

FIXED-MOBILE SUBSTITUTION

A REPORT PREPARED FOR BT

SEPTEMBER 2001

TABLE OF CONTENTS

Executive Summary	vi
1. Introduction	1
2. Fixed-mobile substitution: market survey analysis	7
2.1. Characteristics of respondents	7
2.2. Indicators of call substitution	9
2.3. Indicators of line substitution	11
3. Fixed-mobile substitution: accounting for differences in taste	14
3.1. Fixed line usage and mobile ownership – theoretical background	14
3.2. Estimation method	16
3.3. Data and specification	19
3.4. Results	20
4. Analysis of macro-level data across countries	30
4.1. Modelling the impact of mobile take-up on demand for fixed telephony	30
4.2. Results	33
4.3. Similar results in the academic literature	37
4.4. Summary	39
Appendix A: Detailed description of 2001 survey results	40
Appendix B: Market research questionnaire	77

TABLES AND FIGURES

Table 1: Sample sizes for respondent categories.....	19
Table 2: Reduced form probit (3 rd survey).....	21
Table 3: Fixed telephony spending (selectivity adjusted for mobile phone owners, 3 rd survey).....	23
Table 4: Fixed telephony spending (selectivity adjusted for non-mobile users, 3 rd survey).....	24
Table 5: Reduced form probit (1 st and 2 nd survey).....	25
Table 6: Fixed telephony spending (selectivity adjusted for mobile users, 1 st and 2 nd survey).....	25
Table 7: Fixed telephony spending (selectivity adjusted for non-mobile users, 1 st and 2 nd survey).....	26
Table 8: Structural probit estimates (3 rd survey).....	27
Table 9: Structural probit estimates (people who buy their own mobile phones, 3 rd survey).....	28
Table 10: Structural probit estimates (people who buy their own mobile phones, 1 st and 2 nd survey).....	29
Table 11: Estimation of speed of penetration using standard regression.....	34
Table 12: Estimation of speed of penetration using Instrumental Variables.....	34
Table 13: Specification statistics.....	35
Table 14: Hausman specification test.....	36
Table 15: First differences model.....	37
Table 16: Sample sizes for respondent categories.....	41
Table 17: Estimates of relative probabilities of answering the household fixed line.....	44
Figure 1: Estimated population proportions.....	8
Figure 2: Voice and data usage on fixed and mobile phones.....	11
Figure 3: Reasons for not having a fixed line.....	12
Figure 4: Willingness to install a fixed line.....	12

TABLES AND FIGURES

Figure 5: Price sensitivity of line choice – hypothetical choice of mobile/fixed line depending on relative price.....	13
Figure 6: Number of fixed lines per 100 inhabitants.....	32
Figure 7: Number of mobile subscribers per 100 population.....	32
Figure 8: Household size and composition.....	45
Figure 9: Number of individuals in the household owning a mobile.....	46
Figure 10: Age of respondents.....	46
Figure 11: Age of non-mobile users.....	47
Figure 12: Proportion of retired amongst single fixed users.....	47
Figure 13: Social class of respondents.....	48
Figure 14: Home ownership and type of dwelling.....	49
Figure 15: Household income of respondents.....	50
Figure 16: Employment status of respondents.....	51
Figure 17: Proportions of home workers.....	51
Figure 18: Main use of lines.....	52
Figure 19: Main use of mobiles.....	53
Figure 20: Main use of main fixed line.....	53
Figure 21: Main use of secondary fixed line.....	53
Figure 22: Phone usage – voice, fax and Internet/data.....	54
Figure 23: PC ownership, fax ownership and Internet access.....	55
Figure 24: Reasons for mobile ownership.....	55
Figure 25: Contract vs. pre-paid mobiles.....	56
Figure 26: Type of mobile contract and social class.....	57
Figure 27: Type of mobile contract and household income group.....	57
Figure 28: Who pays for the mobile bill.....	58
Figure 29: Who bought the mobile phone.....	58

TABLES AND FIGURES

Figure 30: Making mobile calls from home	59
Figure 31: Reasons for making mobile calls from home	59
Figure 32: Perceived impact of mobile phone ownership on home fixed line use.....	60
Figure 33: Easy access to a fixed line at work?.....	61
Figure 34: Making mobile calls at work	62
Figure 35: Reasons for making mobile calls at work	62
Figure 36: Different mobile use by home workers	63
Figure 37: Mobile phone usage by home workers	63
Figure 38: Home workers making mobile calls from home.....	64
Figure 39: Reasons for home workers making mobile calls from home.....	64
Figure 40: Attitudes towards mobile phones.....	65
Figure 41: Impact of changes in mobile call pricing on fixed line usage.....	66
Figure 42: Use of e-mail and impact on voice calls	66
Figure 43: Access to e-mail.....	67
Figure 44: Use of SMS and impact of voice calls.....	68
Figure 45: Length of time without a fixed line	68
Figure 46: Detailed reasons for not having a fixed line	69
Figure 47: Detailed willingness to install a fixed line.....	70
Figure 48: Likelihood of adopting a second fixed line or a mobile.....	71
Figure 49: Reasons for preferring a second fixed line or a mobile.....	71
Figure 50: Choice between a fixed or mobile phone – mobile-only users.....	72
Figure 51: Choice between a secondary fixed and mobile phone – single fixed with mobile users	73
Figure 52: Likelihood to adopt a secondary line / mobile phone – potential mobile adopters	73
Figure 53: Reasons for preferring a mobile even if price differences were significant.....	74

TABLES AND FIGURES

Figure 54: Choice between a secondary line and a mobile –multiple fixed line users.....74

Figure 55: Likelihood to adopt a secondary line / mobile phone – potential second line
adopters75

Figure 56: Reasons for preferring fixed line even if price differences were significant76

EXECUTIVE SUMMARY

Oftel's views about fixed-mobile substitution

1. Mobile telephony has rapidly become ubiquitous with around 70% of UK adults having a mobile phone. According to a recent Oftel survey, about 15% of UK adults consider their mobile to be their main method of making and receiving calls. This survey found that about one and a half million UK households are without fixed phones, with 9 out of 10 of these homes using a mobile instead.
2. Oftel acknowledges that, according to its own survey evidence, about two-thirds of those having both fixed and mobile phones “*find occasions on which they do substitute mobile usage for fixed usage*”.¹ However, despite this evidence, Oftel maintains the position that fixed and mobile telephony constitute distinct markets and that mobile telephony does not act as a competitive constraint on pricing of fixed telephony. Oftel concludes “*mobiles are seen by most customers as a complement to the fixed line rather than as a substitute for it*”.²
3. Oftel’s presumption that fixed and mobile telephony are distinct markets is unjustified. We find direct evidence of substitution between fixed and mobile telephony and, therefore, competitive interaction. Oftel’s hypothesis that fixed and mobile telephony are complements is unambiguously rejected by our survey data; mobile adoption tends to reduce fixed bills rather than increase them as would be the case for complements.

Call and access substitution

4. Oftel makes a strong distinction between *call substitution* – customers with access to both fixed and mobile phones choosing which to use to make calls – and *access substitution* – customers choosing between fixed and mobile subscriptions. However, these two forms of substitution are intimately linked: the anticipation of call substitution eventually leads to access substitution. When making subscription decisions, consumers will anticipate the use they expect to make of a service and the extent to which subscribing would affect the use of other services. If an expectation of call substitution reducing the size of the fixed bill increases the likelihood of taking out a mobile subscription, this indicates access substitution.

¹ Oftel, *Competition in the provision of fixed telephony services*, Consultation document issued by the Director General of Telecommunications, 31 July 2001, paragraph 2.25.

² *Ibid.*, paragraph 2.10.

Our market research findings

5. We have performed very extensive market research in order to test directly whether there is substitution between fixed and mobile telephony, conducting 7,702 telephone interviews across three waves in September 1999, February 2000 and September 2001.
6. Those reluctant to get a mobile are increasingly becoming restricted to the elderly. Mobile phones are perceived to be good value for money with few limitations due to call quality or battery life.

Evidence of call substitution

7. In line with Oftel's own survey, we find extensive evidence of call substitution. Over 40% of those with access to both fixed and mobile phones at home use their mobiles to call from home at least sometimes. The *predominant* reason given for this behaviour is that mobile phone calls are sometimes cheaper, clearly demonstrating that customers take account of the relative prices of fixed and mobile calls.
8. Many more mobile phone users report that their fixed phone usage has decreased as a result of getting a mobile, than report that it has increased. This contradicts Oftel's assertion of complementarity between fixed and mobile services.
9. We find evidence that SMS and, to a lesser extent, e-mail substitute for voice calls.
10. Substitution of fixed voice calls, both by mobile phones and other modes of communication, reduce the net benefit of subscribing to fixed services. At the margin, this will affect some customers' subscription decisions.

Evidence of access substitution

11. Access substitution occurs in parallel through two distinct mechanisms:
 - *substitution for additional lines* - an individual in a household who already has at least one fixed line may compare getting (or retaining) an *additional* fixed line with getting (or retaining) a mobile phone; and
 - *substitution for first lines* - an individual in a household making a comparison between getting (or retaining) a fixed line at all and getting (or retaining) a mobile phone.
12. Substitution for additional lines is closely associated with increasing demand for access due to Internet use. By allowing the migration of voice traffic from existing fixed lines, mobile phones can be used as a substitute for additional lines for PC's and faxes. PC ownership, Internet connectivity, e-mail use and fax machine ownership are all more prevalent amongst groups with *either*

additional fixed lines *or* a mobile, consistent with mobiles providing a means of meeting incremental demands for access amongst those with mobiles.

13. Additional line substitution is particularly relevant for wealthier, home-owning or larger households. This group may have a large household demand for telephone access that can be met in a variety of ways, including through mobile ownership to free-up fixed lines for data and fax use. Almost two-thirds of those having both fixed and mobile access at home and using the Internet relatively intensely report using their fixed line for Internet access and their mobile for voice calls at home.
14. Substitution for first lines tends to be most prevalent amongst the young and those living in rented accommodation. However, it would be incorrect to suppose that mobile-only individuals form a narrow group with distinct characteristics. Resistance to mobile ownership amongst older age groups is breaking down. Similar levels of full and part-time working are found amongst mobile-only individuals as amongst the population at large.
15. Mobile-only individuals go without fixed lines for extended periods even when they could have a fixed line if they wanted. Therefore, going mobile-only is a conscious choice for many individuals.
16. Given hypothetical scenarios about the pricing of fixed and mobile services, respondents will switch both calls and subscription decisions in response to relative price changes. Therefore, there is evidence of pricing interaction in fixed and mobile subscription and calling decisions.

Mobile and fixed services are substitutes, not complements

17. Our survey data provides a *direct* test of Oftel's hypothesis that fixed and mobile services are complements, rather than substitutes. Analysing reported usage patterns, we find that there is strong statistically significant evidence that mobile ownership on average *lowers* fixed line usage.
18. This is a difficult hypothesis to test statistically, as mobile adopters generally tend to be heavier users of telephone services. However, using the current best-practice statistical techniques to correct for self-selection effects, we find unambiguous evidence rejecting Oftel's hypothesis of complementarity in favour of the two services being substitutes. On average, mobile ownership reduces the quarterly fixed bill by about £70 through a combination of reducing fixed calling and having fewer fixed lines. Moreover, the expectation of a reduced fixed bill is a statistically significant factor in the decision to get a mobile phone.

Cross-country analysis shows access-level substitution

19. We have also examined macro-level data on fixed and mobile take-up from OECD countries. Evidence from cross-country aggregate data is consistent with the existence of access-level substitutability of fixed and mobile telephony.

Looking across a panel of 20 OECD countries, we find that higher levels of mobile ownership are associated with slower growth in fixed-line take-up. This association is strongly statistically significant and robust to many alternative econometric specifications. A number of other recent academic studies find similar access-level substitution effects.

20. Overall, there is a considerable weight of evidence from a variety of unrelated sources to suggest that any prima facie case that fixed and mobile services lie in distinct markets is unsafe.

1. INTRODUCTION

In its recent consultation document on competition in the provision of fixed telephony services³, Oftel considers how relevant retail markets for telecommunications services might be defined. In line with the approach taken in the application of competition law, Oftel regards the definition of relevant markets as the first step in assessing the level of competition faced by BT.

Oftel acknowledges that the definition of the relevant market may change over time as new technologies are introduced and mature. This is particularly relevant to the changing role of mobile telephony, with increased take-up, lower prices and increased quality over recent years all tending to increase the potential for mobile telephony to compete with fixed telephony. Therefore, any question about the relationship between fixed and mobile telephony cannot be determined by a priori argument and must be addressed empirically.

Access and call substitution

We can distinguish two forms of substitution:

- *access-level substitution*, that is customers choosing to make or retain subscriptions to fixed or mobile services depending on the relative prices of these services; and
- *call substitution*, that is customers with access to both fixed and mobile phones choosing which mode to use on the basis of the relative price of a call.

Although apparently logically distinct, there is a close relationship between these two forms of substitution. In particular, if customers anticipate that they will substitute calls, this can lead to access-level substitution. For example, if a customer switched most calls from a fixed line to a mobile phone, the value of subscribing to the fixed line would be reduced, potentially affecting the decision to subscribe to the fixed line in the first place. Therefore, the existence of material call substitution will inevitably lead to some access-level substitution at the margin. The two forms of substitution are necessarily linked as subscription decisions depend on anticipated usage.

³ Oftel, *Competition in the provision of fixed telephony services*, Consultation document issued by the Director General of Telecommunications, 31 July 2001.

Access-level substitution can occur through consumers cancelling fixed line subscriptions, either for first or second lines. However, this is not the only mechanism for access-level substitution. In particular, whenever there is growth in demand for access, it is possible that mobile phones rather than new fixed lines could meet this incremental demand. Therefore, at least in principle, access-level substitution can occur without there being cancellation of fixed line subscriptions. Given the growth of Internet usage, migration of voice traffic onto mobiles to free existing fixed lines for other uses is an important potential substitution mechanism, as well as more obvious possibilities such as individuals choosing to have a mobile phone but no fixed phone.

Oftel's current views on fixed-mobile substitution

Oftel currently believes that separate markets should be defined for fixed and mobile services. Its conclusions on the interaction between fixed and mobile telephony can be summarised as follows.

Even though there is a sizeable proportion of UK households without fixed line access who are using a mobile phone connection as an alternative, Oftel believes that the fact that the rise in mobile ownership has resulted in an increase in the number of households with both a fixed and a mobile line suggests that “mobiles are seen by most customers as a complement to the fixed line rather than as a substitute for it.”⁴ Oftel has also argued that that “the advent of the mobile has, to a significant degree, expanded the market for making calls, rather than substituting fixed calls, implying that a large majority of mobile calls are complementary to fixed calls.”⁵

According to Oftel, absence of access-level substitution is further confirmed by survey evidence showing that around 29% of respondents would never completely replace their fixed telephone with a mobile, whilst the increase in the quarterly fixed bill required to induce such a switch would be 102% averaged over the remainder.⁶ Oftel takes this as evidence to suggest that mobile access is not an effective substitute for fixed access and, therefore, does not impose a competitive constraint on the pricing of fixed services. This appears to run somewhat contrary to the standard practice of market definition, in which two services lie in the same economic market if there are a sufficient number of customers willing to switch on the basis of relative price; it is not necessary for all or

⁴ Ibid, paragraph 2.10.

⁵ Oftel, *Effective competition review: mobile*, Statement issued by the Director General of Telecommunications, 26 September 2001, A1.14. This view that fixed and mobile telephony are, in some sense, complementary is repeated in paragraph 2.29 of Oftel, “*Review of the charge control on calls to mobile*”, 26 September 2001.

⁶ Oftel, *Competition in the provision of fixed telephony services*, Consultation document issued by the Director General of Telecommunications, 31 July 2001, paragraph 2.10.

even the majority of customers to be willing to switch. Indeed, in other documents, Oftel acknowledges this: “Oftel does not require full substitutability on the demand side, rather it assesses whether a **sufficient** number of consumers would switch to an alternative product in response to an increase in the price.”⁷

Despite evidence of substitution of mobile for fixed calls – according to Oftel’s survey evidence, about two-thirds of those having both a fixed and a mobile connection “*find occasions on which they do substitute mobile usage for fixed usage*”⁸ – Oftel believes mobile originated calls are not currently in the same market as calls made from fixed lines. This implies that, whilst Oftel does acknowledge some substitution at the level of calls, it considers this substitution too weak to constitute an effective competitive constraint on the pricing of fixed lines.

Oftel has pointed to the potentially asymmetric nature of any substitution between fixed and mobile calls, saying that:

“On the demand side, mobile phones may be viewed by consumers as ‘added value’ versions of fixed line phones; the latter are attached to a place, the former belong to a person and can travel with that person. This suggests that fixed lines are unlikely to act as substitutes for mobiles. The fact that mobiles have evolved implies that they have created a market of their own. This would further imply that if the price of fixed line phone calls decreased, there would be no material impact on mobile phone usage.”⁹

Clearly there are important functionality differences between fixed and mobile telephones. However, this observation is not by itself sufficient to reach Oftel’s conclusion that mobile phones might substitute for fixed phones, but that the reverse is impossible. Whenever some customers select between two functionally different services on the basis of the relative value for money, it follows that changing the price of *either* service will affect the demand for *both* services, in that there will be a group of marginal customers who will switch. This conclusion remains true even if one service provides all the functions of the other service (plus extra functionality).

In light of the growing role played by mobile phones in everyday communication Oftel’s conclusions appear to be extremely conservative. As the Director General of Telecommunications observed earlier, “*over 50% of the UK population now has a mobile*

⁷ Oftel, *Effective competition review: mobile*, Statement issued by the Director General of Telecommunications, 26 September 2001, paragraph A1.4.

⁸ *Ibid.*, paragraph 2.25.

⁹ Oftel, *Effective competition review: mobile*, Statement issued by the Director General of Telecommunications, 26 September 2001, paragraph A1.9.

phone.”¹⁰ and “mobile penetration is now approaching that of fixed lines and many pundits predict the replacement of fixed lines by mobile.”¹¹ In a survey carried out by Mori¹², OFTEL found that “70% of UK adults claimed to have a mobile [phone]” and that “15% of all UK adults consider their mobile to be their main method of making and receiving calls ... 7 in 10 of these consumers ... also had a fixed phone at home”, which implies that for about 4.5% of adults the mobile is the only form of access to the telecommunications network. Overall, “7% of UK homes were without fixed phones. Almost 9 in 10 of these homes used a mobile instead.” This implies 6.3% of homes are mobile-only, which represents approximately one and a half million UK households.¹³

Our findings

This report considers the extent to which mobile connections and mobile usage actually substitute for fixed lines and fixed usage. Specifically, we combine the analysis of data gathered through extensive, bespoke market surveys and publicly available macro-level data to show that fixed-mobile substitution is a reality, and that its impact is significant.

In Section 2, we summarise the findings of an extensive market survey conducted during September 2001 by FDS International. The format of this analysis follows that of two previous reports prepared by •econ for BT and presented to OfTel.¹⁴ We find substantial changes in how mobiles are used. The main findings of the survey are that:

- those reluctant to get a mobile are increasingly restricted to the elderly;
- mobile phones are perceived to be good value for money with few limitations due to call quality or battery life;
- over 40% of those with access to both fixed and mobile phones at home use their mobiles to make calls from home at least sometimes, with the predominant reason being that mobile calls are cheaper than fixed calls;

¹⁰ David Edmonds, *Regulating Converging Markets*, 2001, at <http://www.wmrc.com/businessbriefing/pdf/wireless2001/book/edmonds.pdf>

¹¹ *Ibid.*

¹² Consumers’ use of mobile telephony: Summary of OfTel residential survey Q5 May 2001, OFTEL, at <http://www.oftel.gov.uk/publications/research/2001/q5mobr0701.htm>

¹³ Calculated using predicted UK households for 2001 from the Regional Trends Dataset.

¹⁴ The second report (which also summarises the main findings from the first report) is available at <http://www.dotecon.com/images/reports/mobile.pdf>.

- mobile adoption is much more often reported to have reduced fixed line usage than to have increased it;
- mobile-only individuals go without fixed lines for extended periods of time even when they could have a fixed line if they wanted;
- Internet and fax usage is higher amongst groups with *either* additional fixed lines *or* a mobile, consistent with mobiles providing a means of meeting incremental demands for access; and
- given hypothetical scenarios about the pricing of fixed and mobile services, respondents will switch both calls and subscription decisions in response to relative price changes.

Overall, these three surveys provide a rich dataset for *systematically* testing hypotheses about the relationships of fixed and mobile services. In Section 3, we use this data to test Oftel's hypothesis that fixed and mobile services are complements, in the sense that owning a mobile leads to greater fixed line expenditure. We find that, in Oftel's terms, the services are in fact strong substitutes, as mobile ownership is associated with a large *reduction* in fixed line expenditure.

We examine this using an econometric approach that can take into account self-selection effects that might otherwise result in mistaken conclusions. At the individual level, it is possible to see a positive association between fixed and mobile usage even if the two services are in fact substitutes. This is because of the underlying taste differences and self-selection effects. We find that individuals with mobile phones on average tend to use their fixed lines more intensely (or have a larger number of fixed lines) than people without mobile phones simply because they have a generally greater demand for telephony services and not because of any underlying complementarity between the services. An appropriate test for substitutability would require one to establish the consumption of fixed telephony services of a mobile customer if this person did not have a mobile phone and vice-versa. We use a so-called *endogenous switching model* to compare fixed and mobile usage holding tastes constant and stripping out any biases due to self-selection of those with and without mobiles. This analysis provides very strong statistical evidence that mobile and fixed phone services are substitutes, not complements as Oftel asserts.

Section 4 uses macro-level data from a range of countries to show the interaction between mobile and fixed line penetration. More specifically, using annual data for a panel of 20 OECD countries over nine years, we show that an increase in mobile penetration has a significant negative impact on the growth of fixed line penetration. This is consistent with access-level substitutability between fixed and mobile telephony. This finding is supported by recent results from the academic literature assessing the relationship between mobile and fixed line penetration.

Thus, we find strong evidence for the presence of significant levels of fixed-mobile substitution both call-by-call and at the access-level from a variety of different sources. In assessing the extent to which this imposes a constraint on the pricing of fixed line services, one has to take into account further factors that Oftel appears not to have considered fully.

Firstly, in order to provide a material competitive constraint, substitution possibilities only need to exist for a potentially small subset of customers. In particular, in industries where a considerable proportion of costs are fixed and therefore any revenue change impacts directly on the bottom line, the number of customers that would need to be prepared to switch to another product or service to render a price increase unprofitable is very small. Our surveys suggest that one important source of substitution is the migration of voice traffic onto mobile phones to free fixed lines for other uses, such as Internet access. Therefore, mobile phones may substitute for *additional* fixed lines for those customer groups with growing demand for access, who also tend to spend relatively more on telecommunications services and use these services more intensely.

Even on the basis of Oftel's own evidence, it is difficult to see why Oftel does not accept that mobile telephony may now provide a competitive constraint on fixed line prices.

Secondly, in order to assess whether competition with regard to the provision of a particular service is effective, one should not confine one's attention to only one potential substitute. A range of substitutes might exist for making voice calls from a fixed line, and it is the combined effect of all substitution possibilities that need to be taken into account when assessing competitive constraints. This further reduces the extent to which fixed-mobile substitution would need to take place in order for there to be an effective constraint on the pricing of fixed line services. For example, we have found substantial numbers of respondents in our surveys who report using e-mail and SMS *in place of* making voice calls.

Overall, this implies that given the evidence of fixed-mobile substitution both with regard to calls and at the access level, Oftel may well have significantly underestimated the extent of the competitive constraint on the fixed market provided by mobile telephony.

2. FIXED-MOBILE SUBSTITUTION: MARKET SURVEY ANALYSIS

In earlier reports prepared on behalf of BT and submitted to Oftel, we have presented the results of market research into the usage of fixed and mobile telephony and how this is related to fixed-mobile substitution.¹⁵ During September 2001, FDS International has undertaken a further wave of market research based on a slightly modified questionnaire, and in this section we present an overview of the results from this survey (including, where appropriate, comparisons with the results from the earlier surveys). A more detailed description of survey results can be found in Appendix A and the full questionnaire is reproduced in Annex B.

