Is it only about Internet Access? An Empirical Test of a Multi-Dimensional Digital Divide

Abstract. Scholars from different disciplines have recently studied a phenomenon called "the digital divide". Since many of the new government information technology initiatives are based on Internet technologies and require the use of the Internet by citizens, understanding the digital divide (and consequently, the potential demand) is very important for e-government scholars. For some researchers, the divide is not a problem and Internet access is the only relevant determinant of Internet use (access divide). For other researchers, the divide is rooted in more fundamental social differences and opportunities (multi-dimensional divide). Using data from the Piedmont region in Italy, this paper tests these two competing views of the digital divide. Overall, the models based on a multi-dimensional view have greater explanatory power and provide evidence about the relevance of multiple factors affecting both Internet access and Internet use. For instance, females use the Internet for a smaller number of activities than males. Individuals with more formal education and who can speak English use the Internet more. Finally, individuals with more experience using a PC and the Internet itself also use the Internet to perform a broader range of activities.

Keywords: Digital Divide, E-Government Demand, Social Aspects, Internet Use, Internet Access

Track: Research Papers

Introduction

In recent years, scholars and practitioners have recognized the importance of understanding how diverse social groups use information and communication technologies (ICTs) in their daily lives. The so-called digital divide has been conceptualized very differently, from access to computers and the Internet, to a much more complex social phenomenon with multiple dimensions and frames of reference. Since many of the newest government information technology initiatives are based on Internet technologies and required the use of the Internet by citizens, understanding the digital divide (and consequently, the potential demand) is very important for e-government scholars.

A fairly comprehensive examination of the literature reveals the difficulty in describing all of the different meanings and relationships among concepts such as technology, information, information and communication technologies, and the Internet. The term digital divide carries broad social and political implications. Robinson, DiMaggio and Hargittai (2003) write, "[t]he digital divide implies that significant minorities of the population are effectively denied access to a technology that, like other public facilities like libraries and super highways, is thought to be open to anyone" (p. 2). The consequences of which, imply differing life chances and opportunities for those who are not technologically savvy (DiMaggio & Hargittai, 2001; Servon, 2002).

Using data from the Piedmont region in Italy, this paper explores the relationships between multiple factors, access to the Internet, and the extent of Internet use. We argue that computer and Internet access do not automatically lead to meaningful uses of the Internet, but that there are several other important determinants. The digital divide is not only about access, but also about other characteristics that define the social opportunities of an individual such as gender, education, employment status, IT skills, and an ability to speak foreign languages, among others. In addition, this paper operationalizes Internet access and Internet use using multiple variables and concepts instead of a dichotomous variable.

The paper is divided in five sections, including these introductory comments. Based on a review of existing academic literature, the second section describes two of the most important approaches to study the digital divide: access divide and multi-dimensional divide. Relevant hypotheses are developed for each of the two views. Section three briefly presents the research design and method used in this paper, including the main characteristics of the respondents and the operationalization of the dependent variables. Using multiple and logistic regression, section four empirically test the two views and discusses the results. Finally, section five provides some concluding remarks and suggests future areas for research in this topic.

Characterizing the Digital Divide: Approaches and Assumptions

The digital divide is often characterized as some type of relationship between information and communication technologies (ICTs) and groups of individuals, who are situated within a complex arrangement of social, environmental, political, and economic issues. ICTs include any communication device (such as a computer hooked up to the Internet, radio, satellite systems, cellular phones, etc.) used to communicate with and access information. Neil Selwyn (2002) argues for reconsidering what is meant by ICT as necessary for digital divide research and that scholars should be concerned with a "heterogeneous range of technologies, types of information and resources – not all necessarily analogous to each other." (p. 7) He states, "World-wide web resources, for example, are accessible through a variety of platforms – from computers to digital television to WAP mobile telephones. Yet here as well, we are referring to a wide range of 'information' and services." (p. 7)

Scholars often narrow the term ICT to mean either personal computers (e.g., hardware and software) or the Internet, in an attempt at a meaningful representation of the digital divide. The following section outlines the viewpoints and assumptions taken by different authors. While scholars investigate many different types of technology, connectivity and uses, the last fifteen years yielded two common approaches to understanding the digital divide: access divide and multi-dimensional digital divide. Hypotheses are developed based on the factors and relationships relevant to each view.

