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ICT and Socio-Economic Exclusion — Source link

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ICT and Socio-Economic Exclusion

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Abstract:

Using an innovative dataset for ICT use for five countries in Europe, we examine the impact and association of ICT on socio-economic exclusion. Using OLS regression we find significant wage premiums for PC and internet usage at the workplace. Following Dinardo/Fortin/Lemieux (1997), we examine the impact of ICT on the distribution of wages. We find that the risk of economic exclusion increases markedly for those not having ICT at the workplace, with the largest effects being found in Britain. To examine the impact of ICT on social exclusion, we create a multi-dimensional index of social exclusion, and also following DFL97, examine the change in the distribution of the exclusion index. Not being able to afford or knowing how to operate a home PC in Britain and Israel is associated with a large increase in the risk of social exclusion.

JEL: **J31, I31, I32**

Keywords: **Exclusion, Wage Differentials, Training**

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1 Introduction

With an estimated fortune of $50 Billion, the richest private person in the world in the year 2002 is William H. Gates, the chairman and CEO of Microsoft Corporation, a maker of computer software and computer operating systems. Virtually every person in the world has been touched in some way by his products. In fact many of today's nouveau-riche (and in more recent times, nouveau-pauvre!) are indeed in the computer industry. The increase in computer productivity has been documented exhaustively. However, how does this increase in computer productivity spill over into increased labour productivity? Perhaps only a certain few individuals have access to the same computer skills required to create computer operating systems as William Gates, and therefore only a certain few gain in the productivity gains, leaving many somehow excluded from the benefits. It seems today that computers have penetrated all aspects of society. Booking flight and rail tickets over the internet, purchasing music through large discount volume sellers and even ordering and paying for goods using a mobile phone have become as commonplace as any other standard technological innovation in the past. It seems almost impossible to live without computers today.

This chapter examines the role of computers, the internet and mobile phones in economic and social exclusion. For instance, those who have computer skills may have better prospects in a labour market geared toward a production technology depending on computers, thereby earning more than those who do not have these skills. Furthermore, there may be some differential effects depending on whether one is very poor or very rich, not just simply an "average" person. Perhaps computers have become so important in society that "being without" implies some particularly bad hardship. In today's information society, not having access to information means not being informed of current events, access to inexpensive goods, better opportunities in the job market, etc. Perhaps today's "haves" and "have-nots" can be defined by access to computers, the internet and mobile phones.

Firstly, we will examine information technology and its relation to "economic exclusion". We will present results from earnings regressions which identify the mean effects. Then we examine the distributional effects of information and communication technology (ICT) usage. We can create some counterfactual scenarios to answer the questions:

(a) What would an average person's wage look like if he/she were to use (not use) a PC at the workplace?

(b) What would a particularly poor (rich) person's wage look like if he/she were to use (not use) a PC at the workplace?

(c) How would the distribution of labour earnings change if one removed the positive productivity effects of ICT from the distribution?

Next we examine the role of ICT on non-monetary aspects of exclusion, namely so-called "social exclusion". We focus on a host of goods and characteristics which would be beneficial to somebody, such as having a large apartment, owning a computer at home, having a mobile phone or perhaps other consumer durables, being well educated, in good contact with friends and family, etc. From these characteristics, one can construct an index of social exclusion and ask very similar questions:

(d) What does the distribution of social exclusion index look like? What percentage of persons are well below the median, i.e. the ones we should be potentially concerned about as social scientists?

(e) What would this exclusion index look like, if one did not have access to various ICT items (i.e. creating counterfactual scenarios)?

(f) Would the probability of falling into the lower end of the distribution increase (increased risk of social exclusion) and by how much?

For each section, we briefly review the relevant literature to provide a benchmark for the analysis. Then results coming directly out of the **e-Living** analysis are presented and conclusions are drawn.

2 ICT Use and Economic Exclusion

In the United States, the 1980s witnessed a widening in earnings inequality both across skill groups and within narrowly defined groups of workers. The interpretation of these changes dominating the labor literature is an explanation in terms of skill-biased technological change within industries. This refers to the increase in relative demand by firms for highly educated workers as compared to the lower educated. With the growing importance of computers at the workplace and in society in general, this could have profound economic and sociological implications for for low skilled, uneducated employees. Krueger (1993) examined the role of the computer as a determinant of wages and whether this computer premium can account for *changes* in the wage structure in the 1980s. He found significant work-related computer usage premia using American CPS data for 1984 and 1989. In this new and very exciting strand of literature, DiNardo and Pischke (1997), and Entorf and Kramarz (1997) have shown that for Germany and France respectively, cross-sectional results do indeed demonstrate work-related computer usage to generate wage premia. Entorf and Kramarz (1997) however when using a panel and controlling for unobserved individual heterogeneity, find that these computer premia for France are rendered insignificant. DiNardo and Pischke (1997) stress the need for panel data to control for unmeasured individual effects. They find wage effects for using, among other things, a pencil and hand calculator. In contrast, Bell (1996) using British longitudinal data with additional skills and aptitude test information confirms the findings of Krueger (1993) and finds that up to one half of the increase in the return to education can be attributed to various measures of technical skill (computer usage being one of them). Haisken-DeNew and Schmidt (1999) using cross-section data from the German Socio-Economic Panel for 1997, conclude that there indeed is a computer wage premium of around 7%, however after controlling adequately for unobserved individual heterogeneity using panel estimators for 1984-1997, the wage premium is reduced to a mere 1%.

Here we provide an outline of the existing American and European literature regarding the role of computer usage (whether at work or at home) and its effect on the wage structure, earnings, and employment prospects and provide a roadmap for future research in this area with particular focus on the use of **e-Living** panel data.

The previous international literature has focussed predominantly on *overall main effects*. Even if it can be successfully argued that *overall* effects are small, as some have found under certain conditions, there may be significant *between-group averaging* of effects, such that in some groups there may be large positive effects whereas in others, perhaps very small or insignificant effects. How are the gains to ICT usage shared between groups? Is there disparity? Who are the "winners"; who are the "losers"? The **e-Living** panel data will allow an in-depth analysis, examining the effects by many detailed socio-economic and demographic groups. (See **Table 1** for the list of socio-economic and demographic indicators to be used.)

2.1 Previous Studies

Krueger (1993) links the observed change in the return to education in the United States in the 1980s to increasing popularity of the computer at the workplace. He found that wage differentials gained by those high skilled workers using a computer at work could account for 42% of the increase of the *return* to education in the private sector in this time period. In the analysis, Krueger used two waves of the October CPS from 1984 and 1989 and found that women were more likely to be using a computer at work, and that in some particular industries more than others, such as the Banking sector, computers were prevalent. He found that males and females aged 29 to 39 and the highest educated tended to use computers the most. Krueger (1993) found raw wage differentials (without any controls) for PC work use in 1984 to be 28%, rising in 1989 to 33%.

One might expect that there are some unobserved positive employer characteristics that are correlated with the existence of PC's in a particular firm, i.e. firms with generous salary packages (efficiency wages) might also as a matter of course provide PC's as a sort of "perk". If this were the case, then one would pick up spurious PC wage differentials simply reflecting the generosity of the employer in an employer-employee rent sharing model. Krueger controls for industry but cannot control for firm size, as it is not asked in the CPS, however Krueger cites Hirschorn (1988) who does not find a strong link between firm size and computer usage. (This contrasts with Haisken-DeNew and Schmidt (1999) who find a positive and strong relationship between firm size and computer use in Germany.) Controls for demographic background, employer characteristics, human capital and union membership reduce the wage impacts of PC use to 14% and 16% respectively. The 1989 CPS differentiates between various computer specific tasks, such as word processing, bookkeeping, CAD, email, inventory control, programming, DTP, spreadsheets, sales and computer games and finds a range of returns for the items, with a high of 15% for email to -5% for DTP and inventory control compared to any "other use" of a PC. Krueger suggests the high return to email might come from the fact that highly paid managers use email intensively. Further, Krueger (1993) draws the link between additional computer-related qualifications or certificates and pay raises for some occupation groups. Thus, Krueger does find large and stable effects for PC usage. However, workers with unobserved skills could be thought to enjoy wage differentials seemingly due to computer usage at work, whereas the real effect came from their ability. By including computer usage at home and its interaction with computer usage at work, any bias in the PC usage effect at work due to omitted factors that are associated with computer use in general, were *thought to be eliminated*. Indeed Krueger found little change. The wage differential in general for using a computer at the workplace, depending on the specification of the estimation, was found to be between 10 and 15%.

Entorf and Kramarz (1994) and Entorf and Kramarz (1997) examine the role of unmeasured ability in the estimations of the computer usage wage premium. They use French Labor Force Survey panel data from 1985-1987 with additional merged firm-level information. For more than 15,000 persons, they have information concerning technology usage at the workplace such that the individuals can be identified over time for a maximum of 3 years in a rotating panel, making up a total of more than 35,000 person-year observations in the panel. In cross-sections, firm effects do not alter the computer usage wage premia. Entorf and Kramarz (1997) can also distinguish between various types of ICT usage, but more importantly, also the kind of usage, i.e. in their terminology "intelligent use" referring to creative use versus "stupid use" referring to robots and assembly lines. They find positive wage effects consisting of two components: whether or not one uses a computer, and also the number of years of experience using a computer. However, they further conclude that indeed, using fixed-effects panel estimation, all computer usage wage premia except for computer experience effects disappear ("differ radically"). The computer experience factor however still remains significant in the panel results. They state, "In particular, to check the effect of NT [New Technologies] on wages, panel data on individuals is necessary, since, as we saw, cross-section data matching workers and firms do not capture the individual ability component of the wage. See Entorf and Kramarz (1997), p. 1504.