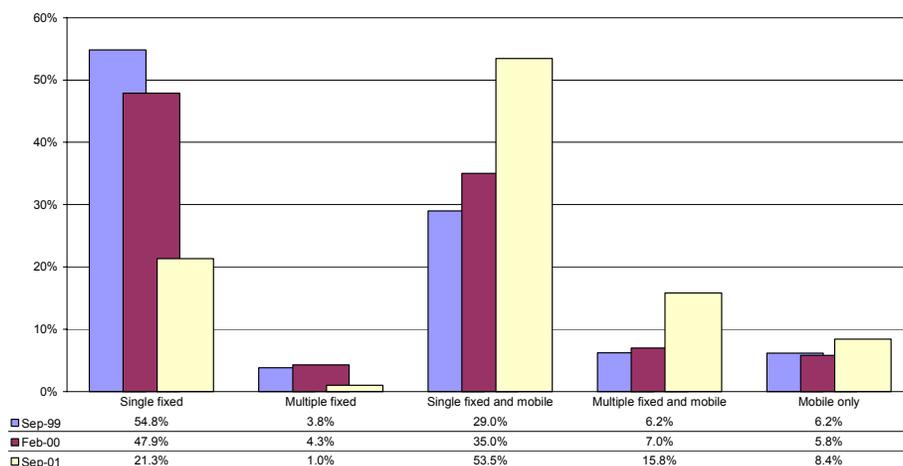
2.1. CHARACTERISTICS OF RESPONDENTS

The survey was undertaken by randomly contacting respondents by telephone, both via fixed lines and mobile telephones. Respondents can be divided into five categories, according to the combination of telephony services that they subscribe to. These are:

- single fixed line users;
- multiple fixed line users;
- single fixed and mobile users;
- multiple fixed and mobile users; and
- mobile-only users.

Based on the relative proportion of respondents in our sample, the estimated proportion of each category in the population can be calculated (for a description of how the problems of sampling bias have been addressed in order to calculate these proportions see Appendix A). The results are displayed in Figure 1, which also includes the respective population proportions from our earlier surveys.

¹⁵ The second report (which also summarises the main findings from the first report) is available at <http://www.dotecon.com/images/reports/mobile.pdf>.

Figure 1: Estimated population proportions

Starting from our first survey, there has been a clear trend towards higher mobile usage and away from single fixed/multiple fixed. The single fixed and mobile category has increased at the expense of single fixed line use, and, multiple fixed line and mobile has grown at the expense of multiple fixed users.

Household size

Unlike in the earlier surveys, mobile-only households are no longer predominantly single person households and instead now represent a greater variety of household sizes. Mobile-only no longer appears to be an attractive option for single person households only, but has broadened its appeal to larger households who use mobile instead of a fixed line.

Age

Mobile take-up is negatively associated with age. The largest proportion of respondents using only a single fixed line (almost 40%) is aged above 65 whereas more than half of all mobile-only users are younger than 30. More generally, the age profile of mobile users (single fixed line + mobile or multiple fixed lines + mobile) has a higher proportion of younger people than the age profile of the corresponding fixed-only user groups (see Figure 10 in Appendix A).

However, relative to the earlier surveys mobile use has grown throughout most age groups: the age profile of those without a mobile has shifted dramatically towards people over 65, implying that mobile usage has become more widespread amongst middle-aged customers (and in particular the group between 25 and 45, see Figure 11 in Appendix A).

Income and social class

Despite the fact that growth in mobile penetration through the proliferation of pre-paid packages is often associated with increasing mobile use in lower income groups, mobile ownership tends to be associated with higher income. Comparing both single fixed and multiple fixed user groups with the corresponding groups using mobile telephony as well, the income distribution within these groups is more skewed towards higher income for mobile users (see Figure 15 in Appendix A).

Similarly, the strong growth in pre-paid packages has not resulted in a significant change in the social class profile within user groups (see Figure 13 in Appendix A).

Main use of lines

The broadening appeal of mobile telephony and the growth of pre-paid packages is reflected in a clear trend over time between the three surveys: mobiles are being increasingly used for personal purposes, and less often for work. This contrasts with fixed line use where the relative importance of different uses has remained largely unchanged. Adjusting for the sample bias that might result from mobile users being more or less likely to answer calls on a fixed line in the same household, we find that mobile users are indeed less likely than non-mobile users to answer fixed line calls (see the discussion in Appendix A), and that this probability has decreased since our first survey. This suggests that mobile users are increasingly regarding the mobile as their main connection for making and receiving calls.

Use of voice, fax and Internet

There is little difference between respondent categories in voice usage across the groups. However, fax and Internet use is linked to having a second fixed line and/or having a mobile. Those having multiple connection are more likely to have a PC and Internet connection. Compared to single fixed or mobile-only users, the differences between multiple fixed with and without mobiles or single fixed plus mobile users are not large (see Figure 22 and Figure 23 in Appendix A).

Reasons for having a mobile

The most important reason given for owning a mobile is both being contactable and being able to make contact in case of an emergency. Of secondary importance is ease of being able to contact and being contacted by friends and family (see Figure 24 in Appendix A).

2.2. INDICATORS OF CALL SUBSTITUTION

Call substitution means that when users have a choice of access to both fixed and mobile phones, they choose which one to use depending on cost and convenience. Users may have a choice between making a call on a fixed or a mobile phone if they are in the workplace or from home where both are available.

Only 26% of users with access to both fixed and mobile lines never make mobile calls from home. More than 40% make mobile calls at least sometimes (see Figure 30 in Appendix A). Similarly, more than one third of users claiming to have easy access to a fixed line at work use their mobile at least sometimes for making calls (see Figure 34 in Appendix A).

The main reason given by users making mobile calls from home is that mobile calls are often cheaper (more than 50% of respondents). By comparison, other reasons such as increased convenience are much less important (see Figure 31 in Appendix A). In elucidating the reasons for use of mobiles, our survey did not prompt respondents with particular possible answers, but rather allowed respondents to articulate their own reasons that were then coded by the market researchers.

This is reflected in the impact of getting a mobile on fixed usage. More than one quarter of respondents say that as a result of getting a mobile they use their fixed line less (compared to less than 5% saying that mobile ownership has increased their fixed line usage). Similarly, more than 30% of respondents without a mobile report that as a result of getting a mobile they would expect their fixed line usage to fall (with around 12% expecting fixed line usage to increase, see Figure 32 in Appendix A). This rejects the presumption of complementarity.

By contrast, use of mobiles for making calls at work is mainly driven by the user's inability to get to a fixed line (around 43% of responses) with the lower price of mobile calls being a less important reason (around 13% of respondents, see Figure 35 in Appendix A).

For home workers using their mobile to make calls despite having access to a fixed line, price is again the most important reason for doing so, but other reasons (such as separate billing for mobile and fixed lines or the fixed line being in use) are also important (see Figure 39 in Appendix A).

In general, a significant proportion of users would respond to a fall in the relative price of mobile usage by reducing their fixed line usage – the 'cross-price elasticity' is positive (see Figure 41 in Appendix A). The large majority of mobile users considers the mobile service to be good value for money, and neither call quality nor battery life would appear to be an issue with regard to using mobiles rather than fixed phones (see Figure 40 in Appendix A).

In addition to being able to substitute a fixed voice call by a mobile voice call, respondents also report using SMS and e-mail instead of making voice calls. Between 25% and 53% of respondents who reported using e-mail in each category stated that this reduced the number of voice calls they made (see Figure 42 in Appendix A). Similarly, SMS usage affects how many voice calls are being made. More than a half of mobile users using SMS stated that this reduced the number of voice calls they made (see Figure 44 in Appendix A).

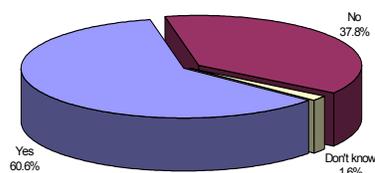
2.3. INDICATORS OF LINE SUBSTITUTION

Evidence of substitution between fixed and mobile lines, i.e. at the access level, is more difficult to establish because such substitution may not necessarily imply that subscribers cancel their fixed line subscription as a result of getting a mobile. More often it may mean that demand for additional connectivity (e.g. as a result of fax and Internet use) is satisfied by getting a mobile, migrating voice traffic onto the mobile and freeing the fixed line for data traffic. Comparing the use of fax, Internet and e-mail across single fixed and single fixed plus mobile users, and multiple fixed and multiple fixed plus mobile users, we find that in every single case mobile users are more likely to use these services (see Figure 22, Figure 23 and Figure 42 in Appendix A).

Figure 2 shows that almost two-thirds of single fixed users with mobile using the Internet relatively intensely tend to use their fixed line for the Internet, and the mobile for voice calls while at home.

Figure 2: Voice and data usage on fixed and mobile phones

Do you tend to use your fixed line for internet and your mobile for voice when at home?
 - single fixed and mobile users, except those who reported using the internet never or rarely
 N = 254



A significant proportion of mobile-only users have made a deliberate choice not to have a fixed line. Since our earlier surveys, the proportion of mobile-only customers having been without a fixed line for more than 2 years has increased to almost one third (from around 15% in 1999). This indicates that having a mobile but no fixed phone is not a transitory state, but potentially permanent. More than 50% of mobile-only users had a fixed line at the time they got the mobile. Around 40% of these have since cancelled their fixed line, and most of the remainder have moved to a place where they could have a fixed line, but decided not to get one (see Figure 3).

Figure 3: Reasons for not having a fixed line

Did you have a fixed line when you got the mobile phone?

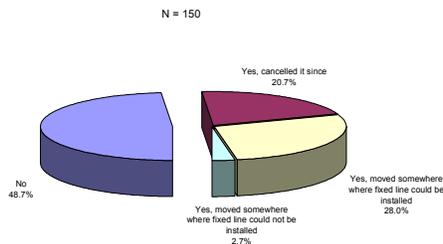
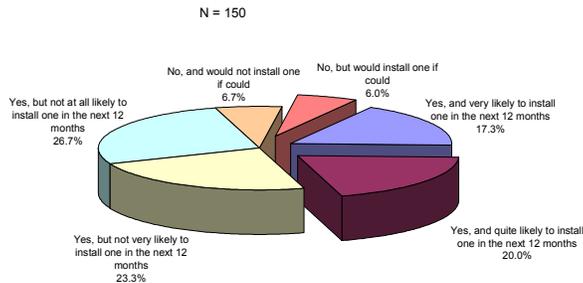


Figure 4 confirms that the majority of mobile-only users could have a fixed line, and that their decision to remain mobile-only is a deliberate decision against a fixed line. Moreover, roughly only half the respondents who could not have a fixed line installed would install one if they could.

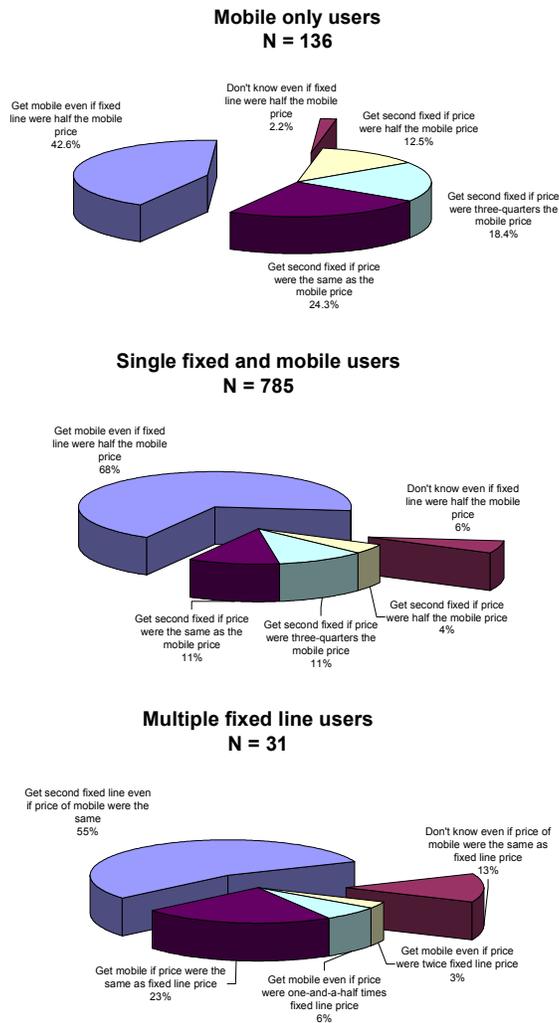
Figure 4: Willingness to install a fixed line

Could you have a fixed line installed where you live? How likely are you to get a fixed line?



Again, when confronted with a number of questions about the hypothetical choice between a fixed/additional fixed line and a mobile, respondents clearly show price sensitivity, suggesting that the choice between fixed and mobile access is affected by their relative price. Figure 5 shows the extent to which particular user types would respond to changes in the relative price of fixed and mobile connections. This clearly indicates that the choice between mobiles and (additional) fixed lines is affected by price (for a more detailed analysis see Figure 50 to Figure 55 in Appendix A).

Figure 5: Price sensitivity of line choice – hypothetical choice of mobile/fixed line depending on relative price



It is remarkable that the alleged lower call quality of mobile phones is not in general perceived to be the problem. None of the respondents gave better quality of fixed lines as a reason for preferring a fixed line to a mobile if both cost the same. By contrast, some of the respondents gave call quality as a reason for not switching from mobile to fixed even if fixed lines were considerably cheaper.

3. FIXED-MOBILE SUBSTITUTION: ACCOUNTING FOR DIFFERENCES IN TASTE

In this section we analyse data on usage and respondent characteristics¹⁶ from the market surveys undertaken by FDS using an endogenous selection model in order to establish the link between mobile ownership and fixed usage.¹⁷

This approach explicitly addresses the self-selection effects that might result in observing higher fixed usage amongst owners of mobile phones regardless of whether fixed and mobile telephony are substitutes or complements. For example, individuals with mobile phones may use their fixed lines more intensely (or have a larger number of fixed lines) than people without mobile phones simply because of their overall greater demand for telephony services and not because of any underlying complementarity between the services. In order to test for substitutability, therefore, one has to strip out any underlying taste affecting both fixed and mobile demand.

Controlling for such self-selection effects, we find that using a mobile phone significantly diminishes the use of fixed lines. This strongly rejects the notion that fixed and mobile phones are complements in the sense that mobile ownership on average increases fixed line expenditure.

3.1. FIXED LINE USAGE AND MOBILE OWNERSHIP – THEORETICAL BACKGROUND

Our objective is to study the effect of mobile ownership on fixed line telephone usage, which may be measured by the amount spent on fixed telephony services. When deciding whether to get a mobile phone a customer can be expected to take into account the likely impact of mobile phone usage on fixed line expenditure: an expected reduction in expenditure on fixed telephony would count as a benefit of mobile ownership (in addition to other benefits such as being able to make and receive calls when away from the fixed line), whilst an expected increase would count as a further cost (in addition to the expected mobile bill and the price of the connection/handset). If fixed line expenditure is expected to decrease as a result of mobile ownership, then fixed and

¹⁶ It is perhaps worth stressing that the analysis in this section does not in any way rely on data gathered in response to hypothetical questions or questions aimed at establishing attitudes towards fixed and mobile telephony.

¹⁷ The problem is similar to the problem of establishing the link between union membership and wages or labour market participation and wages. Probably the most well-known example of such an endogenous switching model framework is that of Lee (Lee, L-F., 1978, 'Unionism and wage rates: A simultaneous equations model with qualitative and limited dependant variables', *International Economic Review*, 19(2), 415-433).

mobile telephony are substitutes. Conversely, if mobile ownership is expected to increase fixed line expenditure, mobile and fixed telephony would be complements.

More specifically, let Y_{ni} and Y_{mi} be individual i 's fixed bill if she had or did not have a mobile phone respectively. The effect of having a mobile phone on the fixed bill is $Y_{ni} - Y_{mi}$. We assume that the individual buys a mobile phone if:

$$Y_{ni} - Y_{mi} > \eta_i \quad (1)$$

where η_i is a threshold value that captures the expected benefits from mobile phone usage net of the expected costs of mobile ownership (e.g. the size of the mobile bill).¹⁸ Both expected benefits and expected costs depend on personal characteristics X_i . Assuming a simple functional relationship between the threshold value and these individual characteristics, we can write η_i as:

$$\eta_i = \alpha X_i + \varepsilon_i \quad (2)$$

where ε_i stands for a number of unobservable and random factors. We assume that ε_i is normally distributed with zero mean and variance σ_ε^2 .

Using equations (1) and (2) the following inequality must hold for those who have decided to use a mobile phone:

$$(Y_{ni} - Y_{mi}) - \alpha X_i - \varepsilon_i > 0. \quad (3)$$

We can write this inequality in the form of a probit equation for mobile adoption decisions:

$$I_i^* = \lambda_0 + \lambda_1(Y_{ni} - Y_{mi}) + \lambda_2 X_i - \varepsilon_i \quad (4)$$

where we observe $I=1$ (i.e. mobile phone ownership) if and only if $I^* > 0$ and $I=0$ (i.e. no mobile phone) otherwise. If in estimating this relationship we find the value of λ_1 to be positive this indicates fixed-mobile substitution at the access level: the expectation of a reduced fixed bill increases the likelihood that a customer decides to become a mobile user.

Unfortunately, we cannot estimate this equation directly. This is because for any given individual we cannot observe both Y_{ni} and Y_{mi} . Rather, we observe:

¹⁸ η_i can be positive or negative.

$$Y_{mi} \text{ when } I_i = 1 \text{ and}$$

$$Y_{ni} \text{ when } I_i = 0.$$

Therefore, we have to predict the fixed telephony expenditure of mobile phone owners in case they would not have a mobile phone. Similarly, we need to forecast how the fixed expenditure of non-mobile customers would change if they became mobile users.

In order fully to capture the differences in calling habits between the two groups, we specify a separate equation for each of the two groups for how fixed line expenditure depends on personal characteristics (which ultimately also drive mobile ownership):

$$Y_{mi} = \delta_{m0} + \delta_{m1} X_{mi} + \varepsilon_{mi} \quad (5)$$

$$Y_{nj} = \delta_{n0} + \delta_{n1} X_{nj} + \varepsilon_{nj} \quad (6)$$

where X_{mi} and X_{nj} are individual characteristics of person i owning a mobile, and for person j not owning a mobile. The error terms ε_{mi} and ε_{nj} are assumed to be normally distributed with zero mean and variances σ_m^2 and σ_n^2 respectively. Estimating these equations from our survey data¹⁹, we can then predict a given individual's fixed line spending with and without owning a mobile phone. These predictions then can be used to estimate the probit model in equation (4).

3.2. ESTIMATION METHOD

The theoretical model is given in the simultaneous equations system given in (4)-(6). We want to accomplish two tasks by estimating the above system:

- we want to compare the predicted fixed line expenditure of a given individual under the two scenarios. That is, we want to calculate the effect of mobile ownership on the fixed bill. If mobile ownership reduces the fixed bill then fixed and mobile are substitutes, if it increases, they are complements; and
- using the predicted expenditures, we want to examine whether a higher expected reduction in the fixed bill is associated with greater probability of having a mobile phone (i.e. whether λ_i is positive). If this were the case, then the decision to become a mobile phone user is at least partly motivated by an expected reduction in the fixed bill as a result of substituting mobile for fixed telephony.

¹⁹ As our data does not include the exact spending but rather an interval in which an individual's average spending lies, we have to use a special technique developed for interval regressions. In particular, we use a generalised tobit model.

3.2.1. ESTIMATION OF FIXED TELEPHONY EXPENDITURE

The fixed line expenditure equations in (5) and (6) have zero-mean error terms on the overall sample. However, we do not observe Y_{mi} and Y_{ni} for the whole sample. Therefore, equations (5) and (6) cannot, in general, be consistently estimated using estimation methods that assume error terms with zero mean (such as the interval regression or ordinary least squares). The problem is caused by the *selectivity bias*, namely that only specific segments of the spending distribution are observed for the two scenarios, that is:

$$E(\varepsilon_{mi} | I_i = 1) \neq 0 \quad \text{and} \\ E(\varepsilon_{ni} | I_i = 0) \neq 0.$$

In particular, for individuals who have mobile phones the following inequality holds:

$$Y_{ni} - \eta_i > Y_{mi}$$

Therefore, the mean of fixed expenditure for people with mobile phones can be expressed as:

$$E(Y_{mi} | I_i = 1) = E(Y_{mi} | Y_{mi} < Y_{ni} - \eta_i) = \bar{Y}_m + \sigma_{m\varepsilon^*} \frac{\phi(\Psi_i^*)}{1 - \Phi(\Psi_i^*)}$$

where \bar{Y}_m is the overall mean of fixed spending of mobile phone owners (i.e. the expected fixed spending if everyone had a mobile phone), ϕ is the density and Φ is the distribution function of the standard normal distribution and $\sigma_{m\varepsilon^*} = \text{cov}(\varepsilon_m, \varepsilon^*)$ is the covariance of ε_m and ε^* (see below). Ψ_i^* stands for the consistent estimate of the probability of person i having a mobile phone.

Similarly, the expected fixed expenditure of fixed line users without mobile phones is:

$$E(Y_{ni} | I_i = 0) = \bar{Y}_n - \sigma_{n\varepsilon^*} \frac{\phi(\Psi_i^*)}{\Phi(\Psi_i^*)}.$$

If we add the appropriate selectivity terms to the fixed bill equations they can be consistently estimated by standard interval regression techniques. In particular, we can estimate equations (5) and (6) using the following two-step procedure. First we estimate the probability of having a mobile phone. This probability is estimated using the reduced form of the model in equation (4). Reduced form refers to the fact that we substitute the fixed expenditure equations (Y_{ni} and Y_{mi}) into the probit equation:

$$I_i^* = \gamma_0 + \gamma_1 Z_i - \varepsilon_i^* \quad (7)$$

where Z_i is the matrix of all individual characteristics that appear in the theoretical model (X_i , X_{mi} and X_{ni}). In this case $\varepsilon^* = (\varepsilon + \lambda_1(\varepsilon_n - \varepsilon_m)) / \sigma^*$ where σ^* is the standard deviation of $(\varepsilon + \lambda_1(\varepsilon_n - \varepsilon_m))$.

Using the consistent estimates of the probability ($\Psi_i^* = \gamma_0^* + \gamma_1^* X_i$) we can calculate the selectivity variables. Subsequently, we can consistently estimate the two fixed telephony spending equations:

$$Y_{mi} = \delta_{m0} + \delta_{m1} X_{mi} + \sigma_{m\varepsilon} \frac{\phi(\Psi_i^*)}{1 - \Phi(\Psi_i^*)} + \zeta_{mi} \quad \text{for } I_i = 1 \quad (8)$$

$$Y_{ni} = \delta_{n0} + \delta_{n1} X_{ni} - \sigma_{n\varepsilon} \frac{\phi(\Psi_i^*)}{\Phi(\Psi_i^*)} + \zeta_{ni} \quad \text{for } I_i = 0 \quad (9)$$

where ζ_{mi} and ζ_{ni} are zero mean error terms.

After obtaining the consistent estimates of the parameters of equations (8) and (9), we can predict the fixed line spending for the two scenarios for each individual in the sample using:

$$Y_{mi}^* = \delta_{m0}^* + \delta_{m1}^* X_{mi} \quad \text{and}$$

$$Y_{ni}^* = \delta_{n0}^* + \delta_{n1}^* X_{ni}.$$

This allows us to compare the average fixed telephone expenditure of different groups (such as present mobile owners, home workers, females, etc) under the two scenarios. Likewise, we can compare the average fixed bills under the different scenarios for the whole sample. We are then able to determine whether fixed and mobile telephony are substitutes or complements. In particular, if the predicted fixed bill is lower with than without a mobile, leaving personal characteristics unchanged, then we can conclude that fixed and mobile telephony are substitutes, i.e. mobile owners use their fixed phones less than they would if they did not have a mobile phone.

3.2.2. ESTIMATION OF THE MOBILE TAKE-UP EQUATION

Once we have the consistent predictions of Y_{mi} and Y_{ni} the probit model in equation (4) can be estimated consistently:

$$I_i^* = \lambda_0 + \lambda_1 (Y_{ni}^* - Y_{mi}^*) + \lambda_2 X_i - \varepsilon_i. \quad (10)$$

The estimation of this equation can shed light on the underlying reasons to buy a mobile phone. Particularly, if coefficient λ_1 is positive then we can conclude that one of the incentives to buy a mobile phone is the expected reduction in the fixed bill.

3.3. DATA AND SPECIFICATION

We use data from the three consecutive surveys conducted by FDS on behalf of BT (for a description of these surveys see Appendix A). The data is in a repeated cross-section format as respondents of the three surveys cannot be linked to each other. Respondents of the three surveys are divided into five categories, according to the combination of telephony services that they subscribe to (see Table 1).

Table 1: Sample sizes for respondent categories

<i>Survey</i>	<i>Single fixed line</i>	<i>Multiple fixed lines</i>	<i>Single fixed and mobile</i>	<i>Multiple fixed and mobile</i>	<i>Mobile- only</i>	<i>Total</i>
September 1999	983	99	990	346	182	2,600
February 2000	1,000	160	999	581	263	3,003
September 2001	600	42	902	405	150	2,099

Because we want to analyse the impact of mobile ownership on fixed line expenditure we only use the subset of fixed line subscribers (with and without mobile phones) and exclude mobile-only individuals.

