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**The value of mixed method longitudinal panel studies in ICT research:  
Transitions in and out of 'ICT poverty' as a case in point.**

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**Abstract**

This paper uses a unique British three wave longitudinal dataset to examine the rates of transitions into and out of 'ICT poverty' defined as having Internet access in the household and/or having a mobile phone. This serves three purposes – it shows that many are still 'passing by' ICT ownership, that 'gaining ICT' access is not a one-way street - many just pass through; and that the rates of dropping out differ for different ICTs and for different groups of people. This has implications for both commercial and public policy strategy. It also shows the value of longitudinal approaches to data collection without which this kind of analysis would be impossible.

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## 1 Introduction

It is by now quite well known that there are fundamental differences between those who undergo brief but transitory periods of poverty and those who are in poverty, however defined, for some considerable length of time (Layte and Whelan 2002). The former, those in transient poverty, turn out to be relatively frequent. It is quite likely that many of us will, at some stage in our lives, undergo a period of poverty. However it is far less likely that we will suffer from persistent poverty and because the kinds of people who are likely to suffer from transient and persistent poverty are substantially different, the policy responses to these two phenomena must also be different. Differentiating between these two phenomena requires a certain kind of survey design. This is the longitudinal panel design where the same individuals are followed over time and which can therefore show who is currently in poverty, for how long they have been in poverty and what factors might affect their movements in and out of poverty.

As an example, Figure 1 shows a hypothetical situation where poverty is measured cross-sectionally at two points in time. If this were all the data we had then we would conclude that there had been little change in overall poverty levels. Indeed if we were public policy makers we might be pleased to note that there had been a small decline of 0.1%. However when we consider the longitudinal design which has followed the same individuals from time one to time two we can see a rather different picture (Figure 2). Now we see that of the 8.3% who had been in poverty at time one, roughly a 40% (3.2% of the population) were still in poverty but about 60% were no longer in poverty. Conversely 5% of the population consist of those who were not in poverty at time one but are by time two. We can now see that slightly more of the population has left poverty as has entered it, thus producing the 0.1% difference but we can also see the differing proportions of those in transient and persistent poverty. These kinds of results have been crucial to an empirical understanding of the relationship between persistent and transient poverty and in putting in to context the concept of a 'culture of poverty' and the existence of an 'underclass' (Layte and Whelan 2002).

**Figure 1: Cross-sectional measures of poverty**

**Figure 2: Longitudinal measures of poverty**

What does this have to do with information and communication technologies (ICTs)? There are some obvious parallels with current approaches to measuring the incidence

of ICT take-up. Cross-sectional surveys are frequently used to measure overall 'diffusion' and it is often assumed that such take-up is a one-way street. However such measures can give a very misleading picture of the dynamics of ICT diffusion and they can give us no guidance on who might move in and out of access to ICTs and who might be persistent non-adopters or even persistently 'excluded'. As we have seen, the study of poverty dynamics, as opposed to poverty incidence, has produced extremely important results of relevance to poverty-alleviation policy-making. Might the same be true of the study of ICT uptake dynamics?

The extent to which such an analysis might matter can be seen in the UK and Europe by reference to statements about participation for all in the 'European Knowledge Society' (CEC 2002) and the UK 'e-Society' (Office of the e-Envoy 2003). Clearly, patterns of uptake, use and non-use are critical to the achievement of any policy objectives which rely on there being a close to 100% universality of 'access' to ICTs and in most cases 'ICT' is conflated with 'Internet'. The UK Government has recently congratulated itself on the progress made with household and individual level internet access (Office of the e-Envoy 2003) citing a recent academic survey (Rose 2003) that suggests that only 4% of the UK population do not have a reasonably accessible location from which they can access the net (home, school, work, public library). The sophistry of this claim is unnerving given that the same survey shows that 89% of Internet users access the net from home, that only 48% of UK households had Internet access in June 2003 (Office of the e-Envoy 2003) and that a recent review of public access points concluded that usage by those deemed to be socially excluded was currently generally low (Loader and Keeble 2004). Leaving aside the issue of what kind of 'access' constitutes 'useful and usable access' the UK e-Envoy report goes further in stating that

"With 61% of the population now reporting that they have used the internet at some time, 'e-citizens' now make up a majority of the adult population." p6.

