Measuring the relationship between ICT use and income inequality in Chile

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Working Paper 26
October 26, 2003.

Abstract: This note explores the relationship between the penetration level of Information and Communication Technologies and earnings inequality in Chile. The purpose of the note is to check whether income distribution significantly differs among ICT users and non users. I find that in addition to having a higher average income, the group of ICT users presents a broader dispersion of earnings than the group of ICT non users. In addition I present the results of a logistic regression showing that the most important factors facilitating or inhibiting Internet access are income, education, area of residence and gender.

A note prepared for the University of Texas Inequality Project and Economists Allied for Arms Reduction
Pursuant to a project on Inequality and Democratic Development
Funded by the Ford Foundation

The relationship between the penetration level of Information and Communication Technology (ICT) and inequality is not straightforward. While some have argued that the consumption level of ICT differs according to factors such as income, education, race and geography[1], others have suggested that policies aimed at spreading the use of ICT increase worker productivity and tend to reduce economic inequality[2]. Thus the question: to what degree, if any, does the penetration of ICT in society contribute to changes in inequality? The purpose of this note is not to establish a causal relationship between inequality and the penetration of new technologies; rather it is to explore whether income distribution significantly differs among those who use ICT and those who do not. This finding provides a starting point for further analysis.

Using the Chilean Household Survey (CASEN, 2000), private employees are selected and classified as non-users, partial-users or full-users of ICT. Partial-users are defined as workers who access computers, whereas full-users are defined as workers who access both computers and the Internet[3]. Workers who access neither computers nor the Internet are classified as non-users.

Figure 1 below shows that inequality tends to increase with the diffusion of ICT[4]. The group of non-users shows a Theil index of 0.085, whereas the group of partial-users has a Theil index of 0.1595. The cluster of full-user employees presents the highest level

[1] Compaine, Benjamin M. The Digital Divide: Facing a Crisis or Creating a Myth? Cambridge, Mass. MIT Press, 2001.
[2] Lloyd- Ellis, H. "Endogenous Technological Change and Wage Inequality" The American Economic Review, March 1999.
[3] ICT access has not been restricted to the workplace only, due to the fact that penetration levels of ICT in the workplace are highly correlated with firms' and jobs' characteristics that may well be correlated with income level and other explanatory variables. See McConnel (1996) "The role of computers in reshaping the workforce", Monthly Labor Review, August, page 5.
[4] For a theoretical model of this hypothesis see Aghion, P "Technology, Knowledge and Inequality" Harvard University

of inequality with a Theil index of 0.2577. By contrast, the Theil index measuring inequality between these three groups is 0.0752, composed by the sum of the contributions to inequality of each group. These contributions are –0.0875, 0.0082 and 0.1545, for non-users, partial-users and full-users of ICT, respectively. Within and between these groups, the Theil indexes reveal the existence of a somewhat homogeneous low-income group (non-users of ICT), a rather dispersed high-income group (full-users of ICT) and a medium-income group with some degree of heterogeneity (partial-users of ICT). The differences between the groups are rather small compared to the differences among workers in the group of full-users[5].

Figure 1: Theil Index within categories of ICT Use among Private Firms' employees. Chile 2000.

