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# ACCESS TO COMPUTER, INTERNET AND MOBILE PHONE AT HOME IN FINLAND, IRELAND, NETHERLANDS AND SWEDEN

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**Abstract:** The purpose of this study is to analyse statistically factors that affect individual access to and household ownership of new technology. This paper reviews the literature on the diffusion of new innovations, the use of new technology and relevant consumer theory. Also some descriptive statistics on Finland, Ireland, Netherlands and Sweden are presented. The main contributions are the logit regression analyses conducted with Dutch, Finnish and Swedish data. The Dutch part is just a review of former study by van der Veen (2003). The Finnish analysis is conducted using the Finnish household budget survey 1998. The Swedish analysis is conducted using the survey on individual ICT access and use in 2002. In the analyses conducted the research question is how region, household composition, age, gender, education, income and social position affect the probability of owning or having access to computer, Internet and mobile phone at home. The effects were similar in most respects in all the three countries. It seems that having access to these new technologies is most clearly affected by household type, age and income. The results show that the regional differences in E-access were mostly caused by demographic differences between the regions.

**Key words: ICT access, households, logit**

**Tiivistelmä:** Tässä tutkimuksessa tarkastellaan tilastollisesti tekijöitä, jotka vaikuttavat uuden teknologian omistukseen kotitalouksissa. Tässä tutkimuksessa käydään läpi lyhyesti uusien innovaatioiden diffuusiota, uuden teknologian käyttöä ja tähän liittyvää kuluttajan teoriaa käsittelevää kirjallisuutta. Kuvailevia tilastotietoja esitetään Suomesta, Irlannista, Alankomaista ja Ruotsista. Tutkimuksen keskeinen osa on logit regressiomallilla tehdyt analyysit koskien Alankomaita, Suomea ja Ruotsia. Alankomaiden osuus on tiivistelmä van der Veenin (2003) tutkimuksesta. Suomea koskeva analyysi on tehty kotitalouksiin kohdistuvalla Tilastokeskuksen vuoden 1998 kulutustutkimuksen aineistolla. Ruotsia koskeva analyysi on tehty yksilöihin kohdistuvalla Ruotsin tilastokeskuksen ICT:n käyttöä koskevalla aineistolla vuodelta 2002. Tutkimusongelmana on kuinka alue, kotitalouden rakenne, ikä, sukupuoli, koulutus, tulot ja sosiaalinen asema vaikuttavat todennäköisyyteen, että kotitalous omistaa tai yksilö omaa kotona yhteyden tietokoneeseen, internettiin ja matkapuhelimeen. Näiden eri tekijöiden vaikutukset ovat hyvin samankaltaisia kaikissa kolmessa maassa. Kotitalouden rakenne, ikä ja tulot vaikuttivat selvimmin siihen löytyvätkö nämä uudet teknologiat kodista. Havaitut alueelliset erot johtuvat pääosin demograafisista eroista alueiden välillä.

**Asiasanat: Yhteydet ICT:aan, kotitaloudet, logit**

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# 1. Introduction

The purpose of this study is to statistically analyse the factors that affect individual access to and household ownership of new technology, thus locating the possible bottlenecks in adapting it. That individuals have access to new technology is an essential part in transition towards the information society. This study is part of MUTEIS (Macro-economic and Urban Trends in Europe's Information Society) research project and also has links to a project in Government Institute of Economic Research (VATT) which studies income and consumption at households at national and regional level.

MUTEIS is a pan-European research project. The overall objective of the project is to analyse the effects of the so called "digital economy" on national economies in Europe and to explore the way these effects manifest themselves at the level of urban regions. The first stage of the project took place in 2001 and 2002. It is an analysis of the macro-economic growth performance during the 1990's of four countries that are front runners in take up of the digital economy in Europe: Finland, Ireland, Netherlands and Sweden. These countries are referred to as the FINS. The second stage of the project concerned a more qualitative analysis of the most important regional and urban developments in the FINS. It entailed case studies in two different kinds of regions in each country where one region was the national frontrunner in ICT (Information and communications technology) take up and the other was a more remote but successful in ICT too. The first part of the regional studies concentrated on the development patterns of the ICT clusters. Van der Meer et al. (eds.) (2003) present these case studies made in Amsterdam, Cork, Dublin, Groningen, Helsinki, Jönköping, Oulu and Stockholm. This study is part of the second part of the second stage of the project. That stage analyses the impact of ICT on other sectors of the economy, society and urban governance.

In the second chapter a very short look is taken on the literature on the diffusion of new innovations, the use of new technology and consumer theory. In the third chapter some descriptive statistics are presented. The next chapters present the results of logit regression analyses conducted with Dutch, Finnish and Swedish data. The Dutch part is just a review of former study by van der Veen (2003). It is summarized in chapter four. The Finnish analysis is conducted using the Finnish household budget survey 1998. The results are presented in chapter five. The Swedish analysis is conducted using the survey on individual ICT access and use in 2002. The results are presented in chapter six. In the logit analyses conducted for this study the research question is how region, household composition, age, gender, education, income and social position affect the probability of owning or having access to computer, Internet and mobile phone at home.

# 2. Consumer theory, innovation diffusion and the use of new technology

Households differ in size, age composition, educational level and other characteristics and, in general, we would expect households with different characteristics to have different expenditure patterns. Just as we are interested in modelling the effects on demands of differences in prices and budget levels, so it is legitimate and useful in summarizing a great deal of information to model the effects of household characteristics. In general, we can model differences by making demand depend not only on prices and total expenditure but also on some list of household characteristics. (Deaton and Muellbauer 1980.)

Computer, Internet access and mobile phone have some properties of durable goods. They also need services to be of any use. In addition to a modem or a mobile phone one needs a service from some operator to connect one to the network. In this study it is assumed that the durable good properties are dominant and they are treated as such. For many durable goods the choice is between ownership and nonownership and, in this situation of discrete choice, it is often argued that conventional demand analysis is irrelevant. Deaton and Muellbauer (1980) introduce a simple way to model this type of choice.

Take the example of computer ownership and assume that that ownership can be had for the payment of an annual rental v*. The single period budget constraint, conditional on the total expenditure, is then

(1) $pq + v^*S = x,$

where p is the price and q the quantity of the nondurable, and S = 1 if a computer is owned with S = 0 if a computer is not owned. x denotes the total expenditure. Let the single period utility function be

(2) $u = \upsilon(q, S, \varepsilon),$

where ε is a vector of parameters that differs from household to household and that picks up differences in tastes or in circumstances such as household composition, which are not reflected in the budget constraint. Thus if utility levels $u_0$ and $u_1$ are associated with nonownership and ownership respectively, we have

(3) $u_0 = (x/p , 0, \varepsilon)$

(4) $u_1 = ((x - v^*)/p , 0, \varepsilon) .$

Households for which $u_1 > u_0$ will own a computer while those with $u_1 < u_0$ will not. Which households fall into which category depends upon the values of x and