In our preferred specification the probit equation in (4) is estimated using the following variables:

$$\begin{aligned}
 I_i^* = & \lambda_0 + \lambda_1(Y_{ni} - Y_{mi}) + \lambda_2WWW_i + \lambda_3FAX_i + \\
 & + \lambda_4HOMEW_i + \lambda_5GENDER_i + \lambda_6AGEDUM_i + \\
 & + \lambda_7INCDUM_i - \varepsilon_i
 \end{aligned} \tag{11}$$

where $Y_{ni} - Y_{mi}$ is the difference between fixed bill without and with mobile phone usage. WWW captures Internet usage, taking the value 1 if the subscriber has an Internet connection and 0 otherwise. Similarly, FAX takes the value 1 if the subscriber has a fax machine connected to the fixed line, 0 otherwise. $GENDER$ equals 1 if the subscriber is male and is 0 if the subscriber is female. $HOMEW$ equals 1 if the subscriber works primarily from home and 0 otherwise. $AGEDUM$ is a set of dummy variables for the age group of the subscriber and $INCDUM$ is a set of income dummies.

Equations (5) and (6) take the following form:

$$\begin{aligned}
Y_{mi} &= \delta_{m0} + \delta_{m1}WWW_i + \delta_{m2}FAX_i + \\
&+ \delta_{m3}HOMEW_i + \delta_{m4}AGEDUM_i + \quad \text{for } I_i = 1 \quad (12) \\
&+ \delta_{m5}SCDUM_i + \delta_{m6}HSIZEDUM_i + \varepsilon_{mi}
\end{aligned}$$

$$\begin{aligned}
Y_{ni} &= \delta_{n0} + \delta_{n1}WWW_i + \delta_{n2}HOMEW_i + \\
&+ \delta_{n3}HSIZEDUM_i + \varepsilon_{ni} \quad \text{for } I_i = 0 \quad (13)
\end{aligned}$$

where *SCDUM* is a set of dummy variable for the social class of individual *i* and *HSIZEDUM* is a set of dummy variables for the size of household of the subscriber.

The two fixed expenditure equations include different explanatory variables. The independent variables in the preferred specifications are selected in order to obtain the best diagnostic results. This enables us to pin down the drivers of change in fixed telephony spending as a result of getting a mobile phone.

3.4. RESULTS

We first present the results for the estimation of the fixed expenditure equations. This is followed by the analysis of the incentives of buying mobile phones. We estimate the above equations separately for data taken from the latest survey and the two previous surveys.

3.4.1. ESTIMATION OF FIXED TELEPHONY EXPENDITURE

September 2001 survey

The results of the reduced form probit equation, estimating the probability of having a mobile phone depending on individual characteristics, are presented in Table 2. They suggest that Internet usage increases the probability of having a mobile phone (as a mobile phone would provide the ability to make and receive calls while the fixed line is busy with a dial-up connection). Men are more likely to have mobile phones. The test of joint significance of different groups of dummy variables suggests that income and age play an important role in mobile take-up.

Table 2: Reduced form probit (3rd survey)

<i>Variable</i>	<i>Coefficient</i>	<i>z-value</i>
<i>WWW</i>	0.59	5.47
<i>FAX</i>	0.11	0.71
<i>GENDER</i>	0.26	2.75
<i>HOMEW</i>	-0.00	-0.02
<i>SC_2</i>	-0.47	-1.63
<i>SC_3</i>	-0.18	-0.62
<i>SC_4</i>	-0.13	-0.43
<i>SC_5</i>	-0.16	-0.48
<i>SC_6</i>	-0.28	-0.86
<i>AGE_2</i>	-0.10	-0.22
<i>AGE_3</i>	-0.37	-0.86
<i>AGE_4</i>	-0.57	-1.35
<i>AGE_5</i>	-0.60	-1.44
<i>AGE_6</i>	-0.84	-1.99
<i>AGE_7</i>	-0.90	-2.16
<i>AGE_8</i>	-1.23	-2.92
<i>AGE_9</i>	-1.67	-3.89
<i>HSIZE_2</i>	0.15	1.19
<i>HSIZE_3</i>	-0.04	-0.30
<i>HSIZE_4</i>	-0.17	-1.03
<i>HSIZE_5</i>	0.17	0.71
<i>HSIZE_6</i>	-0.22	-0.71
<i>INC_2</i>	0.05	0.28
<i>INC_3</i>	0.07	0.33
<i>INC_4</i>	0.21	0.98
<i>INC_5</i>	0.47	1.98
<i>INC_6</i>	0.40	1.70
<i>INC_7</i>	0.50	2.20
<i>INC_8</i>	0.86	3.02
Constant	0.97	1.94
Wald Chi ² (df=29)	213.68	
Observations	1048	

Z-values are calculated using robust standard errors.

The number of observations used in the estimation of the reduced form probit is determined by the number of respondents who gave complete answers for the questions referring to the variables in the specification (which is obviously smaller than the sample size).

The results of the fixed spending equations are presented in Table 3 and Table 4. In the two equations we use different sets of explanatory variables. More specifically, we have selected the independent variables in order to identify the drivers of change in fixed expenditure as a result of a customer getting a mobile phone. In the selection process we have dropped variables that were not significant at the 15% level.

For example, ownership of a fax machine does not have any significant impact on the telephone bills of people not owning a mobile phone. On the other hand, in the equation for mobile users this variable is positive and significant. This indicates that even though having a fax machine does not significantly influence fixed spending without a mobile phone, the extent to which fax owners getting a mobile phone substitute fixed by mobile usage is less than the extent to which subscribers without a fax substitute fixed by mobile usage. This is to be expected, as it may be more difficult to substitute fixed fax calls by mobile ones than it is to substitute fixed voice calls by mobile ones.

Similarly, age and social class impact on the extent to which fixed usage is substituted by mobile usage. Unsurprisingly, Internet usage tends to increase the size of the fixed bill. Similarly, people who work from home have a higher fixed line expenditure. Larger households tend to spend more, confirming that fixed phones are used by all members of a household (whereas mobile phones are more likely to be used by individuals).

The selectivity parameter is positive and significant in both equations.²⁰ Therefore, the selectivity terms are positive and negative, respectively:

$$\sigma_{me^*} \frac{\phi(\Psi_i^*)}{1 - \Phi(\Psi_i^*)} > 0 \quad \text{and}$$

$$-\sigma_{ne^*} \frac{\phi(\Psi_i^*)}{\Phi(\Psi_i^*)} < 0.$$

The signs of the selectivity terms indicate that mobile owners spend more than average under both scenarios (with and without mobile phones). Therefore, people who actually own mobile phones have a higher usage of fixed telephony as well, but this is due to

²⁰ The following inequality has to hold for the selectivity parameters by definition: $\sigma_{me} > \sigma_{ne}$. In our case the inequality holds confirming that indeed there is selectivity bias.

underlying taste parameters rather than some form of complementarity between fixed and mobile telephony.

Table 3: Fixed telephony spending (selectivity adjusted for mobile phone owners, 3rd survey)

<i>Variable</i>	<i>Coefficient</i>	<i>z-value</i>
<i>WWW</i>	7.36	1.54
<i>FAX</i>	23.53	5.65
<i>HOMEW</i>	13.81	3.14
<i>SC_2</i>	5.38	0.72
<i>SC_3</i>	-1.10	-0.15
<i>SC_4</i>	-5.84	-0.79
<i>SC_5</i>	0.19	0.02
<i>SC_6</i>	7.72	0.83
<i>AGE2</i>	-12.72	-1.32
<i>AGE3</i>	-10.23	-1.07
<i>AGE4</i>	-4.00	-0.43
<i>AGE5</i>	-14.55	-1.58
<i>AGE6</i>	-7.24	-0.74
<i>AGE7</i>	1.03	0.11
<i>AGE8</i>	-0.17	-0.01
<i>AGE9</i>	0.25	0.02
<i>HSIZE_2</i>	7.82	1.93
<i>HSIZE_3</i>	14.19	3.25
<i>HSIZE_4</i>	21.92	4.98
<i>HSIZE_5</i>	23.69	3.70
<i>HSIZE_6</i>	27.21	2.89
Constant	-6.89	-0.17
Selectivity parameter	51.75	1.87
Wald Chi ² (df=22)	265.00	
Observations	751	

Z-values are calculated using robust standard errors.

Table 4: Fixed telephony spending (selectivity adjusted for non-mobile users, 3rd survey)

<i>Variable</i>	<i>Coefficient</i>	<i>z-value</i>
<i>WWW</i>	10.80	1.81
<i>HOMEW</i>	12.90	1.50
<i>HSIZE_2</i>	3.98	0.95
<i>HSIZE_3</i>	20.26	3.11
<i>HSIZE_4</i>	13.46	2.14
<i>HSIZE_5</i>	32.69	2.13
<i>HSIZE_6</i>	10.70	0.89
Constant	67.41	5.43
Selectivity parameter	33.23	1.64
Wald Chi ² (df=8)	68.87	
Observations	297	

Z-values are calculated using robust standard errors.

Having estimated the fixed bill equations we are able to compute the predicted spending of mobile users if they did not have a mobile phone as well as the predicted expenditure of non-mobile users if they decided to use a mobile phone. We find that for both groups the effect of (actual/potential) mobile phone ownership is a similar reduction in the size of the fixed bill. However, this reduction in fixed expenditure is not sufficient for people who do not buy mobile phones to offset the expected net costs of mobile ownership (expected mobile bill less benefits from mobile usage). The expected reduction in the fixed bill as a result of getting a mobile for whole sample is around £74 per quarter.

1999 and 2000 surveys

In case of the first two waves of the survey we also find that owning a mobile phone decreases fixed telephony expenditure. The following tables present the results estimated on these samples. On this occasion, fax usage remains significant in both fixed expenditure equations.

Table 5: Reduced form probit (1st and 2nd survey)

<i>Variable</i>	<i>Coefficient (probit)</i>	<i>z-value</i>
<i>WWW</i>	0.31	5.81
<i>FAX</i>	0.39	5.82
<i>GENDER</i>	0.38	8.64
<i>HOMEW</i>	0.28	4.37
Constant	0.72	3.92
Wald Chi ² (df=25)	861.62	
Observations	4220	

The estimation includes jointly significant age, social class, household size and income dummies. Z-values are calculated using robust standard errors.

Table 6: Fixed telephony spending (selectivity adjusted for mobile users, 1st and 2nd survey)

<i>Variable</i>	<i>Coefficient</i>	<i>z-value</i>
<i>WWW</i>	17.96	8.02
<i>FAX</i>	22.76	2.86
<i>HOMEW</i>	13.58	4.93
Constant	15.10	0.85
Selectivity parameter	28.34	2.07
Wald Chi ² (df=20)	729.62	
Observations	2324	

The estimation includes jointly significant age and household size dummies. Z-values are calculated using robust standard errors.

Table 7: Fixed telephony spending (selectivity adjusted for non-mobile users, 1st and 2nd survey)

<i>Variable</i>	<i>Coefficient</i>	<i>z-value</i>
<i>WWW</i>	18.23	6.73
<i>FAX</i>	12.96	3.34
<i>HOMEW</i>	15.85	4.78
Constant	68.58	2.97
Selectivity parameter	25.20	2.97
Wald Chi ² (df=12)	360.23	
Observations	1896	

The estimation includes jointly significant household size dummies. Z-values are calculated using robust standard errors.

The expected reduction in the fixed bill for the whole sample is around £39.50 per quarter.

3.4.2. ESTIMATION OF THE MOBILE TAKE-UP EQUATION

September 2001 survey

Using the predicted fixed line expenditure we can consistently estimate the structural probit model to test whether the expected saving on the fixed bill is one of the reasons for getting a mobile phone. The results are presented in Table 8. In order to quantify the effect of the explanatory variables on the probability of having a mobile phone we present the marginal effects of the coefficients around the means of explanatory variables (dprobit estimates).

Table 8: Structural probit estimates (3rd survey)

<i>Variable</i>	<i>Coefficient (probit)</i>	<i>Coefficient (dprobit)</i>	<i>z-value</i>
<i>Y_n-Y_m</i>	0.01	0.003	1.70
<i>WWW</i>	0.53	0.16	4.95
<i>FAX</i>	0.40	0.11	1.86
<i>GENDER</i>	0.26	0.08	2.76
<i>HOMEW</i>	-0.01	0.00	0.04
<i>AGE2</i>	-0.21	-0.07	-0.45
<i>AGE3</i>	-0.45	-0.16	-1.01
<i>AGE4</i>	-0.58	-0.20	-1.37
<i>AGE5</i>	-0.74	-0.26	-1.66
<i>AGE6</i>	-0.91	-0.33	-2.12
<i>AGE7</i>	-0.84	-0.29	-2.04
<i>AGE8</i>	-1.13	-0.41	-2.72
<i>AGE9</i>	-1.58	-0.57	-3.77
<i>INC_2</i>	0.05	0.02	0.26
<i>INC_3</i>	0.06	0.02	0.30
<i>INC_4</i>	0.22	0.06	1.12
<i>INC_5</i>	0.44	0.12	2.12
<i>INC_6</i>	0.36	0.10	1.70
<i>INC_7</i>	0.42	0.12	2.11
<i>INC_8</i>	0.77	0.19	3.30
Constant	-0.05		-0.09
Wald Chi ² (df=20)	210.43		
Observations	1048		

Z-values are calculated using robust standard errors.

Indeed, we find that an increase in the expected saving on the fixed bil increases the probability of getting a mobile phone. Therefore, we can conclude that the expected saving on fixed expenditure provides one incentive for buying a mobile phone. The dprobit results suggest that an expected quarterly saving of £10 increases the probability of getting a mobile phone by 3% for the average individual.

Similarly, having an Internet connection increases the probability of having a mobile phone by 16%. Having a fax machine increases this probability by 11%. This is

consistent with the view that access substitution often takes place through migration of voice traffic onto the mobile in order to free up the fixed line for data traffic.

The results presented in Table 8 are estimated for the whole sample. However, the sample includes people whose mobile phones were bought by their employer or were gifts. We would expect the anticipated saving on fixed bills to play an even more important role in the decision of people who buy their own mobile phones. Therefore, we estimate the last equation for a different dependent variable that is set equal to 1 for mobile users who have bought the mobile themselves, and 0 otherwise. Table 9 presents the results of this estimation (without the dummy groups).

Table 9: Structural probit estimates (people who buy their own mobile phones, 3rd survey)

<i>Variable</i>	<i>Coefficient (probit)</i>	<i>Coefficient (dprobit)</i>	<i>z-value</i>
$Y_n - Y_m$	0.02	0.006	2.76
WWW	0.33	0.13	3.46
FAX	0.40	0.16	2.25
$GENDER$	0.42	0.17	5.06
$HOMEW$	-0.10	-0.04	-0.74
Constant	-1.35		-2.84
Wald Chi ² (df=20)	173.16		
Observations	1048		

The estimation includes jointly significant age and income dummies. Z-values are calculated using robust standard errors.

As expected, the anticipated saving in the fixed bill plays a more important role: an expected quarterly saving of £10 increases the probability of buying a mobile phone by 6%.

1999 and 2000 surveys

Whilst mobile ownership reduces the fixed line bill also for the first two waves of the survey, there is no evidence to suggest that the expected saving on the fixed bill is a significant incentive for getting a mobile. Even focusing on mobile users who have bought the mobile themselves, we find no significant effect of $Y_n - Y_m$ on mobile take-up (see Table 10).

Table 10: Structural probit estimates (people who buy their own mobile phones, 1st and 2nd survey)

<i>Variable</i>	<i>Coefficient (probit)</i>	<i>Coefficient (dprobit)</i>	<i>z-value</i>
$Y_n - Y_m$	0.00	0.000	0.06
WWW	0.25	0.09	5.09
FAX	0.22	0.08	2.18
$GENDER$	0.41	0.15	9.62
$HOMEW$	0.23	0.08	3.63
Constant	-0.46		-1.21
Wald Chi ² (df=14)	586.10		
Observations	4220		

The estimation includes jointly significant age dummies. Z-values are calculated using robust standard errors.

However, the failure to find a significant effect may be due to the fact that income, which is highly significant in the mobile take-up equation in 2001, had to be omitted from our estimation for the earlier sample as these surveys did not include income information. Therefore, no robust conclusions can be drawn from the failure to find a statistically significant relationship between the first two and the third samples. However, there is an alternative explanation for the structural change between the first two and the third sample. The difference in the results of the structural probit equations together with the fact that the expected saving on the fixed line bill has increased considerably between the first/second and third wave of the survey is consistent with the view that, as the cost of using mobile telephony has fallen, the extent to which customers replace fixed line use with mobile use and the consequent reduction in the fixed bill have increased so much that they have changed from being a pure side-effect of mobile ownership into a significant reason for getting a mobile. According to this interpretation, the extent of access level substitution has increased greatly since the 1999 survey.

4. ANALYSIS OF MACRO-LEVEL DATA ACROSS COUNTRIES

In this section we present the econometric analysis of aggregate data on fixed line and mobile take-up across a range of countries. Based on a simple adoption model for fixed lines we find that higher mobile penetration is associated with slower growth in the number of fixed lines. This is consistent with fixed-mobile substitution at the *access level* rather than just on a call-by-call basis, and in line with the results found in a number of academic studies estimating penetration models for mobile and/or fixed phones.

4.1. MODELLING THE IMPACT OF MOBILE TAKE-UP ON DEMAND FOR FIXED TELEPHONY

We estimate the relationship between the rate of growth of fixed line penetration and several explanatory factors, namely: the subscription charges for fixed services, income (captured by per capita gross domestic product) and mobile line penetration, controlling also for the level of fixed line penetration. Using the following variables:

- *fixpen*: residential fixed line demand penetration, i.e. the number of residential main lines divided by the population of the country, measured by the number of telephone main lines per 100 inhabitants (as used by the ITU);
- *mobpen*: mobile penetration, i.e. the number of mobile telephone subscribers divided by the population;
- *fixsub*: annual fixed line subscription cost in US dollars; and
- *GDP*: per capita gross domestic product in US dollars;

we estimate the following equation:

$$\Delta \ln \text{fixpen} = \alpha + \beta_1 \ln \text{fixpen} + \beta_2 \ln \text{mobpen} + \beta_3 \ln \text{fixsub} + \beta_4 \ln \text{GDP} + \varepsilon$$

where Δ is the first difference operator and \ln denotes the natural logarithm. By using logarithms of the respective variables, we avoid problems that might arise because of differences in country size in our cross-country sample.²¹

²¹ It is possible to estimate a similar model using mobile subscription prices as an explanatory instead of mobile penetration. However, these data is not as reliable due to measurement problems. Nevertheless, similar results can be obtained from this alternative approach.

This specification assumes that the take-up of fixed lines may be affected by prices (subscription charges) and income as well as mobile penetration. Moreover, it captures the underlying dynamics of technology adoption models where the growth rate of penetration changes along a typical diffusion path of a new technology, and therefore depends on its level.²²

We use the International Telecommunications Union's (ITU) World Telecommunications Database 5th edition, which contains annual data covering the period from 1975 to 1999 for over two hundred countries. As mobile telephony is a recent phenomenon we restrict our analysis to the period from 1990 onwards. Furthermore, as we are particularly interested in countries with developed fixed and mobile telecommunications, we include only those countries that were members of the OECD²³ at the start of this period. However, due to insufficient data, we had to exclude Austria and Ireland. Furthermore, we excluded the USA and Turkey as their mobile markets are not representative of the UK for several reasons, namely lower penetration, and, in the USA, significantly different charging models. This gives a panel of 20 countries over nine years.

Figure 6 and Figure 7 show the patterns of fixed and mobile penetration, respectively, for each country. It is easy to see that across the panel mobile subscription grows exponentially, whereas fixed penetration grows much more slowly. This reflects the fact that the mobile sector was in its infancy during the observed period whilst fixed line use was much closer to full penetration.

²² See Bass (1990) "The Relationship between Diffusion Rates, Experience Curves and Demand Elasticities for Consumer Durable Technological Innovations", *Journal of Business* 53 or Hendry (1972) "The Three Parameter Approach to Long Range Forecasting", *Long Range Planning* 51.

²³ These are: Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Iceland, Italy, Japan, Luxembourg, Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, United Kingdom and USA.

Figure 6: Number of fixed lines per 100 inhabitants

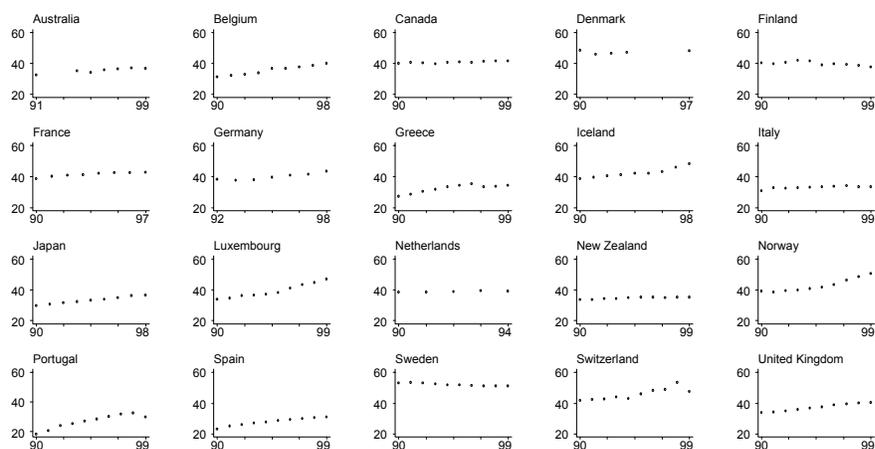
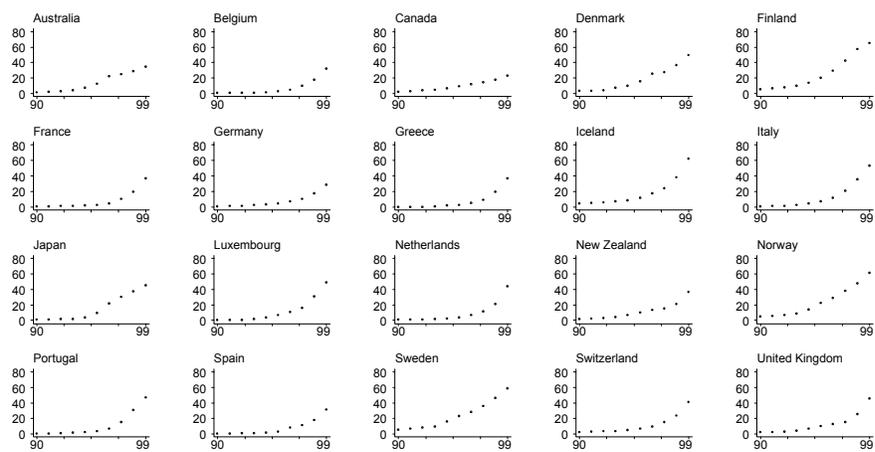


Figure 7: Number of mobile subscribers per 100 population



We estimated the fixed-line diffusion equation specified above using a variety of methods:

- an ordinary least square (OLS) ‘fixed effects’ model, which assumes that differences between countries are deterministic and systematic over time;
- a generalised least square (GLS) estimation ‘random effects’ model, which assumes that differences between countries are random and may change over time; and
- an instrumental variable (IV) variant of each of these approaches, which takes account of the fact that there are likely to be common drivers of both mobile and fixed take-up which might lead to spurious correlations. For example, increased demand for Internet access is potentially a driver of take-up of both fixed and mobile subscription. This could (in theory) lead to a positive correlation of fixed and mobile penetration, as a higher level of demand for Internet access will lead to higher demand for both services.

However, there is very little data available on potential common drivers of mobile and fixed demand. Using instrumental variables estimation addresses this problem. Specifically, for each country we instrument its regressors with the corresponding regressors from all *other* countries.²⁴ In the fixed effect cases we use 2-stage least squares (2SLS), while for random effects we use 2-stage generalised least squares (2SGLS).

4.2. RESULTS

Table 11 and Table 12 present the results for standard and instrumental variable regressions respectively.

²⁴ Suppose we were using a panel made up of countries A , B and C and that we were interested in estimating the coefficients of the regression “ $y_{it} = \alpha + \beta x_{it}$ ” where the $i = \{A, B, C\}$ is the country index, and t is the time index. Suppose that there is a missing variable amongst the regressors. Ordinary least square estimation would give inconsistent estimates, and instrumental variables estimation would remove this bias. Our approach would then suggest to instrument country A 's regressor x_{At} using x_{Bt} and x_{Ct} . Similarly, for country B and C , x_{At} and x_{Ct} , and x_{Bt} and x_{Ct} are instruments respectively.

