

# SOCIAL AND BEHAVIORAL BARRIERS

TO THE UTILIZATION OF E-GOVERNMENT INITIATIVES IN  
MAYAGÜEZ, PUERTO RICO<sup>1</sup>

*Walter Díaz*<sup>2</sup>

*Mario Núñez*<sup>3</sup>

## ABSTRACT

Following the literature on e-government, political theory and political participation, this paper addresses some of the consequences of the development of e-government initiatives for the democratization of governance in Mayagüez, Puerto Rico. Applying survey methodology and bivariate and multivariate analysis techniques, we find that the interaction of e-government initiatives with the digital gap impede the potential democratizing effects of e-government efforts.

**Key words:** Government, Political Participation, Social Impacts of Technological Innovation

## INTRODUCTION

Electronic government systems have the potential to improve the responsiveness of governments to the needs of the people that they are designed to serve. To this day, this potential is barely beginning to be exploited as significant barriers hinder the effective integration of information technologies into government practices and their adoption by the public. There are many reasons for this. For instance, governments, particularly local ones, often have considerable difficulties dealing with the costs of both implementing electronic government initiative and of recruiting and retaining the qualified personnel required to maintain and operate them. Furthermore, constant and rapid technological change may strain these governments' resources so that it becomes difficult for them to update their technologies and stay abreast of these changes.

A multidisciplinary group including researchers from the University of Puerto Rico-Mayagüez (UPRM) and personnel from the municipal government from the city of Mayagüez, Puerto Rico, have combined their talents in Public Administration, Computer Science, Engineering and Social Sciences, in order to: identify significant barriers to the effective transfer of information technology into government practices and their adoption by the public, engineer novel solutions to help overcome these barriers, and test their solutions in a real municipal governmental environment. This effort is part of the project titled *Multidisciplinary Research and Education in Digital Governments as a Catalyst for Effective Information Technology Transfer to Regional Governments*, which is supported by the National Science Foundation. The team from the city of Mayagüez includes experts on Information Systems, Engineering and Public Administration. The technical side of the UPRM group encompasses faculty members with expertise in Distributed Data Base Systems, Information Retrieval, and High Performance Computing. From the Social Sciences the UPRM group includes faculty members with expertise in Political Sciences and Learning Technologies.

According to Pavlichev and Garson (2003) e-government can be described as the use of Information Technology by governmental institutions to improve services and information flows to citizens, improve both the efficiency and effectiveness of the public sector, and substantially increase the government's transparency to the public while providing greater opportunities and venues for citizen participation in democratic governance. On the other hand, political participation has been defined in many ways, but a particularly useful definition was proposed by Nagel (1986): "Participation refers to actions through which ordinary members of a political system influence or attempt to influence outcomes". Joining these views, it is clear that e-government initiatives in fact create new forms of political participation.

The development of e-government initiatives can be seen as a three stage process. The first stage is comprised by efforts to make as much governmental information as possible available to citizens. This may include everything from contact information for public officials, statistical data, calls for bids, contracts and so on. The second stage consists of developing systems that allow citizens to perform governmental transactions online. These may include paying taxes, renewing driver's licenses, requesting copies of legal documents —such as birth and marriage certificates, and applying for different forms of governmental aid, among many others. The third and final stage involves the implantation of procedures to maximize citizen interaction with governmental decision makers and decision making (Ballard, 2001).

All three stages are potentially beneficial in that they increase transparency in government, efficiency and citizen opportunities to obtain services. However, it is the third stage that is most critical if both information technologies in general and e-government initiatives in particular, are to fulfill their promise of increased democracy. This is to be achieved by democratizing both the dissemination and accessing of information (Bimber, 2003). The central thesis of this view is that until the late 20<sup>th</sup> century, the relatively high costs of information and commu-

nication favored the development of hierarchical bureaucratic organizations wherein access to and control of information was the key to power. This certainly extends to government wherein it has been amply shown that policy outcomes sharply favor actors, such as interest groups and political parties, who are better organized, informed and capable of participating in such ways that permit them to reward or punish incumbents based on said policy outcomes (Bimber, 2003; Lijphart, s.f.). However, it is now argued that the ascendancy of the internet has resulted in a totally changed information market wherein the marginal costs of information have been greatly reduced. If this is correct, it would in turn mean that larger well organized hierarchical groups and organizations no longer have inherent informational advantages over smaller organizations or even unorganized majorities (Bimber, 2003). Herein lay the potential for enhanced democracy through information technology and e-government initiatives (Dahl, 1986, Bimber, 2003).