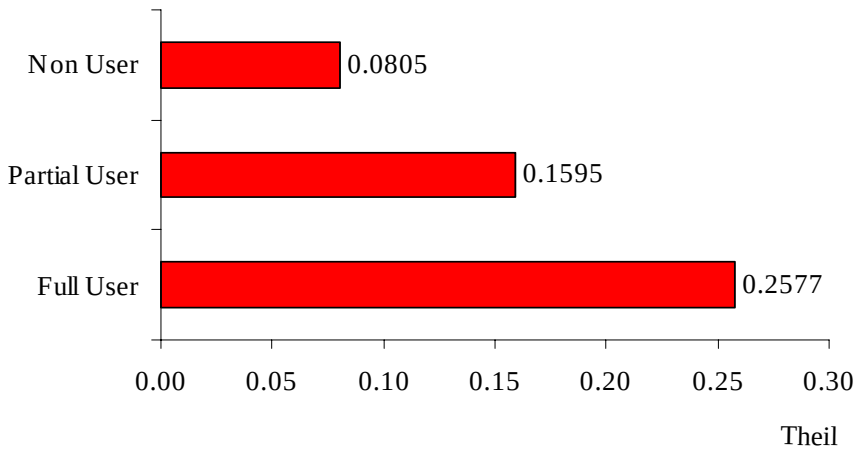
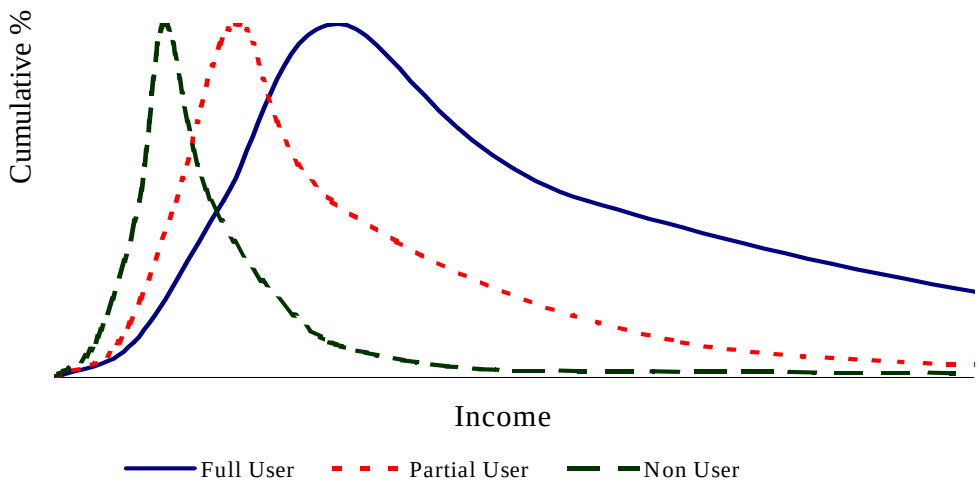


Figure 2 illustrates the income distribution among non-users, partial-users or full-users of ICT. The difference is noticeable: in addition to showing a higher average

[5] A brief analysis of the Theil index between groups is developed in annex 1. Also note that since the group of full-users comprises only 19% of the population as compared to 66% for non-users we can be sure that our measured inequality in the former group is indeed larger than in the latter. The differences are not an artefact of the different group sizes.

income, the group of full-users presents a broader dispersion of earnings than the group of partial-users, which in-turn shows a higher average income and broader income dispersion than the group of non-users. Thus, we can conclude that the deeper the penetration of ICT, the higher the average income and the greater the level of inequality among workers. It is not, however, to be concluded that ICT brings about higher levels of inequality; nor does the evidence suggest that the introduction of ICT is the magical cure for inequality.

Figure 2: Income distribution across network use categories among private firm employees. Chile, 2000.



We may infer from the evidence above that the relationship between income and ICT can be interpreted as though *income drives computer use and Internet access.* Nevertheless, although the cluster of full-users of ICT shows a higher average income level than the clusters of partial and non-users of ICT, the heteroscedastic nature of the relationship suggests that there are other factors mediating the relationship between income and ICT use. In order to scrutinize this hypothesis I run a multinomial logistic regression modelling the probability of a) accessing both computers and the Internet and

b) accessing only computers in relation to the probability of accessing neither computers nor the Internet.

It has been suggested that although a combination of factors such as race, age, education, reliance on technology and area of residence determine the likelihood of ICT use, income is nonetheless the strongest predictor. However, once statistical analysis takes into account the impact of income, we find that demographic factors also materially influence ICT use.