DiNardo and Pischke (1997) refute the ability to measure true computer effects on wages. Using cross-sectional data for Germany from the German Qualification and Career Survey 1979, 1985-86, 1991-92 they compare German results to the American CPS, replicating Krueger (1993). They include a list of other "office tools" such as pencils, telephones, hand calculator, sitting while working, where one might not expect any particular wage premium to arise. However, they find significant differentials in Germany. The criticism is then, what is actually being measured by a computer usage indicator in a wage regression? They are skeptical of any causal relationship between computer usage and wage premia, "these findings cast some doubt on the literal interpretation of the computer use wage differential as reflecting true returns to computer use or skill." Further, they stress the need for panel data to control for unobserved individual heterogeneity, "Since Krueger relies on cross-section data, he cannot and does not control for individual fixed effects." See DiNardo and Pischke (1997), p. 291.

Bell (1996) uses the unique British National Child Development Study from 1981 and 1991 to examine the role of ability and individual heterogeneity in looking at the computer wage premium issue. Here additional test scores are available for reading comprehension and mathematical aptitude. In cross-section, he finds a large significant computer wage premium of 11%, even after controlling for additional skills such as math, planning ability, organizational capabilities. See Bell (1996) Table 5, column (4), p. 28. Using his 1991-1981 difference model, he finds a significant computer wage premium of 13%. He finds, "we show that wages are positively related to these [technical] skills and that there is little evidence that unobserved characteristics of either the individual or the firm are driving the correlation. Furthermore it is the use of these skills in the workplace that is important for wages not simply ability. This suggests that a productivity enhancing interpretation is most appropriate." See Bell (1996), p. 22.

In Haisken-DeNew and Schmidt (1999), the German Socio-Economic Panel data set from 1984 to 1997 was used and indeed *cross-sectional* results from 1997 indicate a highly significant wage premium of 7% for computer usage at work in Germany. They conclude that although cross-sectional evidence may deliver appealing initial results when analyzing the wage differential of computer usage, for instance as in Krueger (1993) for the United States, one must include adequate controls for unobserved individual heterogeneity to avoid over-interpreting the results. Simply adding indicators for PC usage at home and interactions between home and work usage are alone insufficient to account for possible "ability" effects. Using all waves and the pooled OLS estimator, the wage premium of using a PC at work is almost 9% and is highly significant, however when using a panel estimator with individual fixed-effects and controlling for computer related skills, this premium all but disappears to 1% and is barely significant, confirming the results of Entorf and Kramarz (1997) for France. This paper extends the results from DiNardo and Pischke (1997) with respect to the data, as one can directly control for unobserved individual heterogeneity using panel data. The GSOEP offers a unique opportunity to examine this question as it provides 14 years of panel information. In stark contrast to Bell (1996), they find that in this analysis for Germany, unobserved individual heterogeneity or ability plays *the key role* in effectively explaining away the apparent wage premium for using a computer at work.

2.2 eLiving Application: Average Wage Effects of Computer Use

The previous studies have shown that many factors are important in addressing the issue of impacts of computer usage on wages. It is not simply enough to collect data on computer usage at the workplace, but rather one must also be able to control for specific tasks that people do with the computers and which specific skills people have. To be able to compare the relative importance of all of these effects, one needs to collect all of these components together and over several years, i.e. a panel. Over time, the changes in exogenous variables will be able to give some insight into the changes in endogenous variables, net of person-specific unobserved heterogeneity. **Appendix Table 1** lists key questions found in the **eLiving** questionnaire which will be of critical importance in analysing the impacts of computers and ICT in general. In the past, most analyses have merely focussed on the wage impacts. How are people socially and economically disadvantaged by not having access to ICT, ICT training, ICT at the workplace ? How do these factors differ by country ?

In this part, we will use linear regression estimation techniques to model individual wages (labour earnings) as is standard in the literature. Standard human capital factors such as occupation, education/qualification and experience, demographics, and firm characteristics such as sector, firm size, region will be included as the main explanatory variables (Appendix Table 1a). This basic model will be augmented with computer use at work (Appendix Table 1b), computer use at home (Appendix Table 1c), and (years of) experience using computers, components of which have been found for example in Krueger (1993), Entorf and Kramarz (1997) and Haisken-DeNew and Schmidt (1999). We can not only control for standard factors found in the literature, but also for the factors listed in Table 1, such as intensity of computer use (Table 1d), specific computer tasks (Table 1g), and specific computer skills (Appendix Table 1h) *simultaneously*. People's own attitudes toward computers (Appendix Table 1i) may also give insight to otherwise unobserved individual heterogeneity. This will be especially useful in a cross-sectional setting in the first wave before the panel component has been established. The computer use at work and at home indicators can be interacted with any other main explanatory variables to give say sector/occupation specific returns to computer use, or perhaps varying by educational level (Appendix Table 1a). Contrary to Krueger (1993), Haisken-DeNew and Schmidt (1999) do indeed find differing firm size PC take-up rates differences and also effects of computer usage. As the panel becomes established, random and fixed effect panel estimators will allow explicit controls for unobserved individual heterogeneity as in Bell (1996), Entorf and Kramarz (1997) and Haisken-DeNew and Schmidt (1999). Bell (1996) in fact only uses two waves of the British NCDS.

We examine log earnings (yearly) as a function of demographics (gender, marital status), human capital (labour market experience, education), job characteristics (setting own schedule, hours/week), ICT characteristics (use PC, use Internet, Basic Office computer activities, Network related computer activities). This will allow us to find the wage impacts (conditional on all other variables, *ceteris paribus*) of having a PC and the Internet at the workplace, found in Table 1. Here we find that in all countries, Great Britain, Italy, Germany, Norway and Israel, there are significant wage premia paid for having a computer at the workplace. The premia are indeed rather large, ranging from 15.8% in Germany to 37.5% in Israel with Great Britain at

27%, Italy at 22.2% and Norway at 17.9%. However, as mentioned earlier, with only one wave of the eLiving dataset, one cannot control for unobserved individual heterogeneity directly. We must wait for future waves of the data to be collected. Thus to some degree, these are to be interpreted as “top boundries”, with more waves tending to lower these effects. Nonetheless, we can explain about half of the differences between the wages of those having a PC and those not (raw differentials) using other explanatory variables, thereby calculating “net differentials”. For instance, without additional controls, in Great Britain, those using a PC at work enjoy a 55% wage premium, but this drops to 27% with controls. (Some of the high raw return to computer use was in fact due to overly high education, experience or long hours worked of those who used a computer.)

Most countries had strong and significant raw differentials (no controls) for Internet use at the workplace, ranging from 11% to 18%. However, when using identical controls as above, the use of the Internet at the workplace seems only to be significant in Norway at 11.5%. All other countries had insignificant (net) effects.

Table 1: Wage Impacts of PC/Internet Use at the Workplace

	Great Britain	Italy	Germany	Norway	Israel
Male	0.211	0.213	0.330	0.193	0.267
	(4.71)**	(3.39)**	(6.60)**	(6.52)**	(4.68)**
Married	0.061	0.032	-0.105	0.002	0.122
	(1.40)	(0.47)	(2.16)*	(0.07)	(2.18)*
Experience	0.034	0.044	0.035	0.028	0.028
	(4.98)**	(4.30)**	(4.74)**	(5.86)**	(3.81)**
Experience²	-0.001	-0.001	-0.000	-0.001	-0.001
	(4.47)**	(2.83)**	(3.00)**	(4.64)**	(2.81)**
Years Education	0.035	0.047	0.029	0.013	0.025
	(5.67)**	(6.46)**	(5.31)**	(4.27)**	(4.46)**
PC	**0.270**	**0.222**	**0.158**	**0.179**	**0.375**
	(4.10)**	(2.40)*	(2.03)*	(3.62)**	(5.29)**
Internet	**0.057**	**0.098**	**0.114**	**0.115**	**0.010**
	(1.00)	(1.13)	(1.74)	(3.37)**	(0.12)
Basic Office	**0.035**	**0.115**	**0.105**	**-0.011**	**-0.017**
	(0.62)	(1.38)	(1.51)	(0.28)	(0.24)
Network	**0.122**	**-0.002**	**0.111**	**0.002**	**0.080**
	(2.25)*	(0.02)	(1.81)	(0.07)	(1.02)
Own Schedule	0.138	0.071	0.062	0.087	0.147
	(3.26)**	(1.13)	(1.34)	(2.95)**	(2.81)**
Hours/Week	0.027	0.016	0.023	0.015	0.015
	(14.81)**	(5.53)**	(11.18)**	(10.87)**	(8.47)**
Constant	0.871	0.537	1.006	2.127	1.040
	(7.06)**	(3.01)**	(8.08)**	(25.84)**	(7.83)**
Observations	655	337	475	767	421
R-squared	0.52	0.39	0.52	0.38	0.42

Note: * significant at 5%; ** significant at 1%, Absolute value of t statistics in parentheses

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: Here we present mean effects on earnings of PC usage and Internet for each each of the five countries. For instance, overall there would be a 37.5% wage premium associated with using a PC at the workplace in Israel whereas only 15.8% in Germany. Only in Norway are there significant earnings effects of 11.5% for using the Internet at the workplace.

2.3 eLiving Application: Distributional Earnings Effects of Computer Use

2.3.1 Distributional Counterfactuals

Combining the two concepts of average (mean) effects and distributional effects, we can pose the question of PC impacts slightly differently. Here we are interested in the question: What would the *distribution* of wages look like if we could net out the positive effects of PC usage, that is to say, if everyone were paid at the non-PC use level. It would be entirely surprising if the entire distribution were to shift leftwards by exactly the amount of the average effect from the OLS analysis. That would assume that all persons at all points in the distribution would be affected identically.