However, there is no guarantee that even a large reduction in the marginal costs of information or participation will result in such a desirable outcome. In fact, in relation to other forms of political participation it has been shown that even large reductions in the marginal costs of participating often do not lead to increased participation (Rosenstone & Hansen, 1993; Lijphart, s.f.). Therefore it may very well be the case that policy outcomes will still favor the already better informed and politically active. It follows then that for e-government efforts and the information technologies that make it possible to become truly democratizing factors, it is first necessary that present day biases in political interest, knowledge and participation be reduced.

Following the literature on political participation we therefore argue that democratization will occur only to the extent that the following conditions are met:

1. There must be a reasonable degree of equality of access to the technology necessary to make use of the IT revolution and e-government initiatives.

2. The different subpopulations and demographic groups in society must have knowledge of these opportunities and know how to exploit them.
3. There should not be major biases in the extent to which different groups make use of these opportunities.

These conditions do not constitute an exhaustive list of the criteria that must be met for democratization to occur; rather they are intended as a set of necessary, but not sufficient, criteria.

However, research into political participation shows that the social and economically privileged participate more extensively, and effectively, in politics than do the less well off (Rosenstone & Hansen, 1993; Lijphart, s.f.; Verba, Schlozman & Brady, 1995). If we consider the use of e-government options to be a form of political participation, it follows that although decreasing in extent, the continued existence of the digital divide in the United States wherein the more economically privileged and educated have greater access to both computers and the Internet shows that these individuals will also accrue a greater proportion of the benefits of e-government initiatives and will further increase their advantageous position with respect to public policy outcomes (Bureau, 2003; Bimber, 2003; Lijphart, s.f.).

This paper examines these issues within the context of ongoing e-government initiatives by the city of Mayagüez, Puerto Rico, in order to identify the nature of some of the socioeconomic and behavioral barriers to the utilization of e-government initiatives. This research addresses the following questions:

1. To what degree can the population of Mayagüez benefit from e-government initiatives?
2. Which subpopulations in city stand to benefit more from the efforts and what does this mean for the promise of greater democracy through e-government initiatives? How is this related to the socio-economic and demographic characteristics of the population?

3. What is the significance of these biases for democratic governance?

## METHODOLOGY

Our data were obtained through a mixed mode survey of Mayagüez residents aged 18 and over. The core survey consisted of 401 telephone interviews with respondents selected through the use of random digit dialing techniques (see Appendix 1 for the exact text of questions for the analyses presented in this paper). Given that, according to the US Census of Population and Housing, a substantial 24% of households in Mayagüez do not have telephone service, we also implemented a face to face survey with residents of housing units in which there was no phone service. This was achieved by sampling census block groups with probability of selection proportional to the amount of housing units without phones within them. Once the block groups were selected, blocks, housing units (without phone service) and respondents were randomly selected from each one. This procedure resulted in an additional 146 interviews for a total sample size of 547 interviews, of which 73.3% were phone interviews and 26.7% were face to face.

The data were analyzed using both bivariate and multivariate methodologies as described in the following section.

## FINDINGS

We examine three different but obviously related indicators of the potential for e-government efforts to achieve the goal of facilitating citizen access to services and information and to increase citizen participation in decision making: computer ownership, Internet access and actual use of e-government services and information.