Access Digital Divide: Simple Dichotomy

One of the first, and most simplistic accounts of the digital divide expresses a separation between the "haves" and "have nots." This viewpoint implies that the "haves" have access to computers and the Internet and the "have nots" do not. Scholars argue that a gap exists solely because of an 'access to technology problem' and tend to frame the access divide as an inherent delay in the diffusion of technology among different geographic areas and social groups (Adriani & Becchetti, 2003; Benjamin, 2001; Compaine, 2001). One assumption is that "once online, there is no gap" (Walsh et al., 2003 p. 281). Accordingly, this implies that once online, everyone has the same potential to use and benefit from the information society. In addition, it is assumed everyone uses the Internet for the same purposes (Walsh et al., 2003). Based on these assumptions, access to the Internet and use of the Internet are often equated (DiMaggio & Hargittai, 2001).

Scholars of this viewpoint recognize there are other factors influencing access and use, but compared to research in differing viewpoints, there is little attempt to investigate further that complexity. Whether different types of gaps exist among other characteristics, such as gender, education, skills or use; or whether other factors influence each other, these are not incorporated in to analyses. Solutions often promote market forces as being able to eventually close the "perceived" gap and public policy or government intervention is not necessary. If government intervention is suggested, from this view, public policies should foster only Internet access, since use depends, and is derived almost exclusively from access.

Fig. 1. Access Digital Divide

Thus, one of the main assumptions of this approach is that only Internet access has a direct effect on Internet use. Therefore, the research endeavor is to identify and test how different factors affect Internet access and how access influences Internet use. In general terms, access to the Internet and computers is strongly correlated with socio-economic status (Bimber, 2000; Selwyn, 2002). Access divide scholars attempt to explain factors responsible for an individual having or not having access to computers and/or the Internet. Three main factors have been associated with access: income, age, and education (Hoffman, Novak, & Schlosser, 2000; Mossberger, Tolbert, & Stansbury, 2003; Robinson et al., 2003). Additional factors that have been examined are attitudes toward technology, race/ethnicity, geography (i.e., rural *versus* urban), and gender (Bimber, 2000; Ferro, 2005; Mossberger et al., 2003). Therefore, based on the access divide view, relevant hypotheses are:

H1: Income has a positive effect on *access* to the Internet
H2: Age has a negative effect on *access* to the Internet
H3: Education has a positive effect on *access* to the Internet
H4: Attitude about technology has a positive effect on *access* to the Internet
H5: Race/ethnicity has a significant effect on *access* to the Internet
H6: Geography has a significant effect on *access* to the Internet
H7: Gender has a significant effect on *access* to the Internet
H8: Access to the Internet has a positive effect on *use* of the Internet

A Multi-Dimensional Digital Divide

A competing viewpoint has challenged the simple access dichotomy. Servon (2002) and Norris (2001) assume access to be a basic building block (i.e., almost a "given"). DiMaggio and Hargittai (2001) take this position also stating, "As the technology penetrates into every crevice of society, the pressing question will be not 'who can find a network connection at home, work, or in a library or community center from which to log on?' but instead, 'What are people doing, and what are they able to do, when they go on-line?'" as important factors in understanding the digital divide. These authors challenge the "access only matters" argument. Generally, this view advocates for public policy intervention and does not see the market as being able to close the gap over time with respect to access (Chin & Fairlie, 2004; Cole, 2004; Mossberger et al., 2003), information literacy, employment opportunities, or community redevelopment.

In addition, this view understands access to the Internet and use of the Internet as something different. For example, if a person has access to the Internet, scholars do

not automatically assume people will wish to use the Internet or engage in meaningful uses. Therefore, relationships between access and use are examined separately.

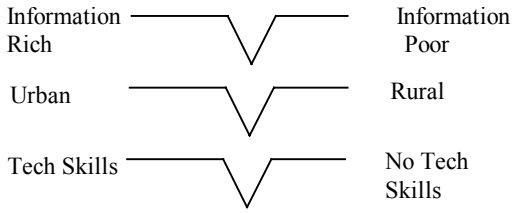

Fig. 2. A Multi-Dimensional Digital Divide

Access is treated as one more dimension of the digital divide, equally as important as other factors such as race/ethnicity, income, skills, geography, cultural content, education, and training (Norris, 2001; Servon, 2002). These factors have been identified in other fields as having a long tradition of engendering inequalities and therefore, the digital divide simply mirrors other patterns of socioeconomic inequality (Castells, 2001; Norris, 2001; Warschauer, 2003).

