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Abstract

This paper uses an ordered probit model to empirically assess the determinants of the digital divide in Egypt, using a sample of 15,029 individuals between the ages of 10 and 29. The main contribution of the current study is in the construction of the ICT composite indices for Egypt, namely the digital divide index, measuring the urban and rural digital divide among youth in Egypt based on the SYPE survey. Our results show that there is a positive correlation between urbanization and the digital divide. Other control variables such as gender, wealth, and the level of education are found to be significant predictors of the digital divide as well. These results are in line with previous empirical literature. Finally, policy implications are also discussed.

JEL Classification: O31; L 96

Keywords: Digital divide, Egypt, Urbanization, Ordered probit models, young people

ملخص

تستخدم هذه الورقة نموذجا تجريبيا لتقييم الاحتمالية لمحددات الفجوة الرقمية في مصر، وذلك باستخدام عينة من 15029 فرد والذين تتراوح أعمارهم بين 10 و 29. المساهمة الرئيسية للدراسة الحالية هى بناء مؤشرات تكنولوجيا المعلومات والاتصالات فى مصر، وهي مؤشر الفجوة الرقمية، وقياس الفجوة الرقمية في المناطق الحضرية والريفية بين الشباب في مصر استنادا إلى مسح SYPE. تظهر نتائجنا أن هناك علاقة إيجابية بين التحضر والفجوة الرقمية. تم العثور على متغيرات التحكم الأخرى مثل النوع ، والثروة، ومستوى التعليم ليكون مؤشر كبير للتنبؤ بالفجوة الرقمية. هذه النتائج تتماشى مع الأدبيات التجريبية السابقة. وأخيرا، تناقش هذه الورقة أيضا الآثار المترتبة على السياسات.

1. Introduction

Digital divide is a new phenomenon emerging with the development of the information and communication technologies (henceforth, ICTs). The digital divide can be defined as the gap between those with a permanent, effective access to new ICTs and those with none (e.g. Hoffman and Novak 2000; Rice and Katz 2003; Fairlie 2004; Andonova 2006; Chinn and Fairlie 2007). Nevertheless, there may be other important dimensions of the digital divide such as gender, and urban/rural communities that cannot be neglected. Thus, for instance, the OECD (2001) defines the digital divide as ‘‘the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard both to their opportunities to access information and communication technologies and to their use of the Internet for a wide variety of activities’’.

Prior studies on the diffusion of ICTs have shown that disparities in ICTs diffusion may play a critical role in the diffusion of knowledge, levels of political engagement, e-commerce growth, as well as on economic growth (Ho et al. 2011; Norris 2001; Steinmueller 2001; Brynjolfsson & Hitt 2003; Wallsten 2005; Seo et al. 2009). Developing countries have become aware of how decisive a political strategy to eliminate the abovementioned effects can be, in order to catch up with more developed countries. However, this gap in ICT diffusion is found not only across different countries, but within the same country, namely between urban and rural areas. According to UN ICT Task Force (2002), in Sub-Saharan African countries, the digital divide between urban and rural areas is even greater than in the rest of the world. Most of the telecommunication services and users are concentrated in the towns, while the majority of Africans are scattered in small communities spread-out across vast rural areas. There is a very limited diffusion of telecommunications networks into rural areas. Often over 75 percent of the country’s telephone lines are concentrated in the capital city and irregular or non-existent electricity supplies are a common feature and a major barrier to the use of ICT, especially outside major towns. The urban/ rural digital divide is the main focus of the present study. In particular, the magnitude of this divide and its impact on the youth population is one of the research questions addressed in this study.

We believe that a better understanding of all aspects of the digital divide is essential in order to be able to implement adequate policy formulations as documented by leading international organizations (see, for instance, UNCTAD 2005). The processes involved in technology diffusion, emerging trends, and their magnitude can be important inputs for the design and implementation of public policies in both developed and developing countries in the world.

Table 1 displays the percentage of individuals using the Internet split into urban and rural areas according to the latest available year. The dominance of a negative gap between the use of the Internet in urban compared to rural areas should be noticed. This negative gap—i.e. urban use is much higher than rural use of the Internet—reaches its highest value (-35.2%) in Morocco in the year 2010. Although Egypt has the same problem, it is not that severe, with a negative gap of 16.5% difference between urban and rural Internet use. Surprisingly, a few countries such as Mauritius and Zambia suffer from a positive gap, where rural Internet use is higher compared to urban with an average of about 1.75% difference.