To implement this type of estimation, we employ the tools developed by DiNardo, Fortin and Lemieux (1996) who examine the distributional effects of union membership on the earnings distribution. In our case we will simply exchange "union membership" for "PC use" in examining the earnings distribution.

The DiNardo, Fortin and Lemieux (1996) methodology is as follows:

1. We calculate the distribution (kernel density) of wages for *all* workers, regardless of PC use. This becomes our baseline earnings distribution.
2. Now we start with the counterfactual. We estimate the unconditional probability of *not* using a PC i.e. just the simple average of *not* using a PC, say τ (tau).
3. We estimate then a probit model to generate a predicted (conditional) probability of using a PC at the workplace, say p_i. Then $(1-p_i)$ is the conditional probability that a particular worker "i" does *not* use a PC.
4. We calculate the person specific weighting factor θ_i (theta), which is $\theta_i = \tau / (1- p_i)$. The factor θ_i (theta) allows one to weight persons proportionally more who are observed *not* to have a PC *and* are less likely to have a PC at the workplace, as predicted by the probit model. Persons that are observed *not* to have a PC at the workplace *inspite* of a high predicted probability are weighted relatively lower.
5. We calculate the distribution (kernel density) of wages for those workers who do *not* use a PC at the workplace, but weighting by the factor θ_i (theta). This becomes our counterfactual earnings distribution.

Step (1) yields the distribution of earnings the way we observe it in reality. Step (5) yields the distribution of workers as if they were *all* paid the *non*-PC wage rate, i.e. the counterfactual. The difference in the two distributions is the "distributional effect of PC use at the workplace". In step (3) we use indicators for gender, age, years of education and managerial duties to determine the individual prediction probability.

Once we have a distribution for each country, we calculate a country-specific "exclusion threshold", which is defined to be 80% of the median value (a commonly used, although arbitrary level). This is listed as the "Baseline Risk" in Table 2 and the vertical line to the left side of the distributions in Figure Set 2.

Table 2 summarizes the results from Figure Set 2. The blue line on all graphs is the distribution of yearly labour earnings for a particular country, as they are observed. The red line is the distribution of labour earnings, given that all were paid at the non-ICT level (the counterfactual). The ICT item is broken down into four components: PC use, Internet, Basic Office computer activities and Network computer activities. Thus, examining Germany in Figure 2(a), we observe that the economic exclusion threshold is defined to be 80% of the median, meaning that those earning less than 19,620 Euro per year are "economically excluded" as we define it, making up 36.8% of the sample. This becomes our benchmark. We then simulate paying everyone at the non-PC pay level and determine what happens to the distribution, as defined by the red line in Figure 2(a)(1). For all points to the left of the exclusion threshold, we see that the red line is above the blue line, meaning that the total number of persons "at risk" of economic exclusion has increased. Therefore the total risk of economic exclusion would increase by 6.7%, given persons were to be paid at the non-PC wage (representing 37.3% of persons). This effect is largest in Great Britain, see in Figure 2(b)(1), at 17.2% additional risk (over baseline) of economic exclusion. Here the entire earnings distribution has shifted leftwards, with even more skewing to the left. Israel and Italy are similar to that of Britain regarding the effects of PC use on the earnings distribution.

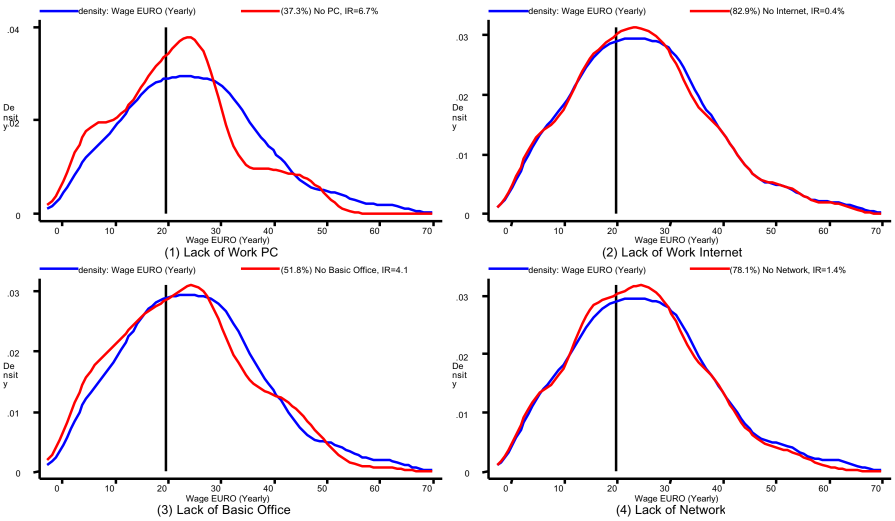
Table 2: ICT and Economic Exclusion (Summary of Figure Set 2)

		Baseline Risk of Economic Exclusion	No Work PC	No Work Internet	No Text & Spreadsheet	No Networking
Germany	Risk	36.8%	+6.7	+0.4	+4.1	+1.4
	Share	100%	37.3%	82.9%	51.8%	78.1%
Great Britain	Risk	34.6%	+17.2	+5.0	+7.4	+8.5
	Share	100%	35.9%	80.3%	53.2%	61.8%
Israel	Risk	29.6%	+14.6	+6.3	+6.5	+6.9
	Share	100%	48.3%	84.1%	69.7%	82.2%
Italy	Risk	31.1%	+15.8	+5.5	+9.2	+4.4
	Share	100%	44.5%	81.7%	62.3%	74.8%
Norway	Risk	24.9%	+8.3	+2.4	+3.6	+1.0%
	Share	100%	28.1%	68.0%	45.7%	66.1%

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: For each country a Baseline Risk is calculated to be 80% of the median earnings. For instance, in Germany, according to this definition, 36.8% of workers are below this threshold and are therefore economically "excluded". This proportion increases by an additional 6.7% (Increased Risk) for those who do not work with a PC (around 37.3% of the work force).

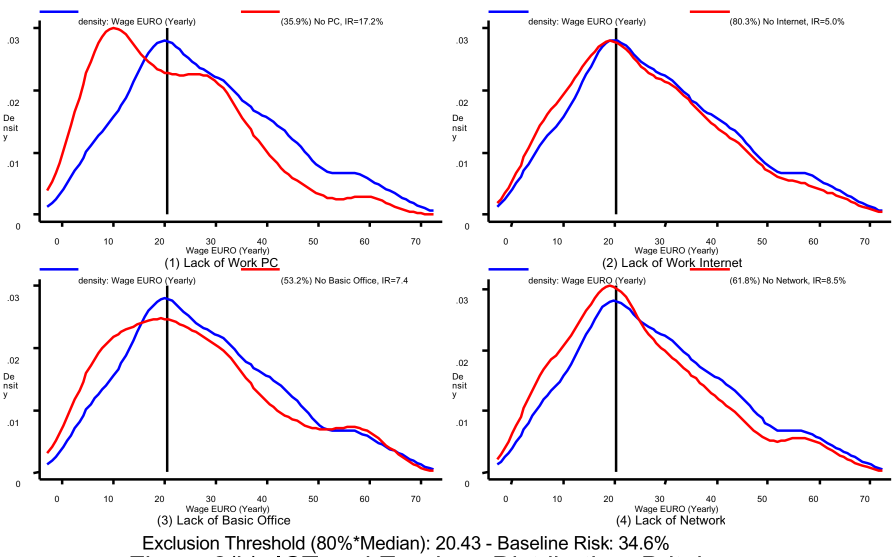
Similarly, we can observe the effects on the labour earnings distribution for Internet usage at the workplace. The effects in general are all substantially smaller than for PC usage, which we expected, given the results of Table 1. In Germany, for example in Figure 2(a)(2) we see that the Increased Risk (IR) is near zero. However in Britain, as shown in Figure 2(b)(2), it is 5.0% over baseline risk, similarly 6.3% in Israel and 5.5% in Italy. Norway seems to be affected only marginally at 2.4% increased risk.

Next, we examine the monetary reward to standard office type computer activities such as text processing and spreadsheets. Although we found from Table 1 no significant effects on average, when we ask the counterfactual question for the earnings distribution, we observe an increase risk of economic exclusion of between 3.6% in Norway as in Figure 2(e)(3) and 9.2% in Italy as in Figure 2(d)(3) in the left tail of the distributions. For computer network related activities, we find the highest increased risk of 8.5% in Great Britain as shown in Figure 2(b)(4) and the lowest in Norway at 1.0% as shown in Figure 2(e)(1).