Norris (2001) suggests the digital divide should be understood as a phenomenon with three distinct aspects including a global divide (divergence of Internet access between industrialized and developing nations), a social divide (a gap between the information rich and poor), and a democratic divide (the difference between those who do, and do not, use the variety of digital means to engage in public life). Servon (2002) lists important dimensions as access, training and information technology literacy, and content. DiMaggio and Hargittai (2001) list five dimensions of digital inequality, including equipment, autonomy of use, skill, social support, and the purpose technology is employed.

The main assumption of the multi-dimensional divide is that access and use of the Internet are associated with a number of factors (race, gender, income, education, skill, etc.) There is no consensus among scholars concerning which factors predict Internet use; however, it is clear that they agree there are many dimensions that do. Robinson et al. (2003) found education is more consistently associated with increases in Internet use (including types of sites visited, uses made of the Internet, and political engagement) and that the higher your education, the more likely you are to use the Internet. Hargittai (2002) argues that skill, defined as "the ability to efficiently and effectively find information on the Web," will determine the likelihood of using the medium to the person's maximum benefit. (p. 3). Kennedy et al. (2003) suggest that people with children use the Internet less than people without children. Hollifield and Donnermeyer (2003) find that employment by a company has a positive relationship with an individual's adoption of technology. Bimber (2000) argues that gender is a very important factor, which affects not only Internet access but also Internet use. Mossberger (2003) found that use is not related to race when controlling for access. Therefore, hypotheses concerning use of and access to the Internet according to the multi-dimensional perspective are:

H9: Income has a positive effect on *use* of the Internet
H10: Age has a negative effect on *use* of the Internet
H11: Education has a positive effect on *use* of the Internet
H12: Attitude about technology has a positive effect on *use* of the Internet
H13: Race/ethnicity does not have a significant effect on *use* of the Internet
H14: Geography has a relationship to *use* of the Internet
H15: Gender has a significant effect on *use* of the Internet
H16: Speaking English has a positive effect on *access* to the Internet
H17: Speaking English has a positive effect on *use* of the Internet
H18: Having a PC at home has a positive effect on *access* to the Internet
H19: Having a PC at home has a positive effect on *use* of the Internet
H20: PC use has a positive effect on *access* to the Internet
H21: PC use has a positive effect on *use* of the Internet
H22: Information technology skills have a positive effect on *access* to the Internet
H23: Information technology skills have a positive effect on *use* of the Internet
H24: Size of household has a significant effect on *access* to the Internet
H25: Size of household has a significant effect on *use* of the Internet
H26: Employment status has a significant effect on *access* to the Internet
H27: Employment status has a significant effect *use* of the Internet
H28: Individual Internet experience has a positive effect on *use* of the Internet
H29: Household Internet experience has a positive effect on *use* of the Internet

Research Methods and Design

This paper is based on a survey to 2206 Italians who live in the region of Piedmont. The sample used for the purpose of this paper was created from a database provided by the Italian National Statistical Institute (ISTAT) whose data refer to the last periodical census carried out in 2001. The entire data set was collected via Computer Aided Telephone Interviews (CATI). Thus people without a fixed line are not represented in the sample. The stratified sample was created using a differentiated probability approach in order to over-represent segments with a higher variance in terms of technology adoption and usage (i.e., young *versus* older people). The variables adopted for the stratification of the sample were: age, gender, and size of town of residence. Following the guidelines provided by the European Statistical Institute, people less than 16 years old were excluded from the sample. Respondents were asked questions about computer ownership, Internet access and Internet use. Relevant individual demographics and household characteristics were also collected.

Characteristics of the Respondents

Table 1 presents some relevant characteristics of individual respondents and their households. The average age of participants is forty-eight years and the sample is almost equally split between men and women. Almost three-fifths of the population have dependent children, making the average household size slightly less than three persons. Approximately, eight out of ten have a primary and secondary education, while thirty-eight percent have an upper secondary education. Occupation among respondents varied, nearly one-third identified as employed. The majority of respondents live in either a town or village. Forty-four percent speak English. Over

half of respondents have a personal computer (PC) at home, about half of them have Internet access and slightly less than half use the Internet.