In 2004, 30% of the world’s population had 66% of the world’s GDP, 64% of the world’s PCs, and they represented 58% of the world’s Internet subscribers and 75% of broadband users. Despite the high level of these disparities, it is interesting to note that the Internet is experiencing a change in its trend toward inequality. In 1997, 93% of Internet subscribers were concentrated among only a fifth of the world’s people (Kiiski and Pohjola 2002).

Little empirical research has addressed young people in relation to the digital divide. Furthermore, primary analysis of the data obtained from the Survey of Young People in Egypt (henceforth SYPE) (Population Council 2011) emphasizes the existence of rural-urban divide. The present research examines the source of inequalities in the use and access of young people in Egypt. For that purpose, we use the available survey data from the SYPE survey for the year 2009. The idea is to examine inequalities by age, gender, and urbanization in relation to the access of Internet and Internet use. We restrict our sample to individuals who are 10-29 years old. To our knowledge, this is the first paper to use micro level data on the access and use of ICTs for Egypt and to use the composite index of digital divide.

In addition to providing empirical evidence of the digital level of use and access of ICTs in Egypt between urban and rural regions, this study has a number of innovative elements (i) the construction of the ICT composite indices for Egypt, namely the digital divide index measuring the urban/rural digital divide among youth in Egypt based on the SYPE survey. Determining the proper forms and weights with which to combine original variables is a challenge within the context of ICT indices. As we mentioned, there is an urban-rural divide. Indeed, we can see a concentration of information flow to urban and central areas in developing countries (ii) the current research also evaluates the findings in light of the experience of digital divide in order to provide appropriate policy recommendations, on how to close this inequality between urban and rural areas in Egypt.

Our findings show that urbanization is positively correlated with the digital divide composite indicator. Urbanization is associated with structural change where the share of agricultural sector in GDP decreases, whereas the share of both manufacturing and services sectors in GDP increase. Urbanization is critical, since by 2030 about 60% of the global population will live in urban cities. The urban context includes proximity, diversity, density, dynamics and complexity. Migration is one phenomena associated with urbanization. Migration has to be viewed as a process not as a problem and policy intervention are thus needed in this regard. Migration is also associated with an increase in transaction costs. The complexity of this phenomenon is due to the fact that it is a multidiscipline process, which includes economics, sociology and political science. This migration process together with other factors deepens the divide between urban and rural areas and negatively impacts the digital divide globally, and Egypt is not an exception (Beall et al. 2012).

A critical motivation for the present study is the importance of including the young population, especially the rural youth, within the knowledge based economy context. This is important given the fact that most of the young people reside either in Lower Egypt (42.6 %) or Upper Egypt (34.2%), while urban governorates contain only 21.4% of the young people.

Another motivation for the current study is that ICT can be used as a useful tool for the social inclusion of the young generation into the knowledge-based economy. Thus, measuring the digital divide and examining if urbanization is an impediment to including youth population in the new paradigm of the knowledge-based economy would be an important contribution of the present study. The digital divide index is constructed from the questions—available in SYPE—addressed to young individuals about Internet use and access, mobile phones and fixed line phones, personal computers and laptops. In particular, this study will focus on the answers given to questions on access and use of these ICT devices to create the digital divide index as outlined in the SYPE questions.

The remainder of this paper is organized as follows. The next section describes the evolution of the ICT sector in Egypt. Section 3 discusses the empirical literature on the digital divide index. Section 4 presents the data and outlines the empirical model. Section 5 discusses the main empirical findings, and section 6 concludes with some policy recommendations.

2. Current Status of the Information and Communication Technology Sector in Egypt

Since the digital divide phenomenon is related to the diffusion of ICT, it will be useful to shed some light on the current progress of the ICT sector in Egypt. The Egyptian IT sector is one of the fastest growing information and communication markets in the world since the government launched an integrated strategy to develop the ICT sector. It hosts both foreign and local companies,

The ICT sector's contribution to GDP (at fixed prices) increased to 4.2 percent in 2012 compared to 3.4 percent in 2008. Also, the growth rate of the ICT sector is almost double the growth rate of GDP, as ICT is an emerging environment where huge amount of FDI flows to the sector in form of 3G mobile licenses & investment of off-shoring. IT sector exports reached $1,487 million in 2012, compared to $750 million in 2008.