Table 11: Estimation of speed of penetration using standard regression

	<i>Fixed Effects</i>			<i>Random Effects</i>		
	Coefficient	Standard Error	p-value	Coefficient	Standard Error	p-value
<i>ln(mobpen)</i>	-0.03191	0.006051	0.000	-0.0182	0.004524	0.000
<i>ln(fixsub)</i>	0.017023	0.018548	0.361	-0.00218	0.009363	0.816
<i>ln(fixpen)</i>	0.216805	0.059414	0.000	0.009348	0.030349	0.758
<i>ln(GDP)</i>	0.001915	0.034233	0.955	0.003587	0.012581	0.776
Constant	0.012247	0.333519	0.971			

Table 12: Estimation of speed of penetration using Instrumental Variables

	<i>IV – Fixed Effects</i>			<i>IV – Random Effects</i>		
	Coefficient	Standard Error	p-value	Coefficient	Standard Error	p-value
<i>ln(mobpen)</i>	-0.03267	0.006514	0.000	-0.01723	0.004842	0.000
<i>ln(fixsub)</i>	0.011879	0.020109	0.555	-0.00248	0.010213	0.808
<i>ln(fixpen)</i>	0.16282	0.065424	0.013	-0.01854	0.032992	0.574
<i>ln(GDP)</i>	0.012367	0.034939	0.723	0.011108	0.013298	0.404
Constant	-0.07906	0.340483	0.816			

The coefficient for mobile penetration is negative and significant across all four models. Therefore an *increase* in mobile penetration is associated with a slow down in the take-up of fixed lines. This is evidence of fixed to mobile substitution at the access level.

We do not present estimates of a pooled model as there is strong evidence of substantial differences between the countries. This is confirmed by an F-test of the country fixed effects. In Table 13 we report this statistic, along with the usual diagnostics statistics for the four models.

Table 13: Specification statistics

	<i>Fixed Effect</i>	<i>Random Effect</i>	<i>IV Fixed Effect</i>	<i>IV Random Effect</i>
R ² – Within	0.3065	0.2293	0.2998	0.2084
R ² – Between	0.0876	0.2344	0.0279	0.3392
R ² – Overall	0.0113	0.2197	0.0352	0.2315
Joint significance of all regressors (p-value)	0.000 (Reject)	0.000 (Reject)	0.000 (Reject)	0.000 (Reject)
Zero country effects (p-value)	0.0003 (Reject)	NA	0.0017 (Reject)	NA

All models we have estimated show a statistically significant strong negative impact of mobile take-up on the rate of fixed line adoption. In order to choose the most efficient estimation method, we perform a series of Hausman specification tests.²⁵ These tests rely on the property that, under the hypothesis of correct specification of the model, all estimations are equally consistent, though with different variances. The Hausman specification test checks if there are statistically significant differences between the coefficients estimated with the various methods. If there are no systematic differences, all methods produce consistent estimates, and therefore a preferred method can be selected purely on the basis of the smallest variance. We report the results of these tests in Table 14 for various pair wise comparisons of our estimation methods. Where this test is passed, this means that coefficients estimated with the less efficient method are not systematically different to those estimated with the more efficient method.

²⁵ Hausman J. (1978), “Specification Tests in Econometrics”, *Econometrica*, vol. 46.

Table 14: Hausman specification test

<i>More efficient</i>	<i>Less efficient</i>	<i>Chi²</i>	<i>p-value</i>
Random Effects	Fixed Effects	17.55	0.1475 (accept)
Fixed Effects	IV-Fixed Effects	6.43	0.8469 (accept)
Random Effects	IV-Random Effects	3.91	0.9689 (accept)
IV-Random Effects	IV-Fixed Effects	12.89	0.4646 (accept)

According to the Hausman tests, our preferred approach is the fixed effects model with natural regressors – OLS estimation.

Using the estimates from this model suggests, for example, that in a country in which fixed line penetration is at 95%, mobile penetration is at 70%, the annual fixed-line subscription fee is \$180 and its GDP per capita is \$18,000, a 10% increase of mobile penetration would reduce the growth in fixed take-up by 0.5% per annum. Considering that we are gauging the change in the growth rate of fixed line penetration, this is a remarkable change.

As additional evidence of the robustness of the model we also estimated the two random effects models in first differences (which implies using the second difference of the logarithm of fixed penetration as the dependent variable). Table 15 summarises the results which are similar to those presented above. Therefore, we can rule out the possibility that our results above arise from possible spurious correlations due to trended regressors. Increases in mobile penetration are associated with slowing in the growth of fixed penetration; this relationship is strongly statistically significant.

Table 15: First differences model

	<i>GLS Random Effects</i>			<i>IV Random Effects</i>		
	Coefficient	StdError	p-value	Coefficient	StdError	p-value
$\Delta \ln(mobpen)$	-0.03577	0.010607	0.001	-0.03615	0.012678	0.004
$\Delta \ln(fix.sub)$	-0.00679	0.02229	0.761	-0.01461	0.026443	0.581
$\Delta \ln(fixpen)$	0.751587	0.085817	0.000	0.687621	0.117142	0.000
$\Delta \ln(GDP)$	-0.02021	0.04174	0.628	-0.01143	0.044021	0.795
Constant	-0.0108	0.009888	0.275	0.000362	0.005977	0.952

4.3. SIMILAR RESULTS IN THE ACADEMIC LITERATURE

A number of academic papers have addressed the interrelationship between fixed and mobile penetration, and in general our findings are consistent with those found in the literature.

Sung, Kim and *Lee*²⁶ examine the impact of rapid growth in mobile penetration on the demand for fixed lines in Korean regions over the period 1991-1998. They estimate a demand system for fixed and mobile sectors using fixed and random effects models and conclude that a 1% increase in the number of mobile telephones results in a reduction of 0.1%-0.2% in new fixed connections and a 0.1%-0.2% increase in fixed disconnections. This is in line with our results.

Pita Barros and *Cadima* investigate the influence of cellular sector growth on the penetration rate of fixed line (and vice-versa) in Portugal.²⁷ They estimate an interdependent system of diffusion equations – one for the fixed and one for the mobile sector – using full-information maximum likelihood estimators (FIML). They find a

²⁶ Sung, Kim and Lee (2001), “Is POTS dispensable? Substitution effects between mobile and fixed telephones in Korea”, *Korea Telecom*.

²⁷ Pita Barros, P. L. and Cadima N. (2000), “The impact of mobile diffusion on the fixed-line network”, *CEPR* n. 2598.

negative effect of mobile phone diffusion on fixed-lines penetration rate. The effect is a 10% decrease in the fixed-line penetration in comparison with the absence of mobile phones. No effect in the reverse direction (i.e. on fixed line take-up on mobile adoption decisions) seems to exist.

Gruber and **Verboven**²⁸ analyse the factors likely to have influenced the growth of the mobile sector, using panel data from European Union and from 140 countries in two separate exercises. Although, in both cases, they do not focus explicitly on fixed to mobile substitution, they include fixed penetration amongst the determinants of mobile growth, to indicate substitution/complementarity effects between the two services.

In their first paper, the authors study the technological and regulatory determinants of the diffusion of mobile telecommunications services in the European Union, using panel data to estimate a logistic model of diffusion. Amongst the explanatory variables they include the number of fixed lines per capita. Their major finding is that the transition from analogue to digital technology during the early nineties had a major impact on the adoption of mobile telecommunications. The impact of introducing competition was also significant, though the effect was small compared to the technology effect. Countries that granted licenses at later points in time show a significant but slow catching-up effect. The fixed-lines variable is negative and significant, indicating that both technologies are likely to be substitutes.

In their second paper, they analyse the effects of government policies on the evolution of the global mobile telecommunications market with a logistic diffusion model, using annual data for 140 countries for the period 1981-1999. The number of fixed lines has again a negative and significant impact on the diffusion of mobile phone subscriptions, suggesting substitution at the access level.

²⁸ Gruber H. and Verboven F. (2001), "The diffusion of mobile telecommunications services in the European Union", *European Economic Review*, vol. 3, and Gruber H and Verboven F. (2001), "The evolution of markets under entry and standards regulation, the case of global mobile telecommunications", *International Journal of Industrial Organisation*, forthcoming.

4.4. SUMMARY

In line with several recent academic studies of the adoption of both fixed and mobile telephony, we find strong evidence that the two are substitutes at the access level. Particularly, using a model of the change in fixed line penetration across 20 OECD countries with mature telecoms markets, we show that increased mobile penetration materially slows down the growth of fixed line penetration. We find that our results are robust to a variety of estimation techniques.

APPENDIX A: DETAILED DESCRIPTION OF 2001 SURVEY RESULTS

We have designed, commissioned and analysed market research to investigate the actual behaviour of consumers which was carried out by FDS International during September 2001. The survey was undertaken by contacting random respondents by telephone, both via fixed lines and mobile telephones. The September 2001 survey consisted of 2099 telephone interviews – 1,468 obtained through fixed lines and 631 through mobile phones. It followed a similar methodology and format to the two previous surveys, in order to allow comparisons over time.

Certain questions refer to the actual respondent, while other questions concern the whole of the respondent's household.²⁹

In the tables and figures reported below and throughout this Appendix, we show the number of observations used to calculate a proportion by "N=...". This provides a guide to the likely reliability of the proportion quoted.

THE SAMPLE

Category sample sizes

Table 16 shows a breakdown of the sample by category of respondent for the September 1999, February 2000 and September 2001 surveys. The number of respondents in each category is an indication of the confidence we can have when reporting results split by categories.

²⁹ This is why, for example, a respondent who himself falls into the single fixed line category may nevertheless live in a household with mobiles owned by other household members.

Table 16: Sample sizes for respondent categories

	<i>Single fixed</i>	<i>Multiple fixed</i>	<i>Single fixed and mobile</i>	<i>Multiple fixed and mobile</i>	<i>Mobile-only</i>	<i>Total</i>
<i>September 1999</i>	983	99	990	346	182	2,600
<i>February 2000</i>	1,000	160	999	581	263	3,003
<i>September 2001</i>	600	42	902	405	150	2,099

Notably, owing to the strong response in the single fixed, single fixed and mobile and multiple fixed and mobile categories we can be confident that we have captured a sufficiently large sample to reflect the population at large with reasonable confidence. This is also true, though to a lesser extent, for the mobile-only respondents: since mobile-only customers account for a smaller proportion of the population, the smaller sample should not be of undue concern. However, the limited number of respondents in the multiple fixed line and no mobile group may be of some concern and some caution should be observed when applying results specific to that category to the population as a whole.

Sample Biases

Interviewees were picked by generating random fixed and mobile telephone numbers. As respondents choose whether to participate there may be an element of self-selection bias, which is a general problem with many survey data. However, there is no indication that those who choose not to participate have different telecommunication patterns from the respondents.

The proportion of respondents given in Table 16 is not reflective of the proportion of each of the user categories in the population as a whole. This is because we initially fixed the number of respondents to be contacted by mobile and by fixed phone and imposed quotas on the more prevalent households (such as single fixed and mobile). Furthermore, there is an increased probability of contacting an individual who has several lines which leads to a systematic sampling bias.

There are a number of sources of potential bias:

- over-sampling of either the fixed or mobile respondents due to the ratio of fixed to mobile samples not reflecting that of the population;
- over-sampling of respondents who have both a fixed line and a mobile, as they can be contacted via both modes of telephony; and

- over-sampling of multiple fixed line users, as there is a greater likelihood of contacting them by random digit dialling than single fixed users.

*Estimating True Population Proportions*³⁰

In order to calculate the true population proportions of the five user categories we employ a maximum likelihood technique, similar to that used in the previous report.³¹ Using the respondent proportions as given parameters we calculate the sample numbers that we would obtain through random sampling.

We divide the sample into those contacted by mobile and those contacted by fixed line. Hence by the fixed line survey we can reach all but mobile-only individuals and via mobile survey we contact all but single/multiple fixed line users. Given some (unknown) population proportions we calculate the probabilities of reaching each category in each of the two samples and, given the sample size, the expected sample proportions. The two samples are considered separately, but are used jointly to estimate the unknown population proportions.

The fixed sample

When considering fixed line subscribers confusion may arise over whether it is relevant to consider the household or the individuals within it. When estimating true proportions it is important to stress that we are considering proportions of *individuals* in certain user categories, rather than proportions of *households*.

Multiple fixed lines

Given the method of random generation of telephone numbers, it is reasonable to assume that multiple fixed line households have a greater probability of being reached, as they are likely to have more numbers by which they can be reached. However, many secondary lines may be connected to a fax machine or a modem rather than a telephone. Hence the probability that a multiple fixed line household is reached through a secondary fixed line should be substantially less than that of reaching a fixed line household on its main fixed line.

To account for the increased probability of contacting a multi line household we introduce an over-sampling parameter d where $1+d$ is the average effective number of telephone lines a multiple fixed line household uses for receiving incoming calls. One

³⁰ By population we refer to individuals having access to any type of telephony. This does not account for individuals not having either a fixed line or a mobile.

³¹ The only difference with the estimations for the 3rd survey is that we do not have to consider quotas as we categorised all individuals who were willing to be interviewed, even after quotas were filled.

would expect d to lie between 0 and 1.³² A d of zero indicates that households are contactable only through their main fixed line. A d between 0 and 1 shows that secondary lines are less likely to be answered for incoming voice calls. We estimate d jointly with the population proportion of various groups.

Mobile phones

When contacting a household by fixed line, only one individual answers the telephone and responds to the questionnaire. This individual may or may not own a mobile phone.

In the simple case that individuals owning a mobile and individuals not owning a mobile are equally likely to answer the household fixed phone, the probability that an individual owning a mobile answers should equal the ratio of the number of mobile users in the household to the total number of household members.

However, mobile and non-mobile respondents may not be equally likely to answer the household fixed line for two conflicting reasons. In a household with two individuals where only one owns a mobile, the mobile owner may be less likely to answer the fixed line since he/she owns a mobile to receive personal calls – which would lead to under-sampling of fixed line users with a mobile. Alternatively, the mobile owner may own a mobile specifically because of a stronger preference for using telecommunications, and would therefore be more likely to answer the fixed line – which would lead to over-sampling of fixed line users with a mobile.

Our approach to this problem is to estimate the probability that an individual answers the household fixed line and to allow this to vary according to whether the individual has a mobile or not. We introduce a parameter m , which should to take a value between -1 and 1 , to measure this mobile ownership effect on the probability of answering calls on the fixed line. Where a negative m shows mobile owners are less likely to answer the household fixed phone, a positive m shows that mobile owners are more likely to answer the household fixed line than non-mobile owners in a household. We estimate m jointly with d and the population proportions of various groups.

The mobile sample

Dealing with the mobile sample is simpler as multiple mobile ownership can be ignored. As the probability of reaching a mobile user by a mobile number is likely to be independent of the number of fixed lines to which this user has access, no corrections for sampling bias had to be undertaken.

³² A value of d greater than one is possible as households may have more than two fixed lines. However, this scenario is unlikely as it requires that a significant proportion of multiple line households have more than two lines that are used for incoming voice calls.

Estimation method

Taking the factors above into account (i.e. m and d), we can determine the probabilities of reaching particular individuals using our sampling method, and the expected sample proportion sizes corresponding to particular population proportions. We can then estimate the true population proportions using a maximum likelihood method, which computes the probability of obtaining the observed sample sizes depending on the population parameters, and take the values that maximise this probability as the best estimates of these parameters.

This method produces estimates for our over-sampling parameters. The probability of a second fixed line being answered has fallen for each survey as shown in Table 17 and in the current survey is insignificant. This suggests that second fixed lines are increasingly being used for Internet and fax only.

Furthermore, the difference in probabilities of a mobile user and a non-mobile user in a household with a fixed line answering the phone, m , is negative indicating that individuals without mobiles are more likely to answer than those with a mobile. Mobile users have become increasingly less likely to answer the fixed line with each survey, which confirms that mobile users are increasingly regarding their mobile as their main phone for voice communication.

Table 17: Estimates of relative probabilities of answering the household fixed line

	<i>September-1999</i>	<i>February-2000</i>	<i>September-2001</i>
<i>d (probability of second fixed line being answered)</i>	10.4%	9.7%	0.0%
<i>m (difference in probability of mobile owners and non-mobile owners answering the household fixed line)</i>	-2.2%	-13.2%	-17.5%

CHARACTERISTICS OF RESPONDENTS

Household size and composition

Figure 8 illustrates the number of individuals in the respondents' households (all members/members over the age of sixteen). Unsurprisingly, the proportion of one and two person households is highest amongst single fixed users. In addition, households with either multiple fixed lines, or multiple fixed lines and mobiles tend to be larger.

Single person households are of particular interest since for these individuals there is no incentive to get a mobile because the fixed line is being used by other family members or because they wish to separate out some calls on a separate bill – except maybe for work. Rather, the choice between fixed and mobile telephony should be influenced primarily by value-for-money and convenience concerns.

Figure 8: Household size and composition

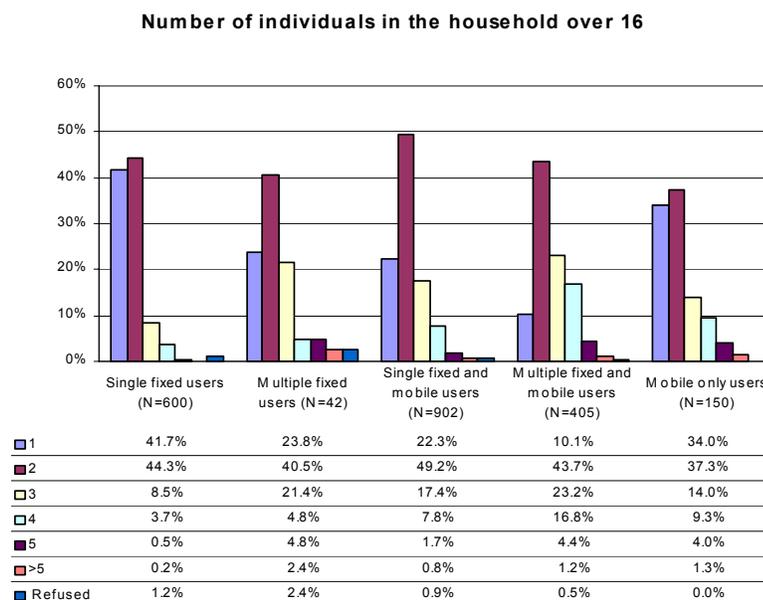
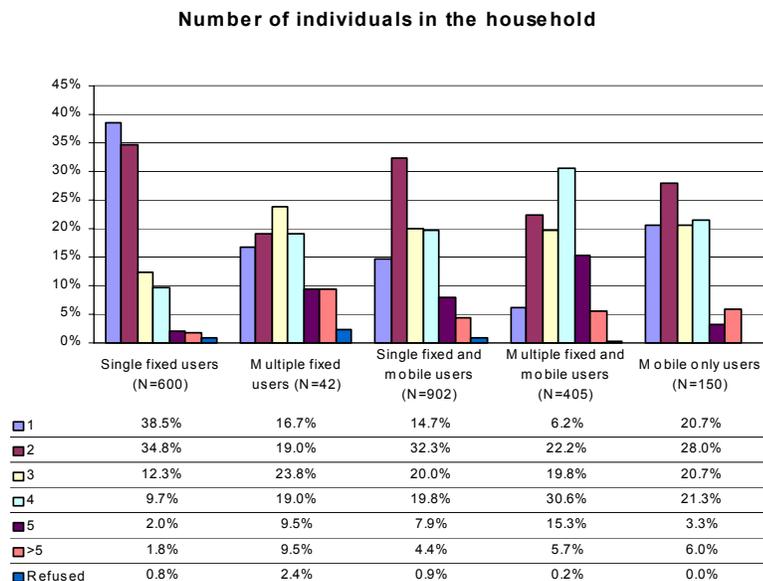
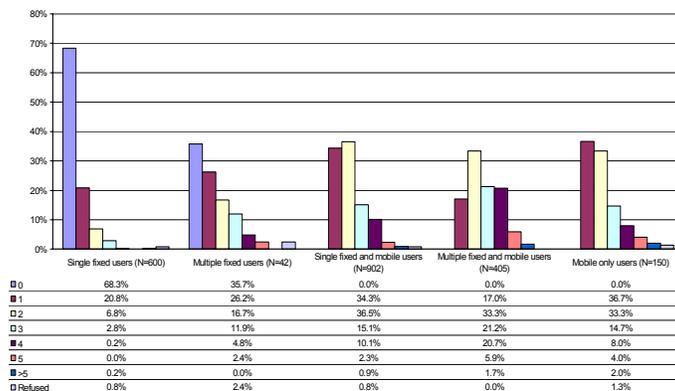


Figure 9 shows the number of mobiles in a household by respondent category. This shows that mobile users tend to live in households with other mobile users (more than 50% of cases).

Figure 9: Number of individuals in the household owning a mobile



Age and socio-economic characteristics of respondent types

Figure 10 shows the age distribution of respondents by category. Respondents with ‘single fixed’ or ‘multiple fixed’ – i.e. respondents not having a mobile – are disproportionately older, while mobile-only respondents are disproportionately younger. It is apparent that mobile take-up is negatively correlated with age.

Figure 10: Age of respondents

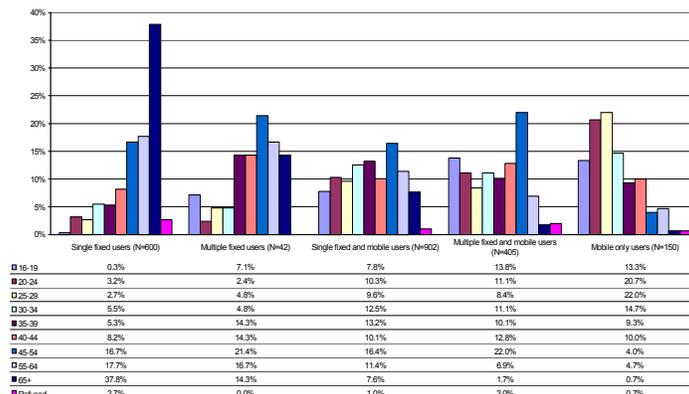


Figure 11 illustrates the clear change over the three survey years in the tendency for non-mobile users to be in certain age categories. This increase is most marked in the 65+ age

category, which has increased its share of non-mobile users from almost 20% in 1999 to almost 40% in 2001. In all age categories below 45 years mobile take-up has increased.

Figure 11: Age of non-mobile users

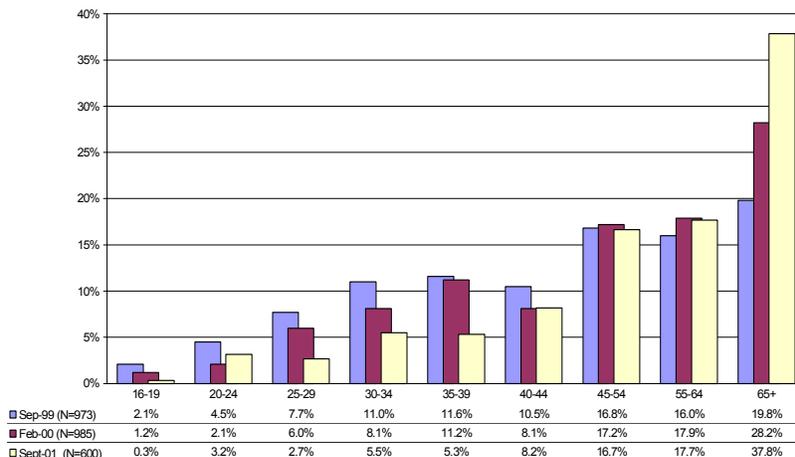


Figure 12, showing the growing proportion of retired people amongst single fixed users over the time span of the three surveys, further confirms this trend, with mobile resisters becoming increasingly restricted to the over-65s.

Figure 12: Proportion of retired amongst single fixed users

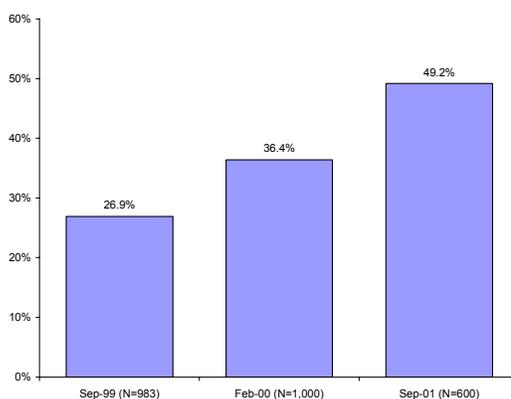


Figure 13 shows the social class profile within each respondent category. Even though there are some differences between pre-paid and contract in terms of the social class of users (see Figure 26 and Figure 27 below), there has been no significant and apparent change in the class profile within each group.