Table 1. Characteristics of the Individual Respondents and Households

Variables	Mean	Standard Deviation	Minimum	Maximum
Age	47.67	18.704	16	92
Gender (Female = 1)	0.51	0.500	0	1
Occupation (Employee = 1)	0.31	0.461	0	1
Occupation (Self Employed = 1)	0.10	0.302	0	1
Occupation (Unemployed = 1)	0.06	0.232	0	1
Occupation (Student = 1)	0.10	0.295	0	1
Occupation (Other = 1)	0.44	0.496	0	1
Education (None = 1)	0.05	0.220	0	1
Education (Primary/Sec. = 1)	0.45	0.498	0	1
Education (Upper Secondary = 1)	0.38	0.487	0	1
Education (Tertiary = 1)	0.11	0.318	0	1
Other Language (English = 1)	0.44	0.497	0	1
Internet Use = 1	0.44	0.496	0	1
PC Use = 1	0.53	0.499	0	1
Household Size	2.83	1.189	1	10
Dependent Children	0.59	0.860	0	8
PC at Home = 1	0.61	0.489	0	1
Internet Access = 1	0.50	0.500	0	1
Location (City = 1)	0.06	0.235	0	1
Location (Town = 1)	0.47	0.499	0	1
Location (Village = 1)	0.48	0.500	0	1

Operationalization of Dependent Variables

Generally, Internet access and Internet use are studied as dependent variables and their operationalization varies from study to study (DiMaggio & Hargittai, 2001). Internet access has many different meanings. However, Warschauer (2003) found that the two most common *models of access* to technologies are those based on *devices* and *conduits*. Access in the sense of a device, refers to physical access to a computer or other device; whereas, access in the sense of a conduit, implies a connection to a "supply line that provides something on a regular basis." (p. 33). For example, Mossberger et al., (2003) used various measures such as access to a computer at home, home access to the Internet, and an e-mail account to operationalize Internet access. Ferro et al. (2005) used specific access types (i.e., modem or broadband). The way access is characterized often depends on the nature of the complex public problems in need of investigation and also based on the availability of data. This study uses three measures of Internet access: (1) the number of locations where an individual can access the Internet, (2) the number of devices an individual uses to access the Internet, and (3) a dichotomous variable representing whether the individual has access to the Internet.

Internet use also has different meanings. Generally, frequency of use and type of use are operationalized. Bimber (2000) looked at the frequency of Internet use ranging from never to daily. Kennedy, Wellman, and Klement (2003) looked at types of Internet uses (i.e., what people actually do when they were on line: meeting new people, searching for information, participating in recreation activities such as games,

and engaging in commerce). This study uses two measures of Internet use: (1) a dichotomous variable representing whether an individual uses the Internet, and (2) the number of distinctive activities that an individual uses the Internet for.

Analysis and Main Findings

Based on multiple and logistic regression models, this section presents the results of testing the access divide and the multi-dimensional divide views. Overall, it seems clear that the additional variables suggested by the multi-dimensional view significantly improves the explanatory power of the models. Therefore, other factors such as gender, employment status, IT skills, PC use and ability to speak other languages, among others are important determinants of Internet access and Internet use. The following sections present and describe the results for several specifications of the models for Internet access and Internet use.

Table 2. Determinants of Internet Access (Number of Locations)

Independent Variables	Access Divide Model	Multi-Dimensional Divide Model
Constant	0.069 (0.331)	0.497 (2.487)
Income	<0.001*** (4.863)	<0.001* (1.697)
Age	-0.016*** (-12.940)	-0.001 (-0.346)
Education	0.252*** (8.638)	0.088*** (3.151)
Attitude towards Computers	0.110*** (8.444)	0.049*** (4.048)
Nationality (Italian = 1)	0.103 (0.737)	-0.064 (-0.524)
Location (Town = 1)	-0.027 (-0.323)	-0.069 (-0.929)
Location (Village = 1)	-0.045 (-0.537)	-0.070 (-0.948)
Gender (Female = 1)	-0.149*** (-3.864)	-0.072** (-2.087)
Other Language (English)		0.093** (2.178)
PC at Home		0.131*** (2.813)
PC Use		0.706*** (13.267)
IT Skills		0.137*** (3.151)
Household Size		-0.028* (-1.697)
Occupation (Employee = 1)		-0.588*** (-7.644)
Occupation (Self Employed = 1)		-0.609*** (-6.639)
Occupation (Unemployed = 1)		-0.598*** (-5.662)
Occupation (Other = 1)		-0.774*** (-8.307)
R-square	0.396	0.542
Adjusted R-square	0.393	0.536
F-statistic	110.712***	92.956***

Note: T-statistics are in parentheses under coefficient values. Those coefficients followed by * are significant at the 10 percent level, those followed by ** are significant at the 5 percent level, and those followed by *** are significant at the 1 percent level.