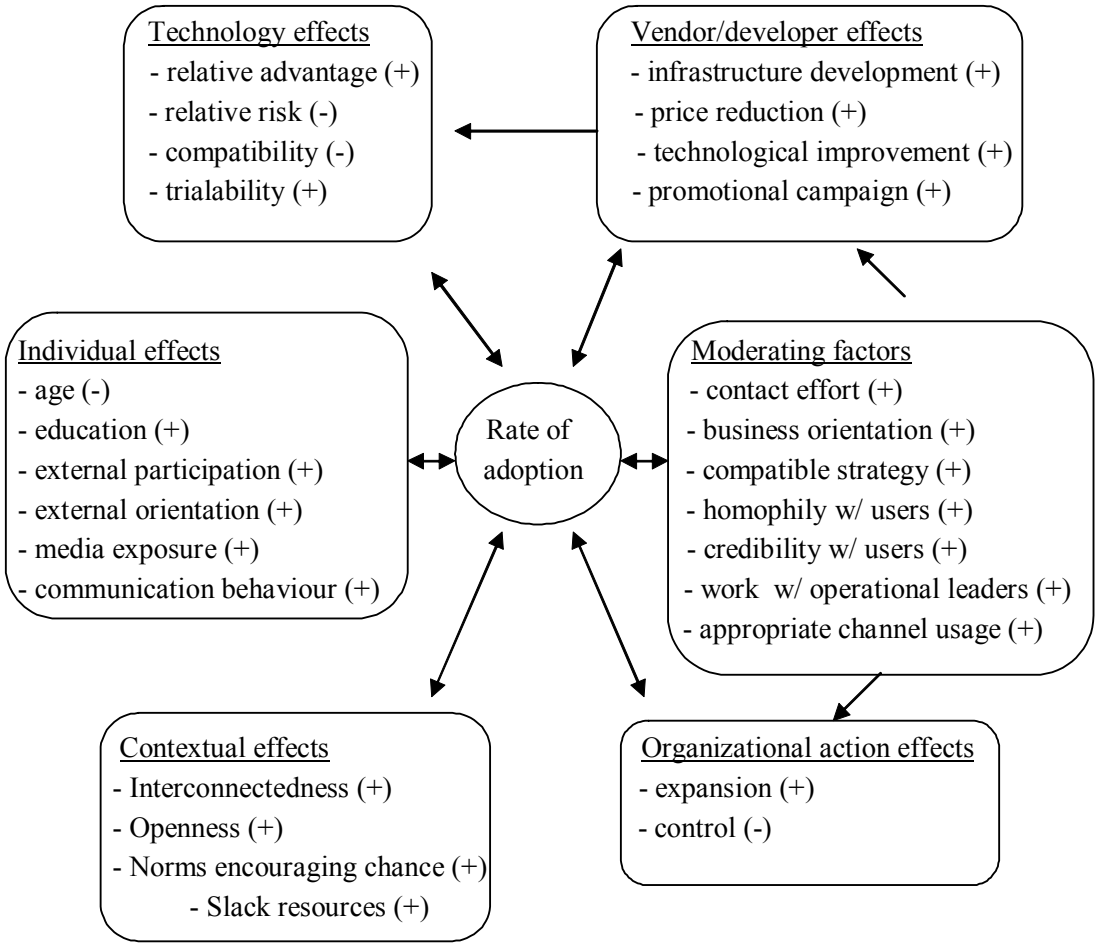
ε, which are the only variables that differ across households. For poorer households $u_o$ is more likely greater than $u_1$ than for richer households. Using microeconomic survey data on individual households, the effects of ε and x on S can be estimated directly. The statistical method used in this study, the logit model, is presented in appendix 1.

It is possible to formulate hypotheses on how the factors in ε may affect the utility that individuals gain from using new technology. Living in a peripheral region could increase the real price of the good due to transportation costs or lesser competition in the market. The possibility to benefit from the network externalities often related to new technology could also differ from one region to another. Different households have very different needs for and the ability to use new technology and thus the utility gained from using such product differs. Also age, gender, education and social position can affect the utility likewise. In this study the effects that these different factors have on the consumption decision on computer, Internet access and mobile phone are looked into. In other words how these innovations diffuse regionally and demographically.

Here innovation diffusion means the adoption of a new product in society. According to innovation diffusion literature the main elements related to diffusion of innovations are the properties of the innovation itself, the channels of communication through which the knowledge about the innovation spreads, social system where the innovation diffuses with its norms and operational environment and the point in time when it diffuses (Uutinen 2002). Brancheau (1987) has described the factors related to the speed of adoption of new innovation with the following picture 1. Factors marked with plus (negative) sign affect the adoption speed positively (negatively). This study focuses only on the individual effects.

According to Viherä (2000), for new users to be able to use new ICT equipment they must have access to that equipment, necessary skills to use them and the motivation to use them. All of these three must be at least at some minimum level. The use of new technology should be approached problem centered. The household can have economic problems with getting access to new technology or a lack of necessary skills to use them. The available information about new technology may not be sufficient or the wide variety of available new technology can be too complicated to get clear picture of. And even if these things do not pose a problem there must be some reason, a motivation, to use the new technology. (Tilastokeskus 2001.)

*Picture 1. Model explaining adoption speed of innovation*




Individuals and households differ very much from each other in many respects. Income, household type and size, the place of residence, education, occupation and age affect the use of new technology. In the next chapters the importance of these factors is assessed within the limits of available data. The focus of this study is only on the access to ICT equipment at home. This is of course rather limited approach as people can also have access to new technology in schools, at work, in libraries and so forth. The reason for this approach was that much of the available data is at household level and thus can only capture the access at home.

# 3. Comparison of the access to computer, Internet and mobile phone at home in the FINS countries

## 3.1 Problems of international comparison

It is not easy to find measures describing the information society that can be reliably used for purposes of international comparison. National surveys have been conducted in various countries, but the questions asked are always formulated with a view to national needs: for many countries it is more important to monitor local trends than to do country comparisons. Surveys conducted in different countries are aimed at different target groups, and the age of the respondents may vary from children over three or over 15 to people aged 64 or 74; sometimes there are no age limits at all. In addition, the surveys may be concerned with consumer behaviour during periods extending from two weeks to three months or the past calendar year or the last 12 months. Sometimes the data are collected "recently" or "in general". (Nurmela et al. 2003.)

In some cases the results reported are based on inquiries among individuals, in others among households. Since the size and structure of households varies widely from country to country, the results of both individual and household surveys may obviously vary quite considerably. It is an entirely different matter whether 50 percent of households have access to the Internet or whether 50 percent of persons aged 15-74 have Internet access from home. Comparability is also reduced by differences in methods of data collection: it is important to exercise caution in comparing the results of postal questionnaires, home visit interviews or telephone interviews. Furthermore it should also be possible to weight the impacts of the sampling method used. (Nurmela et al. 2003.)

It is particularly important to consider the end-purpose for which the indicators produced by the statistics shall be used. The policy objective in the country may guarantee Internet access from home to the whole population, or alternatively to provide access from other sites. The latter might be the more sensible option in view of the goal of promoting the development towards the information society. It is highly questionable automatically to interpret the non-use of certain information or communications media as a sign of marginalisation. From what are people here being marginalised? From basic necessities of everyday life? At least for the time being there are still large numbers of people who do not necessarily need a PC or the Internet even at the workplace. (Nurmela et al. 2003.)

## 3.2 Access to computer, Internet and mobile phone at home in the FINS countries

The information presented in tables 1 and 2 is gathered from various sources and thus the numbers are not very well comparable between different countries. The data on Finland and Sweden were gathered using a harmonized questionnaire and common methodology. The survey was conducted by Statistics Finland and Statistics Sweden in year 2002 and the recall period was three months. The focus was on individuals. The information on Netherlands is from Dutch CBS (Centraal Bureau voor de Statistiek) household survey. The survey consists of 37000 records from year 2000. The information on Ireland is from the Quarterly National Household Survey in the fourth quarter of year 2000. Thus the numbers on Finland and Sweden can be compared without many reservations. The numbers on Netherlands and Ireland can be compared, but with more reservations as the year and the focus are the same but the methodology and the questionnaire are different. There is no basis for comparing Finland or Sweden with Ireland or Netherlands. The only relevant comparison is look at the effect of the different characteristics in each country. For example is access to computer higher in the group with higher education than in the group with lower education in all the countries?

The access to computer is presented in table 1. It is higher in Sweden than in Finland in all the groups. The same applies when Netherlands is compared with Ireland. Larger households and households with children have higher access percentage than smaller and childless households. Males have somewhat higher percentage than females. This difference is especially large in Netherlands. The percentage is very low in the old age groups. Age group 30-49 has the highest access. Groups with higher education have higher access than those with lower education. Groups of employed people and students have high access percentage when the group of retired people have very low access percentage. Table 2 shows the access to Internet. All the conclusions that were made about access to computers apply also to access to Internet. In table 3 there is information about access to mobile phone, but only for Finland and Sweden. The access percentage is higher in Finland. The differences between different population groups seem to be smaller with mobile phones than with computer or Internet. Younger age groups have higher access rates that older and in age group 16-29 the access percentage is 100 in Finland. Other differences between different groups are also similar to differences in computer and Internet access. In the next chapters we examine which of these demographic and regional factors come out as significant in multivariate analysis. The micro data used in the Finnish analysis is different from the one used in tables 1-3.