As we can see there is an explicit assumption that those who have ever used the Internet are still 'cyber-minded', an assumption that clearly also pervades the European Commission's thinking in this regard given that one of their most recent estimates of Internet penetration and use in Europe were based on a survey that did not ask non-users if they had ever been users (Gallup Europe 2002). Contrast this with recent research on Internet dropouts which has shown quite clearly that there are large

numbers who would be in the 'e-citizen' group but for one reason or another either no longer use or no longer have access to the Internet. It should therefore be apparent that in any group of those who 'have ever used' the Internet, some considerable proportion will be ex-users who have simply 'passed through'. The first to notice the existence of Internet 'dropouts' were Katz and Apsden (Katz and Aspden 1998) who have since reported a consistent 10% per annum Internet dropout rate in the USA through the late 1990s (Rice and Katz 2003). Others such as (Wyatt, Thomas et al. 2002) and (Rose 2003) for the UK, (Thomas 2002) for several European countries and (Lenhardt 2002) for the USA have all either reported and/or analysed the factors that might potentially affect dropping out. Thus we are starting to understand who is most likely to become 'ICT poor' or, to put it differently, who is most at risk and indications are that loss of PC access, cost, low perceived utility may all play a role as may demographics (lower educational attainment, certain household types, age, gender) and also historical Internet usage and experience.

However it is not only in public policy that the existence of dropouts matters. Customer churn is an ever present risk and/or opportunity for commercial service providers and this is especially so in a maturing market where totally new customers are increasingly rare. Here profit flows not from increasing the overall market and your share thereof but through attracting customers from competitors, retaining them and driving up the revenue they provide. At the time of writing the mobile telephony market in northern Europe is in exactly this situation (Raban 2004) so that further market growth is unlikely. In Rogers' terms (Rogers 1995) the 'late majority' are now mobile phone owners and only the 'laggards' (and the 'dropouts' – a phenomenon he terms 'discontinuance') remain. In contrast the Internet 'market' is still in the middle of the 'late majority' stage in many European countries although there is evidence that this period is ending much earlier and at lower penetration rates than many pundits had predicted (Raban 2004).

In both the commercial and the public policy contexts it is important to understand the overall significance of those who move in and out of 'ICT poverty' and those who are more permanently 'ICT poor'. In other words, to refer to our opening discussion of poverty, there may well be important and significant differences between those who are persistently ICT poor and those who are merely transitory. Those who are transitory may 'come back' to ICTs, or they may be about to become persistent ex-

users due to bad experiences, low perceived utility or other lifestage and lifestyle changes. Understanding these dynamics will be critical to the ‘Digital Divide’ debates in the same way that poverty dynamics were critical to the debates on the persistence of poverty. If certain vulnerable groups are persistently ICT poor and we believe that such poverty, or exclusion, is socially problematic as opposed to a matter of free choice, then certain kinds of actions may be required.

It may also be that different ICTs exhibit different rates of ‘poverty’ and given that all ICTs are not created equal in terms of the social benefits they afford or the profitable services they can support, it may be that public and commercial policy can justifiably ignore some types of ICT poverty but not others. In addition such analysis might start to indicate which ICTs, and which services have greatest value to their users. If drop-out rates for mobile telephones are significantly lower than for PC based Internet access, then perhaps this tells us something about the utility and value of mobiles compared to the Internet either in general or for specific social groups.

## **2 Research Questions**

There are therefore a series of important questions we need to ask.