Figure 13: Social class of respondents

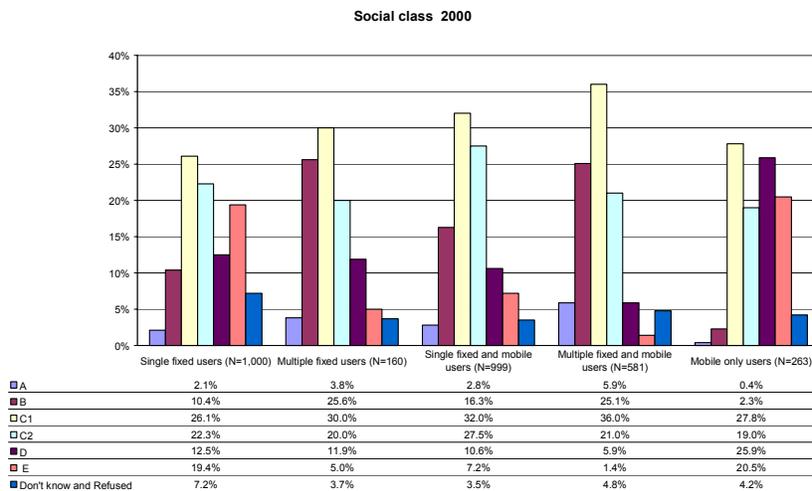
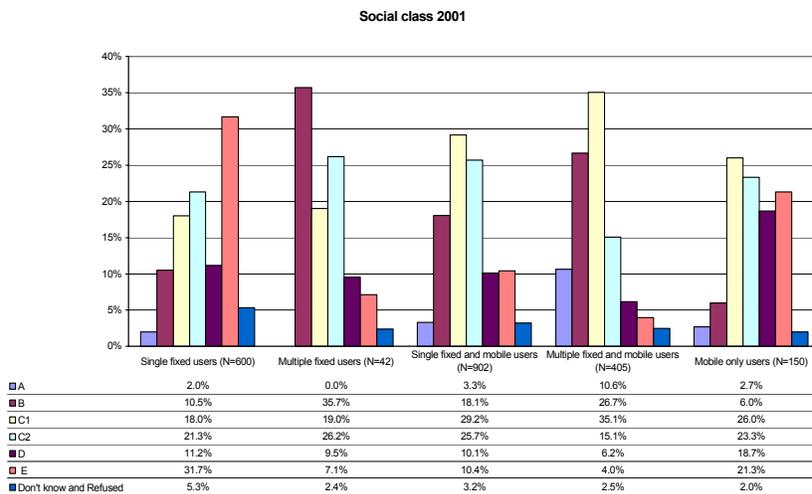
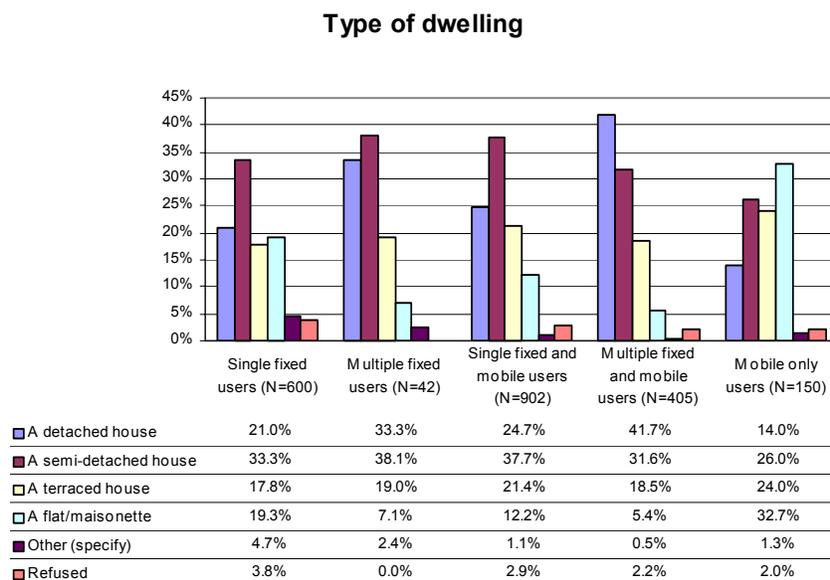
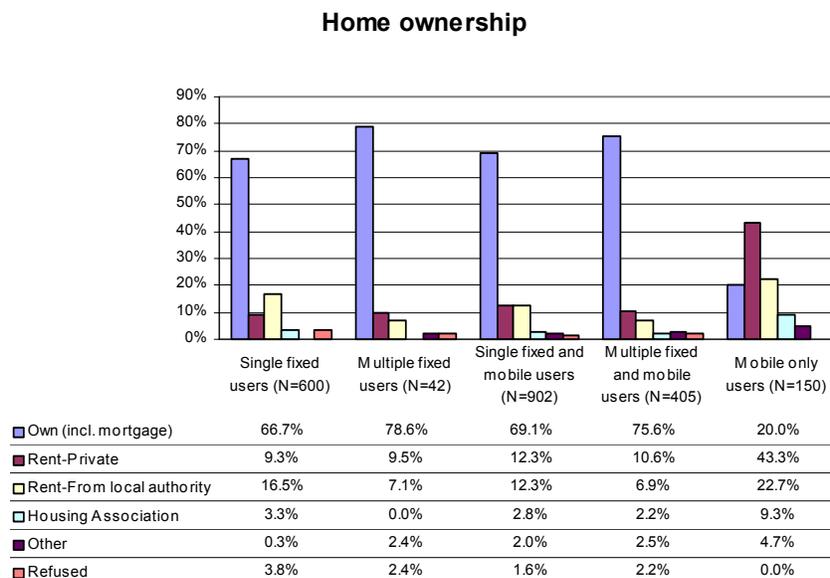


Figure 14 highlights the close relationship between fixed lines and home ownership. This finding is unsurprising, being related to greater security of housing tenure and, typically, higher income levels. Similarly, the proportions of respondents living in detached and semi-detached houses are also comparatively large for respondents with multiple fixed lines.

Figure 14: Home ownership and type of dwelling



Mobile-only respondents are typically renting, and living in a flat/maisonette. This is to be expected in a relatively young group, but also points to less secure housing tenure as a possible driver for mobile-only choice. In particular, installation charges and minimum contract periods for fixed lines may reduce the relative attractiveness of fixed lines against mobile for those with short housing tenures.

In contrast to the previous surveys we asked respondents to place their household income within a band. Figure 15 illustrates the spread across income bands for each group of respondents. ‘Single fixed’ users were most likely to refuse to give household income, which may reflect the high proportion of retired amongst this category. Of those who gave their household income, respondents with more than one connection were more likely to be in the higher income groups, whilst ‘single fixed’ and ‘mobile-only’ respondents were skewed towards the lower income groups.

Figure 15: Household income of respondents

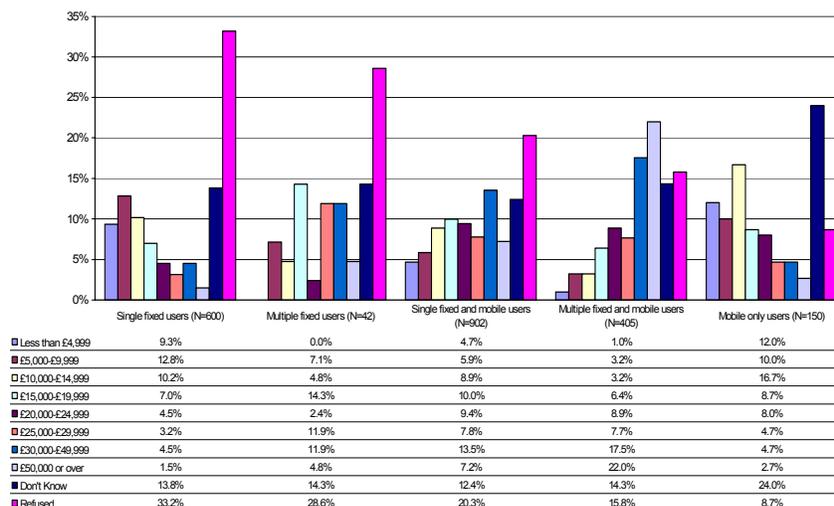


Figure 16 shows the relationship between employment status and types of service connection. Almost half of all single fixed respondents are retired. Over half of mobile-only users are working full time, showing a similar distribution to that of other mobile users with fixed lines. The proportion of full-time workers amongst those without a mobile is lower, as many of these are retired.

Figure 16: Employment status of respondents

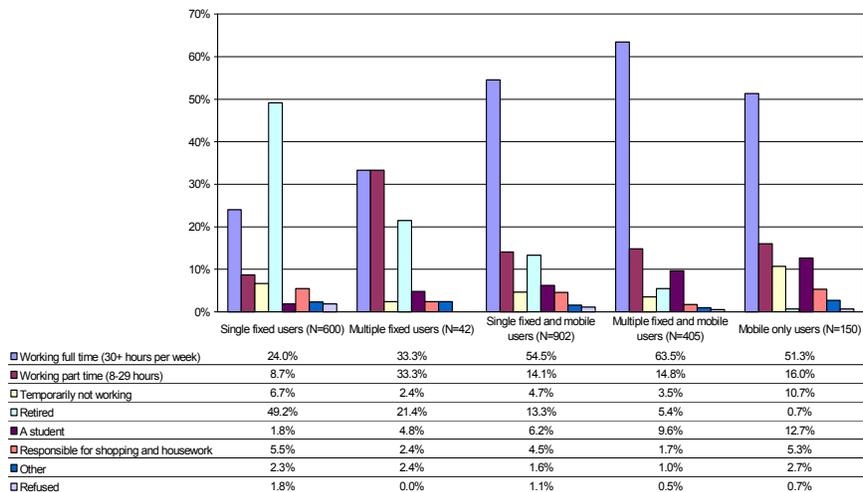
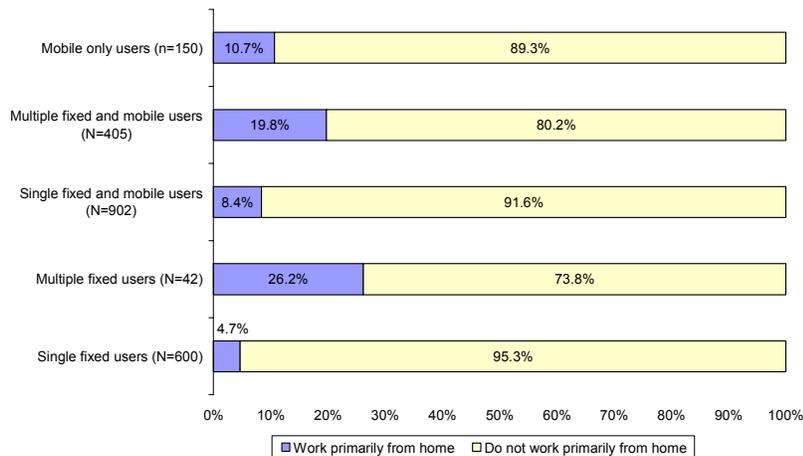


Figure 17 illustrates the proportion of home workers within each respondent category. The proportion of home worker is larger amongst multiple line users, being the largest amongst multiple fixed line users with mobile.

Figure 17: Proportions of home workers



USAGE OF TELEPHONY AND NEW TECHNOLOGIES

Main use of lines

Figure 18 illustrates the main purpose for which lines are used (mainly work, mainly personal or roughly half and half). Overall, mobile users have a more mixed usage pattern. For ‘multiple fixed and mobile’ respondents, there is only a small difference in the extent to which second fixed line and mobile phone are used for work purposes.

Figure 18: Main use of lines

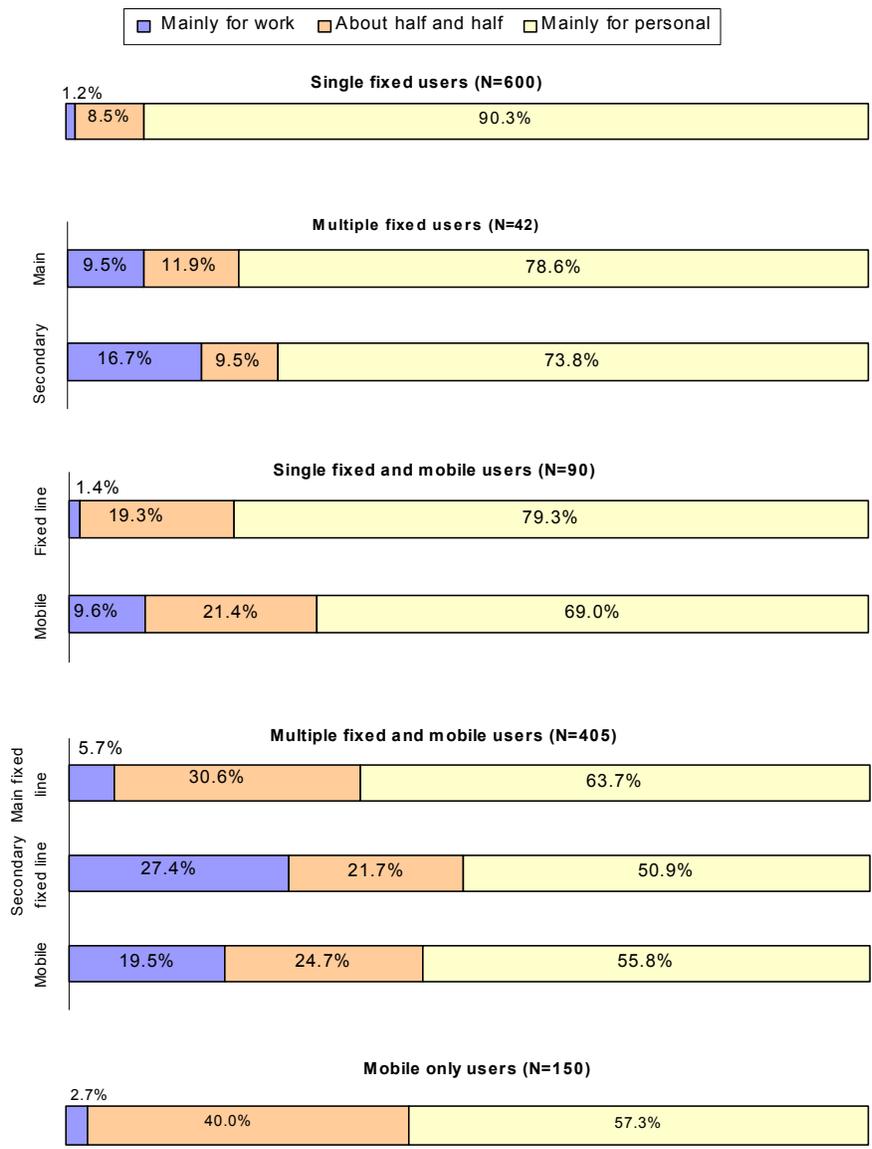
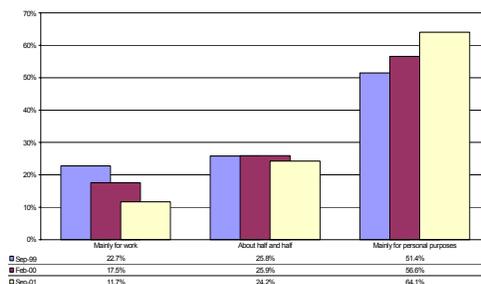


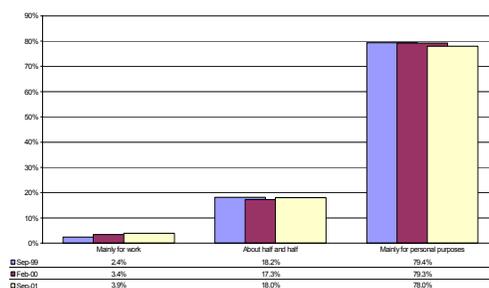
Figure 19 shows how the main purpose of mobile usage has changed over the three survey years: mobiles are being increasingly used for personal purposes, and less often for work.

Figure 19: Main use of mobiles



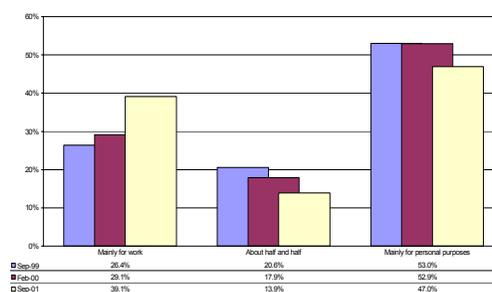
By contrast, Figure 20 shows that the purpose of fixed line usage has remained fairly constant over the survey years.

Figure 20: Main use of main fixed line



By contrast, as Figure 21 shows, secondary fixed lines are increasingly used for work purposes.

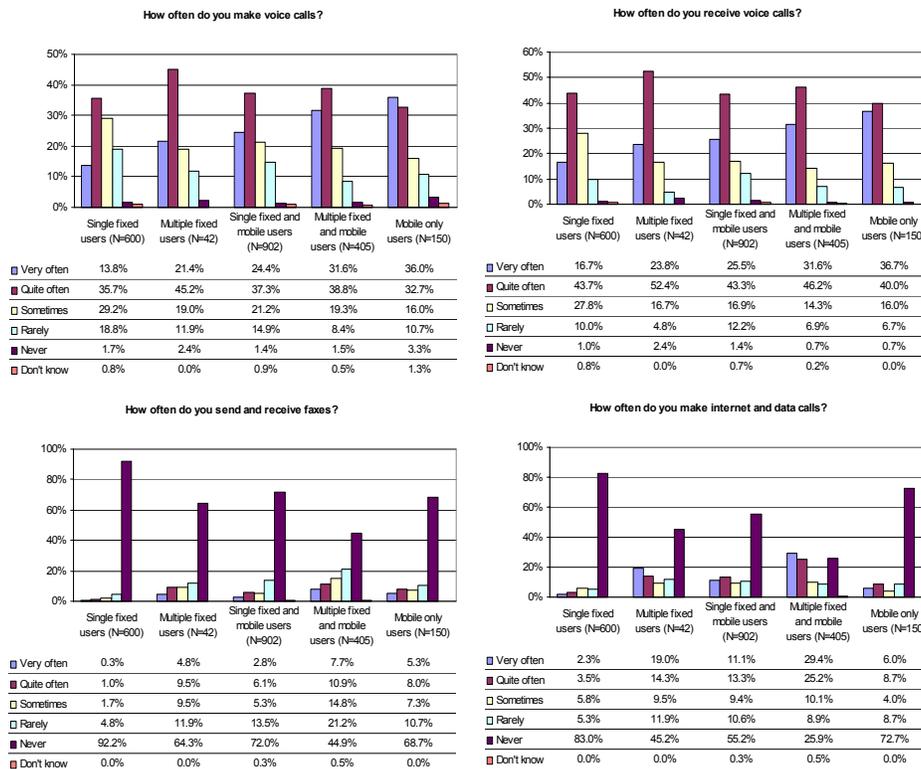
Figure 21: Main use of secondary fixed line



Usage of voice, fax and Internet

Figure 22 illustrates phone usage for voice call, faxing and Internet access. Little difference is seen in voice usage across the groups. However, fax & Internet use is linked to having a second fixed line and/or having a mobile.

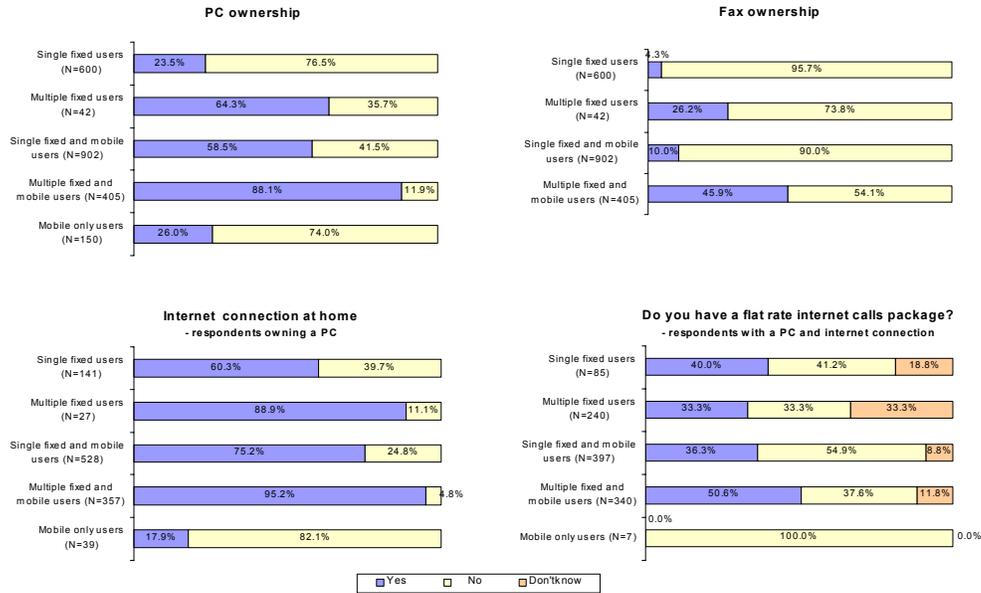
Figure 22: Phone usage – voice, fax and Internet/data



PC and fax ownership and use of the Internet

Figure 23 shows a clear positive association between having multiple lines and PC and fax ownership. With the exception of mobile-only respondents, PC ownership is closely related with Internet access.

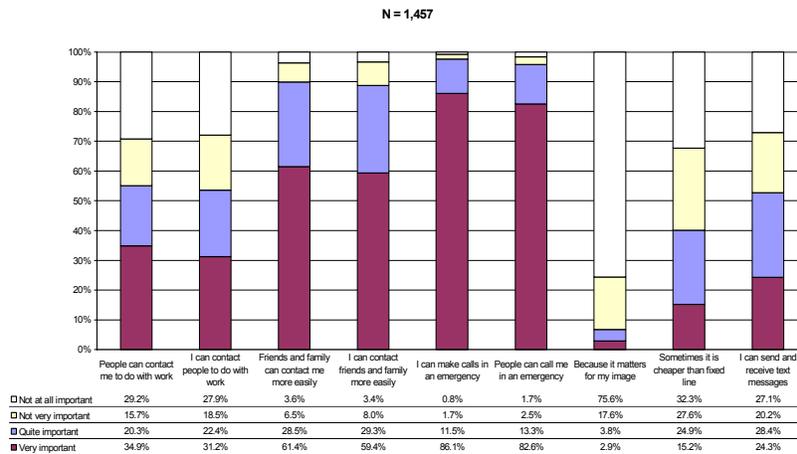
Figure 23: PC ownership, fax ownership and Internet access



REASONS FOR HAVING A MOBILE

Figure 24 shows that the most important reason given for owning a mobile is being both contactable and being able to make contact in case of an emergency. Of secondary importance is ease of contacting and being contacted by friends and family.

Figure 24: Reasons for mobile ownership

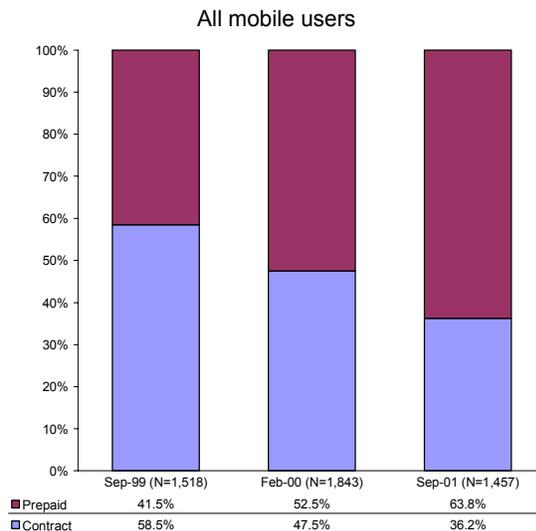
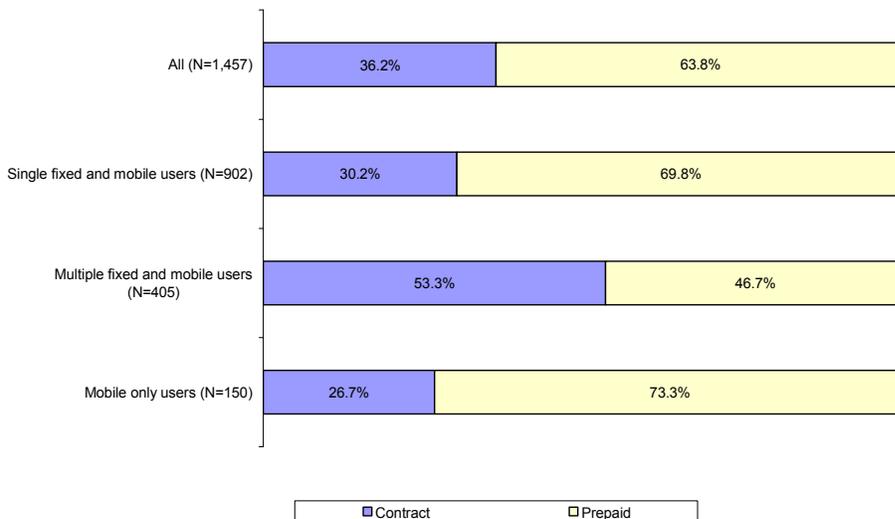




CONTRACT VS. PRE-PAID

Figure 25 shows the relative take-up levels of contract and pre-paid mobile phone packages. Multiple fixed and mobile respondents are most likely to have a contract, which may reflect the higher household income levels observed for this group.