Though having a computer or Internet access in the house is not indispensable so that citizens may make the most from the opportunities provided to them by e-government initiatives,

it is obvious that it is highly convenient for doing so. Citizens who do not have access to a computer or other medium to connect to the Internet from home have to depend on the availability of the necessary technology at their place of work, school or some other public or private facility. Our data show that 47% of our respondents indicated that they had a computer at home, whereas 34% say that they have Internet access at home. The corresponding figures for the United States are 68% and 61%, respectively. Given that the median annual family income for the US in 2003 was approximately \$45,000 (Bureau, 2003) while it was only \$15,000 for Mayagüez (Census, 2000) these differences are not at all surprising. Furthermore, 36% of our respondents indicated that they have access to a computer at their place of work or school, while 28% indicate that they have Internet access at work or school. Overall, 56% of our respondents have access to a computer at home or work or school whereas 48% say they Internet access from home, work or school.<sup>4</sup>

The data also show heavy socioeconomic biases in both computer ownership and Internet access. Tables 3.1 and 3.2 summarize the relationship between these variables and income and education. The digital gap is clearly obvious. Wealthier and more educated individuals are much more likely to own computers, have Internet access and make use of e-government resources than are the less privileged.

Though not exactly comparable because it summarizes only computer and internet access at home, Table 3.3 shows that the same pattern holds for the relationship between education and access to computers and the Internet in the United States.

Tables 3.1 and 3.2 show that citizens of higher socioeconomic status (SES) are much more likely to possess the resources necessary for taking advantage of e-government initiatives than are lower SES citizens.<sup>5</sup> We now examine the relationship between the use of e-government services and SES.

As an indicator for e-government service or information use, we created a variable that indicates whether the respondent has ever accessed information or services from either the Federal or

**Table 3.1 Computer and internet access at home, school or work in Mayagüez, Puerto Rico\* \*\***

	Income		
	\$0-14,999	\$15,000-\$34,999	\$35,000-
<b>Has computer access</b>	40.6% n=114	79.0% 94	97.3% 71
<b>Has internet access</b>	31.7% 89	68.1% 81	90.4% 66

\*  $p < .05$  for both computer and internet access

\*\* Source: Authors' survey

**Table 3.2 Computer and internet access at home by education in Mayagüez, Puerto Rico\* \*\***

	Education (degree completed)		
	Less than high school degree	High school degree	Associate degree or more
<b>Has computer access</b>	15.8% 18	52.8% 102	79.1% 186
<b>Has internet access</b>	8.8% 10	45.1% 87	68.9% 162

\*  $p < .05$  for both sets of relationships

\*\* Source: Authors' survey

**Table 3.3 Computer and internet access at home by education in the United States\* \*\* \*\*\***

	Education (degree completed)		
	Less than high school degree	High school degree	Associate degree or more
<b>Has computer at home</b>	15.8%	63.7	83.6
<b>Has internet access at home</b>	38.2%	44.4	78.4

\*  $p < .05$  for both sets of relationships

\*\* Sample weighted to US population size

\*\*\* Source: US Bureau of the Census, Current Population Survey, October 2003



Puerto Rican government, or had ever sent an email message to any official of either government. Tables 3.4 and 3.5 summarize the relationship between this variable and respondents' income and education, respectively.

We observe that both income and education are strongly related to the use e-government resources. However, we expect that, as is often the case with other forms of participation, the effect of income is an artifact of its correlation with education.

We further explore these results using a multivariate approach. Following Bimber (2003) we utilize logistic regressions to model computer ownership, Internet access and the use of e-government services or information as a function of respondents' age, work status, education, income, gender and whether they are university students or not. These variables encompass indicators for both the ability to meet the costs associated with acquiring and using information technology, the knowledge and interest necessary to do so, and exposure to the technology.

We expected age to be negatively associated to computer ownership and Internet access, but not necessarily with the use of e-government services or information. In other words, we expect the younger will have greater access to technology, but will not necessarily be more likely to use it with political ends. This is so because, we expect that, all else being equal, younger respondents will have had greater exposure to information technology than older ones. However, the literature on political participation shows that the young are often less likely to participate in politics than older individuals (Rosenstone & Hansen, 1993; Cámara Fuertes, 2004). For the same reasons, we expected working outside the house to be positively correlated with all three dependent variables.