- What are the rates of non-acquisition (‘passing by’), of loss and re-acquisition (‘passing through’) and of permanent ICT poverty (‘dropping out’) and do they vary between different ICTs?
- Do these rates differ between different groups of people (and between countries?)
- Are these rates changing over time?
- What are the factors that seem to best predict ‘passing through’ and also persistent non-use?
- Who is therefore most ‘at risk’ and what might be done about it (if it matters)?

This paper presents preliminary analysis that can start to answer some of these questions using two specific forms of ‘ICT poverty’ – household internet access and the personal ownership of a mobile telephone. The paper does not provide complete answers and should be viewed as work in progress but in analysing these two ICTs in a comparative manner we can directly contrast results with those of Rice and Katz (Rice and Katz 2003). In addition by introducing analysis of longitudinal as opposed to cross-sectional data we can provide a more powerful analysis of movements in and

out of ICT poverty and of the factors that are associated with and may even contribute to 'passing through'.

The next section describes the data whilst the results section firstly reports mainly descriptive data in response to questions 1-3 and then reports the results of more sophisticated statistical analysis. The discussion section draws together and synthesises the results whilst the concluding section draws out preliminary implications for public and commercial strategy as well as pointing towards further work.

### **3 Data**

The data comprise the results of the Home On-Line project, a three year ICT focused household multi-method panel conducted in the UK between 1998 and 2001 (Anderson and Tracey 2001; Anderson, Gale et al. 2002). Data was collected using quantitative surveys, qualitative interviews and ICT usage logging (telephone, internet) although only the survey data is used in this paper.

The survey was modelled on the British Household Panel Survey (BHPS (Berthoud and Gershuny 2000)) but with the explicit focus on ICTs. The first wave was conducted between October and December (inclusive) 1998, the second wave began fifteen months later in January 2000 and the third roughly one year after this in February 2001. Fieldwork for waves two and three was considerably extended to maximise the possibility of tracing movers. The original sample was selected using a qualified form of randomisation which ensures inclusion of geographically clustered areas with representation of different social strata close to that of the population. Selection of households was random within these clusters with two important exceptions. First, the design required over-representation of homes with a PC so the selection process ensured that 50% of the households in the sample had a PC. Weights have been included in the dataset to reproduce the expected sample without PC over-representation. Second, household attrition was compensated in wave two through selection of new households to maintain the original household sample size. These were, however, randomly selected out of the same pool of homes used to provide the original sample, and each sampling unit gained the same number of homes that it lost through attrition.

The survey was of all adult individuals (aged 16 or over) in selected households and used the BHPS following rules (Berthoud and Gershuny 2000) to decide who to re-



interview in subsequent waves. Thus in waves two and three any individuals who moved, whether with an original household or alone, remained in the sample, and any new household members, as well as household members just turned age 16, were included. Efforts were made to trace all movers though moves out of the country or into institutions were defined as out of scope. Efforts were also made to convert refusals. Interviews were conducted face to face in wave 1 and by telephone in waves 2 and 3. Replacement households in wave two were interviewed face to face. The surveys 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 socio-demographic variables such as income, age, gender, household type, housing tenure and so forth. In addition, in all waves interviewed respondents were provided with a week-long diary in which to record what they were doing each day of that week every quarter hour of that day. The activities recorded were determined in advance and included usage of various ICTs. A somewhat simplified diary (fewer activities) was given to children in sample homes aged 9 to 15 inclusive. Diaries were returned by post and in return respondents received a gift voucher. The dataset is now in the public domain via the UK's Social Science Data Archive.

**Table 1: Home On-Line - Final sample size of individuals, including children**

**Table 2: Home On-Line - Number of waves interviewed and number of waves for which a diary was completed**

These methods produced the cross-sectional response rates described in Table 1 and, as Table 2 shows, a true longitudinal sample (individuals interviewed in all waves) of 842. However longitudinal analyses often pool transitions so that those who were interviewed in at least 2 waves can be used as well. As we can see, 1590 individuals were interviewed in at least 2 waves.