Figure 25: Contract vs. pre-paid mobiles



The growth in popularity of pre-paid mobiles over the three survey years is also shown. Figure 26 illustrates the higher likelihood of the ABC1 social class groups to have a contract mobile, and the C2DE groups to use pre-paid.

Figure 26: Type of mobile contract and social class

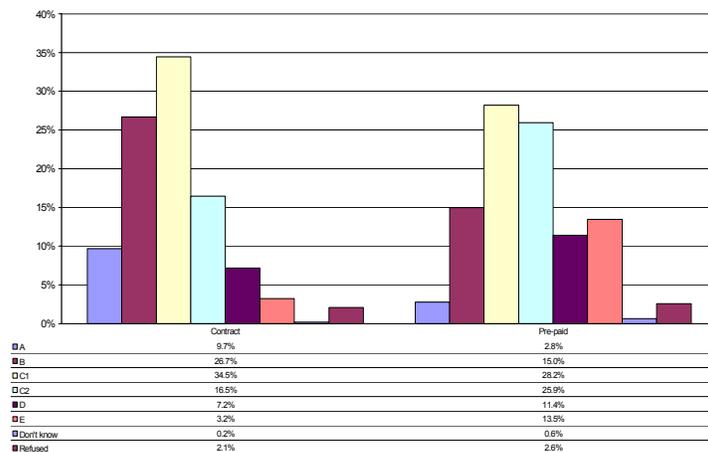
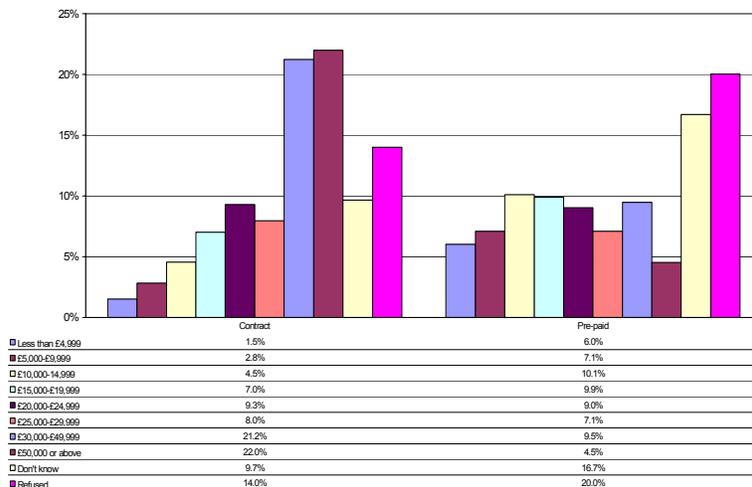


Figure 27 reflects the above trends, showing that high household income is related to contract mobiles, and low household income to pre-paid.

Figure 27: Type of mobile contract and household income group



WHO PAYS THE MOBILE BILL AND WHO BOUGHT THE MOBILE PHONE

Figure 28 shows that the majority of respondents pay their own bills, especially mobile-only users, and Figure 29 shows how mobiles tends to be bought by the user, again especially for mobile-only users.

Figure 28: Who pays for the mobile bill

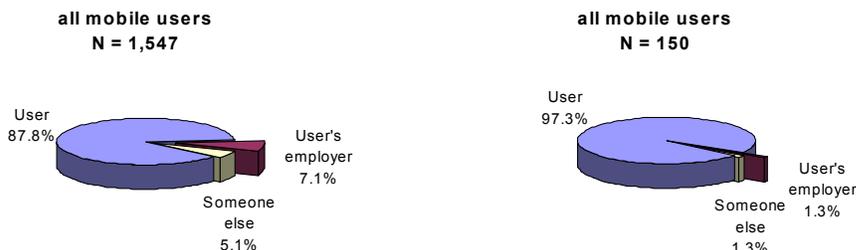
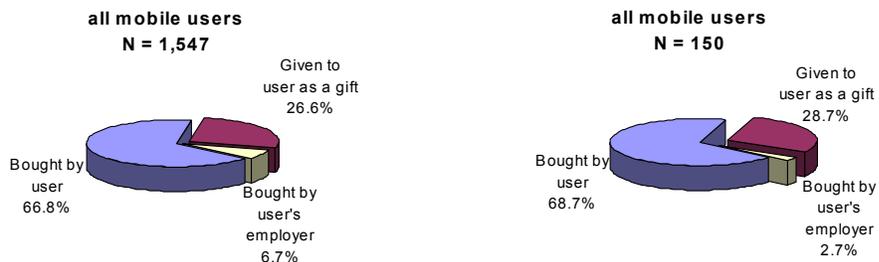


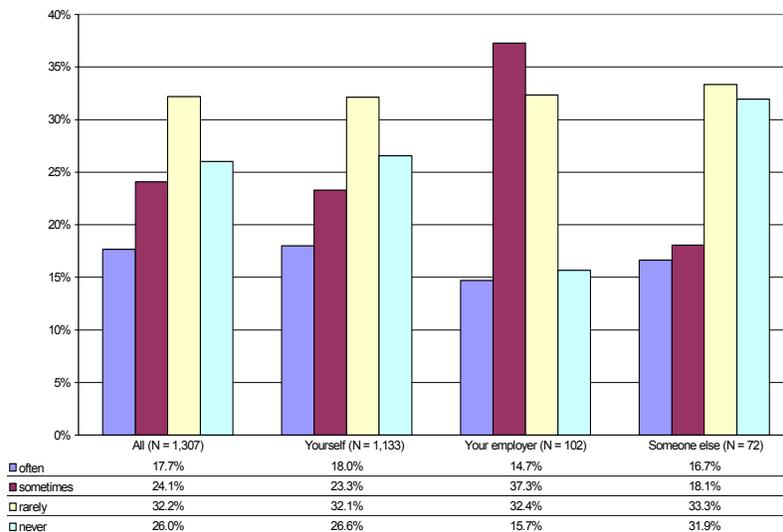
Figure 29: Who bought the mobile phone



USE OF MOBILE PHONE FROM HOME

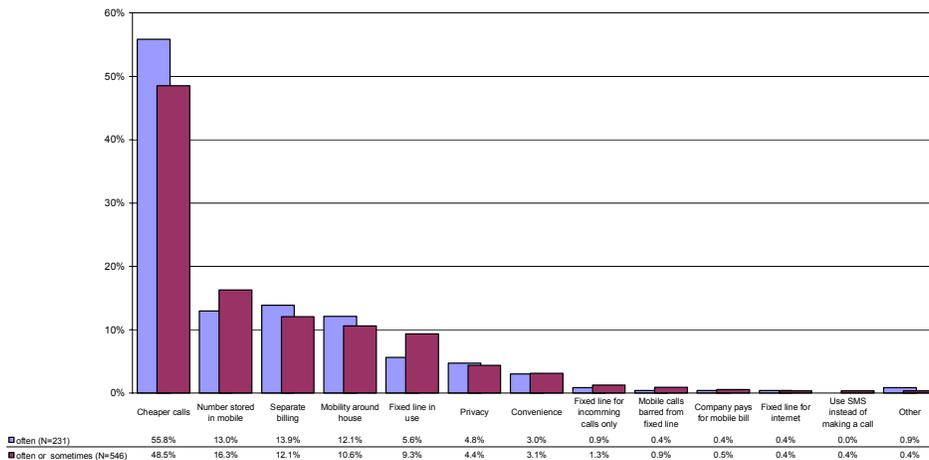
Figure 30 shows that all mobile users tend to make some calls from home, especially those whose mobile bill is paid for by their employer.

Figure 30: Making mobile calls from home



The main reason for using the mobile instead of the fixed phone (provided by those using their mobile sometimes or often for making calls from home) is that mobile calls are cheaper at some times (see Figure 31).

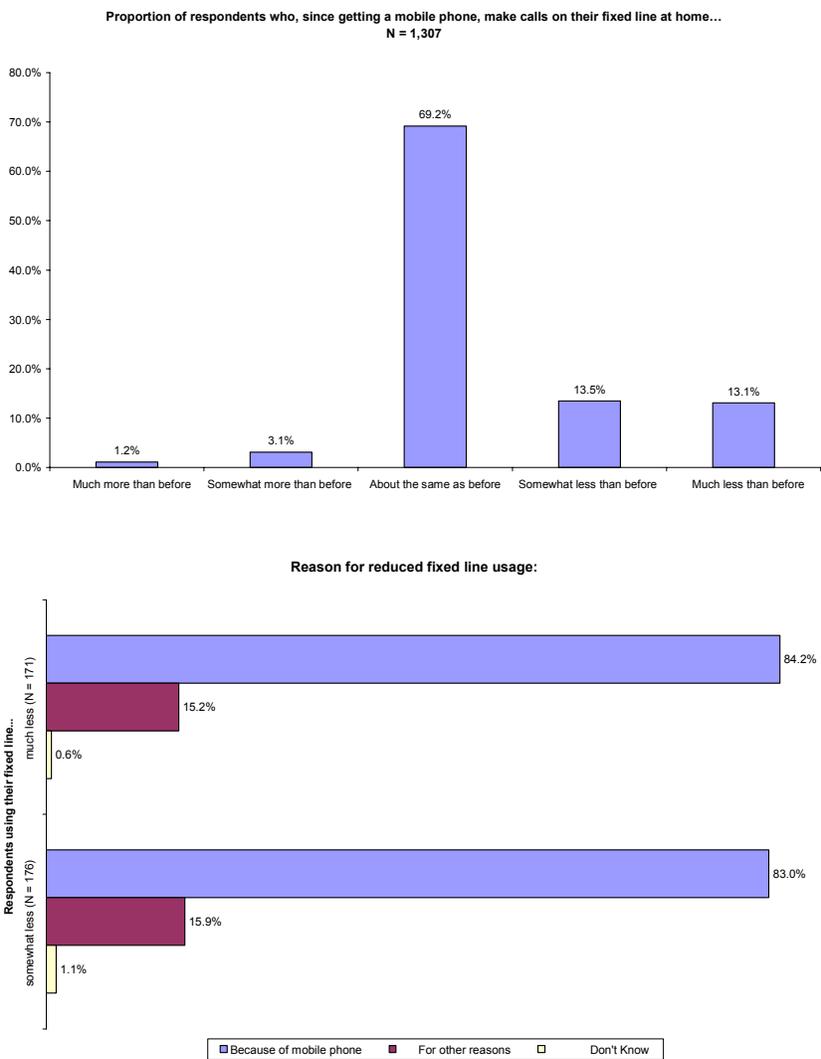
Figure 31: Reasons for making mobile calls from home

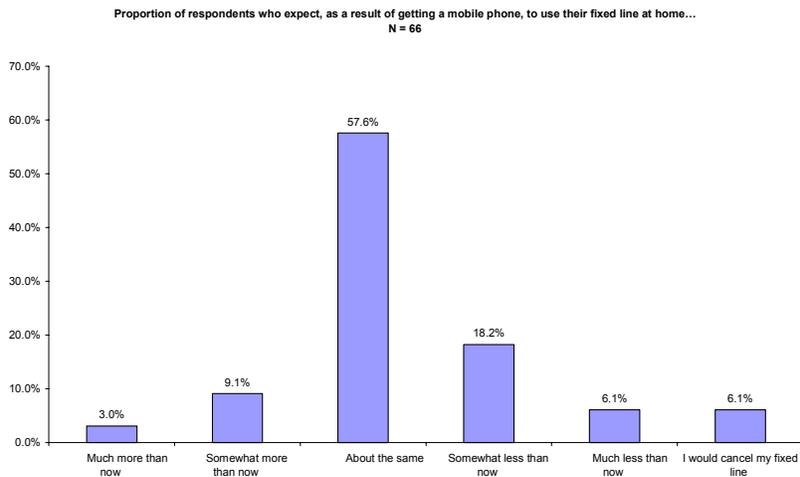


Respondents were asked whether usage of their fixed phone had changed on acquiring a mobile and, if so, for what reason. Figure 32 shows that the majority of respondents believe having a mobile has caused no change in their usage of their fixed line. However, of those using their fixed line somewhat or much less, over 80% attribute this to having a mobile. Of those respondents who intend to obtain a mobile during the 12

months following the survey, over half expect having a mobile to have no impact on their fixed line usage, and over a quarter anticipated reducing usage or cancelling their fixed line.

Figure 32: Perceived impact of mobile phone ownership on home fixed line use

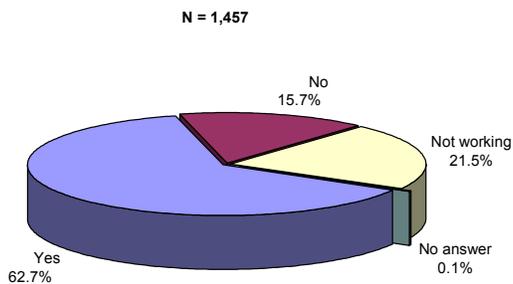




USE OF MOBILE PHONE FROM WORK

Figure 33 shows that almost two-thirds of respondents have easy access to a fixed line at work.

Figure 33: Easy access to a fixed line at work?



Nevertheless, 30% of those who pay their own mobile bill make mobile calls often or sometimes from work, while two-thirds of those whose bill is paid by the employer make mobile calls often or sometimes from work, as shown in Figure 34. The main reason given is inability to get to a fixed line (see Figure 35).

Figure 34: Making mobile calls at work

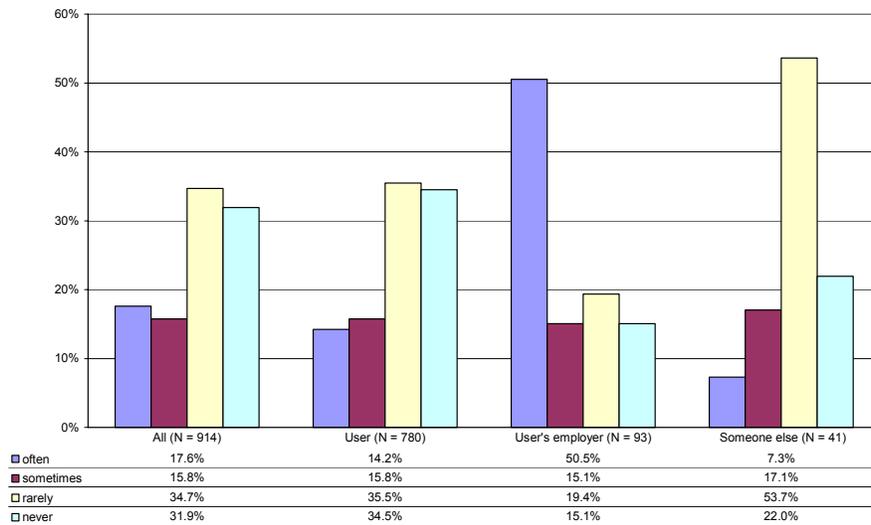
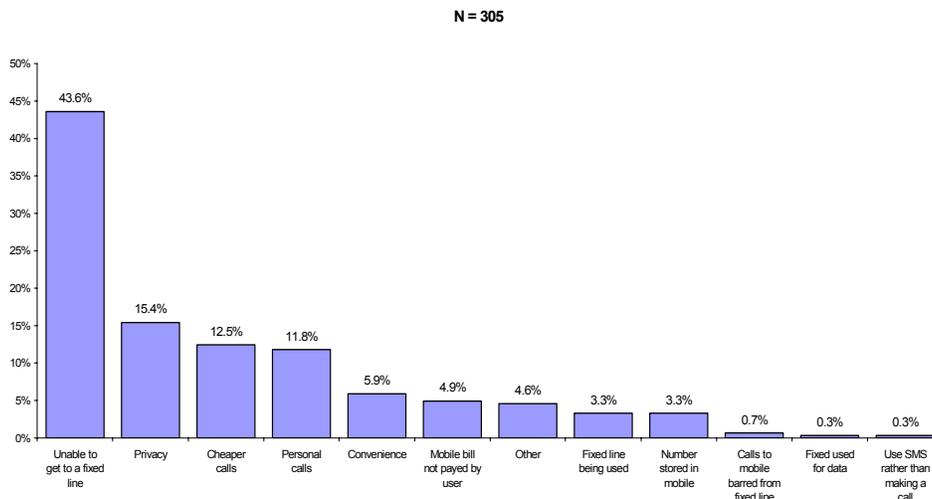


Figure 35: Reasons for making mobile calls at work



HOME WORKERS

Figure 36 and Figure 37 show that while home workers are the most likely group to use their mobile phones for work, the proportion of those using a mobile mainly for work purposes has decreased and the proportion of home workers using mobiles predominantly for personal purposes has increased.

Figure 36: Different mobile use by home workers

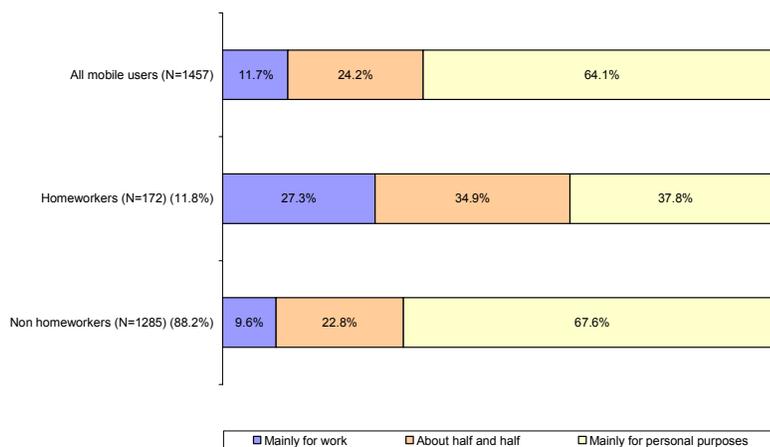


Figure 37: Mobile phone usage by home workers

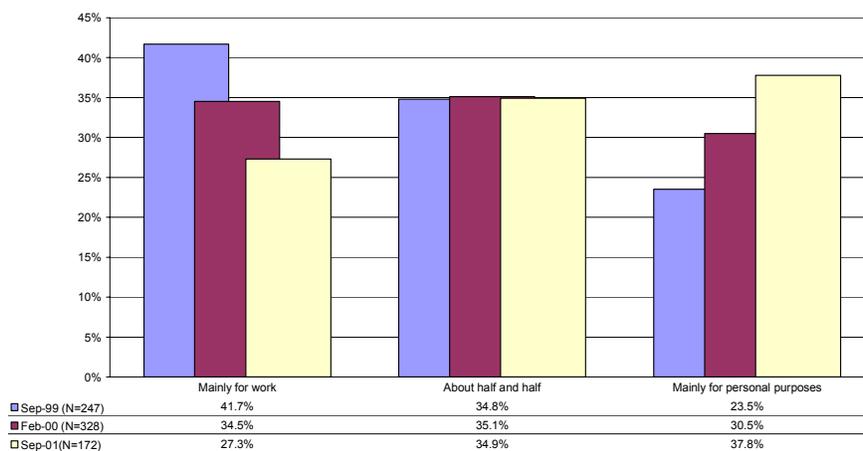


Figure 38 shows that who pays the bill makes little difference in the propensity of home workers to use their mobile from home, and Figure 39 shows that the main reason for home workers using a mobile at home is that calls are cheaper.

Figure 38: Home workers making mobile calls from home

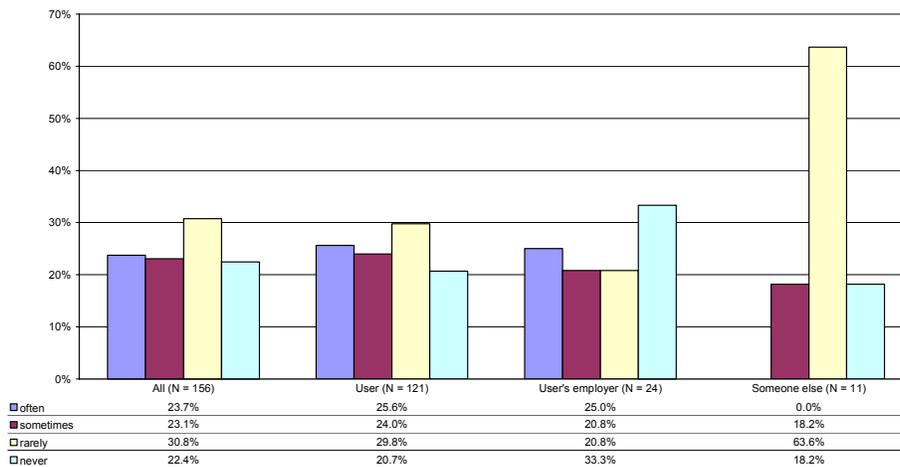
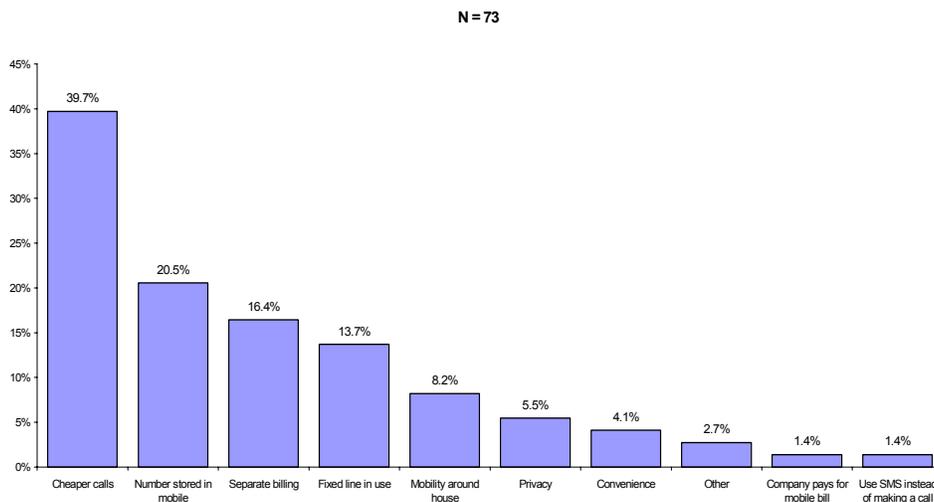


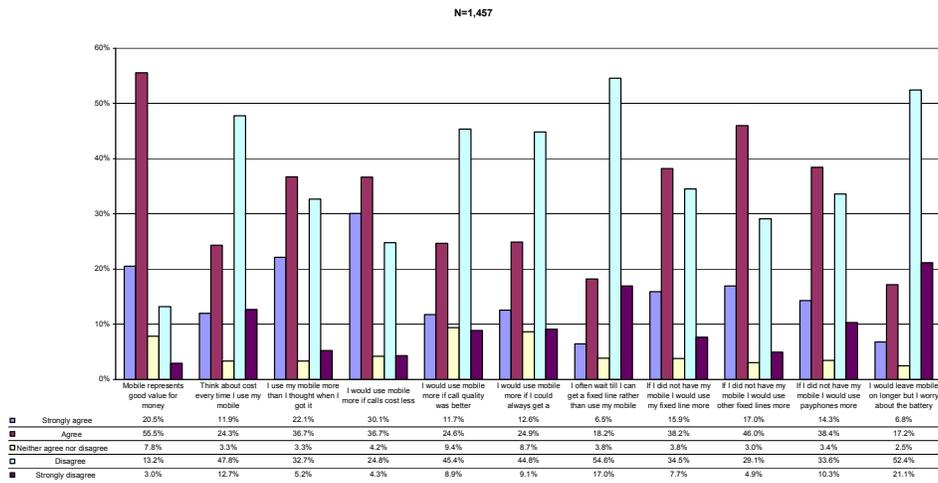
Figure 39: Reasons for home workers making mobile calls from home



ATTITUDES TOWARDS MOBILE USAGE

Respondents were asked whether they agreed or disagreed with a series of statements, including whether mobile phones represented good value for money. Figure 40 shows that the majority of users considered mobile telephones to offer good value for money. Moreover, although there is price sensitivity, few users think of the cost every time they use their mobile phone, and very few wait to get to a fixed line to make their calls. Neither quality nor battery life are an issue with mobiles.