We expected education to also be positively related with all three variables as it contributes in various ways to increase their likelihood. First, the more educated will have an easier time meeting some of the information costs associated with both purchasing and using IT and also of e-government services. For example, all else equal, one would expect the more educated

**Table 3.4 Use of e-government services or information by income in Mayagüez, Puerto Rico\* \*\* \*\*\***

	Income		
	\$0-14,999	\$15,000-\$34,999	\$35,000-
<b>R has not used e-government services</b>	90.4 % n=254	80.7% 96	69.9% 51
<b>R has used e-government services</b>	9.6% 27	19.3% 23	30.1% 22

\* p<.05

\*\* Source: Authors' survey

**Table 3.5 Use of e-government services or information by education in Mayagüez, Puerto Rico\* \*\* \*\*\***

	Education		
	Less than high school degree	High school degree	Associate Degree or more
<b>R has not used e-government services</b>	98.2% 112	90.2% 174	76.2% 179
<b>R has used e-government services</b>	1.8% 2	9.8% 19	23.8% 56

\* p<.05

\*\* Source: Authors' survey

to be better able to decide which technologies to purchase as a means to achieve IT related goals. Furthermore, they will also be more likely to understand the importance, possibilities and limitations related to different forms of political participation—including the use of e-government resources—and should also be more likely to know about the availability of e-government options to interact with the governmental apparatus (Rosenstone & Wolfinger, s.f.; Rosenstone & Hansen, 1993; Lijphart, s.f.; Bimber, 2003).

Income is also a powerful predictor of some forms of political participation, particularly those that require a monetary investment. For example, income is an important predictor of

making contributions to political campaigns and membership in groups that require the payment of dues. However, once education is accounted for, it is only weakly associated with voting (Rosenstone & Hansen, 1993; Cámara Fuertes, 2004). Following this line of thought, we expect income to be strongly and positively associated with computer ownership, less strongly with having Internet access and weakly, if at all, with the use of e-government resources.

Finally, we include a dummy variable identifying university students —because Mayagüez has various university campuses with a total of approximately 18,000 students among them. Given that we did not exclude them from our samples even if they were not permanent residents of Mayagüez (because even then they are consumers of municipal services), and that we expected them to be more likely to own computers and to access the Internet than would otherwise be predicted, we included a variable identifying university students in the analysis. We also include a dummy variable to account for access to computers and the Internet at home, work or school in the models for Internet access and e-government service usage.

Table 3.6 clearly shows that the more educated and financially better off have clear advantages over the less privileged in relation to computer ownership. This is not surprising given that, as expected, the more educated and wealthier individuals should be better able to deal with the costs associated with purchasing and owning computers.

Furthermore, younger individuals are more likely to report having access to computers at home, school or work than older ones, even when controlling for factors such as education, income, and currently being a university student. Working outside the home has a positive effect on access to computers whereas gender had no bearing on it.

Notice also the large marginal effects associated with these variables (see Appendix 2). All else being equal, on average, the most highly educated are 57% more likely to have access to computers than the least educated, while respondents in the highest

**Table 3.6 Computer access at home, work or school\***

	<b>Computer access at home, work or school</b>			
	<b>B</b>	<b>Standard Error</b>	<b>P</b>	<b>Marginal Effect</b>
<b>Age in years</b>	-.039	.009	.000	-.37
<b>Work outside home or not</b>	.966	.282	.001	.13
<b>Ln(Education)</b>	2.395	.544	.000	.57
<b>Ln(Income)</b>	1.342	.242	.000	.39
<b>Gender</b>	-.064	.279	.817	NA
<b>University student</b>	2.320	.584	.000	.27
<b>Constant</b>	-3.381	.998	.001	NA
N=470, chi-sq.=265; p=0.000, Nagel. $r^2 = .582$				