#### **4 Results**

We now use these data to explore the research questions outlined above for household Internet access and for personal ownership of a mobile telephone. First we will examine comparative rates of 'passing by', 'passing through' and 'dropping out' and then move on to a more detailed statistical analysis. First however we will digress for a moment to consider some possible differences between the penetration rates of household Internet access and mobile telephones.

**Figure 3: Penetration of household internet access and personal mobile telephone ownership in the UK 1998-2001. Source = Home OnLine data, % of individuals in each age group (w1,2,3, weighted)**

Figure 3 shows the penetration of household internet access and personal mobile phone ownership for the UK by age from 1998 to 2001 as reported in the Home OnLine data.

As we can see there are clear temporal and age-related patterns with those over 55 being far more likely to have neither a mobile phone nor household internet access than those under 54 in every year. However there are also some dissimilarities between mobile and Internet distributions. From similar starting distributions their rates of growth differ with mobile penetration outstripping that of household internet access in all age groups but especially for those aged under 45 so that the penetration of mobiles is upward of 80% for all those under 45 by 2001. However the distribution of those with household internet access is much lower, around 60% for the under 25s and falling steadily with age. Whilst young people were not necessarily the first to adopt these ICTs as shown in particular for mobiles in 1998, they have rapidly become the dominant population segment with access to them. In addition it is clear that even amongst the older groups, mobiles have a far greater penetration level.

Given the ongoing policy focus on 'internet access' and given the known social benefits of connectedness offered by the telephone (Haeussermann and Petrowsky 1989; Fischer 1992; Katz 1999; Haddon 2000) it may be that the mobile telephone warrants more policy attention than it currently has not least because of its increasing pervasiveness.

#### **4.1 Comparative rates - evidence from Home On-Line**

This section presents comparative descriptive data on the rates of passing through for household Internet access and for personal ownership of the mobile telephone.

Figure 4 shows the incidence of transitions in and out of household Internet access whilst Figure 5 shows the incidence of transitions in and out of personal mobile ownership over the three years. These figures indicate the extent to which a lot of dynamic processes underpin the apparently smooth growth of ICT diffusion.

In the case of household Internet access we can see the rapid increase in penetration over the three years of the panel so that by 2001 around 50% of the longitudinal panel had it. However by looking at the longitudinal dynamics we can see that 45% of the longitudinal sample did not have household Internet access at any wave – they were

in persistent 'ICT poverty', 19% had Internet access at all waves<sup>1</sup> and that between each wave some 20-25% of those who did not have it acquired household Internet access. The transitions between wave two and three are more complex. We can see that of those who acquired access in 2000, some 4% had lost it again by 2001 whilst of those who had access in both waves one and two, 2% had dropped out. These figures are much lower than in the previous period. Of those who dropped out between waves one and two about half had re-acquired access by 2001. Half of course had not. Overall some 35% of the sample had undergone an Internet related transition of some sort by 2001 and from just these three waves we can see that by 2001 around 2% had passed through 'Internet poverty' whilst 1% had passed through 'Internet non-poverty'. With more waves of data collection we might expect these rates to increase. Unfortunately the small number (19) who passed through either Internet poverty or non-poverty are not sufficient for meaningful analysis.

In the case of personal mobile ownership, we can see again the rapid increase in penetration over the three years of the panel so that by 2001 around 70% of the longitudinal sample had one. In contrast to Internet access, only 28% were in persistent 'mobile phone poverty' whilst 21% had a mobile at all waves. The 'acquisition rates' varied from 34% of those who did not have one at wave one to 43% for those who did not have one at either waves one and two. The rate of dropout after wave one was 8% and of those who did, roughly half then re-acquired a mobile by wave 3, a similar pattern to that reported above for Internet access. Again wave two to three transitions are more complex with 7% of those who acquired a mobile between waves one and two then dropping out again compared to only 2% of those who had one at waves one and two. Overall some 51% had undergone a mobile ownership transition of some sort, 1% had gone through transient 'mobile poverty' whilst 2% had passed through 'mobile non-poverty'. Again with more waves of data collection we might expect to see an increase to both these rates.