Determinants of Internet Access

Table 2 shows the results of an access divide model and a multidimensional model using number of locations for accessing Internet as the dependent variable. Income is positively associated with Internet access in both specifications. Age is significant and negatively associated with Internet access in the access divide model, but is not significant when controlling for other variables suggested by the multi-dimensional divide view. Education and attitudes toward computers have a positive effect on Internet access. Being female is negatively associated with Internet access.

Table 3. Determinants of Internet Access (Number of Devices)

Independent Variables	Access Divide Model	Multi-Dimensional Divide Model
Constant	-0.343**	-0.217
	(-2.232)	(-1.537)
Income	<0.001***	<0.001***
	(7.675)	(3.813)
Age	-0.009***	0.002*
	(-10.483)	(1.776)
Education	0.174***	0.033*
	(8.139)	(1.700)
Attitude towards Computers	0.093***	0.038***
	(9.705)	(4.450)
Nationality (Italian = 1)	0.164	0.028
	(1.603)	(0.319)
Location (Town = 1)	0.079	0.031
	(1.290)	(0.593)
Location (Village = 1)	0.049	0.013
	(0.803)	(0.240)
Gender (Female = 1)	-0.109***	-0.047*
	(-3.860)	(-1.916)
Other Language (English)		0.120***
		(3.966)
PC at Home		0.105***
		(3.191)
PC Use		0.630***
		(16.756)
IT Skills		0.083***
		(2.685)
Household Size		0.003
		(0.235)
Occupation (Employee = 1)		-0.258***
		(-4.744)
Occupation (Self Employed = 1)		-0.264***
		(-4.070)
Occupation (Unemployed = 1)		-0.231***
		(-3.101)
Occupation (Other = 1)		-0.338***
		(-5.132)
R-square	0.407	0.580
Adjusted R-square	0.403	0.575
F-statistic	115.712***	108.750***

Note: T-statistics are in parentheses under coefficient values. Those coefficients followed by * are significant at the 10 percent level, those followed by ** are significant at the 5 percent level, and those followed by *** are significant at the 1 percent level.

Several of the additional variables in the multi-dimensional divide model were also statistically significant. For instance, speaking English was positively associated with Internet access. Having a PC at home and individual use of a PC are positively associated with Internet access. Being involved in an IT training course is positively associated with Internet access. Household size is negatively associated with Internet

access. Employment status is a significant predictor of Internet access. Finally, there is an important adjusted R-square improvement from 0.393 to 0.536.

Table 3 presents the results of an access divide model and a multi-dimensional divide model using the number of devices for Internet access as the dependent variable. Income is positively associated to Internet access. Age is significantly associated with Internet access, but in the access divide model the relationship is negative and in the multi-dimensional model it is positive. Education and attitude towards computers are positively associated with Internet access. Being female is negatively associated with Internet access measured as the number of devices to access the Internet.

Table 4. Determinants of Internet Access (Dummy Variable)

Independent Variables	Access Divide Model	Multi-Dimensional Divide Model
Constant	-3.584*** (22.614)	-23.913 (<0.001)
Income	0.001*** (59.409)	<0.001*** (6.901)
Age	-0.038*** (79.853)	0.013 (1.851)
Education	0.524*** (26.298)	0.080 (0.228)
Attitude towards Computers	0.320*** (44.754)	0.275*** (15.018)
Nationality (Italian = 1)	0.620 (1.555)	-0.115 (0.019)
Location (Town = 1)	0.683** (5.094)	0.440 (0.954)
Location (Village = 1)	0.636** (4.460)	0.595 (1.743)
Gender (Female = 1)	-0.160 (1.356)	-0.041 (0.037)
Other Language (English)		0.287 (1.454)
PC at Home		22.011 (<0.001)
PC Use		0.790*** (8.918)
IT Skills		-0.429* (3.092)
Household Size		0.086 (0.723)
Occupation (Employee = 1)		-0.688 (1.692)
Occupation (Self Employed = 1)		-1.366** (5.463)
Occupation (Unemployed = 1)		-1.113 (2.621)
Occupation (Other = 1)		-1.538*** (6.809)
-2 Log likelihood	1326.973	625.152
Cox & Snell R-square	0.328	0.601
Nagelkerke R-square	0.438	0.802
Chi-square	534.653***	1233.653***

Note: Wald-statistics are in parentheses under coefficient values. Those coefficients followed by * are significant at the 10 percent level, those followed by ** are significant at the 5 percent level, and those followed by *** are significant at the 1 percent level.