Figure 40: Attitudes towards mobile phones

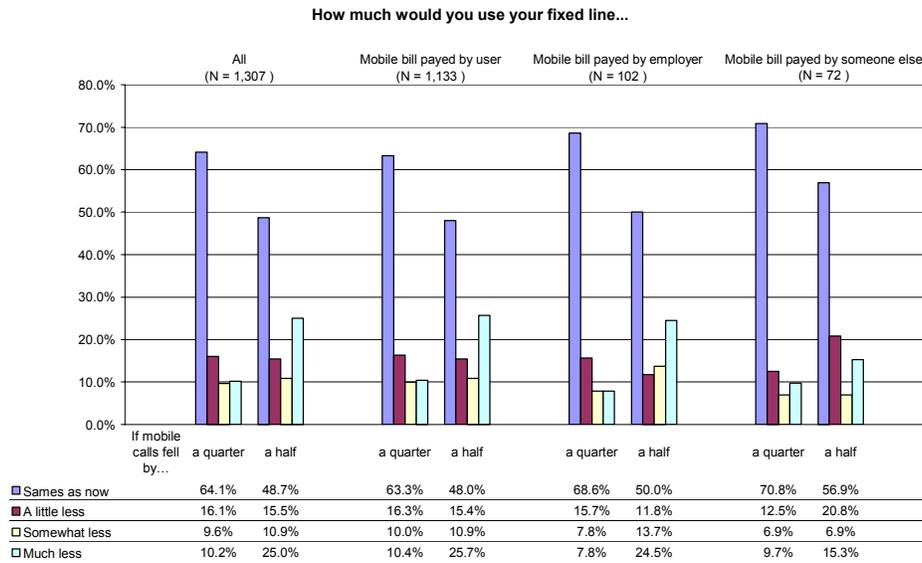


PRICE SENSITIVITY ON CALLS

Respondents were asked how their fixed line usage would change if the price of mobile calls were to fall.

Figure 41 demonstrates price sensitivity (broken down by who pays the mobile bill) – were mobile call prices to fall, a significant proportion of respondents would expect to change their fixed line usage.

Figure 41: Impact of changes in mobile call pricing on fixed line usage



SUBSTITUTING SMS AND E-MAIL FOR VOICE CALLS

Figure 42 shows e-mail usage to be relatively widespread with the exception of single fixed users. E-mail use impacts upon telephony usage, and between one quarter and a half of those using e-mail in each category make a less voice calls, which indicates a degree of substitution.

Figure 42: Use of e-mail and impact on voice calls

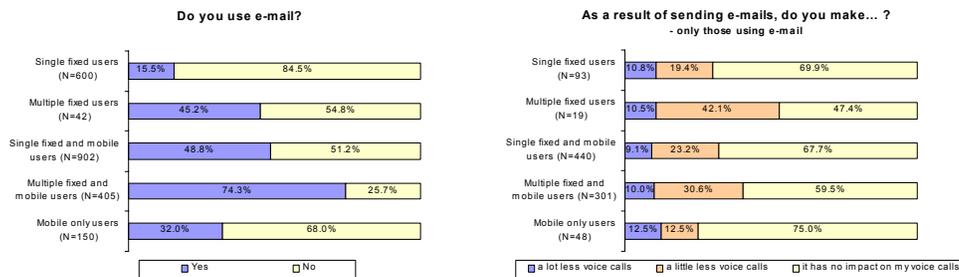


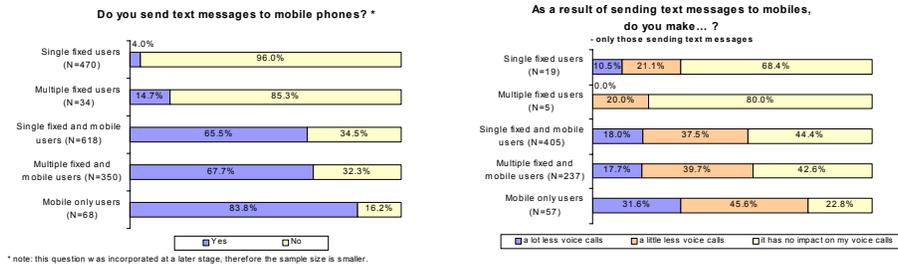
Figure 43 shows that those respondents with more than one fixed line are most likely to use e-mail from home, with over one third of respondents using e-mail at least somewhat from work. Use of Internet cafes for e-mail purposes and sending e-mail from mobile phones does not seem widespread, even amongst mobile-only respondents.

Figure 43: Access to e-mail



Figure 44 shows that text messaging is widely used by mobile customers, although 15% of multiple fixed users also send text messages (using the Internet or other individual's mobiles). Almost 80% of mobile-only users who send text messages state that as a result they make less voice calls. This is clear indication of substitution of SMS for voice calls. Over half of mobile users who send text messages and who also have one or more fixed lines believe that as a result of sending text messages they make a little or a lot less voice calls, showing that this is not confined to mobile-only respondents.

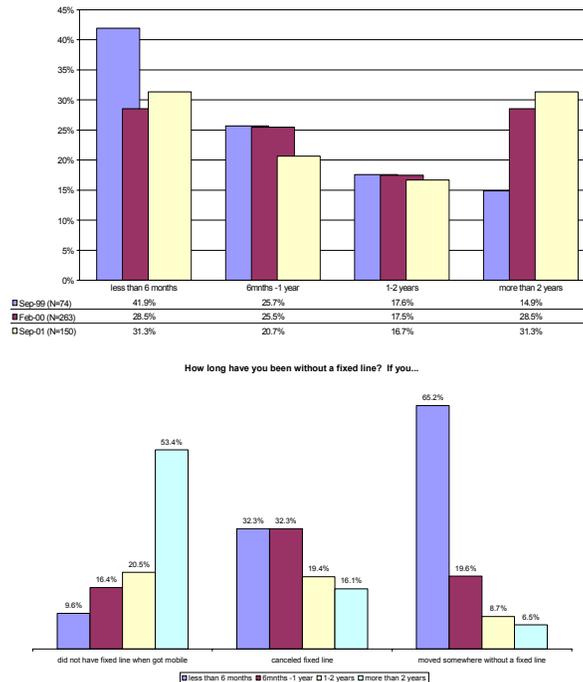
Figure 44: Use of SMS and impact of voice calls



SUBSTITUTION OF FIRST FIXED LINES

Figure 45 shows that the proportion of mobile-only users who have been without a fixed line for more than two years has increased two-fold to one third of all mobile-only users. In addition, respondents were queried on their reasons for not having a fixed line. Almost two-thirds of those who had moved somewhere without a fixed line had been ‘mobile-only’ for less than six months, and over half of those who did not have a fixed line when they got their mobile have been without a fixed line for over two years. This indicates clearly that while having only a mobile is a transitory state for many mobile-only respondents, one third of mobile-only users have been so for a longer while, providing evidence of deliberate access substitution.

Figure 45: Length of time without a fixed line



REASONS FOR GOING MOBILE-ONLY

Figure 46 shows that although half of all mobile-only respondents had a fixed line when they got their mobile, the main reasons for going ‘mobile-only’ were either moving home and not installing a fixed line, or cancelling the fixed line. Only 5% moved to a new home where a fixed line could not be installed.

Figure 46: Detailed reasons for not having a fixed line

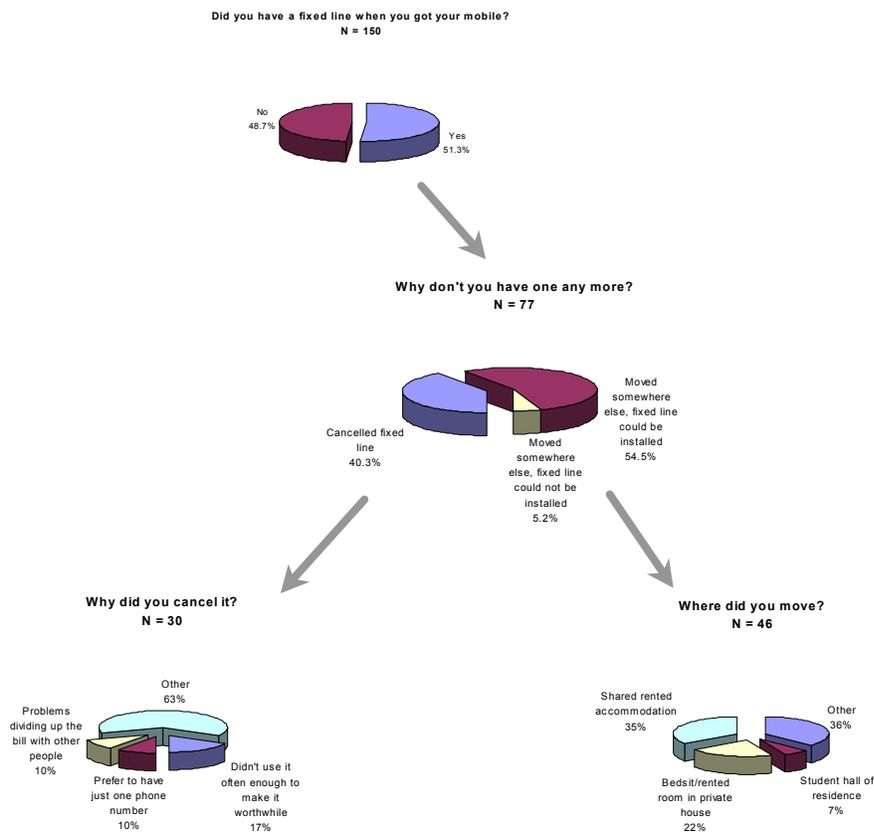


Figure 47 shows that of those able to have a fixed line installed, over half are not at all, or not very likely to have one installed within the next 12 months.

Figure 47: Detailed willingness to install a fixed line

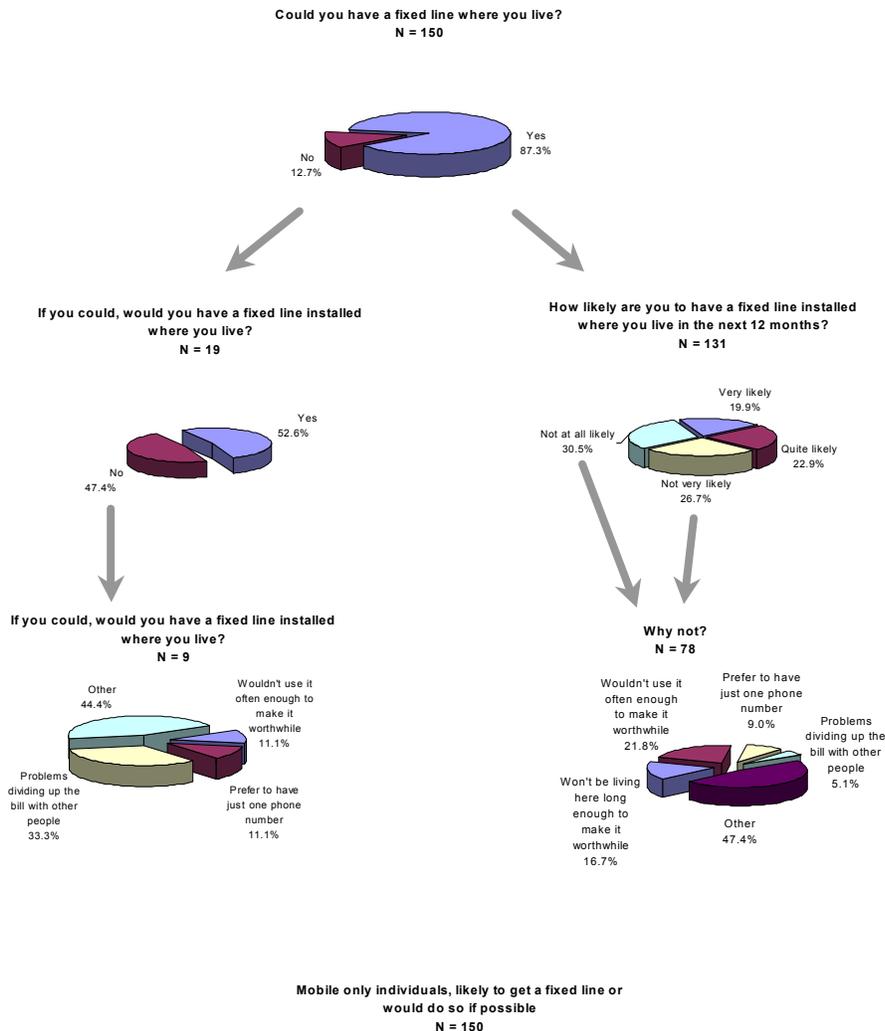
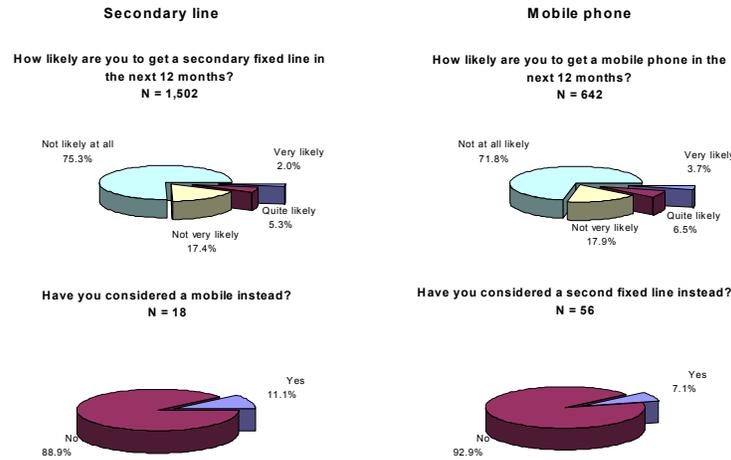


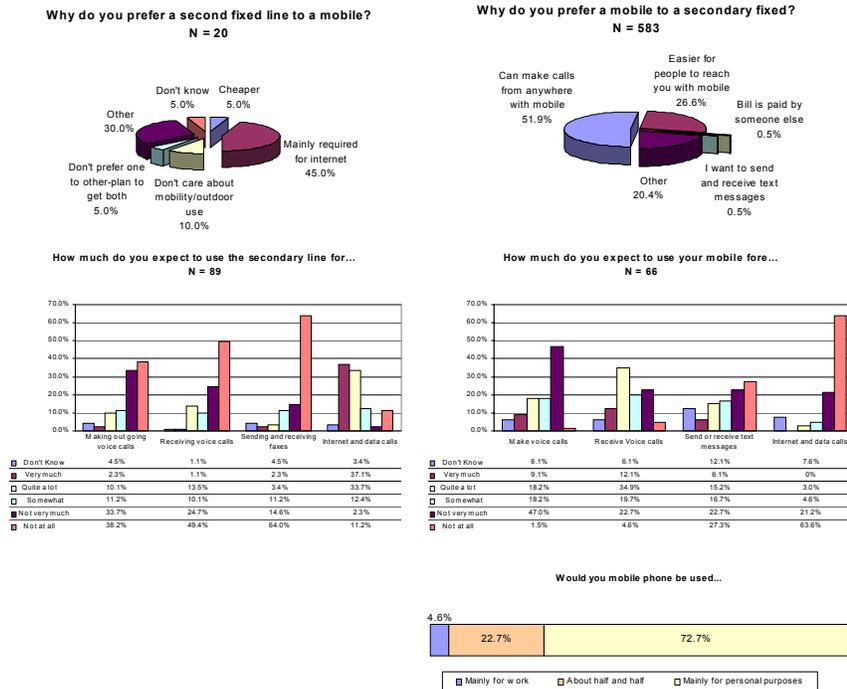
Figure 48 shows that, of those with a single fixed or fixed and mobile, three quarters are unlikely to obtain an additional fixed line in the next 12 months, and amongst single fixed users willing to acquire a second fixed line almost 90% have not considered a mobile instead. Likewise, the majority of single or multiple fixed respondents are unlikely to obtain a mobile within the next 12 months, and almost all single fixed have not considered a secondary fixed line. These responses are unsurprising given the older age group and low usage of technology apparent among single fixed users. However, only a minority of those planning to acquire a mobile phone have considered a second fixed line instead.

Figure 48: Likelihood of adopting a second fixed line or a mobile



Of those preferring a secondary fixed line, Figure 49 shows the main reason to be for use in accessing the Internet. For those that would prefer a mobile to a secondary fixed line, the main reason is the convenience of being able to make (predominantly voice) calls from anywhere.

Figure 49: Reasons for preferring a second fixed line or a mobile

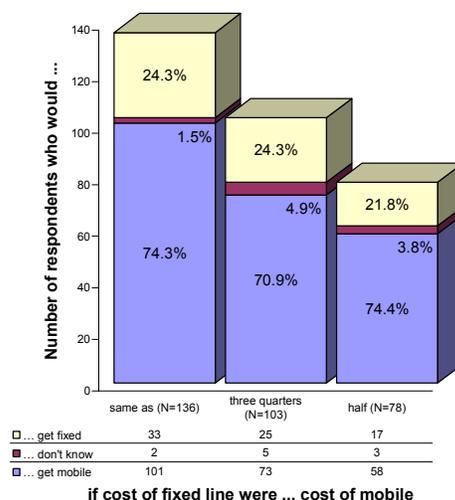


LINE CHOICE UNDER DIFFERENT PRICES

In order to establish how the choice between fixed and mobile phones would be affected by changes in relative prices, we asked a series of hypothetical questions about adoption decisions.

Mobile-only users were asked to imagine they had no mobile. Figure 50 shows how they would choose between a fixed and a mobile phone, depending on relative prices. Unsurprisingly, most of the respondents would choose a mobile phone, but over a half would respond to price differences by adopting a fixed line instead.

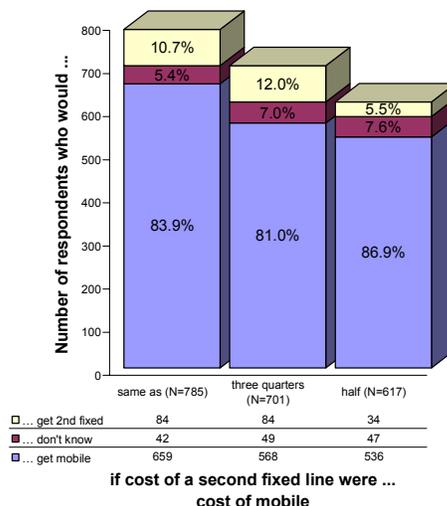
Figure 50: Choice between a fixed or mobile phone – mobile-only users



Note: absolute numers reported on the table.

Single fixed with mobile users were asked to imagine they had no mobile. Figure 51 shows how these users would decide between a mobile or an additional fixed line depending on relative prices. Again, the majority would choose exactly as they have by adopting a mobile, but a significant proportion – one quarter of respondents – would respond to price differences.

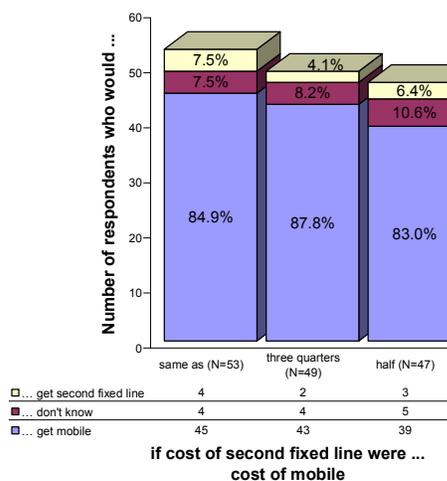
Figure 51: Choice between a secondary fixed and mobile phone – single fixed with mobile users



Note: absolute numers reported on the table.

A similar result has been obtained by asking single fixed respondents who have said they were likely to obtain a mobile within the next 12 months. As Figure 52 shows, the majority would stay with their planned choice, but some would respond to price differences.

Figure 52: Likelihood to adopt a secondary line / mobile phone – potential mobile adopters



Note: absolute numers reported on the table.

Figure 53 illustrates why those who would not get a mobile instead of a fixed line even if price differences were large prefer the mobile option. Mobility is by far the main factor.

Figure 53: Reasons for preferring a mobile even if price differences were significant

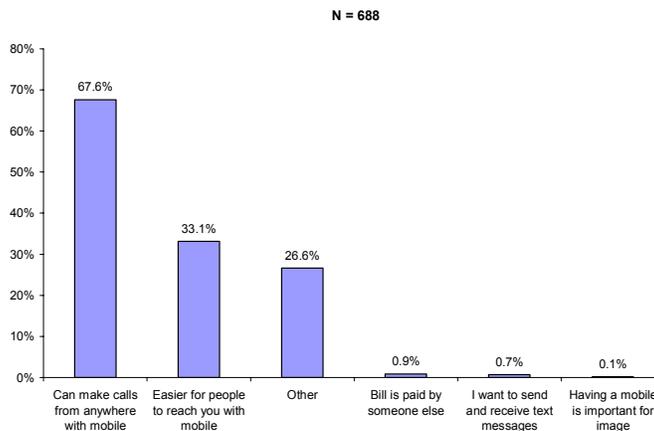
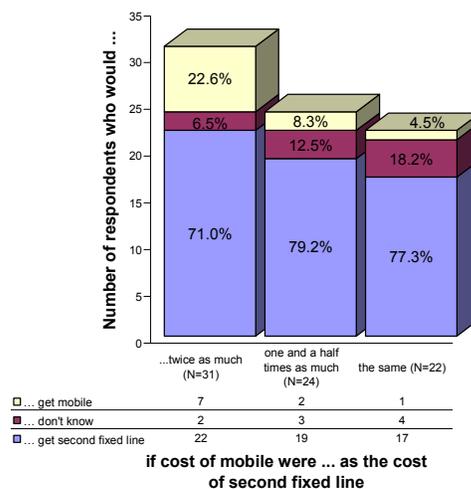


Figure 54 shows that of those respondents with multiple fixed lines (and no mobiles) again the majority would choose as they did, but around one third of respondents would respond to price differences.

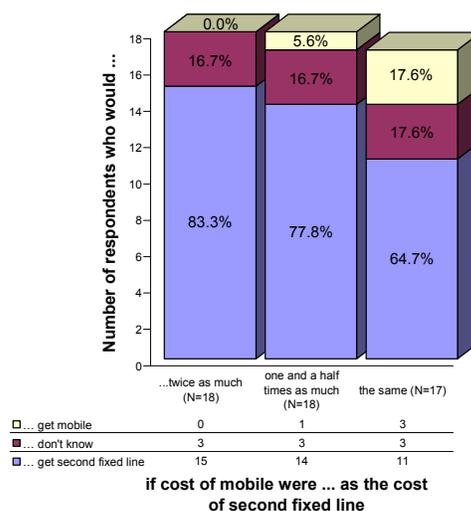
Figure 54: Choice between a secondary line and a mobile –multiple fixed line users



Note: absolute numbers reported on the table.

Figure 55 shows that the majority of single fixed respondents who have indicated a likelihood of obtaining a secondary fixed line would stay with this choice even if price were different, but around one fifth of respondents would respond to price differences by reversing their choice. However, given the small number of individuals willing to install a second fixed line, these values should not be considered as reliable as the previous ones.

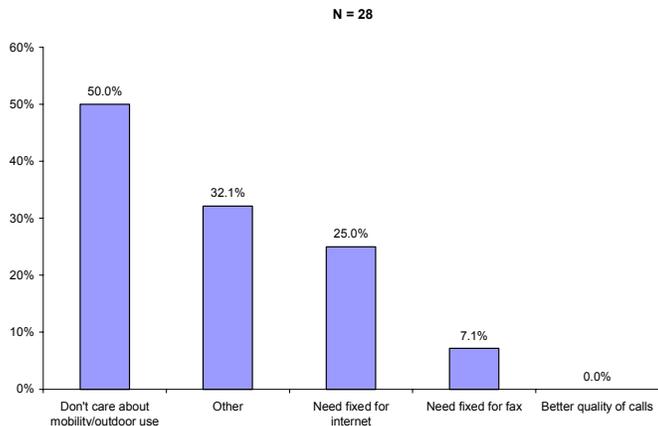
Figure 55: Likelihood to adopt a secondary line / mobile phone – potential second line adopters



Note: absolute numbers reported on the table.

Unsurprisingly, Figure 56 shows that the main reason for preferring an additional fixed line over a mobile is the lack of interest in mobility.