The similarities between these descriptive patterns are more obvious than their differences. Overall mobile penetration is higher in 2001 than is household Internet access from a similar starting position in 1999 reflected for the most part by the higher rates at which those who had never had a mobile acquired one. This results in

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<sup>1</sup> Bearing in mind that household Internet access in 1998 was roughly 24%

fewer individuals 'suffering' from persistent 'mobile poverty' than from persistent 'household internet access poverty' over the three waves of the panel. The rates both of dropping out and of passing through 'transient' poverty are however extremely similar.

So who are the persistently 'ICT poor' and what factors are associated with dropping out? As we have seen they are currently more prevalent than those who suffer transient 'ICT poverty' and being the laggards in the terms of diffusion theory (Rogers 1995), they must be the focus of 'Digital Divide' concerns since it is they who are 'missing out' on whatever economic and social benefits may follow from household Internet access and ownership of a mobile phone.

**Figure 4: Transitions in household Internet access in the UK 1998-2001. Source = Home OnLine waves 1-3, longitudinal sample only, unweighted**

**Figure 5: Transitions in the personal ownership of mobiles in the UK 1998-2001. Source = Home OnLine waves 1-3, longitudinal sample only, unweighted**

#### **4.2 So who is at risk?**

Having established that these dynamics exist, we now need to understand who is most likely to be persistently 'ICT poor' and who is only transiently 'ICT poor'. As we have noted *n* is too small to consider those who are transient so we focus here on those who are persistently ICT poor and those who dropout whether or not they returned. The three waves allow us to see how many of our longitudinal sample moved in and out of 'ICT poverty' over the three years and by pooling adjacent years we can increase the number of respondents who underwent a transition thus making the group amenable to statistical analysis. This is a standard method in panel analysis and has already been used with the same dataset to analyse the effects on time-use of acquiring household Internet access (Gershuny 2003).

**Figure 6: Proportion of age groups who were persistently ICT poor and who were ICT dropouts over three waves of the Home On-Line panel survey. Unweighted, age at wave one (1999).**

Figure 6 shows that persistent ICT poverty is not random with respect to age whilst the rates of dropping out most probably are. Older people were significantly more at risk of being persistently 'ICT poor' and we might hypothesise that this would also be the case for were women, the unemployed/retired/long term sick or disabled and the less well educated. However those most at risk of 'dropping out' appear to be distributed more or less evenly. It is also worth noting that in the case of age, the risk of being persistently 'Internet poor' is always higher than being persistently 'mobile

poor' re-affirming the conclusion that mobiles are a far more ubiquitous ICT in the UK and therefore should be more seriously considered in the discussions of how to address the Digital Divide. Also of note in this context is the cohort of younger people who this dataset indicates were likely to suffer persistent 'Internet poverty' but much less so 'mobile poverty'.

We turn now to our final analysis, which uses regression modelling techniques to infer the relative risks of being persistently ICT poor and of dropping out. To do this we construct two models where the outcomes are binary. In model 1 either a person suffered persistent ICT poverty over the three waves or they did not, in which case they had ICT access at some point. In model 2 either a person 'dropped out' at some point over the three waves or they did not so the comparison here is between those who dropped out by time  $t_2$  and those who still had access at  $t_2$ . As mentioned above we pool the three waves in order to develop model 2 so that those who dropped out between waves one and two and those who dropped out between two and three are analysed together as a single group. We label the models 1.1 for persistent internet poverty, 1.2 for the equivalent in the case of mobile phones, 2.1 for internet drop-outs and 2.2 for mobile drop-outs. In order to construct the factors affecting these outcomes we return to the literature discussed above and derive the required variables. The models vary slightly according to the outcome of interest and the dropout models make use of the longitudinal nature of the data to include dummies for transitions that the dropouts may have experienced at the same time and which may have an influence on the risk of dropping out. We use a range of household level variables in order to understand the influence of some of the background socio-demographic variables and include two wealth proxies<sup>2</sup> – the household fixed line telephone bill and the number of cars (controlled by the number of individuals in the household). Of course household phone bill could also be an indicator of cost of Internet use given that this data was collected during a period when Internet use in the UK was predominantly charged on a per-minute basis by the telephone service providers. At the level of the individual we include gender, age (categorised), education and work status either at wave 1 (for model 1) or at the wave preceding dropping out (model 2). In models 1.1 and 2.1 we include measures of negative attitudes to PCs based on a