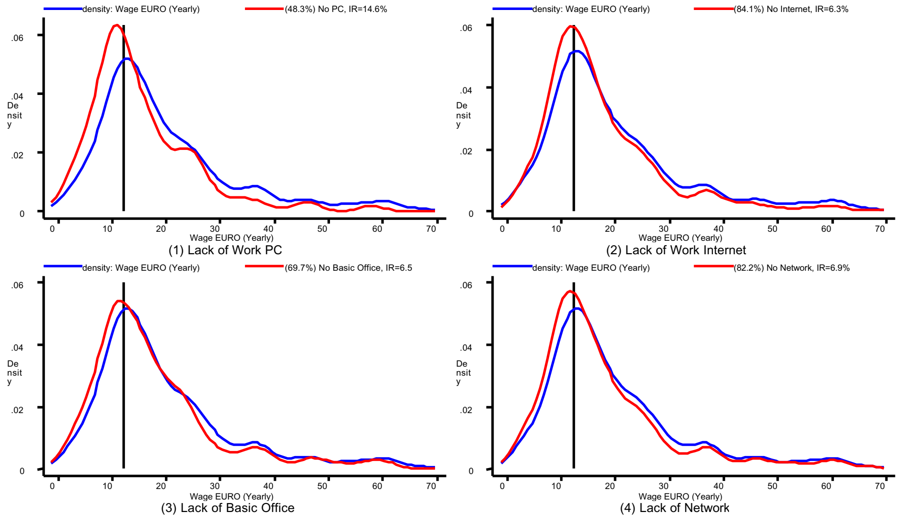
Exclusion Threshold (80%*Median): 19.62 - Baseline Risk: 36.8%

Figure 2(a): ICT and Earnings Distribution: Germany



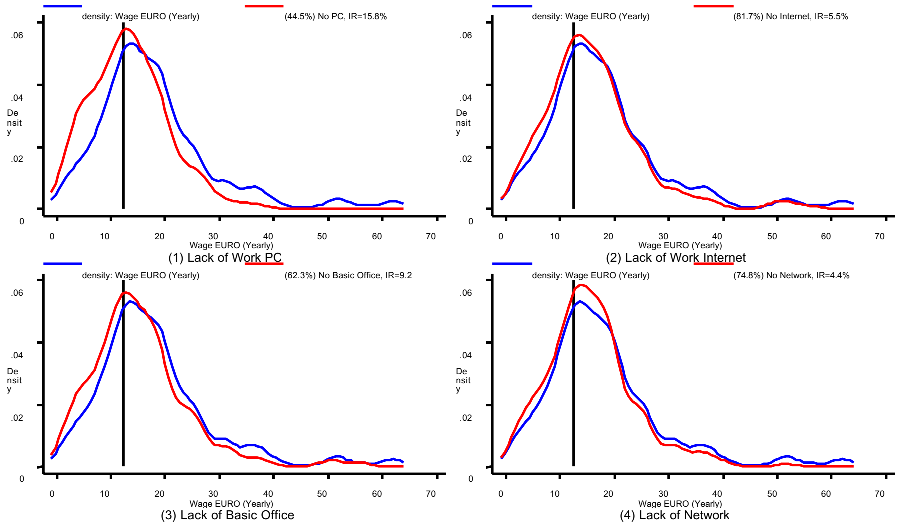
Exclusion Threshold (80%*Median): 20.43 - Baseline Risk: 34.6%

Figure 2(b): ICT and Earnings Distribution: Britain



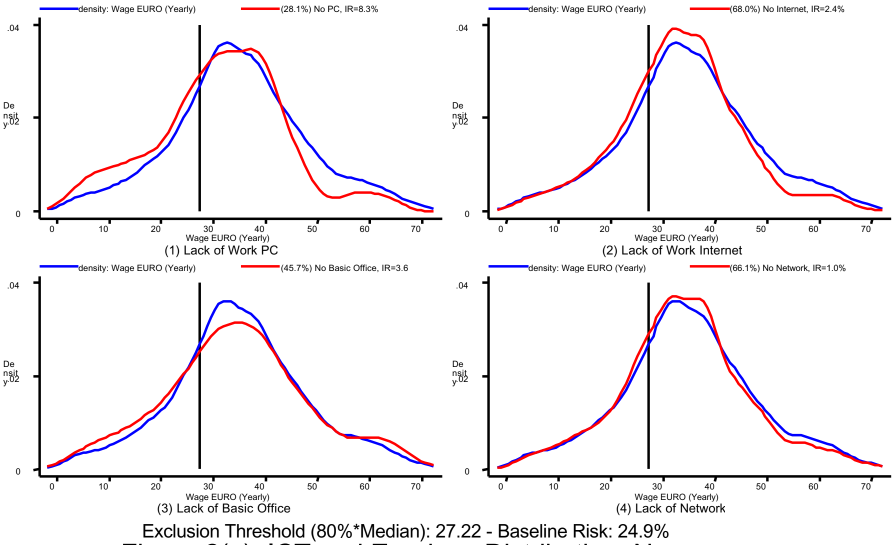
Exclusion Threshold (80%*Median): 12.19 - Baseline Risk: 29.6%

Figure 2(c): ICT and Earnings Distribution: Israel



Exclusion Threshold (80%*Median): 12.40 - Baseline Risk: 31.1%

Figure 2(d): ICT and Earnings Distribution: Italy



Exclusion Threshold (80%*Median): 27.22 - Baseline Risk: 24.9%

Figure 2(e): ICT and Earnings Distribution: Norway

2.3.2 Quantile Regression

In quantifying the impact of computer use on wages, the existing literature seems to focus exclusively on average effects, i.e. overall coefficients, which give the average effect of using a PC at the workplace as opposed to not using a PC. However, there might be differential effects over the *distribution of wages*. For instance, it could be that the effects of PC usage might be much higher for those in the lower end of the earnings distribution, i.e. using a PC might dramatically increase their earnings, as has been demonstrated in the previous section. This would suggest analysing the data not with regular OLS regression but rather with quantile regression, evaluating not at the mean but rather at various cuts in the distribution. We could examine the distribution at the 10%-ile (very poor off) , 25%-ile (poor), 50%-ile (median), 75%-ile (well off) and the 90%-ile (very well off).

Table 2.1 illustrates differential effects by various points in the earnings distribution for Great Britain. The endogenous variable is log yearly earnings, explained by indicators for gender, marital status, labour market experience as a quadratic, years of education, hours per week, and whether one can set one’s own schedule at the job. In addition there are ICT related indicators for the workplace, such as computer use, internet access, basic “office” computer related programs like word processing and spreadsheets and networking or systems operations activities.

On average using OLS regression, there is a 27% wage premium associated with using a PC at the workplace. For the median worker (based on the earnings distribution) this is almost the same at 26.7%. However, this effect could be as low as 18.6% or as high as 36.3% depending on where one sits in the earnings distribution (see the row labelled "PC").

Table 2.1: Great Britain: Quantile Regression at Various Percentiles in the Earnings Distribution

	Mean (OLS)	10%-ile	25%-ile	50%-ile	75%-ile	90%-ile
	(1)	(2)	(3)	(4)	(5)	(6)
Male	0.211	0.171	0.222	0.236	0.251	0.257
	(4.71)**	(1.38)	(4.00)**	(4.66)**	(4.57)**	(5.41)**
Married	0.061	0.169	0.091	0.024	0.029	-0.007
	(1.40)	(1.30)	(1.54)	(0.65)	(0.68)	(0.13)
Experience	0.034	0.034	0.028	0.037	0.042	0.045
	(4.98)**	(2.56)*	(3.81)**	(7.20)**	(7.34)**	(3.96)**
Experience²	-0.001	-0.001	-0.001	-0.001	-0.001	-0.001
	(4.47)**	(2.14)*	(2.97)**	(6.00)**	(7.79)**	(3.77)**
Years Education	0.035	0.022	0.020	0.036	0.052	0.048
	(5.67)**	(1.90)	(3.60)**	(3.61)**	(4.70)**	(4.01)**
PC	**0.270**	**0.363**	**0.327**	**0.267**	**0.186**	**0.280**
	(4.10)**	(3.22)**	(3.06)**	(4.64)**	(3.04)**	(2.57)*
Internet	**0.057**	**0.157**	**0.089**	**0.059**	**0.078**	**0.052**
	(1.00)	(1.03)	(1.19)	(1.11)	(1.58)	(0.72)
Basic Office	**0.035**	**0.049**	**0.039**	**0.082**	**0.004**	**0.030**
	(0.62)	(0.33)	(0.48)	(1.53)	(0.08)	(0.37)
Network	**0.122**	**0.210**	**0.097**	**0.116**	**0.117**	**-0.010**
	(2.25)*	(1.83)	(1.80)	(2.07)*	(2.38)*	(0.13)
Own Schedule	0.138	0.099	0.158	0.150	0.106	0.049
	(3.26)**	(1.23)	(3.80)**	(4.33)**	(2.72)**	(0.82)
Hours/Week	0.027	0.030	0.030	0.028	0.023	0.014
	(14.81)**	(8.64)**	(10.18)**	(10.07)**	(7.36)**	(3.52)**
Constant	0.871	0.231	0.738	0.825	1.127	1.744
	(7.06)**	(0.95)	(5.14)**	(6.29)**	(7.01)**	(6.14)**
Observations	655	655	655	655	655	655
R-squared	0.52	0.37	0.38	0.37	0.31	0.24

Note: * significant at 5%; ** significant at 1%, Absolute value of t statistics in parentheses. Remaining countries are reported in the following table.

Source: Own calculations using Wave 1 of the **eLiving** data set.

Interpretation: Here mean effects as in column (1) are compared to effects at certain points in the earnings distribution, as in column (2) through (7). For instance, overall there would be a 27% wage premium associated with using a PC at the workplace, however this would jump to 36.3% for those very poor off at the 10%-ile of the earnings distribution.

Thus workers on the low end of the distribution would gain much more if they had access to a computer at the workplace. This is of course by itself far too simple: the workers must first have sufficient skills to use the computer, and also work in such an environment that the technology of production can incorporate computer use, i.e. there must be adequate demand for this type of skilled labour. Clearly, a simple newspaper boy who uses a computer, will probably not experience a wage increase due to increased productivity. However, all things being equal, putting computers to use together with workers on the left tail of the earnings distribution has the largest impact of increasing earnings.