The structure of the access mode changed in July 2011 as it includes mobile Internet & USB modem users (43 percent). Mobile Internet and USB modems are the most widely used methods in Egypt, as there are 37.7 percent Internet users in July 2012. However, ADSL is the access mode most used by government agencies, when the government adopted e-applications such as e-government, which is used to perform Internet services. In August 2012, mobile Internet and USB modems became the most widely used access modes in Egypt (45 percent), followed by ADSL (36 percent), dial-up and ISDN (10 percent), and leased line (9 percent).

Internet penetration rate started very modestly at 1 percent of the population, in 2000 and then it increased dramatically to 37.79 percent in July 2012 due to many reasons such as the introduction of the free Internet initiative and the PPP (Public Private Partnership) as a type of investment to promote the Internet uptake in Egypt. This has been fueled by the increase in Foreign Direct Investment (FDI) flow to Egypt in this sector in the form of new 3G mobile licenses and other investments in off-shoring services and investment in establishing IT companies. Lately, the recent Egyptian revolution created an incentive for many people who were not familiar with the Internet to try it and to log on.

The percentage of mobile subscribers increased by 64 percent in 2007 and by 30 percent in July 2011. This means that the growth rate of mobile subscribers in 2011 decreased as Egypt started to approach to the saturation level where the penetration rate of mobile reached 113 percent in July 2012. The fixed line telephone service increased steadily to reach 11.4 million until 2008. However, it decreased to 8.41 million in July 2012 due to the competition of mobile services. Also, the capacity of the local exchanges is still increasing, as it reached the level of approximately 14.6 million subscribers in July 2011. This is largely due to the huge investments in infrastructure that were undertaken by Telecom Egypt in the past years.

Finally, we can say that the ICT sector is considered one of the most important sectors that attract Multinational Companies(MNCs), to invest in due to the high quality of available telecom infrastructure at reasonable rates, the low costs of qualified labor, and the existing human resources pool increasing yearly with about 10,000 IT graduates. As to PC ownership in Egypt, statistics indicate that about 44 percent of Egyptians own PCs (all above mentioned data are from Ministry of Information and Communication Technology and ITU).

3. Literature Review

We will first discuss previous studies pertaining to the digital divide, then we will review the literature related to the construction of digital divide indexes.

3.1 Digital Divide

Though more than half of the world's inhabitants have access to ICT, the distribution of resources has not been uniform throughout the world. For example, there is more communication fiber in the Asian, North American and European continents than in the African continent. In addition, the poor state of peering and interconnectivity among Arab states is well known. It is much easier for a user to connect with European and US IP destinations rather than IP destinations within Arab states. The ITU ranked the Arab World as having the third lowest Internet access across the various continents (2.2 percent overall). Even in the same continent there are huge disparities in the levels of ICT access within a country, and within regions. This digital divide is aggravated by the absence of cooperation between Arab states and the lack of financing and education. Thus, the term digital divide has attracted the attention of academics and policymakers worldwide.

The global economy is currently being driven by greater integration of global markets and the spectacular growth of the ICTs. The widespread use and implementation of ICTs have increased the world's potential for dissemination of knowledge and information. As a result, a positive sense has emerged concerning the uses and potential benefits from the continued growth of the ICTs. More and more attention is given to the final users, whether individuals or households, and to the drivers of the various ICT technologies (ITU 2011). ICT sectors have been growing faster than other sectors and ICT services have been growing even faster, particularly personal computers and related services.

The definition of the digital divide has created a great debate among economists and policy makers. Hilbert (2011), relying on the theory of diffusion of innovations, suggests that combining the various attempts to define the digital divide leads to a flexible definition of the digital divide that considers specific ends with a final impact. Since the impacts of ICTs are diverse, the definitions of the digital divide are too. It is subjective and depends on what is aspired to achieve. Thus, the definition is conditioned on the "desired impact".