Figure 56: Reasons for preferring fixed line even if price differences were significant



Overall, the answers to our hypothetical questions show that users would by and large replicate the choices they have made, but that a significant proportion of respondents would choose differently in response to different relative prices.

APPENDIX B: MARKET RESEARCH QUESTIONNAIRE

INTRO Good *** My name is ***** from FDS Market Research. We are conducting a survey on behalf of BT about people's use of fixed and mobile telephones, to help plan networks for the future. The interview will take about 15 minutes. Is it convenient now?**

Q1 How many fixed phone lines does your household have? That is, how many separate phone numbers do you have, including any numbers used for fax and the Internet, but not counting mobile phones?

Q2 Do you have a personal computer in the household?

Yes.....1

No.....

Q3 Do you have an Internet connection for this computer?

Yes.....1

No.....2

Q3B Do you have a phone package that gives you any free Internet calls?

Yes.....1

No.....2

Don't know.....Y

Q4A Do you have a fax machine at home?

Yes.....1

No.....2

Q4B Do you have a mobile phone yourself?

Yes.....1

No.....2

Q5 How much roughly is your typical total expenditure on your fixed line at your home over a quarter (that is three months), including line rental and calls? INTERVIEWER NOTE: IF RESPONDENT HAS MONTHLY BILL, TIMES BY 3

Less than £20.....1

£20 - £40.....2

£40 - £60.....3

£60 - £80.....4

£80 - £100.....5

£100 - £120.....6

More than £120.....7

Don't know.....Y

Refused.....{

Q5B Does your phone package give you any free local calls?

Yes.....1

No.....2

Don't know.....Y

Q5C Who pays for the fixed line bill?

Yourself.....1

Your family.....]...2

Share.....3

Another member of household....4

APPENDIX B: MARKET RESEARCH QUESTIONNAIRE

Employer.....5
 Refused.....{

Q7 Is your fixed line used:
 Mainly for work.....1
 Mainly for personal purposes.....2
 About half and half.....3

Q9 How likely is your household to get a second fixed line in the next 12 months?
 Very likely.....1
 Quite likely.....2
 Not very likely.....3
 Not at all likely.....4

Q10 Do you yourself have a say in this decision?
 Yes.....1
 No.....2

Now I'd like to ask you how you expect to use the second fixed line, if and when you get one:

Q13B How much do you expect to use the second fixed line

- 1- Making outgoing voice calls
- 2- Receiving voice calls
- 3- Sending and receiving faxes
- 4- Internet and data calls

Very much..... 1 1 1 1
 Quite a lot..... 2 2 2 2
 Somewhat..... 3 3 3 3
 Not very much, or. 4 4 4 4
 Not at all..... 5 5 5 5
 Don't know..... Y Y Y Y

Q14 You said you are likely to get a second fixed line in the next 12 months. Have you considered getting a mobile phone instead?
 Yes.....1
 No.....2

Q15 Why do you prefer a second fixed line to a mobile phone?
 (Probe and circle from list. Do not prompt.)
 (28) MP cheaper.....1
 available to other members of the household.....2
 mainly required for fax.....3
 mainly required for Internet.....4
 better quality of calls.....5
 don't care about mobility/outdoor use.....6
 don't prefer one to other - planning to get both.7
 Other (specify) 29-38) Specified Other (28)
 Don't know.....Y

You said your household doesn't have a second fixed line at the moment, but that you are likely to get one in the next 12 months. How would you choose between getting a second fixed line and getting a mobile phone if the regular bills for using a mobile phone

(including both call and subscription/line rental charges, but excluding any connection or installation charges) were:

Q16 [+a+]?

- 1- Twice as much as a second fixed line
- 2- What if it cost one-and-a-half times as much as a second fixed line
- 3- What if it cost the same as a second fixed line

Get mobile phone.. 1 1 1

Get second fixed line.. 2 2 2

Don't know..... Y Y Y

Q17 Why would you still not want to have a mobile phone, even if it cost the same as a second fixed line phone? (Probe and circle from list. Do not prompt.)

- need fixed line for fax.....1
- need fixed line for Internet.....2
- better quality of calls.....3
- other members of the household need to be able to use it..4
- don't care about mobility/outdoor use.....5
- Other (specify) Specified Other

Q19 Do you use a digital line, such as ISDN or ADSL?

Yes.....1

No.....2

Don't know.....Y

Q20 When did you get your second fixed line?

Less than 1 year ago.....1

1-2 years ago.....2

2-5 years ago.....3

More than 5 years ago.....4

Q20B Do you use your second line for making or receiving voice calls?

Yes, that is it's main use.....1

Sometimes.....2

Very rarely.....3

Not at all.....4

Q21 How much roughly is your typical total expenditure on your fixed lines at your home over a quarter (that is three months), including line rental and calls? INTERVIEWER NOTE: IF RESPONDENT HAS MONTHLY BILL, TIMES BY 3

Less than £20.....1

£20 - £40.....2

£40 - £60.....3

£60 - £80.....4

£80 - £100.....5

£100 - £120.....6

More than £120.....7

Don't know.....Y

Refused.....{

Q21B Do you have a phone package that gives you free local calls?

Yes.....1

No.....2

Don't know.....Y

Q21C Who pays for the fixed line bill?

Yourself.....1

Your family.....2

Share.....3



Another member of household.....4
 Employer.....5
 Refused..... {

Q22 Is your main fixed line used:
 Mainly for work.....1
 Mainly for personal purposes.....2
 About half and half.....3

Q23 And what about your second fixed line? Is it used:
 Mainly for work.....1
 Mainly for personal purposes.....2
 About half and half.....3

Q24 Which did you get first, the second fixed line or the mobile?
 Second fixed line.....1
 Mobile.....2

Q25 Did you yourself have a say in the decision to get a second fixed line?
 Yes.....1
 No.....2

Q26 When you got your second fixed line, did you consider getting a mobile phone instead?
 Yes.....1
 No.....2

Q27 Why did you prefer a second fixed line to a mobile phone?(Probe and circle from list. Do not prompt.)
 cheaper.....1
 available to other members of the household.....2
 mainly required for fax.....3
 mainly required for Internet.....4
 better quality of calls.....5
 don't care about mobility/outdoor use.....6
 Other (specify) Specified Other (64) MP
 Don't know.....Y

Q28 If you were getting your 2nd fixed line today, would you consider using a mobile phone instead?
 Yes.....1
 No.....2

Imagine that your household didn't have a second fixed line. You could choose between getting a second fixed line and getting a mobile phone. Which would you choose if the regular cost of using a mobile phone (that is the total cost including call and subscription/line rental charges, but excluding connection/installation charges) was:

Q29
 -1- Twice as much as a second fixed line
 -2- What if it cost one-and-a-half times as much as a second fixed line
 -3- What if it cost the same as a second fixed line

Get mobile phone .. 1 1 1
 Get second fixed line.....2 2 2
 Get neither..... .. 3 3 3
 Don't know..... ... Y Y Y

Q30 Why would you still not want to have a mobile phone, even if it cost no more than a second fixed line phone? (Probe and circle from list. Do not prompt.)

- need fixed for fax.....1
- need fixed for Internet.....2
- better quality of calls.....3
- don't care about mobility/outdoor use.....4
- Other (specify) Specified Other

Q32 When did you get your mobile phone?

- Less than 1 year ago.....1
- 1-2 years ago.....2
- 2-5 years ago.....3
- More than 5 years ago.....4

Q34 Is it contract or pre-paid?

- contract.....1
- pre-paid.....2

Q35 What is your typical total monthly expenditure on your mobile phone?

- Less than £20.....1
- £20 - 40.....2
- £40 - 60.....3
- £60 - 80.....4
- More than £80.....5
- Don't know.....Y
- Refused.....{

Q36 Do you use your mobile phone:

- Mainly for work.....1
- Mainly for personal purposes.....2
- About half and half.....3

Q37 Was your mobile phone:

- bought by you?.....1
- given to you as a gift?.....2
- bought for you by your employer?.....3

Q38A Who pays the regular bill for your mobile phone?

- Yourself.....1
- Your employer.....2
- Someone else (specify).....3
- Other (specify) 0 (24-33) Specified Other

Q38B When you got your mobile phone, did you consider getting a second fixed line instead?

- Yes.....1
- No.....2

Q38C Why did you prefer a mobile to your second fixed line? (Probe and circle from list. Do not prompt)

- Can make calls from anywhere with a mobile.....1
- Easier for people to reach you with a mobile.....2
- Having a mobile is important for image.....3
- Bill paid by someone else.....4
- Want to be able to send / receive text message...5
- Other (specify) 0 Specified Other (35) MP
- Don't know.....Y

Q38D If you were getting your mobile today, would you consider getting a second fixed line instead?

Yes.....1
No.....2

Q39 Do you have easy access to a fixed line at your place of work?

Yes.....1
No.....2
Not working.....3
No answer.....X

Q40 How often do you make calls on your mobile phone when you are at work?

often.....1
sometimes.....2
rarely.....3
never.....4

Q41 Why don't you use a fixed line to make these calls? (Probe from list. Do not prompt.)

can't always get to a fixed line..... 1
I don't pay for my mobile phone calls..... 2
want to talk in private/don't want to be overheard.....3
cheaper at certain times..... 4
fixed line sometimes being used..... 5
Other (specify) Specified Other

For each of the following possible reasons for having a mobile phone, please say whether each is very important, quite important, not very important, or not at all important for you:

Q42?

- 1- So people can contact me to do with work or business
- 2- So I can contact other people to do with work or business
- 3- So friends or family can contact me more easily
- 4- So I can contact friends or family more easily
- 5- So I can make calls in an emergency
- 6- So people can call me in an emergency
- 7- Because it matters for my image

Very important... 1 1 1 1 1 1 1
Quite important... 2 2 2 2 2 2 2
Not very important 3 3 3 3 3 3 3
Not at all important..... 4 4 4 4 4 4 4

- 8- Sometimes it is cheaper than a fixed line
- 9- I want to be able to send and receive text messages

Very important... 1 1
Quite important... 2 2
Not very important 3 3
Not at all important..... 4 4

In each of the following situations, please say whether you have your mobile phone switched on most of the time, some of the time, not very much or hardly ever.



Q43?

- 1- Whenever you're at home
- 2- Whenever you're at your place of work
- 3- Whenever you're out and about during the day
- 4- Whenever you're out and about during the evening

Most of the time.. 1 1 1 1
 Some of the time.. 2 2 2 2
 Not very much of
 the time..... 3 3 3 3
 Hardly ever..... 4 4 4 4

Can you tell me whether you agree or disagree with the following statements:

Q44?

- 1- My mobile phone represents good value for money
- 2- I think about cost every time I use my mobile phone
- 3- I use my mobile phone more than I thought I would when I got it
- 4- I would use my mobile phone more if the calls cost less
- 5- I would use my mobile phone more if the call quality was better
- 6- I would use my mobile phone more if I could always get a connection
- 7- I often wait till i can get to a fixed phone rather than use my mobile

Strongly agree.... 1 1 1 1 1 1
 Agree..... 2 2 2 2 2 2
 Neither agree nor disagree..... 3 3 3 3 3 3
 Disagree..... 4 4 4 4 4 4
 Strongly disagree. 5 5 5 5 5 5

- 8- If I didn't have a mobile phone, I would use my fixed line more
- 9- If I didn't have a mobile phone, I would use other fixed lines more
- 10- If I didn't have a mobile phone, I would use payphones more
- 11- I would leave my mobile phone switched on more of the time, but I worry about the batteries running out

Strongly agree.... 1 1 1 1
 Agree..... 2 2 2 2
 Neither agree nor disagree..... 3 3 3 3
 Disagree..... 4 4 4 4
 Strongly disagree. 5 5 5 5

Q46 How long have you been living without a fixed line?

less than 6 months.....1
 6 months-1 year.....2
 1-2 years.....3
 more than 2 years.....4

Q45 When you got your mobile phone, did you and your household have a fixed line?

Yes.....1 No.....2

Q47 You said you used to have a fixed line and a mobile, but now you have just a mobile. Did you cancel your subscription for your fixed line or did you move to accommodation where there was no fixed line?

Cancelled subscription for fixed line.....1
 Moved somewhere where no fixed line.....2

Q48 Why did you cancel your fixed line subscription? (Probe and circle from list. Do not prompt.)

Didn't use it often enough to make it worthwhile.1
 Prefer to have just one phone number.....2
 Problems dividing up the bill with other people..3
 Other (specify) Specified Other

Q49 What type of accommodation did you move to?

student hall of residence.....1
 Bedsit/rented room in private house.....2
 Shared rented accommodation.....3
 Hostel.....4
 Hotel.....5
 Other (specify) Specified Other

Q50 If you wanted to, could you have a fixed line installed where you live?

Yes.....1
 No.....2

Q51 How likely are you to get a fixed line installed where you live within the next 12 months?

Very likely.....1
 Quite likely.....2
 Not very likely.....3
 Not at all likely.....4

Q52 Why not? (PROBE AND FROM LIST. DO NOT PROMPT.)

Won't be living here long enough to make it worthwhile.....1
 Wouldn't use it often enough to make it worthwhile.....2
 Prefer to have just one phone number..... ..3
 Problems dividing up the bill with other people. .4
 Other (specify) Specified Other

Q53 If you could, would you have a fixed line installed?

Yes.....1
 No.....2

Q54 Why not? (Probe and circle from list. Do not prompt)

won't be living here long enough to make it worthwhile.....1
 wouldn't use it often enough to make it worthwhile.....2
 prefer to have just one phone number.....3
 problems dividing up the bill with other people.4
 Other (specify) Specified Other

Q55 Imagine that you did not have a mobile phone and nor did anyone else in your household. Your household could choose between getting one or more mobile phones or getting a fixed line. Would you have a say in this decision?

Yes.....1
 No.....2

Q56 Which option would you choose if the regular cost of using a fixed line (including line rental and call charges, but not installation charges) was the same as for your mobile phones or phones?

Get fixed line.....1
 Get mobile phone(s).....2
 Don't know.....Y

Q56B What if it was three-quarters as much as for your mobile phones or phones?

- Get fixed line.....1
- Get mobile phone(s).....2
- Don't know.....Y

Q56C What if it was half as much as for your mobile phones or phones?

- Get fixed line.....1
- Get mobile phone(s).....2
- Don't know.....Y

Q57 Why would you still not want to have a fixed line, even if it cost only half as much as your mobile phones or phones? (Probe and circle from list. Do not prompt.)

- Can make calls from anywhere with mobile.....1
- Easier for people to reach you with mobile.....2
- Having a mobile is important for image.....3
- Bill is paid by someone else.....4
- Other (specify) Specified Other

Q59 Since you got a mobile phone, do you make phone calls on your home fixed line:

- Much more than before.....1
- Somewhat more than before.....2
- About the same as before.....3
- Somewhat less than before.....4
- Much less than before.....5

Q60 Did this happen because you got a mobile phone, or was it for other reasons?

- Because of mobile phone.....1
- For other reasons.....2
- Don't know.....Y

QMB Since you got a mobile phone, is your households fixed phone bill:

- Much more than before.....1
- Somewhat more than before.....2
- About the same as before.....3
- Somewhat less than before.....4
- Much less than before.....5

QMBS Did this happen because you got a mobile phone, or was it for other reasons?

- Because of mobile phone.....1
- For other reasons.....2
- Don't know.....Y

Q61 How often do you make calls on your mobile phone when you are at home?

- Often.....1
- Sometimes.....2
- Rarely.....3
- Never.....4

Q62 Why don't you use your main fixed line to make these calls? (PROBE FROM LIST. DO NOT PROMPT.)

- Want to keep separate billing, e.g. for work.....1
- Cheaper at certain times.....2
- Fixed line sometimes being used.....3
- Want to talk in private/don't want to be overheard...4
- Want to move around house.....5

Easier to call as number stored in mobile phone..6
 Other (specify) Specified Other

Q63 If the cost of calls on your mobile phone fell by a quarter, what difference would it make to how much you use your fixed line (or lines)? Would you use your fixed line . . . ?

- Much less.....1
- Somewhat less.....2
- A little less.....3
- Same as now.....4

Q63A And what if the cost of calls on your mobile phone fell by half?

- Much less.....1 S
- Somewhat less.....2
- A little less.....3
- Same as now.....4

Q65 Imagine that you did not have a mobile phone and nor did anyone else in your household. Your household could choose between getting one or more mobile phones or getting a second fixed line. Would you have a say in this decision?

- Yes.....1
- No.....2

Q66 Which option would you choose if the total cost of having and using a second fixed line was the same as for your mobile phones or phones?

- Get second fixed line.....1
- Get mobile phone(s).....2
- Don't know.....Y

Q66A What if it was three-quarters as much as for your mobile phones or phones?

- Get second fixed line.....1
- Get mobile phone(s).....2
- Don't know.....Y

Q66B What if it was half as much as for your mobile phones or phones?

- Get second fixed line.....1
- Get mobile phone(s).....2
- Don't know.....Y

Q67 Why would you still not want to have a second fixed line, even if it cost only half as much as your mobile phones or phones? (PROBE FROM LIST. DO NOT PROMPT.)

- Can make calls from anywhere with mobile.....1
- Easier for people to reach you with mobile.....2
- Having a mobile is important for image.....3
- Bill is paid by someone else.....4
- I want to send and receive text messages.....5
- Other (specify) Specified Other

Imagine you did not have a fixed line. How would you choose between getting a fixed line and getting one or more mobile phone if the regular bills for using a mobile phone (including both call and subscription/line rental charges, but excluding any connection or installation charges) were:

Q69

- 1- Twice as much as a second fixed line
- 2- What if it cost one-and-a-half times as much as a second fixed line
- 3- What if it cost the same as a second fixed line



Get mobile phone.. 1 1 1
 Get second fixed line..... 2 2 2
 Don't know..... Y Y Y

Q68 How likely are you to get a mobile phone in the next 12 months?
 Very likely.....1
 Quite likely.....2
 Not very likely.....3
 Not at all likely.....4

Q69B Would it be contract or pre-paid?
 Contract.....1
 Pre-paid.....2
 Don't know.....Y

Q70 Would your mobile phone be used:
 Mainly for work.....1
 Mainly for personal purposes.....2
 About half and half.....3

Now I'd like to ask you how you might use your mobile phone:

Q71B How much would you use the mobile phone for [+a+]?
 -1- Making outgoing voice calls?
 -2- Receiving voice calls?
 -3- Sending or receiving text messages?
 -4- Internet and data calls?

Very much..... 1 1 1 1
 Quite a lot..... 2 2 2 2
 Somewhat..... 3 3 3 3
 Not very much, or. 4 4 4 4
 Not at all..... 5 5 5 5
 Don't know..... Y Y Y Y

Q72 If you got a mobile phone, do you think you would use your main fixed line at home:
 Much more than now.....1
 Somewhat more than now.....2
 About the same.....3
 Somewhat less than now.....4
 Much less than now.....5

Q73 You said you are likely to get a mobile phone in the next 12 months. have you considered getting a second fixed line instead?
 Yes.....1
 No.....2

Q74 Why do you prefer a mobile phone to a second fixed line? (PROBE AND LIST. DO NOT PROMPT.)
 Don't prefer one to other - planning to get both.1
 Can make calls when away from home.....2
 Easier for people to reach you with mobile.....3
 Having a mobile is important for image.....4
 Use when main line is being used/engaged.....5



Bill is paid by someone else.....6
 I want to be able to send text messages.....7
 Other (specify) Specified Other

Q75 Who would pay for your mobile phone?:
 Yourself.....1
 Your employer.....2
 Someone else (write in).....3
 Other (specify) Specified Other (
 Don't know.....Y

You said you don't have a mobile phone at the moment, but that you are likely to get one in the next 12 months. How would you choose between getting a mobile phone and getting a second fixed line if the regular cost of using a second fixed line (including call and line rental charges, but excluding any connection or installation charges) was:

Q76A The same as for a mobile phone?
 Get second fixed line.....1
 Get mobile phone.....2
 Don't know.....Y

Q76B Three-quarters as much as for a mobile phone?
 Get second fixed line.....1
 Get mobile phone.....2
 Don't know.....Y

Q76C Half as much as for a mobile phone?
 Get second fixed line.....1
 Get mobile phone.....2
 Don't know.....Y

Q77 Why would you still not want to have a second fixed line, even if it cost only half as much as a mobile phone? (Probe from list. Do not prompt.)
 Can make calls from anywhere with mobile.....1
 Easier for people to reach you with mobile.....2
 Having a mobile is important for image.....3
 Bill is paid by someone else.....4
 I want to be able to send text messages.....5
 Other (specify) Specified Other

SD1 How often do you?
 -1- Make outgoing voice calls
 -2- Receive voice calls
 -3- Send and receive faxes
 -4- Make internet and data calls

Very often..... 1 1 1 1
 Quite often..... 2 2 2 2
 Sometimes..... 3 3 3 3
 Rarely..... 4 4 4 4
 Never..... 5 5 5 5
 Don't know..... Y Y Y Y

QIM Do you tend to use your fixed line for the internet and your mobile for voice calls when at home?
 Yes.....1

APPENDIX B: MARKET RESEARCH QUESTIONNAIRE

No.....2
 Don't know.....Y

QEM Do you use e-mail?
 Yes.....1
 No.....2

QEML Do you use it from?
 internet mobile other home work cafe phone locations

A lot..... 1 1 1 1 1
 Somewhat..... 2 2 2 2 2
 Not much..... 3 3 3 3 3
 Not at all..... 4 4 4 4 4

QEM2 By using e-mail, do you make
 A lot less voice calls?.....1
 A little less voice calls?.....2
 A few less voice calls?.....3
 it has no impact on your voice calls.....4

QSMS Do you send text messages to mobile phones?
 Yes.....1
 No.....2

QSMS2 By sending text messages to mobile phones, do you make
 A lot less voice calls?.....1
 A little less voice calls?.....2
 A few less voice calls?.....3
 it has no impact on your voice calls.....4

HOMEWOR Do you work primarily from home?
 Yes.....1
 No.....2

Q78 How many people are there in your household, including yourself?
 1+ _____ (33-41) Refused..... {

Q78B And how many of these are aged 16 or over?
 1+ _____ (42-50) Refused..... {

Q79 How many members of your household including you have a mobile phone?
 0+ _____ (51-59) Refused..... {

Q80 Which of these age groups do you fall into?
 16-19.....1
 20-24.....2
 25-29.....3
 30-34.....4
 35-39.....5
 40-44.....6
 45-54.....7
 55-64.....8
 65+.....9
 Refused.....{

Q82 Which of the following best describes your employment status? Are you...
 Working full time (30+ hours per week).....1

APPENDIX B: MARKET RESEARCH QUESTIONNAIRE

Working part time (8-29 hours).....2
 Temporarily not working.....3
 Retired.....4
 A student.....5
 Responsible for shopping and looking after the house.....6
 Other.....7
 Refused.....{

Q83 Do you own your own home or rent it? IF RENT: Is that from a private landlord or from the local authority? IF SOMETHING ELSE: code HA or write in.

Own (incl. mortgage).....1
 Rent - Private.....2
 Rent - From local authority.....3
 Housing Association.....4
 Other (specify) Specified
 Refused.....{

Q83B And is your home....READ OUT:

A detached house.....1
 A semi-detached house.....2
 A terraced house.....3
 A flat/maisonette.....4
 Other (specify) Specified Other
 Refused.....{

QINC We have found that in order to help our research we need to ask a general question on income. Would you please mind telling us your approximate household income before tax, but after any benefits or income from investments, is it:

Less than £4,999.....1
 Between £5,000 & £9,999.....2
 Between £10,000 & £14,999.....3
 Between £15,000 & £19,999.....4
 Between £20,000 & £24,999.....5
 Between £25,000 & £29,999.....6
 Between £30,000 & £49,999.....7
 £50,000 or over.....8
 Don't know.....Y
 Refused.....{

QNAME Can I please ask you your name:
 (30)

Refused.....{

QBT You have been interviewed on behalf of BT. BT may be carrying out further research in the future. Would you be willing to be contacted again?

Yes.....1 No.....2

QCLOSE Thank you for your time and co-operation in this survey. If you have any queries about the survey I can give you the name and telephone number of the executive in charge. IF REQUESTED, The FDS executive in charge of the survey is ***** Goodbye.

QSOC INTERVIEWER CODE SOCIAL CLASS



- A.....1
 - B.....2
 - C1.....3
 - C2.....4
 - D.....5
 - E.....6
 - Don't know.....Y
 - Refused.....{
-

QINT INTERVIEWER'S DECLARATION I hereby declare that I have conducted this interview in full, with the person named below in accordance with your instructions and within the MRS code of conduct. TYPE IN YOUR INTERVIEWER NUMBER:

1 TO 999 _____ (34-36)