\* Logit coefficients. Work variable is coded 1 for those who work outside the house, 0 otherwise; gender is coded 1 for males, 0 females. Income refers to household income and is coded as follows: 1 \$0 to \$4,999, 2 \$5,000 to \$9,999, 3 \$10,000 to \$14,999, 4 \$15,000 to \$24,999, 5 \$25,000 to \$34,999, 6 \$35,000 to \$44,999, 7 \$45,000 to \$59,999 and 8 \$60,000 and greater. University student is coded 1 for respondents who are university students, 0 otherwise. A logarithmic transformation is used for both the education and income variables in all multivariate analysis.

**Table 3.7 Internet access at home, work or school**

	<b>Internet access</b>			
	<b>B</b>	<b>Standard Error</b>	<b>P</b>	<b>Marginal Effect</b>
<b>Age in years</b>	-.014	.014	.311	NA
<b>Work outside home or not</b>	.029	.402	.943	NA
<b>Ln(Education)</b>	1.362	.680	.045	.23
<b>Ln(Income)</b>	.749	.318	.018	.12
<b>Gender</b>	-.466	.370	.207	NA
<b>University student</b>	3.248	.912	.000	.17
<b>Access to a computer at home, work or school</b>	5.660	.843	.000	.66
<b>Constant</b>	-6.091	1.480	.000	NA
N=470, chi-sq.=434; p=0.000, Nagel. $r^2 = .804$				

income category are 39% more likely to do so than those with the smallest incomes. Furthermore, as expected, the youngest respondents are 37% more likely to have access to computers than the oldest ones while university students are on average 27% more likely to have access to them than are non-university students. In other words, education and income have the largest impacts, but being a university student strongly subsidizes access to computers.

When we consider Internet access (Table 3.7) we once again find evidence for the primacy of income and education. Those with higher incomes or greater education are more likely to be able to pay for Internet access or to have access to it at either school or work. However, the marginal effects of income and education are considerably smaller than they were for access to computers.

On the other hand, we once again find that gender is not a significant variable; males are no more or less likely than females to report having Internet access. This is noteworthy in that males are almost twice as likely to report having Internet access than are females (62% and 36%, respectively). Furthermore, we also observe that working outside the home has no independent effect on this technology.

Table 3.8 summarizes our findings for having used e-government resources to obtain either services or information from the federal or Puerto Rican governments. The first important point is that the model, though significant, explains only a relatively small amount of the variance in the dependent variable. Furthermore, it is noteworthy that the only independent variables statistically significant were education and having Internet access, whereas the income variable ceased to be significant. On the other hand, the marginal effect of the education variable remained at a substantial 20%. In other words, the most educated respondents were, all else equal, 20% more likely to make use of e-government services or information than the least educated.

**Table 3.8 Made use of e-government resources to access government services or information**

	Internet access			
	B	Standard Error	P	Marginal Effects
<b>Age in years</b>	-.015	.011	.194	NA
<b>Work outside home or not</b>	.127	.332	.703	NA
<b>Ln(Education)</b>	2.705	.883	.001	.20
<b>Ln(Income)</b>	.154	.172	.572	NA
<b>Gender</b>	-.219	.302	.462	NA
<b>University student</b>	.295	.375	.432	NA
<b>Internet access</b>	1.246	.438	.004	.12
<b>Constant</b>	-6.668	1.324	.000	
N=470, chi-sq.=71; p=0.000, Nagel. $r^2 = .245$				

## DISCUSSION

The multivariate analysis provides some key insights into our understanding of barriers to the use of e-government services by the general public. The first is that as we move on from the determinants of access to computers towards Internet access and ultimately to the use of e-government resources, we find that the importance of income decreases. This is consistent with the reduction in costs thesis. Once one has obtained access to a computer, the cost of Internet access becomes relatively trivial and, in turn, once one has obtained Internet access, the additional monetary cost of using it to obtain governmental services and information becomes practically negligible. This finding is consistent with Bimber's argument on the declining marginal costs of information.