Over the past ten years, literature has endeavored to uncover economic, social, and political factors that aided or hindered the divergence of ICT's diffusion rates in several countries. A substantial body of literature has examined the impact of differences in income, human capital, legal environment, and the necessary telecommunications infrastructures on adopting ICTs (e.g. Harggitai 1999; Quibria et al. 2003, Dasgupta et al. 2005 Oxley and Yeung 2001; Robison and Crenshaw 2002; Kiiski and Pohjola 2002; Bellock and Dimitrova 2003; Wallsten 2005; Chinn and Fairlie 2007; Badran et al. 2007). A more limited number of studies have looked at the role of inequality across countries in influencing the international digital divide (e.g. Harggitai 1999; Kiiski and Pohjola 2002).

The relationship between economic prosperity (measured by GDP per capita) and ICTs diffusion is well documented in the literature. For example, Harggitai (1999), Kiiski and Pohjola (2002), Bellock and Dimitrova (2003), and Chinn and Fairlie (2007) all have shown that GDP is a large determinant of Internet access. International disparities in per capita income help to explain the gap in computer and Internet use. But this is not the only important factor affecting the global digital divide. Bellock and Dimitrova (2003) showed that increasing civil liberties also have a positive and significant effect on the Internet diffusion process. Robison and Crenshaw (2002) showed that the development level, political openness, mass education, and the size of the tertiary sector are the most significant determinants of Internet penetration. Also, Kiiski and Pohjola (2002) find that education can be an important factor in Internet diffusion when developing countries are included in the sample. Oxley and Yeung (2001) demonstrated that Internet hosts penetration is positively related with telecom infrastructure, rule of law, and credit card use and negatively correlated with telephone service costs. Quibria et al. (2003), analyzing PC and Internet use per capita, found that GDP, education levels, and infrastructure are the most important drivers of these ICTs diffusion. More recently, Chinn and Fairlie (2007) studied PC and Internet use per capita and found that GDP, telephone density and regulatory quality (pro-market policies) are important determinants of these technologies. The World Bank revealed in a paper titled "Broadband Infrastructure Investment in Stimulus Packages: Relevance for Developing Countries" that the penetration of ICT has a more impressive impact on GDP growth rate in emerging countries compared to the rest of the world (Qiang 2010). For example, 10%

increase in broadband penetration would lead to 1.3% increase in GDP growth rate in emerging countries. Similar results were obtained for Internet access and mobile phones diffusion. An increase of 10% in Internet access leads to 1.12% increase in GDP growth rate.

More recently, another study by Al Hammadany et al (2011) examined the determinants of the use and non-use of Internet in Iraq by using a multinominal logit model, and reached the conclusion that human development and human capital, institutional and legal environment, existing technologies, government policy making and income levels influence the Internet accessibility in Iraq.

3.2 Digital Divide Index

Another branch of the formal literature discusses the construction of the digital divide Index. For instance, Bertot (2003) and Vehovar et al. (2006) argue that the digital divide should not be seen only in binary terms: i.e. someone either has access to ICT or not, someone either uses it or not. The bottom line is that the digital gap or *digital inequality* has almost always measured accounting for a single ICT and the wider dimensions of this concept has been neglected. Previous research has focused on single measures as a proxy for the digital level of countries, such as computer per 1000 inhabitants or Internet users, and only a few have made use or have constructed composite measures or indices to proxy the digital level as well as the digital gap (for instance, Hüsing and Selhofer 2002).

One of the most recent studies explaining the digital divide using quantitative techniques is the study by Billon et al. (2009). Here, the authors introduced a single model to investigate the relationships between several ICTs and a wide range of explanatory variables. They come to the conclusion by using canonical correlation analysis, that in countries registering higher levels of ICT adoption, the digitalization pattern is explained by real GDP, service sector, education and governmental effectiveness. In contrast, in developing countries, population age and urban population are positively associated with ICT adoption, while Internet costs are negatively correlated with ICT adoption. These findings are quite relevant to the present study as similar results were obtained; youth age and urban youth have a positive impact on the constructed digital divide index.

4. Data and Empirical Model

4.1 Data

Remarkably, in Egypt, young people are not only the country's most important form of capital, but they also constitute the largest share of the population. According to the 2006 national census, approximately 40% of Egyptians are between the ages of 10 and 29. With the right investment, this youth bulge can represent a demographic opportunity that will positively shape the country's future. This is referred to as the demographic dividend, where youth need to be empowered with skills and education to meet the needs of a demanding job market.