*Table 1. Access to computer at home by individual or household characteristics in the FINS countries %*

| **Individual 2002** | Finland | Sweden | **Household 2000** | Netherlands | Ireland |
|---|---|---|---|---|---|
| All | 63 | 75 | All | 70 | 32 |
| Capital province | | | Capital province | 69 | 38 |
| **Household size** | | | **Household size** | | |
| 1 | 38 | 55 | 1 | 37 | |
| 2 | 52 | 68 | 2 | 56 | |
| 3 | 75 | 89 | 3 | 79 | |
| 4+ | 87 | 93 | 4+ | 89 | |
| **Family type** | | | **Family type** | | |
| No children | 56 | | No children | 51 | |
| With children | 84 | | With children | 86 | |
| **Gender** | | | **Gender** | Breadwinner | Interviewed |
| Male | 64 | 77 | Male | 73 | 34 |
| Female | 62 | 74 | Female | 50 | 31 |
| **Age** | | | **Age** | Breadwinner | Interviewed |
| 16-29 | 76 | 83 | <19 | 65 | 27 |
| 30-49 | 74 | 88 | 19-24 | 66 | |
| 50-59 | 60 | 75 | 25-30 | 73 | 33 |
| 60-74 | 28 | 44 | 31-34 | 81 | |
| | | | 35-40 | | 47 |
| | | | 41-44 | 87 | |
| | | | 45-50 | | 46 |
| | | | 51-54 | 72 | |
| | | | 55-60 | | 30 |
| | | | 61-64 | 27 | |
| | | | >65 | | 9 |
| **Education** | | | **Education** | Breadwinner | Interviewed |
| Primary | 51 | 59 | Primary | 41 | |
| Secondary | 63 | 78 | Secondary | 60 | |
| Tertiary | 80 | 89 | MAVO/vWO3 | 65 | |
| | | | HAVO/vWO/MBO | 76 | |
| | | | University/HBO | 88 | |
| **Employment** | | | **Employment** | Breadwinner | Interviewed |
| Employed | 71 | 82 | Employed | 82 | 43 |
| Student | 83 | 89 | Unemployed | 54 | 24 |
| Retired | 28 | 38 | Retired | 21 | 21 |
| Other | 50 | 72 | Unfit for employment | 49 | |

Sources: The Digital Economy 2002, Quarterly national household survey, Determinantenonderzoek, Nordic information society statistics 2002.

*Table 2. Access to Internet at home by individual or household characteristics in the FINS countries %*

| **Individual 2002** | Finland | Sweden | **Household 2000** | Netherlands | Ireland |
|---|---|---|---|---|---|
| All | 53 | 68 | All | 45 | 20 |
| Capital province | 62 | 70 | Capital province | 47 | 25 |
| **Household size** | | | **Household size** | | |
| 1 | 29 | 46 | 1 | 21 | |
| 2 | 42 | 60 | 2 | 35 | |
| 3 | 65 | 84 | 3 | 50 | |
| 4+ | 75 | 85 | 4+ | 57 | |
| **Family type** | | | **Family type** | | |
| No children | 46 | | No children | 32 | |
| With children | 71 | | With children | 55 | |
| **Gender** | | | **Gender** | Breadwinner | Interviewed |
| Male | 55 | 69 | Male | 47 | 22 |
| Female | 51 | 66 | Female | 29 | 19 |
| **Age** | | | **Age** | Breadwinner | Interviewed |
| 16-29 | 59 | 76 | <19 | 37 | 14 |
| 30-49 | 64 | 80 | 19-24 | 36 | |
| 50-59 | 52 | 69 | 25-30 | 50 | 22 |
| 60-74 | 25 | 36 | 31-34 | 53 | |
| | | | 35-40 | | 30 |
| | | | 41-44 | 57 | |
| | | | 45-50 | | 30 |
| | | | 51-54 | 44 | |
| | | | 55-60 | | 18 |
| | | | 61-64 | 14 | |
| | | | >65 | | 5 |
| **Education** | | | **Education** | Breadwinner | Interviewed |
| Primary | 44 | 50 | Primary | 20 | |
| Secondary | 50 | 70 | Secondary | 29 | |
| Tertiary | 69 | 82 | MAVO/vWO3 | 38 | |
| | | | HAVO/vWO/MBO | 48 | |
| | | | University/HBO | 66 | |
| **Employment** | | | **Employment** | Breadwinner | Interviewed |
| Employed | 61 | 75 | Employed | 54 | 28 |
| Student | 66 | 81 | Unemployed | 28 | 13 |
| Retired | 26 | 29 | Retired | 10 | 12 |
| Other | 39 | 60 | Unfit for employment | 22 | |

Sources: The Digital Economy 2002, Quarterly national household survey, Determinantenonderzoek, Nordic information society statistics 2002.

*Table 3. Access to mobile phone at home by individual characteristics in Finland and Sweden %*

| **Individual 2002** | Finland | Sweden |
|---|---|---|
| All | 94 | 89 |
| Capital province | | |
| **Household size** | | |
| 1 | 83 | |
| 2 | 93 | |
| 3 | 98 | |
| 4+ | 99 | |
| **Family type** | | |
| No children | 92 | |
| With children | 99 | |
| **Gender** | | |
| Male | 95 | 92 |
| Female | 92 | 87 |
| **Age** | | |
| 16-29 | 100 | |
| 30-49 | 98 | |
| 50-59 | 95 | |
| 60-74 | 76 | |
| **Education** | | |
| Primary | 90 | |
| Secondary | 95 | |
| Tertiary | 95 | |
| **Employment** | | |
| Employed | 97 | |
| Student | 99 | |
| Retired | 74 | |
| Other | 93 | |

Source: Nordic information society statistics 2002.

# 4. Computer ownership and Internet access among Dutch households

Van den Veen (2003) conducted a study on PC possession, Internet access and electronic shopping amongst the Dutch households. This chapter summarises the results gained concerning PC possession and Internet access. The results are based on logit regression analysis on Dutch CBS household survey data which consists of 37000 records in year 2000. The method is discussed more in appendix 1. As explanatory variables household income and composition, age, education level, gender and social position of the breadwinner (the person with the highest income) and province were used.

Van den Veen (2003) found out that PC possession and Internet access are best explained by the educational level of the bread-winner in the household. The higher the educational level of the bread-winner, the higher the chance of PC and Internet access is. The composition of the household and the household income level are the second and third best explanatory variables concerning PC possession. Internet access within households is best explained by the educational level of the bread-winner and the household's income. In general: the higher the household income the higher the chance for PC possession and Internet access. There's a nod in the second income decile: students have low incomes but high percentages of PCs and Internet.

There are big differences in Internet access between the 12 Dutch provinces, but the province is not very important in explaining Internet access. These differences are mostly related to demographic factors.

An additional analysis was conducted concerning the influence of the composition of the household on PC possession. Because the household composition includes a lot of information, it's possible that only certain aspects within the household composition explain PC possession. Both household size and the presence of children are relevant factors. However, the explanatory power of these two aspects alone cannot account for the entire explanatory power of the household composition. The size of the household and the presence of children are found to be powerful alternative explanations, but these partial aspects of the composition of the household are not that important that these should be mentioned separately. So, one should just mention the composition of the household as a whole.

Singles have a low percentage of PCs; couples with children have a high percentage of PCs; one parent families and couples without children are in between. The presence of children within the household increases the chance of PC possession. The biggest positive contribution is made by the presence of two children and children in the age 12-18 years. When a PC is present within the

household, the presence of children exerts a small positive influence on having Internet access.

Every increase in household size enlarges the chance for PC possession, until more than 4 persons are in the household. The same applies for every increase of the number of children, where the line is at more than 2 children. A household configuration of 2 parents and 2 children applies to both characteristics.

In the whole data 44 percentage of the variation in PC possession is explained by the determinants Educational level bread-winner, Household composition and Household income (Nagelkerke $R^2$=0.44). The analysis of PC possession by singles presents $R^2$=0.45. This means that PC possession among singles can be explained just as well as PC possession among the whole Dutch population. Among singles, age determines PC possession and Internet access. The importance of the bread-winner's age decreases when the household size increases. In this case, characteristics of other persons in the household can become more relevant.