The second key point is the role played by education. Compared to its role in determining access to computers, the magnitude of its marginal effect decreases when one considers

its role in relation to Internet access and e-government usage. However, even then its effect remains at a substantial 20%. This suggests that even though advances in IT and e-government may have greatly decreased many of the costs of at least some forms of political participation and of information seeking, it also appears that the use of e-government resources remains costly in terms of either, or both, the informational burdens that must be met to make use of them or the opportunity costs associated with doing so. This means that, at least at present, the promise of enhanced democracy and citizen participation in public affairs through the application of IT is not being fulfilled, as the privileged, particularly the more educated and presumably better informed, will continue to have privileged access to the State. In fact, e-government initiatives, at least in Mayagüez, Puerto Rico, are likely to increase preexistent biases in political participation that are already favorable to the better off. In other words, e-government efforts may actually serve to *increase* political inequality and therefore hinder democratization.

However, we also found that the usual socioeconomic status (SES) variables associated with the so called digital divide explain very little about e-government usage. Our thesis for future work is that e-government usage is a form of political participation and as such, cannot be adequately explained purely by SES. Rather we must also look at issues such as citizen engagement, issue salience, feelings of personal efficacy, trust in government, contextual factors such as mobilization efforts by activists, governmental efforts at promoting its use, and very importantly, understanding the opportunity costs involved in these forms of participation (Cámara Fuertes, 2004; Rosenstone & Hansen 1993; Lijphart, s.f.).

On the other hand, the positive and significant effect of having Internet access, even when controlling for education and income, suggests that present day efforts by the Puerto Rican state government and the municipality of Mayagüez to promote the use of e-government resources by placing digital libraries in the midst of less privileged communities may have at least some

effect on increasing e-government usage by less privileged populations. Future research needs to explore this in much greater detail as our present understanding of this topic is rather limited. As stated previously, this exploration must be undertaken from the perspective of modeling political participation.

Following this line of thought, our findings also suggest that to substantially increase the use of e-government options would require strategies analogous to those used to increase other forms of political participation. This is important, not only for extending the use of e-government resources throughout different social groupings, but also for e-government to make the critical transition from its second stage of development and its emphasis on governmental transactions to its third stage, in which the emphasis is on communication and interaction between citizens, decision makers and decision making processes that must be achieved for e-government efforts to reach their democratizing potential.

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## NOTES

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- 2 Center for Applied Social Research, University of Puerto Rico-Mayaguez. (Tel) 1-787-265-3839, email: wdiaz@uprm.edu
- 3 Center for Internet Enhanced Education, University of Puerto Rico-Mayaguez. (Tel) 1-787-265-3839 email: mnunez@uprm.edu
- 4 The 146 respondents who lacked phone service were asked whether they had ever used a publicly available computing facility. Only 2.4% of them indicated they had ever used a municipal or state operated facility while less than 1% (n=1) indicated he or she had used a privately operated one (e.g. Internet café)
- 5 The exact same patterns held for access to a computer and the Internet at the respondents' place of work.

## APENDIX 1 - QUESTION TEXT

Nuestras primeras preguntas se relacionan al uso que usted hace de computadoras e Internet.

1. ¿Hay alguna computadora en su casa?
  - Sí
  - No
  - NO SABE
  - SE REHUSA
  
2. ¿Tiene acceso a la Internet desde su casa?
  - Sí [PASE A LA PREGUNTA 3]
  - No [PASE A LA PREGUNTA 2a]
  - NO SABE [PASE A LA PREGUNTA 2a]
  - SE REHUSA [PASE A LA PREGUNTA 2a]
  
- 2a. Ya sea desde su casa, lugar de trabajo o estudio o cualquier otro lugar; ¿ha utilizado alguna vez la Internet?
  - Sí [PASE A LA PREGUNTA 4]
  - No [PASE A LA PREGUNTA 6]
  - NO SABE [PASE A LA PREGUNTA 6]
  - SE REHUSA [PASE A LA PREGUNTA 6]
  