The 2009 Survey of Young People in Egypt builds on the The Adolescence and Social Change in Egypt (ASCE) survey from the previous decade. SYPE focuses on the five key life transitions for youth: health, education, employment and livelihood, family formation, and civic participation. The survey covers a nationally representative sample of 15,029 young people aged 10-29.

The Egyptian population has a large youth population relative to other age groups. Based on data collected from all households interviewed for the SYPE, 62 percent of the population is 29 or under, and 39.4 percent is between the ages of 10 to 29, which is the age group that is the focus of SYPE. The dominance of young people in the population is clearly visible. The wide base of the pyramid is the large youth population. The sudden 'gap' in the male 25-29 population is probably due to the higher rate of non-response often encountered among this particular group. Male youth tend to leave home to work in another governorate or abroad before getting married. It might also be due to the rapid increase in international migration of young people observed in Egypt in the early 2000s (Roushdy et al. 2009). This youth bulge population distribution is typical of countries that have recently experienced relatively high fertility, accompanied with a decline in child mortality. Based on the SYPE, 44.7 percent of Egypt's young population is between the ages of 10 and 17 years, 36.1percent is between 18 and 24, and 19.3 percent is between 25 and 29. Most of the young people have never been married. Only 9.6 percent of the interviewed males and 19.5 percent of the interviewed females have been married. The young population is primarily rural. About two-thirds of young people (58.9 percent) are rural residence, while the remaining third lives in urban areas (31.6 percent) or informal urban areas (5.6 percent). Most of the young people reside either in Lower Egypt (42.6 percent) or in Upper Egypt (34.2 percent), while urban governorates contain only 21.4 percent of young people. The SYPE also sampled the frontier governorates, where 1.75 percent of young people live.

Main findings from access to Internet and usage of young people

In today's world, young people worldwide are increasingly using the Internet for social networking. The SYPE asked young people what they use the Internet for, who introduced them to it, and where they use the Internet. Only 7.5% of young people use the Internet. Young people use the Internet primarily for general knowledge and social networking purposes. Browsing for general knowledge, chatting with friends in chat rooms and checking email are the three most popular uses for the Internet by around a third of young people using it. A quarter use it for entertainment (downloading music and movies). Around 20% of the users also use it for educational purposes, and 40 % for general knowledge. The vast majority of young people (60%) who use the Internet were introduced to it by their friends. Teachers introduced it to 13.1%, and 11.2% discovered it on their own. Young people primarily use either the Internet at home (52.6%) or in an Internet café (51%). School and youth centers use is very low. Thus, a greater opportunity for schools and young people centers can be provided to young people to access the Internet.

4.2 Data and Variables

The content of the individual questionnaire can be summarized as follows:

Do you have access to the internet at home/ Internet cafe/ School/ Youth center/ Club/ Friends/ At work?

Your household has Laptop? Your household has Computer? Your household has telephone? How acquire skill: Computer courses/programs? Do you use a computer in your work? Do you use the internet? Have you used a regular phone in job-hunting? Have you used a mobile phone in job-hunting? Have you used the internet in job-hunting? Sources to learn: Internet, e-mails, blogs? Were you involved in Internet use during the last week? Personally own: Telephone? Personally own: Mobile telephone? Personally own: Desktop computer? Personally own: Laptop computer? Personally own: MP3/MP4/IPod? Do you own a mobile telephone? (Population Council 2010)

Dependent variable: The digital divide index

In line with the empirical literature, a composite measure of the digital divide is employed in this study. Popular ICT indices include for example the information society index (IDC 1995), the digital access index (ITU 2003), and more recently the ICT development index constructed by the ITU in 2009. We construct a composite index of the digital divide in young population in Egypt in the spirit of DiMaggio et al (2004) who claim that binary divide fails to value the social resources of diverse groups in many fields. Those indices are related to access to ICTs such as mobile, fixed phone, and Internet. Hüsing and Selhofer (2002) call the attention to one important factor when constructing a digital divide index. They state that "the selection of indicators necessarily reflects what is conceived as state-of-the-art technology in the research context. If, for example the digital divide in developing countries is analyzed, it probably makes sense to include more traditional telecommunications indicators (e.g. access to a telephone at home)." To that effect, our index includes both *use* of and *access* to four types ICTs: fixed and mobile phones, Internet, and PC ownership. The digital divide index will be constructed using the principle component analysis (henceforth PCA) technique. Our aggregate index takes into account accessibility to Internet, use of Internet and computers, mobile and fixed phones.

