2 Instruments. [Online] Available at: http://www.eurescom.de/e-living/deliverables.htm

Finkel, S. (1995) Causal Analysis with Panel Data, Sage Publications, Thousand Oaks, CA and London.

Firth, L. & Mellor, D. (2005) ‘Broadband: benefits and problems’, Telecommunications Policy, vol. 29, nos 2–3, pp. 223–236

Gallup Europe (2002) Flash Eurobarometer 135: Internet and the Public at Large – Results and Comments, Gallup, Brussels.

Gershuny, J. (2003) ‘Web use and net nerds: a neo-functionalist analysis of the impact of information technology in the home’, Social Forces, vol. 82, no. 1, pp. 141–168.

Hoag, A. (1997) Speed and the Internet: The Effects of High Speed Access on Household Usage, 25th Annual Telecommunications Policy Research Conference, Alexandria, VA.

Horrigan, J. B. & Rainie, L. (2002) The Broadband Difference: How Online American’s Behavior Changes with High-speed Internet Connections at Home, Pew Internet & American Life Project, Washington DC.

Ida, T. & Kuroda, T. (2006) ‘Discrete choice analysis of demand for broadband in Japan’, Journal of Regulatory Economics, vol. 29, no. 1, pp. 5–22.

ITU (2003) Birth of Broadband, International Telecommunication Union Internet Report, ITU, Geneva.

Kestnbaum, M., Robinson, J. P., Neustadtl, A. & Alvarez, A. (2002) ‘Information technology and social time displacement’, IT & Society, vol. 1, no. 1, pp. 21–37.

Kraut, R., Mukhopadhyay, T., Szczypula, J., Kiesler, S. & Scherlis, B. (2000) ‘Information and communication: alternative uses of the Internet in households’, Information Systems Research, vol. 10, pp. 287–303.

Kridel, D., Rappoport, P. & Taylor, L. (2002) ‘The demand for high-speed access to the internet’, Topics in Regulatory Economics and Policy, vol. 39, pp. 11–22.

Lee, H., O’Keefe, R. M. & Yun, K. (2003) ‘The growth of broadband and electronic commerce in South Korea: contributing factors’, The Information Society, vol. 19, no. 1, pp. 81–93.

Li, J., Pickles, A. & Savage, M. (2005) ‘Social capital and social trust in Britain’, European Sociological Review, vol. 21, no. 2, pp. 109–123.

Licoppe, C. & Smoreda, Z. (2006) ‘Rhythms and ties: towards a pragmatics of technologically-mediated sociability’, in Computers, Phones, and the Internet: Domesticating Information Technology, eds R. Kraut, M. Brynin & S. Keisler, Oxford University Press, Oxford.
Madden, G. & Simpson, M. (1997) ‘Residential broadband subscription demand: an econometric analysis of Australian choice experiment data’, *Applied Economics*, vol. 29, no. 8, pp. 1073–1078.

Nie, N. H. & Hillygus, D. S. (2002) ‘The impact of internet use on sociability: time-diary findings’, *IT & Society*, vol. 1, no. 1, pp. 1–20.

Paynter, J. & W. Chung (2003) ‘Factors influencing broadband uptake in New Zealand’, *Innovation: Management, Policy & Practice*, vol. 5, nos 2–3, pp. 170–188.

Portes, A. (1998) ‘Social capital: its origins and applications in modern sociology’, *Annual Review of Sociology*, vol. 24, pp. 1–24.

Putnam, R. D. (2000) *Bowling Alone: The Collapse and Revival of American Community*, Simon & Schuster, New York and London.

Raban, Y. (2004) *e-Living D11.1: ICT Uptake and Usage: Panel Data Analysis*, e-Living Project Report, ICTAF, University of Tel Aviv, Israel.

Robertson, A., Soopramanien, D. & Fildes, S. (2004) ‘Understanding residential Internet service adoption patterns in the UK’, *Telekonnik*, vol. 100, no. 4, pp. 84–94.

Selwyn, N. (2005) ‘Whose internet is it anyway? Exploring adults’ (non)use of the internet in everyday life’, *European Journal of Communication*, vol. 20, no. 1, pp. 5–26.

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