Table 2.2 shows the condensed results for the four remaining countries, where the coefficients marked with a star indicate significant effects. Germany for instance has an average PC effect of 15.7% - this means that an average worker using a PC would earn 15.7% more (using standard controls). However a worker whose earnings would put him in the lower tail of the earnings distribution would experience much higher returns, e.g. more than double (32.5%) the return at the 10 %-ile. However at the median the effect is no longer significant. In contrast, in Italy significant effects first start at the 25 %-ile and remain significant moving rightwards over the distribution. Clearly the countries analysed here using quantile regression do indeed behave differently at various parts of the earnings distribution.

Table 2.2: Other Countries: Quantile Regression at Various Percentiles in the Earnings Distribution

Percentile		Germany	Israel	Italy	Norway
	Obs	475	421	337	767
Mean (OLS)	PC	0.157*	0.374*	0.222*	0.179*
	Internet	0.113*	0.010	0.097	0.114*
10 %-ile	PC	0.325*	0.268*	0.230	0.259*
	Internet	0.228*	-0.191	0.041	0.099*
25 %-ile	PC	0.283*	0.464*	0.251*	0.097
	Internet	0.148*	-0.078	0.177*	0.080*
50 %-ile	PC	0.129	0.376*	0.226*	0.107*
	Internet	0.055	0.212	0.146	0.100*
75 %-ile	PC	0.113*	0.313*	0.285*	0.102*
	Internet	0.066*	0.335*	0.143	0.132*
90 %-ile	PC	0.035	0.372*	0.180*	0.086
	Internet	0.138*	0.263*	0.231*	0.176*

Note: * significant at 5%, one sided t-test.

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: Here mean effects as in row (1)are compared to effects at certain points in the earnings distribution, 10%-ile through to the 90%-ile. For instance, overall there would be a 37.4% wage premium associated with using a PC at the workplace in Israel, however this would jump to 46.4% for those poor off at the 25%-ile of the earnings distribution in Israel.

3 ICT Use and Social Exclusion

There is a considerable literature on social exclusion, including with respect to ICT access. Some of this is covered in other work packages, in particular WP3 (ICT patterns) and WP7 (the relationship between ICT access and gender). Previously we focused on whether access to computers significantly enhances individuals' productive potential and therefore wages and therefore whether lack of access limits this. The answer to this questions has clear and substantial welfare implications. However, it is possible that certain categories of people are more constrained than others, and so this issue has to be examined along various social dimensions. Older people are well known to be less familiar and happy with computer technology. In some countries, women still lagged behind men in computer usage, but on the other hand job segregation by gender might also have an impact (which may or may not be protective) . Moreover there might be significant variation in the distribution of access and opportunity both regionally and between countries.

3.1 Previous Studies

The term social exclusion is used often in a blanket manner and can mean many things to different researchers. As D'Ambrosio et al. (2002) write, most importantly the concept of social exclusion deals with the "inability of an individual to participate in the basic political, economic and social functionings of the society in which he/she lives." Of interest here is exactly how this concept can be operationalised into observable indicators available to researchers. An individual is considered to be "excluded" if based on many indicators, he/she cannot participate fully in society. Thus simply to be lacking in one particular area does not constitute "exclusion" and therefore we are interested in a multi-dimensional index which summarizes information from many domains. In the strictest sense of the term, exclusion deals with not having access to something not because one chose not to have it but rather because it was simply beyond the reach of a person, whether due to budget restrictions or institutional restrictions etc. If longitudinal information were present, we could also focus on persistence of exclusion. Typically periodic dips into and out of exclusion would be weighted lower than long-term exclusion. However in the **eLiving** database, we currently only have one wave of data to analyse so the longitudinal aspects cannot yet be addressed here.

We are interested in the role of information technology in bringing people closer together, empowering them and improving their lives. We have in the previous section examined the wage impact of ICT at the workplace. Here we will examine how ICT is associated with social exclusion.

Eurostat (2000) outline various indicators as main components of a multi-dimensional social exclusion index: (a) Financial Difficulties, (b) Basic Necessities, (c) Housing Conditions, (d) Consumer Durables, (e) Health, (f) Social Contact, (g) Dissatisfaction.

This is not the only definition found in the literature. Dekkers (2002) cites many competing definitions, such as those found in Townsend (1979,1993), Whelan and Whelen (1995), Zajczyk (1995), Percy-Smith (2000) etc. For more information, the reader is directed to D'Ambrosio et al. (2002) and Dekkers (2002), who provide and thorough overview of the existing literature on social exclusion.

Dekkers (2002) examines also the role of ICT and social exclusion using Belgian household panel data using very similar ICT consumer durables as in **eLiving**, stressing the importance of "leading" and "laggard" households in their take-up rates with ICT goods. For instance, he finds that poorer households tend to be "laggard" households, where ICT is a top-down phenomenon with the richer households "leading". This appears to be true for mobile phone use in Belgium, where disproportionately more poor households do not have access to mobile phones.

3.2 Operationalisation in eLiving

Using the **eLiving** data set we will be able to operationalise the previously mentioned D'Ambrosio et al. (2002) concepts as follows:

1. Financial Difficulties: being in upper income class with respect to household income.
2. Basic Necessities: having high education, PC skills, working, having a permanent job, having a job in which one sets one's own schedule.
3. Housing Conditions: having housing with more than 2 rooms
4. Consumer Durables: having a car, more than one television, having a clothes washing machine, dish washing machine, microwave oven, CD/stereo, video camera, VCR, digital camera, DVD player
5. (Mental) Health: overall life satisfaction
6. Social Contact: talking often on the telephone to friends, satisfaction with communication with friends
7. Dissatisfaction: satisfaction with free time

All indicators are coded as zero (0) or one (1), with 1 meaning having a particular good or characteristic and zero (0) not. Tsakloglou and Papdopoulos (2001) and Papdopoulos and Tsakloglou (2002) suggest a method of combining these items into a single index. For the population as a whole, one examines first the overall average of persons having a particular item/good/characteristic, say γ_i (gamma). Then one ascertains whether each individual has the particular item and if he/she does have the item, then α_i (alpha) is equal to 1 and zero if not. Multiplying by the average is an attempt to weight the particular importance of a particular item. If all others have an item and a small number do not, then this small number is considered to be relatively more excluded. If however, in general very few people do not have a particular item, say an expensive car, then even though many would not have such an item, they would not be considered very excluded. Thus each person either has zero (0) when he/she does not have a particular item, or he/she has γ_i. The list of items is averaged for every individual and then an overall index of exclusion based on all items is available for each individual.

Assuming there were K items/goods/characteristics, the calculation of the index measure would be as follows for each individual "i":

$$SocEx_i = ([\alpha 1_i * \gamma 1] + [\alpha 2_i * \gamma 2] + \ldots + [\alpha K_i * \gamma K]) / K,$$

where $\alpha 1_i$, $\alpha 2_i$, .., αK_i are either 0 or 1, and $\gamma 1$, $\gamma 2$, ..., γK , range between 0 and 1. Clearly the index $SocEx_i$ is bounded by 0 and 1, with 0 being complete exclusion, and 1 being complete inclusion. Typically though, the empirical distribution will lie between some number larger than zero and some other number smaller than one.

Table 3.1: Indicators of Social Exclusion

Item or Characteristic	Germany	Britain	Israel
High Household Income	11.8%	20.5%	17.2%
Part of Clubs and Groups	68.9%	56.9%	54.3%
Satisfaction with Free Time	22.1%	32.1%	19.2%
Satisfaction with Friends	58.3%	80.4%	51.1%
Satisfaction in General	22.7%	41.3%	22.8%
Highly Educated	9.6%	18.3%	28.8%
Knowledge of PC Use	92.3%	93.9%	96.5%
Working	68.7%	77.4%	66.7%
Permanent Job	59.6%	71.7%	57.0%
Can Schedule one's Own Job	34.9%	33.9%	27.6%
Durable: More than one TV	53.0%	79.8%	61.3%
Durable: Washing Machine	96.7%	97.1%	97.1%
Durable: Dishwasher	71.0%	35.4%	37.3%
Durable: Microwave Oven	72.5%	92.1%	84.1%
Durable: Stereo / CD Player	95.4%	95.1%	76.5%
Durable: Video Camera	32.0%	37.4%	34.4%
Durable: VCR	84.7%	91.7%	76.0%
Durable: Digital Camera	10.6%	20.7%	21.8%
Durable: DVD Player	21.0%	32.5%	19.8%
Durable: Automobile	92.3%	87.6%	77.6%
Dwelling: More than 2 Rooms	87.1%	93.9%	91.5%
Talk with Friends on Telephone	51.2%	66.8%	74.9%

Note: a percentage close to 100 indicates high social inclusion.

There is one particular drawback of this methodology which is worthy of noting. Although we have many indicators from various domains, we explicitly weight the importance of each particular indicator equally. Perhaps in reality, not having a DVD player is not all that important, whereas having enough rooms in one's apartment is much more important. We cannot account for this with this measure. If allowed to be determined endogenously, the rank of importance of the domains will be typically different between countries and over time. This might even be true of individuals in a given country at a given time. (This index is ideally suited for longitudinal analysis, whereas we only have one wave of data currently available in the **eLiving** data set. "Exclusion", defined very narrowly, would occur when one did not have access to many different goods, etc not just in one period but persistently over time. Nonetheless, we can use this index as a starting point for the first wave.)

Nonetheless, having an exclusion index for each individual, one can examine the distribution of the index. Is there clumping around some median or is it spread out with many extreme observations in the low and high ends ? Here we are interested chiefly in what is going on at the left tail of the distribution, not at some mean value. We can define a social exclusion threshold, below which one is considered to be "socially excluded". Standard in the literature is to define some percentage of the median index value: some value such as 70% or 80% of the median is often used. For the analysis with eLiving data, we focus on 80% of the median as the threshold, although this is arbitrary. The exact social exclusion threshold used will vary between countries as the country-specific medians will vary.