Sample

The total sample consists of 15,209 young people aged between 10 and 29 years. This sample is representative of the male/female young population. Summary statistics of the variables employed in the empirical analysis are shown in table A1 of the appendix. Pearson's correlation coefficients for all variables are shown in table A2 of the appendix. These correlation coefficients indicate that the multicollinearity problem does not appear to be at play here.

4.3 Principal Component Analysis

In this paper we are interested in empirically evaluating the impact of urbanization on the digital divide composite indicator. For that purpose we apply the PCA technique guided by the conceptual framework developed by DiMaggio, P., and Hargittai (2004). The PCA is a common statistical technique that is used to transform a larger set of correlated variables into a smaller set of uncorrelated variables, called principal components, that account for most of variation in the original data set. This technique is similar to a statistical regression analysis, and its coefficients are just like the regression coefficients.

The PCA technique can be used effectively to obtain the most appropriate weights for the indicators of the proposed indices and sub-indices, such that the extracted first principal components would explain the largest percentage of total variance captured by this component. PCA is a multivariate technique that analyzes several inter-correlated quantitative dependent variables. Its goal is to extract the important information and represent it as a set of new orthogonal variables called principal components (Abdi and Williams 2010). Thus the objectives of the PCA are to reduce the dimensionality of the data and to construct a new measurable index.

As can be seen from table 1, the first eight principal components account for approximately 66 percent of the variation in all dimensions in urban and rural areas respectively. The criteria applied to determine how many common factors to retain are taken from Jolliffe (2002). We dropped principal components with an eigenvalue smaller than one. Note also that the weights in the first principle component are almost equal across dimensions. However, it is worth mentioning that PCA index is a continuous variable, but in this case it is with natural 3 cut offs, three thresholds were set (percentiles) and ordinal categorical variables were assigned to the indices in the paper. Thus, the continuous PCA index is turned into a discrete one based on the distribution of the PCA index as shown in figure 2, and thus we can estimate ordered probit models. Notice that we obtain 4 groups or cohorts from the PCA index. The first group includes all ICT scores of less than -1, the second group includes ICT scores between -1 and 0.7, the third group includes ICT scores between 0.7 and 3.5, and finally the forth group includes all ICT scores greater than 3.5.

4.4 Ordered Probit Model

Ordered discrete choice models are commonly used for modeling categorical response variables that represent groups of continuous variables with an explicit ordering (Greene

2002). The application of these models can be extended to categorical variables that have an "assessed" order: in our case, the intensity and frequency of use of Internet. Ordered probit analyses are prevalent in the study of the digital divide. The use of Ordinary Least Squares (OLS) with an ordinal dependent variable may lead to misleading results. The ordered probit model is based on a latent variable y* (the digital divide) which is mapped into the observed variable *y (the digital divide index).* The latent variable ranges from -∞ to ∞. The idea is that the observed dependent variable is based on an underlying latent variable. The relationship between the latent variable (a measurement of ICT use and access) and the observed variable is as follows:

$y_i = 1$ if $\mu_0 = -\infty < y_i^* \leq \mu_1$, indicating [low intensity]

$y_i = 2$ if $\mu_1 \leq y_i^* < \mu_2$, indicating [medium intensity]

$y_i = 3$ if $y^* > \mu_2$, indicating [high intensity]

where μ represents the cut-off points of the dependent variable to be estimated

$$y_i^* = \alpha_0 + \alpha x_i + u_i \qquad (1)$$

In equation (1) the unknown variable is the digital divide intensity (y_i*) that derives from the PCA analysis on 24 items. α_0 is the constant term. x_i are the exogenous variables, both binary gender, age group, wealth split into five quintiles, and education levels, and our variable of interest the degree of urbanization variable. These variables are used to predict the probabilities of as shown above. u_i represents the classical error term that follows a standard normal distribution. The αs are the regression parameters to be estimated. These parameters are jointly estimated by the Maximum Likelihood method. A cross sectional analysis is used to estimate these models.