Having a PC is necessary condition for having access to the Internet. For this reason determinants of PC possession are also relevant for Internet access. However, their role is domain restricting. When someone has a PC, the question remains which factors explain having Internet access.

# 5. Computer, modem and mobile phone ownership among Finnish households

This section has links to a project in Government Institute for Economic Research (VATT) which studies income and consumption at households at national and regional level. The results presented in here are based on logit regression analysis conducted on Finnish household budget survey which consists of 4359 household records in year 1998. The accepted data includes 63,4 percent of the observations in the net sample. For more about the data see for example (Ahlqvist and Pajunen 2000). All the explanatory variables used here are dummy variables. The variables and their reference groups are presented in appendix 3.

The ownership of PC, modem and mobile phone was explained with region, household composition and income and education level and social position of the interviewee. The data did not include income information on individual level inside the households. Thus the education level and social position of the interviewee had to be used instead that of the breadwinner.

The central results concerning chapters 5.1 - 5.3 are presented in appendix 4 and the results for chapter 5.4 are in appendix 5. If the estimates B are positive (negative) then the probability of owning a computer increases (decreases) if the household or interviewee belongs to the group indicated by the variable in question instead of the reference group. Only the estimates with the same reference group can be compared with each other. Because of some problems in the model diagnostics that are presented in appendix 2, there is no reason to present the marginal effects. It is assumed these problems do not affect the direction of the effect the explanatory variables have on the dependent variable.

## 5.1 The ownership of PC among Finnish households

In the analysis on the ownership of PC, there were 29 explanatory dummy variables of which 24 were statistically significant. Of the regional variables, the ones concerning MUTEIS-project especially, that is Helsinki and Oulu, living in the Helsinki metropolitan area or in the Northern Ostrobothnia province did not have a statistically significant effect. On the other hand living in an urban municipality did have a positive effect on the probability of owning a computer compared to living in a rural municipality. The probability of owning a computer increased if household was not an elderly household. The effect was largest in households with children. The change was not statistically significant in one-person households (under 65y.). Low income decreases the probability of owning a computer. The change was not significant for the ninth decile compared to the tenth. The income effect is not monotonic for the three lowest deciles. Having

some education compared to basic or no education increases the probability. The education effect is monotonic as the probability increases with more education. The probability of owning a computer increased if the interviewee was not a pensioner. The change was significant in all the social positions except with unemployed.

38 percent of the variation in PC possession is explained by the explanatory variables (The Nagelkerke $R^2$ = 0,38). The model predicts 75 % of the observations correctly when the cut value is set at 0,5. The prediction is more accurate (86,9 %) if the household does not own a computer.

## 5.2 The ownership of modem among Finnish households

The ownership of PC is a necessary condition for owning a modem, thus the results when the ownership of modem is explained are very similar to those when the ownership of computer is explained. There are some differences with the results in chapter 5.1. Income is more important factor for modem ownership than for PC ownership, as all the income decile variables were significant. Now also the change from elderly to one-person household was significant. Lower secondary education did not increase the probability of modem ownership compared to basic education significantly but all higher educations did. Nagelkerke $R^2$ = 0,27, which means that 27 percentage of the variation in PC possession is explained by the explanatory variables. The model predicts 82,5 % of the observations correctly. The prediction is very accurate (96 %) if the household does not own a modem but poor (24,2 %) if it does.

To get better understanding about the effect that region and demographic factors have on the modem ownership the regression is conducted on a sample (n = 1523) that includes only the PC owners. Now only income and being self employed made a significant difference. Among the PC owners, belonging to a lower income decile decreased the probability of owning also a modem. Being self employed instead of pensioner increased that probability but the change to other social positions did not make a difference. Region, household composition and education were irrelevant. Nagelkerke $R^2$ = 0,09 and the model predicts 61,1 % of the observations correctly.

## 5.3 The ownership of mobile phone among Finnish households

In the analysis on the ownership of PC, there were 22 statistically significant variables. Nagelkerke $R^2$=0,27. The model predicts 75 % of the observations correctly. The prediction is more accurate (89,5 %) if the household owns a mobile phone. The region and degree of urbanization did not have a statistically significant effect. The probability of owning a mobile phone increased if

household was not an elderly household. The change was significant in all the household types. Low income decreases the probability of owning a mobile phone. Again the income effect was not monotonic for the lowest deciles. Very surprisingly university education compared to basic education did not increase that probability, but lower education compared to no or basic education did. The probability of owning a computer increased if the interviewee was not a pensioner. The change was significant in all the social positions.

## 5.4 The ownership of PC, modem and mobile phone among Finnish one person households

To be better able to analyse the effects that age and gender have on the ownership of PC, modem and mobile phone the regressions were run with a new sample (n = 957) that includes only the households that have one person. The household composition variables are dropped and age and gender dummies as presented in appendix 3 are included.

In the analysis of PC ownership among all one-person households, the region, degree of urbanization and income were not statistically significant. Higher education excluding lower secondary education increased the probability of owning a computer compared to basic or no education. Of social position only being a student increased that probability significantly compared to pensioners. Belonging to age group 25-34 or 45-54 increased that probability compared to being over 64. Males had clearly higher probability of owning a computer than females among one-person households. Nagelkerke $R^2$ = 0,39. The model predicts 87,9 % of the observations correctly. The prediction is very accurate (97,1 %) if the household does not own a computer but quite poor (29,8 %) if it does.

In the analysis of modem ownership among all one-person households, only gender was statistically significant. Being male clearly increased the probability of owning a modem among one-person households. Nagelkerke $R^2$ = 0,37. The model predicts 94,5 % of the observations correctly. The prediction is very accurate (99,3 %) if the household does not own a modem but quite poor (13 %) if it does.

In the analysis of mobile phone ownership among all one-person households, the region, degree of urbanization and education were not statistically significant. Income seemed to have some effect as higher income increased the probability of owning a mobile phone. That increase was significant in third, fifth, sixth and seventh decile compared to the first. The results concerning social position are quite different from the case of computer ownership. Now all other positions except being a student increased the probability significantly compared to pensioners. Belonging to a younger age group increased the probability clearly

compared to being over 64. Males had higher probability of owning a mobile phone than females among one-person households. Nagelkerke $R^2$ = 0,43. The model predicts 75,5 % of the observations correctly.

# 6. Access to computer, Internet and mobile phone among Swedish individuals

The results presented in here are based on logit regression analysis on the Swedish survey on individual ICT access and use 2002. The data consists of 4404 records in year 2002. The data was provided and the analysis conducted in Jönköping International Business School. The results are presented here for the first time.

The data is stratified depending on age, education and gender and random selection was made for each stratum. That would call for modelling the stratified factor for two reasons. First, there may be parameter differences between different strata and thus omission of the stratum variable may bias the estimates of the model parameters. Second, we may get misleading population estimates. However taking into account the model diagnostics in appendix 2, we can suspect that the estimates are biased anyhow. Thus we choose to avoid the problem of correct weighting and run the regressions just as if a random sample was in question. It is assumed that this failure does not affect the direction of the effect the explanatory variables have on the dependent variable.

The questionnaire included four possible answers for questions do you have access to PC(or laptop)/mobile phone/Internet at home. They were yes, no, don't know, don't want to tell. The last two answers are excluded from the data as missing values to get the dependent variable as well defined as possible. This causes possible problems as the probability of a value being missing may differ over individuals by depending on the values of other variables for the individuals or on the value that would have been observed (Aitkin et al. 1989). Again it is assumed that this possible failure does not affect the direction of the effect the explanatory variables have on the dependent variable.

The access to computer/Internet/mobile phone at home was explained with regional and demographic variables. For the regional variables Stockholm municipality and the Jönköping province were chosen, because they are of interest to the MUTEIS project. The demographic variables include household income and number of person in the household and social position, age, gender and education level of the interviewed individual. All the explanatory variables used here are dummy variables. The variables and their reference groups are presented in appendix 6. The results of the analyses of chapters 6.1 - 6.3 are presented in appendix 7.