Similar to the previous specifications, several variables related to the multi-dimensional divide were found to be important determinants. Speaking English is positively associated with Internet access. Having a PC at home and individual use of a PC are positively associated with Internet access. Information technology skills as

represented by an IT training course is positively associated with Internet access. Finally, employment status is a significant determinant of Internet access. Overall, there was an improvement in adjusted R-square from 0.403 to 0.580.

Table 4 shows the results of an access divide and a multi-dimensional divide logistic regression models, where access was measured as a dichotomous variable. Again, income is positively associated with Internet access. Age is negatively associated with Internet access in the access divide model and not statistically significant in the multi-dimensional divide model. Education is positively associated with Internet access in the access divide model, but not significant in the multi-dimensional divide model. Attitude towards computers was positively associated with Internet access. Location (city, town, or village) was a significant determinant of Internet access.

Similar to previous specifications, some variables related to the multi-dimensional view were also significant. For instance, PC use was positively associated with Internet access. IT skills were a significant determinant of Internet access, but the sign was negative. Finally, employment status seems to be an important variable, but significant differences were found only between students and self-employed and students and other. The Cox and Snell R-square improved from 0.328 to 0.601 and the Nagelkerke R-square went from 0.438 to 0.802 suggesting that the additional variables in the multi-dimensional model have an important impact on the percentage of variance explained.

Determinants of Internet Use

Following a similar logic as with Internet access, this section presents the results from several specifications of Internet use models. Overall, the multi-dimensional divide models have greater explanatory power and untangle the complex relationships in a more specific manner. Table 5 presents the results of three models using the extent of Internet use as the dependent variable. The extent of use is operationalized as the number of activities an individual performs using the Internet. The first regression model is based purely in the access divide view and therefore considers Internet access as the only relevant factor affecting Internet use directly. The second model includes the factors mentioned in the access divide view, but tests direct relationships from all of them to Internet use. Finally, the third model incorporates additional variables related to the multi-dimensional divide view.

Overall, there is an important improvement in adjusted R-square, which went from 0.371 in the access divide model to 0.528 in the extended access divide model, and then to 0.697 in the multi-dimensional divide model. Internet access is positively associated with Internet use in all specifications. Income is positively associated with Internet use in the extended access divide model, but becomes not statistically significant once controlling for other variables. Age is negatively associated with Internet use. Education and attitude towards computers are positively associated with Internet use. Being female is negatively associated with Internet use.

Similar to Internet access, there were several variables related to the multi-dimensional divide that were significantly associated to Internet use. For example, speaking English was positively associated with Internet use. Having a PC at home

was negatively associated with Internet use, but individual use of a PC was positively associated with Internet use. Similarly, individual Internet experience was positively associated with the extent of Internet use, but household Internet experience was negatively associated with the extent of individual Internet use.

Table 5. Determinants of Internet Use (Extent of Use)

Independent Variables	Access Divide Model	Access Divide Model (Extended)	Multi-Dimensional Divide Model
Constant	0.376*** (6.545)	-0.824* (-1.650)	-0.117 (-0.265)
Internet Access	2.929*** (35.882)	1.842*** (16.408)	1.488*** (9.426)
Income		<0.001*** (2.881)	<0.001 (0.912)
Age		-0.023*** (-7.644)	-0.007** (-1.964)
Education		0.550*** (7.801)	0.138** (2.229)
Attitude towards Computers		0.253*** (7.906)	0.099*** (3.706)
Nationality (Italian = 1)		0.276 (0.831)	-0.035 (-0.132)
Location (Town = 1)		0.050 (0.249)	0.051 (0.315)
Location (Village = 1)		-0.012 (-0.060)	0.023 (0.140)
Gender (Female = 1)		-0.554*** (-5.980)	-0.285*** (-3.737)
Other Language (English)			0.201** (2.120)
PC at Home			-0.484*** (-3.461)
PC Use			1.160*** (9.275)
IT Skills			-0.099 (-1.023)
Household Size			-0.025 (-0.660)
Occupation (Employee = 1)			-0.083 (-0.489)
Occupation (Self Employed = 1)			-0.228 (-1.120)
Occupation (Unemployed = 1)			0.133 (0.570)
Occupation (Other = 1)			-0.184 (-0.891)
Individual Internet Experience			0.368*** (18.430)
Household Internet Experience			-0.089*** (-3.548)
R-square	0.371	0.532	0.701
Adjusted R-square	0.371	0.528	0.697
F-statistic	1287.531***	168.124***	152.547***

Note: T-statistics are in parentheses under coefficient values. Those coefficients followed by * are significant at the 10 percent level, those followed by ** are significant at the 5 percent level, and those followed by *** are significant at the 1 percent level.