The analysis of the Chilean case suggests that the greater part of the differences in computer and Internet access can be explained by income and some demographic factors. In fact, the multinomial regression analysis displayed below shows that by far *the most important factors facilitating or inhibiting Internet access are income, education, area of residence and gender*, and not age, which – although statistically significant - affects the odds of accessing ICT by less than 2%.

One additional unit of income[6] increases the odds of being a full-user of ICT by 67.2% and the odds of being a partial-user of ICT by 48%. Similarly, one additional year of education boosts the odds of accessing computers and the Internet by 58% and the odds of accessing only computers by 35.7%. Likewise, the odds of using computers and the Internet, and just computers, for workers that have not participated in training programs during the previous year are 59%, and 47.5% less than the odds for trained workers, respectively. The odds of using computers and the Internet among female workers are 57.8% higher than the odds for male workers, whereas the odds of using only

[6] Income is measured in ten thousands of Chilean pesos. Thus, one additional unit of income refers to ch$10,000 per month, or US$18 approximately.

computers are 54.8% higher for females than for males. The results show that the geographical area of residence also affects the odds of accessing the Internet and/or computers. Workers from non-metropolitan areas[7] are 41.9% less likely to access computers and the Internet than workers from metropolitan areas. The zone of residence also affects the probability of accessing computers only, although to a lesser degree: workers from non-metropolitan areas are 27.7% less likely to access computers than workers from metropolitan areas.

Table 1: Multinomial Logistic Regression. Determinants of ICT use among private firm's workers in Chile, 2000.

	B		Contribution to odds: exp(B) -1	
	Computer and Internet	Computer Only	Computer and Internet	Computer Only
Intercept	-6.659 * (0.01)	-5.230 * (0.01)		
Earnings	0.514 * (0.00)	0.392 * (0.00)	67.2%	48.0%
Age	-0.015 * (0.00)	0.000 ** (0.00)	-1.5%	0.0%
Education	0.458 * (0.00)	0.305 * (0.00)	58.0%	35.7%
Live in other than metropolitan area	-0.543 * (0.00)	-0.325 * (0.00)	-41.9%	-27.7%
Have not received training during the previous year	-0.892 * (0.00)	-0.645 * (0.00)	-59.0%	-47.5%
Female	0.456 * (0.00)	0.437 * (0.00)	57.8%	54.8%

Source: CASEN Household Survey, 2000
Note: This table shows multinomial regression coefficients with each of the two categories of ICT use being compared to non-use of ICT. Numbers in parenthesis are SEs N= 2.976
* P < 0.01
** P < 0.05

[7] Metropolitan areas in Chile are defined as the urban areas from the V, VIII and Metropolitan regions.