## 6.1 Access to computer at home among Swedish individuals

In the analysis on the access to computer, there were 22 explanatory dummy variables of which 16 were statistically significant. The regional variables did not have a statistically significant effect. The probability of having access to a computer at home increased if household size increased from one. High income increased the probability of having access to a computer but only at the two highest quartiles compared to the lowest. Having upper secondary school education or higher compared to lower education increased the probability. Gender did not have statistically significant effect. Age did have a significant effect. Belonging to younger age group increased the probability. Age, income and education effects seem to be monotonic. Being a wage earner, self-employed or a student increased the probability compared to pensioners.

The sample size was 3088. Nagelkerke $R^2$=0,37, which means that 37 percentage of the variation in access to PC at home is explained by the explanatory variables. The model predicts 84 % of the observations correctly. The prediction is more accurate (95,5 %) if the household does have access to computer.

## 6.2 Access to Internet among Swedish individuals

In the analysis on the access to Internet, there were 22 explanatory dummy variables of which 18 were statistically significant. Of the regional variables Jönköping province did not have a statistically significant effect but living in Stockholm increased the probability of having access to Internet at home. The probability increased if household size increased from one. High income increased the probability of having access to the Internet but only at the two highest quartiles compares to the lowest. Having upper secondary school education or higher compared to lower education increased the probability. Being male increased the probability. Age did have a significant effect. Belonging to younger age group increased the probability. Being a wage earner, self-employed or a student increased the probability compared to pensioners. Again age, income and education effects seem to be monotonic. The sample size was 3083. Nagelkerke $R^2$=0,36. The model predicts 78,5 % of the observations correctly. The prediction is more accurate (91,6%) if the household does have access to the Internet.

As expected the results of explaining access to computer and access to Internet were very similar with the exceptions of gender and Stockholm. To get better understanding about the effect that region and demographic factors have on the access to Internet the regression was conducted on a sample (n = 2416) that includes only the people with access to PC at home. Now the last income quartile, living in Stockholm, household size three and four, being a wage earner, self-employed or a student made a significant difference. Education and age were

irrelevant. Nagelkerke $R^2$=0,14. The model predicts 89,4 % of the observations correctly.

## 6.3 Access to mobile phone among Swedish individuals

In the analysis on the access to mobile phone, there were seven statistically significant dummy variables. The regional variables did not have a statistically significant effect. The probability of having access to a mobile phone at home increased if household size increased from one to two. High income increased the probability of having access to a mobile phone but only at the two highest quartiles compared to the lowest. Education, social position and gender did not have statistically significant effect. Age did have a significant effect. Belonging to one of the four youngest age groups increased the probability compared to the oldest. Again age, income and education effects seem to be monotonic. The sample size was 1443. Nagelkerke $R^2$=0,29. The model predicts 91,3 % of the observations correctly. The prediction is more accurate (98,6 %) if the household does have access to mobile phone but poor (19,1 %) if it does not.

# 7. Conclusions

The logit models used in this study were fairly simple. In future studies it would be interesting to utilize panel data instead of one year cross section data as done here. Thus the development patterns of innovation diffusion and dynamics of the process could be captured better. Also the cross effects of some variables would be interesting to analyze. Despite its lacks the results of the analyses done here provide valuable insights on the effects that individual and household characteristics have on the probability of having access to new technology.

The results obtained from the analyses of Finland and Sweden are summarized in tables 4 and 5 respectively. The results confirm most of the findings of the Dutch study. The effects of demographic and regional factors to access to computer, Internet and mobile phone were very similar in most respects in all the three countries. As the effects of demographic factors were very similar also in descriptive statistics in all the FINS countries it can be assumed with a reservation that the following common findings apply also to Ireland.

The probability of having access to computer at home is affected by income, education, social position, household type and age. In Finland also being male increased the probability but in Sweden it did not make a difference. Region did not make a statistical difference. The fact that capital areas have a higher concentration of computers is due to demographic differences. In Finland living in an urban municipality increased the probability. Thus in cities computers are adapted easier, but the capital is no special case.

The probability of having access to Internet at home in addition to computer is affected by income. In Sweden also living in the capital, household type and social position mattered but in Finland they did not. Education and age had no significant effect anywhere. In Finland also being male increased the probability but in Sweden it did not make a difference. In Finland region or degree of urbanization did not make a statistical difference.

The probability of having access to a mobile phone at home is affected by income, household type and age. Region did not make a statistical difference anywhere. Social position was an important factor in Finland but not in Sweden. Also education and gender had some effect in Finland but not in Sweden.

It seems that having access to these new technologies is mostly affected by household type, age and income. Elderly folk who live alone face the highest risk of being left out of the information society. Public policies should be directed at that group if the inclusion of all people is the objective. On the other hand this study finds no basis for regional policies concerning the digital divide.

*Table 4. Variable means and summary of statistically significant effects of the Finnish analysis. (Presented as whole data (PC owners for modem)/singles. + (-) means positive (negative) effect)*

| Variable | Mean | PC | Modem | Mobile |
|---|---|---|---|---|
| fcapr | 0,13/0,17 | no/no | no/no | no/no |
| fnuts3ou | 0,07/0,06 | no/no | no/no | no/no |
| furban | 0,56/0,63 | +/no | no/no | no/no |
| fdense | 0,16/0,13 | +/no | no/no | no/no |
| fophh | 0,15/- | no/NA | no/NA | +/NA |
| fcwchh | 0,21/- | +/NA | no/NA | +/NA |
| fsphh | 0,04/- | +/NA | no/NA | +/NA |
| ftpfchh | 0,32/- | +/NA | no/NA | +/NA |
| fohh | 0,13/- | +/NA | no/NA | +/NA |
| finc1 | 0,07/0,27 | -/ref. | -/ref. | -/ref. |
| finc2 | 0,06/0,22 | -/no | no/no | -/no |
| finc3 | 0,07/0,19 | -/no | -/no | -/+ |
| finc4 | 0,08/0,14 | -/no | -/no | -/no |
| finc5 | 0,09/0,08 | -/no | no/no | -/+ |
| finc6 | 0,11/0,05 | -/no | no/no | -/+ |
| finc7 | 0,12/0,03 | -/no | -/no | -/+ |
| finc8 | 0,13/0,01 | -/no | -/no | -/no |
| finc9 | 0,13/0,01 | no/no | -/no | no/no |
| finc10 | 0,14/0,00 | ref./no | ref./no | ref./no |
| feduc2 | 0,27/0,22 | +/no | no/no | +/no |
| feduc3 | 0,18/0,20 | +/+ | no/no | +/no |
| feduc4 | 0,06/0,05 | +/+ | no/no | +/no |
| feduc5 | 0,03/0,02 | +/+ | no/no | no/no |
| feduc6 | 0,07/0,05 | +/+ | no/no | no/no |
| fsoc1 | 0,10/0,04 | +/no | +/no | +/no |
| fsoc2.1 | 0,25/0,14 | +/no | no/no | +/+ |
| fsoc2.2 | 0,17/0,15 | +/no | no/no | +/+ |
| fsoc2.3 | 0,15/0,07 | +/no | no/no | +/+ |
| fsoc4 | 0,03/0,10 | +/+ | no/no | +/no |
| fsoc5 | 0,06/0,09 | no/no | no/no | +/+ |
| fgenderm | -/0,59 | NA/+ | NA/+ | NA/+ |
| fage1 | -/0,13 | NA/no | NA/no | NA/+ |
| fage2 | -/0,15 | NA/+ | NA/no | NA/+ |
| fage3 | -/0,10 | NA/no | NA/no | NA/+ |
| fage4 | -/0,16 | NA/+ | NA/no | NA/+ |
| fage5 | -/0,14 | NA/no | NA/no | NA/+ |