Thus, when we examine the distribution of the exclusion index, we can calculate the area to the left of the threshold under the distribution line. This becomes the “population at risk” or “baseline risk”. This is of interest by itself, however we are interested in determining how this distribution changes and/or shifts when we examine various sub-populations. We can again use the tools we have borrowed from DiNardo, Fortin and Lemieux (1996) to look at how various ICT components relate to social exclusion.

We have identified four main areas of ICT: (a) having access to a home computer, (b) using a computer at the workplace (c) having access to home internet and (d) having access to a cell/mobile phone. Thus for each main ICT area, we calculate the baseline distribution of the exclusion index and then calculate the counterfactual of what the social exclusion index would look like for all those who had NO access. For home computer access, we even have additional information asked of those who do not have a home computer as to why it was not present in the home. We can identify two reasons for not having a home computer which satisfy stringent exclusions definitions: not being able to afford a computer, (or computers cost too much) or not knowing how to use a computer.

Typically, this implies a leftward shift of some magnitude of the exclusion distribution and an increase in the population at risk. We can calculate the increase in the population at risk and calculate the measure of “increased risk” called IR, as we have discussed in the previous section.

Following DiNardo, Fortin and Lemieux (1996), it is not enough merely to examine those who do not have a particular item, but rather to weight those persons proportionately higher who have the least likelihood of having a particular ICT item in calculating the counterfactual. To predict the *individual probability* of having a certain item, we use indicators for: gender, age, marital staus, years of education, household size and household income. These ICT measures themselves are <u>not</u> used in calculating the SocEx index. We cannot claim any causality however we can examine how likely it is that a person is considered socially excluded (based on a host of non-ICT indicators) given that he/she does not have access to particular ICT items.

3.3 Empirical Application and Interpretation

3.3.1 <u>Interpreting Exclusion Graphically</u>

For each of the five countries Germany, Great Britain, Israel, Italy, and Norway we try to identify the association between various ICT items and social exclusion. The results are summarised in Figure Set 3 in a collection of four graphs for each country whereas Table 3 provides the summary of the figures in tabular form. Some explanation of how to interpret the graphs is required here. For example, let us take the top left graph from Israel (Figure 3c), which depicts the distributional effects of the social exclusion index for the Israeli population at large as we observe them (the blue line) and as a counterfactual, the social exclusion index for those not having a home PC for whatever reason (red line) and those not having a home PC due to definitional exclusion reasons (green line). From the main title in the overall graphic, we know that the threshold (80% of median) is the value 0.30, implying a baseline risk of 22.4%. That is to say, given that we use this particular (common) threshold, 22.4% of Israelis are found to be suffering social exclusion (below the threshold). However, when examining those persons not having a home PC (some 29.8% of the Israeli population), there is a <u>increased risk</u> of 18.5% of social exclusion above and beyond the baseline risk. This is further exacerbated by those 7% of Israelis not being able to afford a home PC with an increased risk of 35.9% over baseline.

3.3.2 Computers, Internet and Social Exclusion

For Germany, we observe no association between broadly defined social exclusion and lack of access to computers at home or the workplace. If anything, those not having access to PC's might even be slightly less likely to suffer social exclusion. Fewer than 5% answered that they did not have a PC at home because of financial constraints or difficulties, i.e. strictly defined "exclusion". (The same was true for Norway and Italy). Thus, this particular aspect was dropped from the analysis as the underlying sub-sample size was insufficiently large for robust analysis.

However for Great Britain, we observe quite well that those not having access to a PC are likely to be defined as suffering social exclusion based on other factors. With a baseline risk of 15.3%, not having a home computer is associated with an increased risk of social exclusion by 8.3%. For those who said they could not afford a home PC, this is associated with a 25.2% increase over the baseline risk! Approximately one quarter of the sample has no access to computers at home or at work, resulting in a 15.5% increase over the baseline risk.

A very similar pattern can be found for Israel. The baseline social exclusion risk is 22.4%. Those not being able to afford a PC have an additional increased risk of 35.9%! Clearly those persons in Israel not being able to afford a home PC are fundamentally different with respect to their social attachment as compared to the rest of society. No PC access whether at home or at work is associated with a 13.% increase over the baseline risk. No home Internet access add 3.2% increased risk.

Italy displays very moderate effects. Less than 5% said they could not afford a home PC, so this does not appear to be an issue. PC and Internet access have apparently little affect with respect to social exclusion. Norway is the most extreme case, where the baseline risk is the lowest (i.e. the country with the most *inclusion*). Here as well, less than 5% said they could not afford a PC. Internet and PC access does not appear to have any association with social exclusion whatsoever. In fact, the measures are slightly negative!

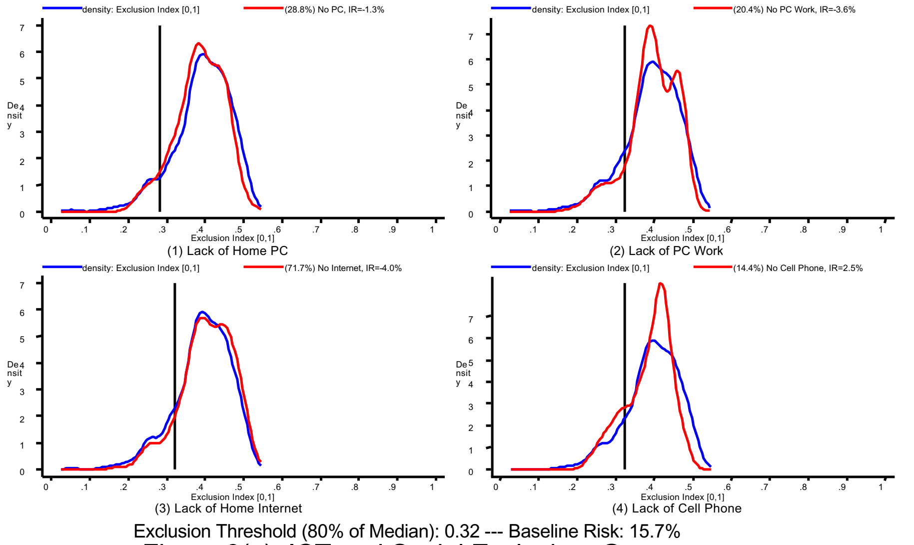
3.3.3 Cell / Mobile Phones and Social Exclusion

Compared to the mild affects of PC and Internet access on social exclusion, cell phone or mobile phone access has a relatively strong association with social exclusion in most countries (except Norway). In Britain the risk increases by 26.6%, in Israel by 44.1%, in Italy by 27.5%. In Germany the effect is quite small at 2.5%. In Norway, the added risk is even negative. As the costs of cell phones have dropped dramatically over the past 5 years to a point in 2000 where prepaid cell phones in Germany were selling for as low as EUR 25, cell phone penetration has reached seemingly saturation levels. For instance only 10% of adult Britons did not have access to a cell phone (In Italy only 7% and in Norway 4.9%). As this particular ICT item is so inexpensive, it seems hardly plausible for most people not to be able to afford it. Those who indeed do not have access to such an item, must almost assuredly be very different to the average. Indeed we see this in the increased risk results.

Table 3.2: ICT and Social Exclusion (Summary of Figure Set 3)

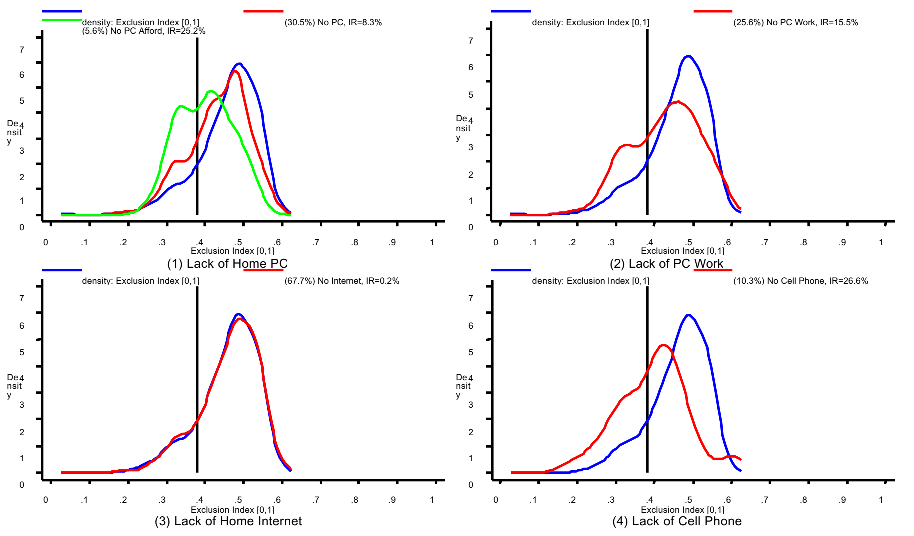
		Baseline Risk of Social Exclusion	No Home PC	No Afford PC	No PC At Work	No Internet	No Cell Phone
Germany	Risk	15.7%	-1.3	--	-3.6	-4.0	+2.5
	Share	100%	28.8%	Under 5%	20.4%	71.7%	14.4%
Great Britain	Risk	15.3%	+8.3	+25.2	+15.5	+0.2	+26.6
	Share	100%	30.5%	5.6%	25.6%	67.7%	10.3%
Israel	Risk	22.4%	+18.5	+35.9	+13.3	+5.9	+44.1
	Share	100%	29.8%	7.0%	35.0%	68.4%	8.6%
Italy	Risk	19.1%	+6.1	--	+3.8	+3.2	+27.5
	Share	100%	44.1%	Under 5%	36.5%	68.5%	6.9%
Norway	Risk	13.8%	+0.1	--	+1.8	-5.1%	--
	Share	100%	17.8%	Under 5%	9.3%	60.1%	Under 5%

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: For each country a Baseline Risk is calculated to be 80% of the median social exclusion index. For instance, in Great Britain, according to this definition, 15.3% of the adults are below this threshold and are therefore socially "excluded". This proportion increases by an additional 8.3% (Increased Risk) for those who do not have a home PC (around 30.5% of the adults). For robustness, only those effects supported by at least 5% of the sample are reported.