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<sup>2</sup> We do not include income due to item non-response.

battery of attitudinal questions and in 2.1 also include personal Internet experience (that may have been gained outside the home). For model 2.1 we include losing access to a PC and for both models 2.1 and 2.2 we include a series of household and work status transitions. In model 2.2 we include a measure of mobile usage before dropping out and, in common with model 1.2, a series of social network measures and a series of attitudinal scores (Likert scales) with which respondents were asked to agree. For each model we report both the co-efficients (B) and the odds ratio ( $\exp(B)$ ) which gives an indication of the overall effect of the variable in relation to the others in the model.

Looking first at the results of model 1 (Table 3), we can see that in both cases the explanatory power is reasonably good. Model 1.1 explains about 53% of the variation in the pattern of persistent 'Internet poverty' whilst model 1.2 explains about 30% of the variation of persistent 'mobile poverty'. The best predictors of persistent 'Internet poverty' were being in a couple with an older child; being a lone parent, especially with older children; living alone and being over 55, having no educational qualifications and having strong negative attitudes to personal computers. Indeed the fewer/lower the educational qualifications, the more likely a person was to be in persistent 'Internet poverty'. Gender (being female) was also a good predictor confirming that women were more at risk of being persistently 'Internet poor'. Compared to those who lived alone and were aged under 56, those who lived alone aged over 55, lone parents, older couples with no children and, perhaps surprisingly, couples with older children were all more likely to be persistently 'Internet poor'. The number of cars in the home and the household phone bill were both good predictors (negative effects) suggesting that wealth also plays a role. Of the working status variables being in full time education appears to reduce the likelihood of being in persistent household 'Internet poverty'. When these variables were controlled, the other variables including age, which is largely controlled by household type and PC attitudes, have no significant predictive effect at all.

With respect to persistent 'mobile poverty' we see a similar picture but with less marked effects. Those in younger child-less couples, those aged 45-54 and older couples were most likely to be in this group. Wealth, represented by the number of cars in the home was also a significant (negative) predictor whilst having no formal qualifications was a strong positive predictor. Of all the attitudinal statements only the

perception of ‘use if need to’ showed a significant effect and this was negative. Thus the more likely a person was to state that they only used the telephone when they had to, the more likely they were not to have a mobile phone at any wave. Interestingly perceptions of cost did not show any effects and nor did any of the social network measures.

Looking now at the results of model 2 (Table 4) we can see that they perform just as well, if not slightly better. Model 2.1 suggests that those who either have little Internet experience or, in particular, who are non-users in an Internet household are most at risk of losing household Internet access. Those aged 24-54 are least at risk of becoming dropouts. The magnitude of the result for ‘non-users’ who lived in an Internet household at time t1 seems suspicious until we note that of the 54 such ‘non-users’ in this analysis, 36 (67%) had dropped out by time t2. Perhaps as interestingly we see no evidence that changing work or household circumstances play any role nor, in contrast to several previous studies (Lenhardt 2002; Rice and Katz 2003), that losing access to a home PC plays a role since whilst the co-efficients are large for this factor, they are not statistically significant.

Model 2.2 is perhaps rather more disappointing in that despite its relatively high r sq score, few of the variables turn out to be statistically significant. The exception is gender. Being female appeared to considerably increase the chances of being a ‘mobile dropout’. We will break with convention just to note the possible effect for perceptions of cost at time t1 which may be associated with ‘giving up’ a mobile phone and it is possible that with a larger sample size some of these effects may turn out to be statistically significant.