*Table 5.* *Variable means and summary of statistically significant effects of the Swedish analysis. (Presented as whole data/PC owners. + (-) means positive (negative) effect)*

| **Variable** | **Mean** | **PC** | **Modem** | **Mobile** |
|---|---|---|---|---|
| seduc2 | 0,41/0,42 | + | +/no | no |
| seduc3 | 0,24/0,30 | + | +/no | no |
| sage1 | 0,18/0,22 | + | +/no | + |
| sage2 | 0,17/0,20 | + | +/no | + |
| sage3 | 0,18/0,20 | + | +/no | + |
| sage4 | 0,17/0,19 | + | +/no | + |
| sage5 | 0,16/0,15 | + | +/no | no |
| sgenderm | 0,50/0,51 | no | +/no | no |
| smstockh | 0,35/0,34 | no | +/+ | no |
| spjönk | 0,03/0,04 | no | no/no | no |
| sperhh2 | 0,24/0,30 | + | +/no | + |
| sperhh3 | 0,12/0,20 | + | +/+ | no |
| sperhh4 | 0,14/0,23 | + | +/+ | no |
| sperhh5 | 0,08/0,13 | + | +/no | no |
| ssoc1 | 0,05/0,07 | + | +/+ | no |
| ssoc2 | 0,39/0,59 | + | +/+ | no |
| ssoc4 | 0,13/0,21 | + | +/+ | no |
| ssoc5 | 0,02/0,03 | no | no/no | no |
| ssoc6 | 0,02/0,02 | no | no/no | no |
| sinc2 | 0,08/0,07 | no | no/no | no |
| sinc3 | 0,16/0,22 | + | +/no | + |
| sinc4 | 0,29/0,46 | + | +/+ | + |

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# *Appendix*

*Appendix 1. The logit model*

The logit model in all the regressions in this study is of the following form.

$$(1) \qquad \Pr ob(Y=1) = \frac{\exp(\boldsymbol{\beta}'\mathbf{x})}{1+\exp(\boldsymbol{\beta}'\mathbf{x})}$$

Y is the (nx1) vector of observations. $Y_i = 1$ if household (/individual) i owns (/has access to) a computer (or Internet or a mobile phone), $Y_i = 0$ if not. β is the vector (Kx1) of parameters that reflect the impact of changes in explanatory variables X on the probability. K is the number of explanatory variables.

In nonlinear models like logit, a change in the value of explanatory variable causes a different change in the probability P(Y=1), depending on its own value and the value of other explanatory variables. Thus there is no direct interpretation for the estimates B. We can only comment on the direction of the effect and its statistical significance. The marginal effects can be calculated in the following way. For the effect of explanatory variables on the binary dependent variable applies

$$(2) \qquad \frac{\partial P(Y=1)}{\partial \mathbf{x}} = \left\{ \frac{dF(\boldsymbol{\beta}'\mathbf{x})}{d(\boldsymbol{\beta}'\mathbf{x})} \right\} \boldsymbol{\beta} = f(\boldsymbol{\beta}'\mathbf{x})\boldsymbol{\beta},$$

where F is some cumulative distribution function and f is the corresponding density function. The marginal effect of single explanatory variable is

$$(3) \qquad \frac{\partial P(Y=1)}{\partial x_k} = f(\boldsymbol{\beta}'\mathbf{x})\beta_k .$$

Thus it is dependent on the values of all the explanatory variables and parameters. In logit models the function F is

$$(4) \qquad \Lambda(\boldsymbol{\beta}'\mathbf{x}) = \frac{\exp(\boldsymbol{\beta}'\mathbf{x})}{1+\exp(\boldsymbol{\beta}'\mathbf{x})}$$

and thus the function f is

$$(5) \qquad \frac{d\Lambda(\boldsymbol{\beta}'\mathbf{x})}{d(\boldsymbol{\beta}'\mathbf{x})} = \frac{\exp(\boldsymbol{\beta}'\mathbf{x})}{[1+\exp(\boldsymbol{\beta}'\mathbf{x})]^2} = \Lambda(\boldsymbol{\beta}'\mathbf{x})[1-\Lambda(\boldsymbol{\beta}'\mathbf{x})].$$

Thus the marginal effects of the explanatory variables X in the logit model are of the form

$$(6) \qquad \frac{\partial P(Y=1)}{\partial \mathbf{x}} = \Lambda(\boldsymbol{\beta}'\mathbf{x})[1-\Lambda(\boldsymbol{\beta}'\mathbf{x})]\boldsymbol{\beta}.$$

Because the marginal effects depends on the values of all the explanatory variables some sensible values should be chosen at which point the effect is reported. It is common to use the sample mean. In this study only dummy variables are used. The marginal effect for those is calculated in the following way. Logit model can be written in the form

$$(7) \qquad P(Y=1 \mid \mathbf{x}^*, d) = \Lambda(\boldsymbol{\beta}_1'\mathbf{x}^* + \beta_2 d).$$

Thus the change in variable d from 0 to 1 when all the other explanatory variables are on their average $\bar{\mathbf{x}}^*$ has the following effect

$$(8) \qquad P(Y=1 \mid \bar{\mathbf{x}}^*, d=1) - P(Y=1 \mid \bar{\mathbf{x}}^*, d=0) = \Lambda(\hat{\boldsymbol{\beta}}_1'\bar{\mathbf{x}}^* + \hat{\beta}_2) - \Lambda(\hat{\boldsymbol{\beta}}_1'\bar{\mathbf{x}}^*).$$

This formula can be used to calculate the marginal effects. As we have many different models in this study this would require a lot of effort and also space to present the results. There are also some problems with the model as we can see from the diagnostics below. Thus the marginal effect could easily be biased. The direction is less vulnerable. Thus in this study we only report the direction of the effect the explanatory variables have on the dependent variable and their statistical significance.

*Appendix 2. The model diagnostics*

The diagnostics of all the models in appendixes 4, 5 and 7 can be commented on simultaneously. Because of the space limit the actual diagnostics are not presented here, just the conclusions. There is reason to suspect multicollinearity because many of the explanatory variables are statistically significantly correlated with some others. However the collinearity diagnostics of SPSS-program showed that these correlations do not cause a problem in our analysis.

Heteroskedasticity was checked by drawing scatter plots of standardized residuals gained from the regressions against the explanatory variables. All of the variables in our analysis were dummy variables but the original variables from which they were generated different in type. For example income is originally continuous, education is ordinal and household composition is nominal variable. Thus checking for possible heteroskedasticity with the explanatory variables actually used in the analysis is useful for only nominal variables. Heteroskedasticity is harder to notice with dichotomous variables than with continuous variables. There was no clear enough evidence of heteroskedasticity in any of the variables that would call for corrective actions.

The large amount of variables in the models here causes reason to suspect model over-specification. Also quite high $R^2$-statistics suggests this. However, this possible problem is neglected as we want to keep our dummy grouping quite specific for theoretical reasons.

The regressions were also run after omitting extreme values. This didn't change the results or improve the model fit much. And more importantly there was no to reason suspect that the extreme observations were wrongly recorded. The common characteristic in these observations was that they were elderly households with one member who owned computer or modem. Thus the original model is preferred.

Misspecification of the probability distribution for y leads to inappropriate estimates for the parameters. Examination of the data for failure of this assumption is through a probability plot (Q-Q plot) of the standardized residuals against the normal quantiles. If the probability distribution is correctly specified, the plot should be roughly a straight line. (Aitkin et al. 1989.) In all the models here the probability distribution is not correctly specified as the residuals are clearly systematically curved. Thus our estimates for the parameters are inappropriate. This is a very serious default in the models here but even so it is accepted. Because of this failure there is no reason to present the marginal effects. It is assumed that this failure does not affect the direction of the effect the explanatory variables have on the dependent variable.