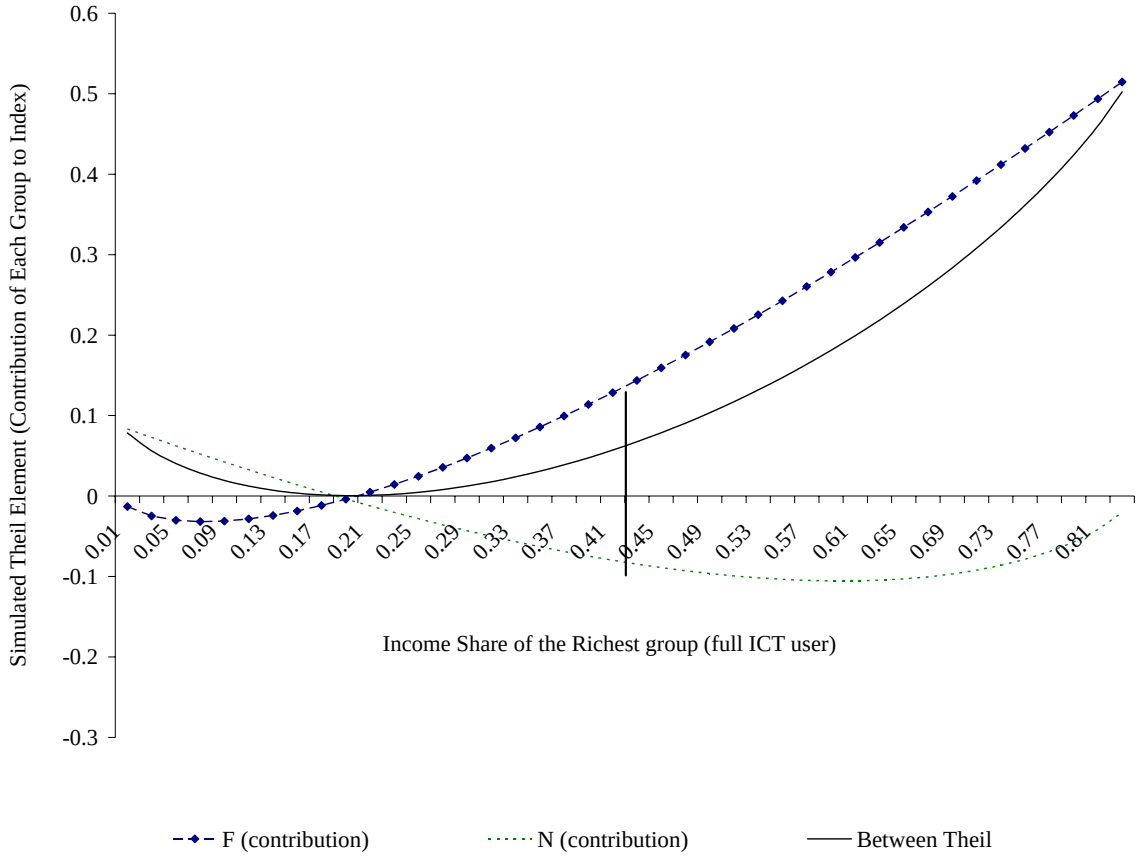
In sum, we can conclude that income is one of the main drivers of ICT use. In addition, income tends to be more dispersed among ICT users than among privately employed workers who do not access ICT. The reason for this disparity is not obvious. We can speculate that, at the level of income that makes ICT affordable, discretionary income is higher and can be spent on a larger set of possibilities. One of those possibilities is computer and Internet use that–as demonstrated by the evidence from Chile--is more likely to be chosen by highly educated female workers from metropolitan areas.

Annex 1: Contribution of the Groups to the Theil Index

Figure A1 depicts the simulated contributions to inequality of the poorest and the richest group, i.e. non-users and full-users of ICT respectively (see Table A1 for income shares and population shares). The contribution to inequality from the middle-income group has been fixed at its observed level of 0.0082[8]. The observed contributions and Theil index are marked with a black line where the rich group (20% of private firms' workers) gathers almost 45% of total income and the poor group (66% of workers) gathers less than 40% of total income[9]. According to the graph and the properties of the Theil index, the group of non-users of ICT is far from its "poorest shape point" that is, from the point where the contribution to inequality is as negative as it can be. Having in mind the relative fairness of the income share of the partial-user group of workers, inequality between categories of ICT usage is almost entirely explained by the differences between non-users and full-users of ICT.

[8] Note that the contribution to inequality of the group of partial-users is almost zero. The contribution is low due to the fact that the income share is almost perfectly equal to average income: the group gathers less than 16% of total income whereas it comprises 14.1% of workers.
[9] See table A1 below.

Figure A1: Between Theil Index (simulation)



Note: The income share of the partial-user group (P) is fixed in 15.8% (real value). Thus, the contribution to inequality of this group is fixed at 0.0082.

Table A1: Income and Population Shares

	Population Shares	Income Shares
Full User	19.9%	44.4%
Partial User	14.1%	15.8%
Non User	66.0%	39.8%