**Table 3: Persistent ‘ICT poverty’ results – models 1.1 and 1.2**

**Table 4: ‘Dropout results – models 2.1 and 2.2**

## **5 Discussion and Conclusions**

So what are we to make of these results and what implications do they have?

To return to the starting point, the paper illustrates that examining the dynamics of ‘ICT poverty’ using longitudinal data as opposed to merely examining growth curves using cross-sectional data can produce a different picture of the processes underlying ICT diffusion and lead us to new insights regarding who may be missing out (passing by), who may be passing through and who may be dropping out.

We have seen that the rates of passing by, passing through and dropping out vary between the two ICTs studied as well as between different socio-demographic groups. We have seen that household Internet access is not a one-way street, a significant minority give up (or lose) Internet access or give up a mobile phone.

It is noticeable that persistent 'household Internet poverty' is more prevalent than is persistent 'mobile phone poverty' but that mobile dropout rates are only slightly lower than household Internet access dropout rates. The results suggest that there may be systematic reasons why people are more likely to be persistently 'Internet poor' than 'mobile poor' but that once used both are deemed equally valuable. This could be taken as limited evidence for Dutton's assertion (Dutton and Shepherd 2003) that Internet use is an 'experience' technology whose value is not easily imagined but once familiarised, becomes as indispensable as a mobile telephone.

The results provide limited evidence that such rates change over time. This data suggests that the rates of dropping out may decrease over time as does the rate of acquisition suggesting a plateau effect for penetration levels. In the period 1999-2001 in the UK, the chances of a person maintaining household Internet access were between 81% and 98% but that the chances of re-gaining Internet access having 'lost' it were only about 50%. Those who drop out may not be coming back. The data for the mobile phone over the same period in the UK show remarkably similar patterns except that the rate of acquisition increased.

Due to the small numbers of those who passed through we have been unable to analyse further the pre-cursors to or factors affecting transient 'ICT poverty'. However we have developed a series of models using the longitudinal nature of the Home OnLine data to associate persistent ICT poverty with starting conditions and ICT dropouts with both starting conditions (prior to dropping out) and contemporaneous transitions.

These models demonstrate the dangers of presenting purely descriptive data on dropouts or those who never have access. Our statistical models support the idea that gender and education make a difference to the risk of experiencing persistent Internet poverty, and they suggest that age (Figure 6) and work status patterns are probably proxies for more complex effects.



### **5.1 Passing by**

Overall we can see that the classic socio-demographic deprivation variables feature strongly as predictors of persistent Internet poverty. Being a lone parent, less well educated, being an older single person, being less well off and being female were all strong predictors of never having had household Internet access between 1999 and 2001 when other effects are taken into account. Interestingly we also find an effect for couples with at least one child aged over 15 which is perhaps counter intuitive and warrants further investigation. In addition those with more negative attitudes towards personal computers are likely to be persistently 'Internet poor'.

For mobile phones on the other hand we see far less in the way of systematic socio-demographic effects. There are age effects for some age groups (45-54 more likely) and household types (younger childless couples, which is also perhaps counter intuitive) and also wealth and education effects although these are less marked than for household Internet access and we see no effect for perceptions of cost of telephony in general although we do for indicators of 'functional' use.

### **5.2 Dropping out**

The analysis of dropping out shows distinctly different patterns to that of 'persistent poverty' and different patterns between the two technologies studied. Household Internet dropouts are very likely to have had little Internet experience. Indeed those who were living in an Internet household at t1 but were not Internet users were the most likely of all to then have lost household Internet access by t2. The various transition variables in the model do not account for this result and it remains for further, perhaps qualitative work to unpack the processes at work in this instance but here again is further evidence in support of Dutton's 'experience technology' assertion since those who have either not familiarised themselves with Internet use or who have never been users may not be motivated to ensure that they have household Internet access in the future if they have, for example, left a household which had it. There are age effects but overall their predictive power is low and they are not surprising. There are no wealth effects and no computer attitudinal effects and perhaps of most interest, losing access to a home PC is not a significant factor nor are changes to economic circumstances such as losing a job nor are selected household transitions. Missing from this analysis and a subject of future work are measures of Internet use at t1 although since the model developed here is intended to analyse

household Internet access and who is at risk of not having it as opposed to personal Internet use it may be that this is not appropriate.