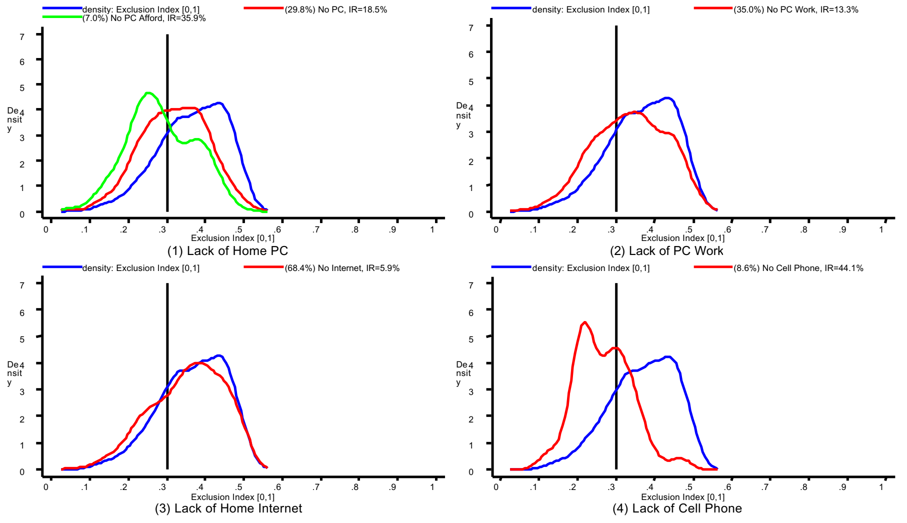
Exclusion Threshold (80% of Median): 0.32 --- Baseline Risk: 15.7%

Figure 3(a): ICT and Social Exclusion: Germany



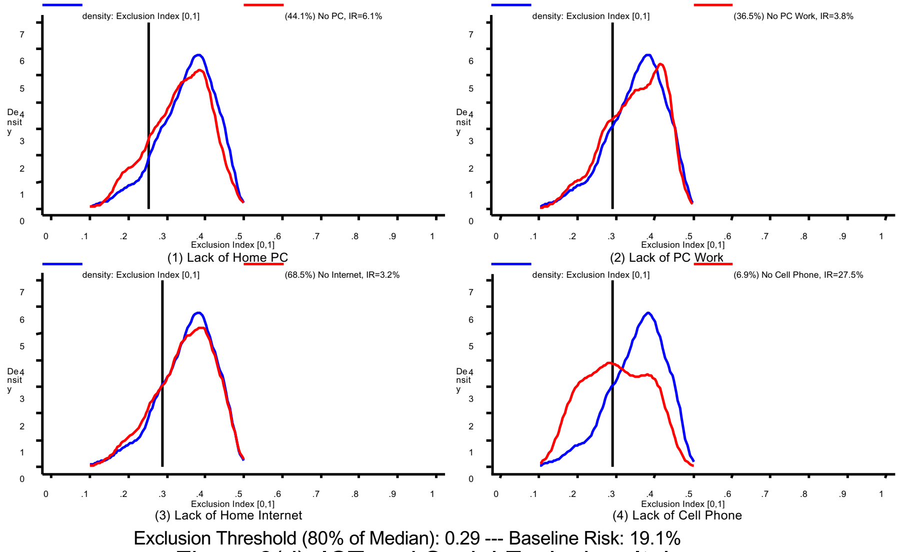
Exclusion Threshold (80% of Median): 0.38 --- Baseline Risk: 15.3%

Figure 3(b): ICT and Social Exclusion: Britain



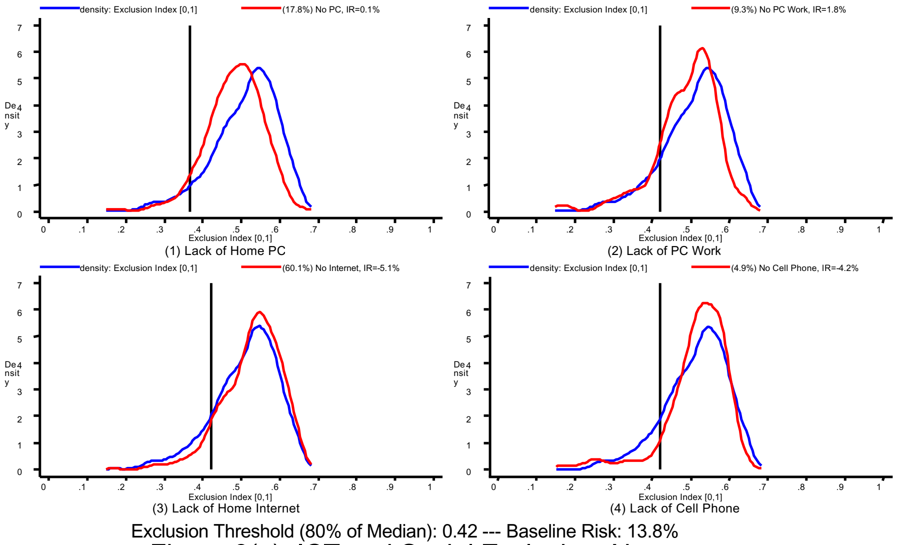
Exclusion Threshold (80% of Median): 0.30 --- Baseline Risk: 22.4%

Figure 3(c): ICT and Social Exclusion: Israel



Exclusion Threshold (80% of Median): 0.29 --- Baseline Risk: 19.1%

Figure 3(d): ICT and Social Exclusion: Italy



Exclusion Threshold (80% of Median): 0.42 --- Baseline Risk: 13.8%

Figure 3(e): ICT and Social Exclusion: Norway

3.3.4 Social Exclusion Types

The next step will be to examine the relationship between ICT use and the various components of social exclusion. Thus we evaluate the social exclusion function with increasing number of exclusions and examine the shares of ICT access/usage. For example, in Germany (shown in **Table 3.3**) taking into account all indicators for social exclusion, those 5.2% who experienced 6 exclusions had on average a score of 0.478 (on a scale of 0 to 1) and 86.2% had a home PC. Compare this to those 5.0% of the sample having 14 exclusions with a social exclusion score of 0.278 and only 43.7% having access to a home PC (almost half)! This trend is confirmed with Internet access, having a PC at the workplace, and mobile/cell phone access. In general increasing social exclusion implies decreased ICT participation (home PC, home internet, work PC, mobile phones). We do not focus on those cells not having at least support of 5% of the observations. Clearly there are very few persons who have almost no items (15-21) or almost all items (0-5 exclusions). Interestingly enough, those experiencing many exclusions (14 and over) still have access to mobile phones to a large extent (at least half). This is probably because the purchase cost of mobile phones has been traditionally quite low, if not subsidised by providers outright, but by locking consumers into long-run contracts or pre-paid cards.

Table 3.3: Germany

Number Exclusions	Index Percent	Inclusion Index Mean	Home PC Access	Internet Access	PC Work	Cell Phone Access
3	0.3	50.6%	100.0%	0.0%	100.0%	100.0%
4	2.0	49.6%	100.0%	47.5%	100.0%	100.0%
5	3.0	50.1%	95.3%	13.5%	100.0%	96.3%
6	5.2	47.8%	86.2%	33.7%	91.5%	97.9%
7	9.2	46.1%	91.4%	29.7%	92.4%	93.5%
8	12.9	44.3%	84.0%	38.1%	87.5%	91.8%
9	13.2	42.1%	85.0%	38.3%	82.7%	88.7%
10	14.2	39.4%	67.2%	24.7%	77.2%	90.6%
11	14.9	37.2%	68.0%	33.3%	75.9%	85.2%
12	10.1	34.6%	56.8%	18.3%	80.0%	80.9%
13	5.3	30.7%	37.8%	15.8%	63.9%	73.7%
14	5.0	27.8%	43.7%	14.4%	67.3%	58.9%
15	2.3	24.5%	24.4%	3.0%	34.7%	58.7%
16	1.2	22.3%	41.3%	36.1%	33.8%	50.7%
17	0.8	18.2%	57.9%	20.2%	45.4%	61.4%
18	0.4	15.1%	21.9%	0.0%	41.4%	80.5%
19	0.1	5.9%	0.0%	0.0%	100.0%	0.0%
21	0.1	4.2%	0.0%	0.0%	0.0%	0.0%

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: Using the definition of Social Exclusion above, one groups all those individuals by the number of exclusions suffered by them. Thus 5.2% of the sample experienced 6 exclusions and had an average of 0.478 on the social exclusion index. However, they also had strikingly high levels of ICT. The horizontal lines indicate those effects supported by at least 5% of the sample (column labelled "Index Percent") are reported.

Table 3.4 presents the results for Great Britain. Computer and Internet use is dramatically higher for those least socially excluded, however, even those considered quite socially excluded (12 exclusions and above), still have high levels of mobile phone access (almost 80%).