Table 6 shows the results of the same three models, but using a dichotomous variable to represent Internet use. Similar to the previous set of models, income is positively associated with Internet use in the extended access divide model, but is not significant in the muti-dimensional divide model. Age is negatively associated with Internet use in the extended access divide model, but is not significant once controlling for other factors. Education and attitude towards computers are positively associated with Internet use. Being female is negatively associated with Internet use.

Several variables related to the multi-dimensional view were also found as important determinants of Internet use. Speaking English is positively associated with Internet use. Individual PC use is positively associated with Internet use, but having a PC at home has a negative effect on Internet use. Employment status is an important determinant of Internet use. Three of the four dummy variables representing employment status were statistically significant. Finally, similar to the previous specifications, household Internet experience has a negative effect on individual Internet use.

Table 6. Determinants of Internet Use (Dummy Variable)

Independent Variables	Access Divide Model	Access Divide Model (Extended)	Multi-Dimensional Divide Model
Constant	-2.035*** (465.236)	-5.940*** (32.128)	-7.143*** (19.617)
Internet Access	3.258*** (749.617)	2.783*** (205.766)	2.837*** (48.038)
Income		<0.001** (5.931)	<0.001 (0.051)
Age		-0.052*** (70.439)	-0.008 (0.568)
Education		0.937*** (45.866)	0.467*** (6.569)
Attitude towards Computers		0.558*** (68.804)	0.457*** (26.508)
Nationality (Italian = 1)		0.878 (1.708)	0.278 (0.073)
Location (Town = 1)		0.085 (0.042)	-0.158 (0.084)
Location (Village = 1)		0.044 (0.011)	0.056 (0.011)
Gender (Female = 1)		-0.712*** (14.491)	-0.428* (3.028)
Other Language (English)			0.617** (6.060)
PC at Home			-0.690* (3.553)
PC Use			4.320*** (129.331)
IT Skills			0.014 (0.003)
Household Size			0.037 (0.109)
Occupation (Employee = 1)			-1.418** (4.360)
Occupation (Self Employed = 1)			-1.391* (3.467)
Occupation (Unemployed = 1)			-0.612 (0.524)
Occupation (Other = 1)			-1.680** (5.007)
Household Internet Experience			-7.143*** (19.617)
-2 Log likelihood	1946.887	791.166	512.667
Cox & Snell R-square	0.381	0.544	0.628
Nagelkerke R-square	0.511	0.728	0.841
Chi-square	1046.738***	1055.026***	1312.777***

Note: Wald-statistics are in parentheses under coefficient values. Those coefficients followed by * are significant at the 10 percent level, those followed by ** are significant at the 5 percent level, and those followed by *** are significant at the 1 percent level.

Overall, the explanatory power of the different specifications improved from a Cox and Snell R-square of 0.381 in the access divide model to 0.544 in the extended access divide model, and then to 0.628 in the multi-dimensional divide model. Similar

improvements can be observed in the Nagelkerke R-square, which values went from 0.511 to 0.728 and then to 0.841, respectively.

Final Comments

In general terms, the results of this paper provide evidence that multiple variables are important in explaining Internet access and use. For instance, income is an important determinant of Internet access (measured as a dichotomous variable and number of devices). Individuals need financial resources to buy the necessary equipment for accessing the Internet. However, income is not as important as a determinant of Internet use, at least it is not when controlling for Internet access, availability of equipment, and location. Similarly, IT skills is an important predictor of Internet access, but not of Internet use. However, education, which creates a broader set of capabilities, is very important for both Internet access and use. Attitude towards computers, employment status, gender, PC use experience, and the ability to speak English are important determinants of Internet Access and Internet use. Finally, there seems to be a reinforcing dynamic regarding Internet use; the more experience an individual has with the Internet, the more activities this individual performs using it.

The results show that Internet access is the most important determinant of Internet use. However, other variables are also important and characterizing the digital divide as being only about access offers a limited understanding of this phenomenon. In fact, it seems clear from the results of this research that once online not everybody uses the Internet for the same reasons and performs the same activities. For instance, females use the Internet for a smaller number of activities than males. Individuals with more formal education and who can speak English use the Internet for a greater number of activities. Finally, individuals with more experience using a PC and the Internet itself also use the Internet to perform more activities.