*Appendix 3. The explanatory variables and their reference groups in the Finnish analysis (Variables according to the representative person or the interviewed household)*

| **Variable label** | **Variable meaning** | **Reference group** |
|---|---|---|
| | | |
| fcapr | Capital region | Rest of the country |
| fnuts3ou | Nuts 3 Northern Ostrobothnia | |
| | | |
| furban | Urban municipality | Rural municipalities |
| fdense | Densely populated municipality | |
| | | |
| fophh | One-person household (under 65y.) | |
| fcwchh | Couple without children | |
| fsphh | Single-parent household | Elderly households |
| ftpfchh | Two-parent family with children | |
| fohh | Other households | |
| | | |
| finc1 | Household disposable income 1.decile | 10.income decile |
| … | | (appendix 2) |
| finc10 | – 10.decile | 1. income decile |
| | | (appendix 3) |
| feduc2 | Lower secondary education | |
| feduc3 | Upper secondary education | |
| feduc4 | Vocational college education | Basic or no education |
| feduc5 | Lower university or polytechnic degree | |
| feduc6 | Higher university or doctorate degree | |
| | | |
| fsoc1 | Self-employed | |
| fsoc2.1 | Wage earners | |
| fsoc2.2 | Lower-level salaried employees | Pensioners |
| fsoc2.3 | Upper-level salaried employees | |
| fsoc4 | Students and schoolchildren | |
| fsoc5 | Unemployed and others not working | |
| | | |
| fgenderm | Gender male | females |
| | | |
| fage1 | Age < 25 | |
| fage2 | Age 25-34 | |
| fage3 | Age 35-44 | People aged over 64 |
| fage4 | Age 45-54 | |
| fage5 | Age 55-64 | |

*Appendix 4. The ownership of computer, modem and mobile phone among Finnish households*

| | **PC** | | **Modem** | | **Mobile phone** | | **Modem** | |
|---|---|---|---|---|---|---|---|---|
| N | 4359 | | 4359 | | 4359 | | 1523 | |
| Data | All households | | All households | | All households | | Households that own PC | |
| Nagelkerke $R^2$ | ,381 | | ,272 | | ,269 | | ,091 | |
| | | | | | | | | |
| **Variables** | **B** | **Sig.** | **B** | **Sig.** | **B** | **Sig.** | **B** | **Sig.** |
| fcapr | ,150 | ,205 | ,149 | ,259 | ,173 | ,143 | ,075 | ,637 |
| fnuts3ou | -,048 | ,742 | ,006 | ,969 | -,144 | ,294 | ,042 | ,836 |
| furban | ,375 | ,000 | ,309 | ,007 | ,119 | ,182 | ,097 | ,497 |
| fdense | ,259 | ,031 | ,222 | ,106 | ,207 | ,067 | ,018 | ,917 |
| fophh | ,482 | ,066 | ,859 | ,024 | ,798 | ,000 | ,736 | ,148 |
| fcwchh | 1,248 | ,000 | 1,315 | ,000 | 1,341 | ,000 | ,486 | ,274 |
| fsphh | 1,931 | ,000 | 1,570 | ,000 | 1,184 | ,000 | ,176 | ,729 |
| ftpfchh | 1,949 | ,000 | 1,817 | ,000 | 1,237 | ,000 | ,473 | ,283 |
| fohh | 1,229 | ,000 | 1,316 | ,000 | ,881 | ,000 | ,450 | ,312 |
| finc1 | -,988 | ,000 | -1,351 | ,000 | -1,270 | ,000 | -1,189 | ,011 |
| finc2 | -1,170 | ,000 | -1,222 | ,001 | -1,343 | ,000 | -,741 | ,106 |
| finc3 | -1,076 | ,000 | -1,407 | ,000 | -1,048 | ,000 | -1,219 | ,001 |
| finc4 | -1,126 | ,000 | -1,130 | ,000 | -1,136 | ,000 | -,706 | ,028 |
| finc5 | -1,031 | ,000 | -,940 | ,000 | -,895 | ,000 | -,426 | ,114 |
| finc6 | -,939 | ,000 | -,798 | ,000 | -,478 | ,003 | -,394 | ,088 |
| finc7 | -,922 | ,000 | -,880 | ,000 | -,497 | ,002 | -,541 | ,007 |
| finc8 | -,590 | ,000 | -,672 | ,000 | -,452 | ,004 | -,524 | ,004 |
| finc9 | -,238 | ,083 | -,368 | ,006 | -,191 | ,221 | -,379 | ,019 |
| feduc2 | ,204 | ,042 | ,183 | ,140 | ,281 | ,003 | ,038 | ,814 |
| feduc3 | ,934 | ,000 | ,658 | ,000 | ,466 | ,000 | ,062 | ,715 |
| feduc4 | ,982 | ,000 | ,500 | ,007 | ,334 | ,045 | -,204 | ,358 |
| feduc5 | 1,405 | ,000 | ,505 | ,030 | ,201 | ,385 | -,389 | ,136 |
| feduc6 | 1,774 | ,000 | 1,142 | ,000 | -,152 | ,393 | ,128 | ,557 |
| fsoc1 | 1,066 | ,000 | 1,420 | ,000 | ,438 | ,004 | ,952 | ,001 |
| fsoc2.1 | ,536 | ,001 | ,482 | ,029 | ,842 | ,000 | ,016 | ,954 |
| fsoc2.2 | ,818 | ,000 | ,735 | ,001 | ,833 | ,000 | ,069 | ,805 |
| fsoc2.3 | 1,099 | ,000 | 1,160 | ,000 | ,568 | ,001 | ,533 | ,057 |
| fsoc4 | 1,793 | ,000 | ,905 | ,014 | 1,880 | ,000 | -,568 | ,193 |
| fsoc5 | ,221 | ,326 | ,412 | ,162 | ,438 | ,010 | ,303 | ,438 |
| Constant | -2,702 | ,000 | -3530 | ,000 | -,468 | ,010 | -,314 | ,462 |

| **Classification tables (Cut value 0,50)** | | | |
|---|---|---|---|
| **Observed** | **Predicted** | | |
| **PC** | 0 | 1 | Percentage correct |
| 0 | 2464 | 372 | 86,9 |
| 1 | 718 | 805 | 52,9 |
| Overall percentage | | | 75,0 |
| **Modem** | 0 | 1 | Percentage correct |
| 0 | 3400 | 142 | 96,0 |
| 1 | 619 | 198 | 24,2 |
| Overall percentage | | | 82,5 |
| **Mobile phone** | 0 | 1 | Percentage correct |
| 0 | 712 | 796 | 47,2 |
| 1 | 298 | 2553 | 89,5 |
| Overall percentage | | | 74,9 |
| **Modem (if PC)** | 0 | 1 | Percentage correct |
| 0 | 427 | 291 | 59,5 |
| 1 | 301 | 504 | 62,6 |
| Overall percentage | | | 61,1 |

*Appendix 5. The ownership of computer, modem and mobile phone among Finnish one-person households (of all ages)*

| | **PC** | | **Modem** | | **Mobile phone** | |
|---|---|---|---|---|---|---|
| N | 957 | | 957 | | 957 | |
| Data | Number of persons in household = 1. | | Number of persons in household = 1. | | Number of persons in household = 1. | |
| Nagelkerke | ,385 | | ,370 | | ,432 | |
| **Variables** | **B** | **Sig.** | **B** | **Sig.** | **B** | **Sig.** |
| fcapr | ,234 | ,428 | -,265 | ,525 | -,160 | ,500 |
| fnuts3ou | -,083 | ,875 | -,584 | ,484 | -,235 | ,545 |
| furban | ,385 | ,251 | ,317 | ,528 | ,002 | ,991 |
| fdense | ,030 | ,952 | -,259 | ,717 | ,138 | ,637 |
| finc2 | -,016 | ,969 | ,935 | ,087 | ,465 | ,104 |
| finc3 | ,016 | ,970 | -,202 | ,758 | ,978 | ,001 |
| finc4 | ,099 | ,823 | ,758 | ,207 | ,488 | ,131 |
| finc5 | -,045 | ,929 | ,513 | ,457 | ,820 | ,024 |
| finc6 | -,770 | ,238 | ,340 | ,681 | 1,048 | ,016 |
| finc7 | -1,186 | ,170 | ,819 | ,421 | 1,027 | ,050 |
| finc8 | -1,290 | ,296 | -8,522 | ,893 | ,890 | ,213 |
| finc9 | -,369 | ,775 | 1,148 | ,411 | 1,512 | ,139 |
| finc10 | -1,685 | ,259 | -10,598 | ,943 | 5,843 | ,443 |
| feduc2 | -,110 | ,778 | -,913 | ,149 | ,428 | ,052 |
| feduc3 | 1,109 | ,001 | ,440 | ,374 | ,263 | ,304 |
| feduc4 | 1,068 | ,034 | -,499 | ,575 | -,087 | ,822 |
| feduc5 | 1,741 | ,010 | -1,014 | ,401 | -,291 | ,602 |
| feduc6 | 2,611 | ,000 | 1,124 | ,120 | -,639 | ,192 |
| fsoc1 | ,928 | ,189 | ,424 | ,636 | ,404 | ,393 |
| fsoc2.1 | ,418 | ,477 | -,401 | ,600 | ,702 | ,044 |
| fsoc2.2 | ,965 | ,096 | ,637 | ,403 | ,785 | ,027 |
| fsoc2.3 | ,913 | ,153 | 1,049 | ,199 | 1,224 | ,010 |
| fsoc4 | 1,875 | ,002 | -,193 | ,813 | ,600 | ,192 |
| fsoc5 | ,336 | ,584 | -,320 | ,693 | ,910 | ,011 |
| fgenderm | 1,249 | ,000 | 2,124 | ,000 | ,520 | ,005 |
| fage1 | 1,401 | ,080 | 8,591 | ,544 | 3,666 | ,000 |
| fage2 | 1,514 | ,043 | 8,468 | ,550 | 2,032 | ,000 |
| fage3 | 1,116 | ,146 | 7,695 | ,587 | 1,364 | ,001 |
| fage4 | 1,490 | ,040 | 7,403 | ,601 | 1,084 | ,003 |
| fage5 | ,925 | ,197 | 7,190 | ,612 | ,687 | ,033 |
| Constant | -5,293 | ,000 | -12,553 | ,375 | -2,887 | ,000 |