In contrast there are very few identifiable single factors effecting loss of a personal mobile phone apart from gender and here again the model gives us little insight into why women are more likely to be mobile dropouts than are men. As with Internet dropouts economic transitions make no difference nor did selected household transitions. We might have expected the number of mobile calls made, the size of local social network and the frequency of calling them to have decreased the chances of dropping out. Whilst the co-efficients are negative, they are not statistically significant.

### **5.3 Implications**

These results suggest that ‘dropping out’ was not a particularly problematic phenomena in the UK between 1999 and 2001 because it appears evenly distributed. It appears that once individuals have ICT access they tend to keep it with the notable exception of those with little or no Internet experience (in the case of household Internet access) and women (in the case of mobile phones). This suggests that it is the analysis of persistent ICT poverty that is most crucial.

We can consider this by re-casting the analysis in terms of ‘risk’. We have seen that certain groups of people are much more at risk of never having household Internet access than others and these groups are generally those who are already disadvantaged. Given that in 2003, 89% of UK Internet users accessed the net from home (Rose 2003) we can see that claiming near ‘universal access’ in the UK is somewhat premature if that access is taken to mean actual ‘practical and useful everyday’ access as opposed to ‘in principle’ access. We have found strong evidence that the ‘Digital Divide’ in terms of household Internet access is persisting and thus becoming increasingly concentrated in already marginalised groups. If social and economic benefits *do* flow from Internet access or, as seems more likely, access to critical social services will increasingly be online, then actions must clearly be taken to prevent useful and usable Internet access becoming just another brick in the wall of social exclusion. Of all the factors that appear to predict persistent household Internet poverty those that seem most amenable to change are wealth (i.e. cost of access) and attitudes towards personal computing. We do not imagine for example that increasing the population’s educational attainment will lead to lower overall Internet poverty

unless such education is associated with developing experience of and skills in using ICTs. What seems more likely is that the provision of applications and services that motivate people to go online, at prices they can afford, will change the 'utility function' of the Internet so that those who do not have access are motivated to acquire it given that it will absorb resources (both money and time) which, for them, might be scarce. Whilst this is true of public policy aspirations it is also true of commercial market strategies. It is increasingly recognised within industry that raising the penetration level of 'the Internet' in the UK will require a shift in its economics and its perceived utility to a mass market.

This is no more evident than when we consider the other ICT we have studied – the mobile telephone. There are far fewer systematic patterns of persistent 'mobile poverty' and since these data were collected the penetration of mobile phones has increased still further and we have less evidence of the 'experience' effect for the mobile telephone compared to the Internet (see also (Anderson 2004) for more recent evidence from six European countries). This may be because it is fairly clear what a mobile telephone is for, and that use, or set of uses, is of clear value to most people. To return to our discussion of mobile/internet penetration it is perhaps time that the Internet industry looked carefully at the processes and values underlying the rapid take-up of the mobile phone and the services it provides (voice, txt etc) and time also that public policy makers do the same. The provision of public services via mobile devices (whether voice or 'data') would appear to have fewer 'digital divide' issues than does provision via the Internet. Given the positive relationship between informal interpersonal communication, social capital and general well-being ((Li, Pickles et al. 2003; Pevalin and Rose 2003) and the obvious fact that those who have no fixed address and no fixed line telephone can own and use them (Goodman 2003), it may be that mobile should be more carefully considered as a bringer of social and economic benefits.

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