An access divide view also limits the capability of governments to develop appropriate policies that address other interrelated inequalities. In fact, public policies regarding the digital divide need to be re-framed and re-examined given the changes over the last 15 years in technology and patterns of Internet use. These policies should also take into consideration that virtual inequalities are the result of other inequalities in terms of education, gender, income, ability to speak foreign languages, IT skills, employment status, etc. The complexity of the associated social problems and their implications to the success of e-government initiatives need to be fully understood and future research should explore these relationships.

In addition, activists, scholars and practitioners are questioning whether the concept of the digital divide, as represented in early studies, actually provides an accurate portrayal of reality. Some scholars have begun re-theorizing technology's relationship with race, gender and culture (Castells, 2001; Kennedy et al., 2003). In this view, the multiple perspectives an individual holds are brought to the center of any discussion about technology (i.e., centering the subject) (Crenshaw, 1999) and circumstances are evaluated based on how the intersections of their race, gender, class, worldview etc. come together (Kennedy et al., 2003; Servon, 2002). Future research should explore how the relationships between Internet access, Internet use

and their determinants are similar o different for different social groups, representing multiple perspectives.

References

1. Adriani, F., & Becchetti, L. (2003). *Does the Digital Divide Matter? The role of ICT in cross-country level and growth estimates*: CEIS Tor Vergata.
2. Benjamin, M. (2001). *Re-examining the Digital Divide*: Internet and Telecom Consortium, MIT.
3. Bimber, B. (2000). Measuring the Gender Gap on the Internet. *Social Science Quarterly, 81*(3).
4. Castells, M. (2001). *The Internet Galaxy. Reflections on the Internet, Business, and Society*. New York: Oxford University Press.
5. Chin, M. D., & Fairlie, R. W. (2004). *The determinants of the Global Digital Divide: A Cross-Country Analysis of Computer and Internet Penetration*: Economic Growth Center Yale University.
6. Cole, J. I., et al. (2004). *The Digital Future Report*: USC Center for the Digital Future.
7. Compaine, B. M. (Ed.). (2001). *The Digital Divide: Facing a Crisis or Creating a Myth?* Cambridge, MA: MIT Press.
8. Crenshaw, K. (1999). Demarginalizing the Intersection of Race and Sex: A Black Feminist Critique of Antidiscrimination Doctrine, Feminist Theory, and Antiracist Politics. In K. T. Bartlett & R. Kennedy (Eds.), *Feminist Legal Theory*. Boulder: Westview Press.
9. DiMaggio, P., & Hargittai, E. (2001). *From the 'Digital Divide' to 'Digital Inequality': Studying Internet Use As Penetration Increases*: Support from the Center for the Arts and Cultural Policy Studies, Woodrow Wilson School, Princeton University.
10. Ferro, E., et al. (2005). Urban vs. Regional Divide: Comparing and Classifying Digital Divide. In B. e. al. (Ed.) (pp. pp. 81-90, M.): TCGOV 2005, LNAI 3416.
11. Hargittai, E. (2002). Second-Level Digital Divide: Differences in People's Online Skills. *First Monday, 7*(4).
12. Hoffman, D. L., Novak, T. P., & Schlosser, A. (2000). The Evolution of the Digital Divide: How Gaps in Internet Access May Impact Electronic Commerce. *Journal of Computer-Mediated Communication, 5*(3).
13. Hollifield, A. C., & Donnermeyer, J. F. (2003). Creating demand: influencing information technology diffusion in rural communities. *Government Information Quarterly, 20*, 135-150.
14. Kennedy, T., Wellman, B., & Klement, K. (2003). Gendering the Digital Divide. *IT & Society, 1*(5), 72-96.
15. Mossberger, K., Tolbert, C. J., & Stansbury, M. (2003). *Virtual Inequality: Beyond the Digital Divide*. Washington, DC: Georgetown University Press.
16. Norris, P. (2001). *Digital divide : civic engagement, information poverty, and the Internet worldwide*. New York: Cambridge University Press.
17. Robinson, J. P., DiMaggio, P., & Hargittai, E. (2003). New Social Survey Perspectives on the Digital Divide. *IT & Society, 1*(5), 1-22.
18. Selwyn, N. (2002). Defining the 'Digital Divide': Developing a Theoretical Understanding of Inequalities in the Information Age. *Cardiff University School of Social Sciences Occasional Paper 49*, 330-967.
19. Servon, L. J. (2002). *Bridging the Digital Divide: technology, community, and public policy*. Oxford: Blackwell Publishers Ltd.
20. Warschauer, M. (2003). *Technology and Social Inclusion: Rethinking the Digital Divide*. Cambridge, MA: MIT Press.