Table 3.4: Great Britain

Number Exclusions	Index Percent	Inclusion Index Mean	Home PC Access	Internet Access	PC Work	Cell Phone Access
1	0.2	60.7%	100.0%	83.2%	100.0%	83.2%
2	0.7	59.4%	100.0%	8.7%	100.0%	100.0%
3	2.3	57.1%	87.5%	36.4%	87.3%	100.0%
4	3.8	55.1%	93.4%	40.9%	91.8%	100.0%
5	7.9	54.2%	85.9%	35.1%	91.0%	98.5%
6	11.8	51.9%	85.8%	37.1%	86.1%	96.1%
7	13.7	49.7%	81.5%	40.3%	79.0%	96.3%
8	13.5	48.2%	77.5%	35.6%	80.0%	97.0%
9	12.3	45.8%	72.5%	33.6%	75.3%	97.1%
10	11.5	43.0%	51.5%	29.2%	69.4%	79.7%
11	7.6	39.8%	62.9%	28.5%	65.3%	79.6%
12	5.6	36.3%	41.9%	26.0%	61.5%	79.5%
13	3.7	32.9%	37.7%	15.5%	44.8%	74.3%
14	2.9	30.4%	19.7%	8.8%	37.8%	69.5%
15	1.4	26.9%	17.7%	0.0%	25.6%	49.8%
16	0.7	23.3%	34.6%	34.6%	16.7%	9.9%
17	0.3	20.3%	0.0%	0.0%	30.7%	30.7%
18	0.1	15.4%	100.0%	0.0%	100.0%	100.0%
21	0.1	4.3%	0.0%	0.0%	0.0%	0.0%

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: Using the definition of Social Exclusion above, one groups all those individuals by the number of exclusions suffered by them. Thus 7.9% of the sample experienced 5 exclusions and had an average of 0.542 on the social exclusion index. However, they also had strikingly high levels of ICT. The horizontal lines indicate those effects supported by at least 5% of the sample (column labelled "Index Percent") are reported.

Table 3.5 presents the results for Israel. Computer and Internet use is dramatically higher for those least socially excluded. Those considered very much socially excluded (14 exclusions and above), still have high levels of mobile phone access (more than 80%).

Table 3.5: Israel

Number Exclusions	Index Percent	Inclusion Index Mean	Home PC Access	Internet Access	PC Work	Cell Phone Access
0	0.1	54.3%	100.0%	100.0%	100.0%	100.0%
1	0.1	53.5%	100.0%	100.0%	100.0%	100.0%
2	0.4	52.0%	100.0%	26.3%	100.0%	100.0%
3	2.5	50.4%	90.2%	22.4%	70.0%	100.0%
4	3.8	48.9%	98.3%	34.3%	95.0%	100.0%
5	4.0	47.0%	94.4%	42.7%	84.5%	100.0%
6	6.1	45.7%	94.9%	49.0%	76.6%	94.0%
7	7.6	44.5%	89.0%	55.1%	81.7%	100.0%
8	10.7	42.4%	82.7%	37.8%	78.8%	100.0%
9	8.2	40.5%	71.7%	37.3%	71.1%	100.0%
10	10.4	37.9%	74.8%	37.4%	73.3%	95.3%
11	10.7	35.1%	71.2%	31.4%	65.0%	97.0%
12	10.9	32.4%	63.3%	23.0%	54.2%	90.0%
13	7.3	29.6%	56.2%	28.2%	63.6%	86.1%
14	6.2	27.3%	42.9%	13.3%	36.1%	83.7%
15	4.1	24.1%	26.6%	6.6%	32.4%	72.1%
16	3.6	21.5%	40.2%	9.6%	24.7%	55.3%
17	1.5	18.4%	22.4%	3.4%	18.4%	28.9%
18	1.3	14.7%	33.7%	9.8%	50.9%	97.9%
19	0.5	11.8%	29.7%	20.4%	20.6%	19.5%
20	0.1	8.5%	100.0%	0.0%	52.6%	47.4%
21	0.1	4.4%	0.0%	0.0%	0.0%	100.0%

Source: Own calculations using Wave 1 of the **eLiving** data set.
Interpretation: Using the definition of Social Exclusion above, one groups all those individuals by the number of exclusions suffered by them. Thus 6.1% of the sample experienced 6 exclusions and had an average of 0.457 on the social exclusion index. However, they also had strikingly high levels of ICT. The horizontal lines indicate those effects supported by at least 5% of the sample (column labelled “Index Percent”) are reported.

4 Conclusions

There appears to be a clear relationship between ICT use/access and decreasing exclusion at the economic and social levels. The richness of the **eLiving** data set allows us to calculate detailed indicators of economic and social exclusion for each country in the data set. We find a substantial degree of variation of effects between countries, which clearly indicates the advantage of a multi-country empirical analysis – not all countries behave the same way and we can identify the differences. Moreover, the exclusion analysis is based on distributional considerations. All of the analyses have allowed for country specific baselines (means, medians, etc), taking into consideration the country specific nature of what is "desirable" in a given country. This takes into account indirectly country specific institutions, patterns of labour market participation, education levels, behaviour in purchasing consumer durables etc.

When dealing with economic exclusion and ICT, the strongest effects come from computer usage at the workplace. Those not using a computer at the workplace, whether they do not have the required training to do so or because their job does not call for it, seem to be disadvantaged economically. Using simple regression techniques, one can identify a computer wage premium of anywhere between 16% in Germany and 38% in Israel on average (over all of the earnings distribution), depending on the country. However, examining the quantile regression results, where one can examine the PC wage premium at various slices of the earnings distribution, those employees with earnings in the left tail (poor off) of the distribution would benefit much more than workers with median earnings.

When examining counterfactual scenarios, such as what the earnings distribution would look like if all were paid according to the non-PC usage wage, we see that employees would be much more likely to fall into the left-tail (poor off, or "excluded" area) of the earnings distribution. This so-called "Increased Risk" of exclusion is at least 6% as in Germany and as high as 17% in Great Britain.

Use of the Internet at the workplace does not seem to be a large issue. Only in Norway could we identify a positive wage premium (on average) of 11.5%. All other countries had insignificant results. We find only a slight increased risk of economic exclusion, ranging from 0.4% in Germany to 6.3% in Israel. Based on the small size of these effects, it would seem that PC usage as opposed to Internet usage dominates the debate by far.

In our analysis of ICT use and social exclusion, we can identify a strong correlation. Based on many accepted indicators, standard in the existing literature, we calculate an overall index of social exclusion. We then examine the shape of the distribution of this exclusion index, for everyone and then for those who do not use ICT. We find a strong increase in social exclusion (left tail of the distribution), for those not using ICT. For instance, those not having a home PC are as much as 18.5% more likely to be considered socially excluded in Israel. This increases even more, to 35.9% for those who say they do not have a PC because the cannot afford one, or simply do not have the skills to use one ("exclusion" in the strict and narrow definition of the word)! There is a fair amount of variation between countries as to the effects of computers on social exclusion. In Germany, Italy and Norway there are hardly any effects of computer use on social exclusion. However there are very strong effects for Great Britain and Israel.

It seems being able to communicate by mobile/cell-phone is associated with high levels of social inclusion, especially for Great Britain, Israel and Italy. Those without access to a cell phone in these countries are very likely to be excluded, based on our multi-dimensional exclusion index. For instance, in Israel, those not having a cell phone (8.6%) have an increased risk of 44.1% of falling in the left tail (exclusion area) of distribution! In Britain and Italy the increased risk is around 26-27%.

We have been able to identify ICT impacts not only on mean wages and the wage distribution but also with regards to an index social exclusion. With additional waves of data, we will be able to test the robustness of these initial cross-sectional results, by allowing for controls for individual specific unobserved heterogeneity, found to be important in previous studies on the impacts of ICT.

Table 1: Key Components for Economic and Social Exclusion Analysis in "*eLiving*"

(a) Standard labor market indicators: Wages, work hours, industry, occupation, education
Study: All

(b) Use of a computer at the work place and since when
Study: All

(c) Use of a computer at home and since when
Study: Krueger (1993), Haisken-DeNew and Schmidt (1999)

(d) Intensity of Computer Use
Study: **eLiving innovation**

(e) Use of the Internet and intensity
Study: Pischner, Wagner and Haisken-DeNew (2000)

(f) Influential Job Characteristics
Study: DiNardo and Pischke (1997), Entorf and Kramarz (1997)

(g) Specific Computer Tasks
Study: Krueger (1993), Entorf and Kramarz (1997)

- Word processing
- Web design or management
- Spreadsheets / database
- E-mail or internet
- Design, analysis, or desk-top publishing
- Programming/network systems management, PC support

(h) Specific Skills and their importance for the job
Study: **eLiving innovation**

- able to write computer programmes,
- able to download a file from the web
- able to construct a web page
- able to send a file by email
- able to cut and paste between programs
- able to reboot a computer
- able to copy a file to a floppy disc

(i) General Attitudes toward computers
Study: **eLiving innovation**

- Generally interested in new technologies
- Computers are intimidating
- Computers can be fun
- Difficulty in understanding new technologies
- Over-dependence on computers
- Computers will make life easier
- Computers are a necessary evil

(j) Leisure time activities
Study: **eLiving innovation** (in connection with IT)

- play sport, keep fit or go walking
- go to watch live sport
- go to the cinema, a concert, theatre or other live performance
- have a meal in a restaurant or cafe, or go for a drink to a bar or club
- attend activity groups such as evening classes
- read newspapers or magazines
- read books, whether fiction or non-fiction
- meet with friends

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