6. ¿En su lugar de trabajo o estudio, ¿tiene acceso a una computadora?
  - Sí
  - No [PASE A LA PREGUNTA 9]
  - No trabaja ni estudia fuera de la casa [PASE A LA PREGUNTA 9]
  - NO SABE** [PASE A LA PREGUNTA 9]
  - SE REHUSA** [PASE A LA PREGUNTA 9]
  
7. ¿Puede acceder a la Internet desde su lugar de trabajo o estudio?
  - Sí

- No [PASE A LA PREGUNTA 9] DEBE CONCORDAR CON LA PREG. 2a
- NO SABE** [PASE A LA PREGUNTA 9] DEBE CONCORDAR CON LA PREG. 2a
- SE REHUSA** [PASE A LA PREGUNTA 9]

9a. Pensando en su acceso a Internet, ya sea desde su casa, lugar de trabajo o estudio o cualquier otro lugar, dígame por favor si alguna vez ha hecho las siguientes cosas.

9b. ¿Accedió a servicios o información, incluyendo enviar correo electrónico a algún oficial o agencia, del gobierno federal (Estados Unidos)? Por favor conteste sí o no.

- Sí
- No
- NO SABE**
- SE REHUSA**

10. ¿Accedió a servicios o información, incluyendo enviar correo electrónico a algún oficial o agencia del gobierno de Puerto Rico?

- Sí
- No
- NO SABE**
- SE REHUSA**

29. ¿Está usted...? (LEA ALTERNATIVAS)

- casado/a
- soltero/a
- divorciado/a o separado
- viudo
- conviviendo
- NO SABE**
- SE REHUSA**

30. ¿Cuál de las siguientes alternativas mejor describe su situación laboral actual? **(LEA ALTERNATIVAS)**

- Trabaja a tiempo completo
- Trabaja a tiempo parcial
- O no esta trabajando fuera de la casa
- NO SABE**
- SE REHUSA**

31. ¿Cuál es el grado o título educativo más alto que usted recibió? **(LEA ALTERNATIVAS)**

- ninguno
- diploma de escuela elemental
- diploma de escuela intermedia
- diploma de escuela superior
- grado asociado/certificación técnica
- bachillerato o más
- NO SABE**
- SE REHUSA**

32. ¿Está usted estudiando en alguna institución educativa, ya sea una escuela, instituto técnico o vocacional, o universidad?

- Sí
- No
- NO SABE**
- SE REHUSA**

34. ¿Cuál de las siguientes categorías describe mejor el ingreso anual total de su hogar? **(LEA ALTERNATIVAS)**

- \$0 a \$4,999
- \$5,000 a \$9,999
- \$10,000 a \$14,999
- \$15,000 a \$24,999
- \$25,000 a \$34,999
- \$35,000 a \$44,999
- \$45,000 a \$59,999

- [ ] \$60,000 en adelante
- [ ] **NO SABE**
- [ ] **SE REHUSA**

## APENDIX 2 - COMPUTING MARGINAL EFFECTS

Because of the non-linear nature of the logit (and other probabilistic models of choice) model there is no obvious straightforward way to estimate marginal effects, as is possible with linear regression. In this paper we have chosen to estimate the maximum possible effect of the independent variables because it permits us to directly compare their potential impact on the respondents' behavior or choices. We do so as follows:

1. Using the estimated coefficients, compute the log of the odds of observing option  $j$  for each respondent  $i$  setting the independent variable to its lowest value
2. Convert the log of the odds to a probability ( $P(j_0)$ )
3. Repeat steps 1-2 setting the variable to its highest value so that we obtain  $P(j_1)$
4. Compute the difference  $P(j_1) - P(j_0)$  for each respondent  $i$
5. Compute the average of the differences across cases.

The average of the difference is the estimate for the marginal effect of that variable and is interpreted as a proportion or probability.