| **Classification tables (Cut value 0,50)** | | | |
|---|---|---|---|
| **Observed** | **Predicted** | | |
| **PC** | 0 | 1 | Percentage correct |
| 0 | 802 | 24 | 97,1 |
| 1 | 92 | 39 | 29,8 |
| Overall percentage | | | 87,9 |
| **Modem** | 0 | 1 | Percentage correct |
| 0 | 897 | 6 | 99,3 |
| 1 | 47 | 7 | 13,0 |
| Overall percentage | | | 94,5 |
| **Mobile phone** | 0 | 1 | Percentage correct |
| 0 | 436 | 113 | 79,4 |
| 1 | 121 | 287 | 70,3 |
| Overall percentage | | | 75,5 |

*Appendix 6. The explanatory variables and their reference groups in the Swedish analysis (Variables according to the interviewed individual and interviewee's household situation)*

| **Variable label** | **Meaning** | **Reference group** |
|---|---|---|
| | | |
| seduc2<br>school | Upper secondary school | Lower t upper secondary |
| seduc3 | Higher than upper secondary school | |
| | | |
| sage1 | Age < 25 | |
| sage2 | Age 25-34 | |
| sage3 | Age 35-44 | Age > 64 |
| sage4 | Age 45-54 | |
| sage5 | Age 55-64 | |
| | | |
| sgenderm | Male | Females |
| | | |
| smstockh | Stockholm municipality | Rest of the country |
| spjönk | Jönköping province | |
| | | |
| sperhh2 | Number of persons in household 2 | |
| sperhh3 | Number of persons in household 3 | Nr of persons in household 1 |
| sperhh4 | Number of persons in household 4 | |
| sperhh5 | Number of persons in household 5+ | |
| | | |
| ssoc1 | Self-employed | |
| ssoc2 | Wage earners and salaried employees | |
| ssoc4 | Student | Pensioners |
| ssoc5 | Unemployed | |
| ssoc6 | Other social groups | |
| | | |
| sinc2 | Household income before tax 120000-200000 crowns | |
| sinc3 | Household income before tax 200000-320000 cr | Income lower t 120000 cr |
| sinc4 | Household income before tax > 320000 cr | |

*Appendix 7. Access to computer, Internet and mobile phone at home among Swedish individuals*

| | **PC** | | **Internet** | | **Mobile phone** | | **Internet** | |
|---|---|---|---|---|---|---|---|---|
| N | 3088 | | 3083 | | 1443 | | 2416 | |
| Data | Individual (only answers: yes/no) | | Individual (only answers: yes/no) | | Individual (only answers: yes/no) | | Individuals with access to PC at home | |
| Nagelkerke $R^2$ | ,368 | | ,356 | | ,291 | | ,140 | |
| **Variables** | **B** | **Sig.** | **B** | **Sig.** | **B** | **Sig.** | **B** | **Sig.** |
| seduc2 | ,713 | ,000 | ,670 | ,000 | ,116 | ,639 | ,286 | ,131 |
| seduc3 | 1,624 | ,000 | 1,276 | ,000 | ,302 | ,324 | ,417 | ,055 |
| sage1 | 1,785 | ,000 | 1,740 | ,000 | 2,876 | ,000 | ,589 | ,213 |
| sage2 | 1,055 | ,000 | ,949 | ,000 | 2,366 | ,000 | ,351 | ,423 |
| sage3 | ,901 | ,001 | ,711 | ,009 | 1,390 | ,005 | -,111 | ,798 |
| sage4 | ,969 | ,000 | ,848 | ,001 | ,880 | ,045 | ,189 | ,660 |
| sage5 | ,702 | ,002 | ,455 | ,046 | ,387 | ,299 | -,187 | ,617 |
| sgenderm | ,169 | ,117 | ,199 | ,040 | ,367 | ,089 | ,203 | ,155 |
| smstockh | ,090 | ,433 | ,328 | ,002 | -,179 | ,413 | ,487 | ,003 |
| spjönk | -,110 | ,672 | -,121 | ,616 | ,197 | ,742 | ,013 | ,972 |
| sperhh2 | ,676 | ,000 | ,594 | ,000 | ,631 | ,013 | ,381 | ,061 |
| sperhh3 | 1,424 | ,000 | 1,379 | ,000 | ,765 | ,079 | 1,125 | ,000 |
| sperhh4 | 2,002 | ,000 | 1,665 | ,000 | ,668 | ,121 | ,976 | ,000 |
| sperhh5 | 1,734 | ,000 | 1,028 | ,000 | ,196 | ,701 | ,256 | ,322 |
| ssoc1 | ,687 | ,012 | ,795 | ,002 | 1,119 | ,067 | ,943 | ,023 |
| ssoc2 | ,471 | ,027 | ,567 | ,007 | ,329 | ,364 | ,697 | ,040 |
| ssoc4 | 1,397 | ,000 | 1,241 | ,000 | ,256 | ,671 | ,982 | ,019 |
| ssoc5 | ,398 | ,213 | ,541 | ,079 | -,347 | ,550 | ,657 | ,171 |
| ssoc6 | ,435 | ,250 | ,103 | ,762 | ,362 | ,621 | -,131 | ,782 |
| sinc2 | -,083 | ,631 | -,222 | ,181 | -,287 | ,318 | -,270 | ,281 |
| sinc3 | ,505 | ,001 | ,326 | ,023 | ,931 | ,002 | -,098 | ,633 |
| sinc4 | ,918 | ,000 | 1,154 | ,000 | 1,533 | ,000 | 1,049 | ,000 |
| Constant | -2,197 | ,000 | -2,521 | ,000 | -,284 | ,409 | -,026 | ,941 |

| **Classification tables (Cut value 0,50)** | | | |
|---|---|---|---|
| **Observed** | **Predicted** | | |
| **PC** | 0 | 1 | Percentage correct |
| 0 | 283 | 384 | 42,4 |
| 1 | 110 | 2311 | 95,5 |
| Overall percentage | | | 84,0 |
| **Internet** | 0 | 1 | Percentage correct |
| 0 | 412 | 478 | 46,3 |
| 1 | 184 | 2009 | 91,6 |
| Overall percentage | | | 78,5 |
| **Mobile phone** | 0 | 1 | Percentage correct |
| 0 | 25 | 106 | 19,1 |
| 1 | 19 | 1293 | 98,6 |
| Overall percentage | | | 91,3 |
| **Internet (if PC)** | 0 | 1 | Percentage correct |
| 0 | 5 | 254 | 1,9 |
| 1 | 2 | 2155 | 99,9 |
| Overall percentage | | | 89,4 |

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