Digital divide index groups

Digital divide index groups	Number of observations (not weighted)	Percent
- ∞ to -1	6,796	45.22
- 1 to -0.7	1,138	7.57
-0.7 to 3.5	3,802	25.3
3.5 to + ∞	3,293	21.91
Total	15,029	100

When the considered coefficient takes the positive sign, a positive change in the independent variable decreases the probability of the lower ranked outcome and increases the probability of the highest ranked outcome. However, "the marginal effects of the regressors on the probability are not equal to the coefficients" (Greene 2002). Therefore, we encounter a difficulty in the interpretation of coefficients. Instead of coefficients, the marginal effects can be calculated for each dependent variable category (Greene, 2002). Hence, for a closer examination of estimation results, in addition to coefficients, as presented in table 5, we also report the marginal effects of key variables such as urbanization. Statistical analysis was carried out using the software package STATA v 12.

5. Results

Table 2 contains the maximum likelihood estimates for the ordered probit model The RESET test was performed to evaluate whether the specification was correct for each model. Our model passes the miss specification test (p-value: 0.29). The test for the overall statistical significance of the variables included in our model yielded a likelihood ratio test of 7665.4 (p value =0.000). The sign on the estimated coefficients provides the directional impact of the explanatory variables on the individual's intensity of ICT use.

The results obtained from the ordered probit reveal that relative to the illiterate category, all levels of education indicate a positive association with the digital divide index, except for the read and write level of education. With regards to gender, there is a negative association between females and the digital divide index. As to the age explanatory variable, we find that compared to the reference category age (10-14), all age groups have positive association with the digital divide. Relative to the urban governorates in Egypt, all other metropolitan regions, which include urban upper Egypt, rural upper Egypt, and frontier governorates, have all negative association with the digital divide index. On the other hand, both the wealth quintiles (level of income), and the urban rural have positive impact on the digital divide.

The urbanization explanatory variable is of special interest, the positive association with the digital divide indicates that the digital divide is low in urban areas, where the Internet penetration rates are higher compared to rural areas. This is consistent with a priori expectations of the positive association between Internet penetration rates and urbanization (Chinn et al 2007) . The estimated thresholds are statistically significant indicating that the ordered probit model with three quintiles is highly appropriate.

The direct interpretation of the parameter estimates is not possible given the probit transformation of the dependent variable required for model estimation (Hammandany 2011). The next step is to compute the marginal effects. Looking at the marginal effects (table 3), at the first cut-off where $y = 1$, being in an urban area compared to a rural area decreases the average probability of the digital divide index by 0.25, however, moving to the rest of the cut-offs we observe that they all increase the average probability of the digital divide index. Thus the overall impact of urban area compared to rural area on the probability of digital divide index is positive. This shows the relationship between urbanization and the digital divide index. We can also see that the marginal effect of urbanization is greater than other explanatory variables.

The marginal effect of the highest wealth quintiles on the probability the digital divide is negative 0.439 (these results are available upon request from the authors). Notice that the sum of marginal effects equals zero.

5.1 Robustness checks

One key in our empirical analysis is the robustness of the relationships between the digital divide index and our variable of interest. There is little consensus in the literature on the additional determinants of the digital divide. We tackle this issue by employing the Extreme Bound Analysis (EBA) as proposed by Leamer (1983). This analysis allows us to examine whether the variable of interest (urbanization) is robust to independent of which additional set of explanatory variables are included in the empirical specification. To test whether urbanization influences the digital divide index if other variables are included, the EBA method is applied. The extreme bound test as in Leamer (1983) for variable U says that if the lower extreme bound (the lowest value of minus two standard deviations) is negative while the upper extreme bound (the highest value for plus two standard deviations) is positive, the variable U is not robustly related to Y. In practice, one should run regressions with all possible combinations of explanatory variables to determine whether the coefficients change when changing the composition of the set of the explanatory variables.

Table 4 displays the minimum and maximum betas of all the regressions, as well as the t-values for those betas. The results regarding the effect of urbanization on the digital divide index are robust, independent of the explanatory variables included in our specification. From a simple inspection of table 3 we see that the minimum and maximum coefficients have the same sign and also the confidence intervals.

6. Conclusion

This paper investigates the digital divide in Egypt. For that purpose we construct a composite indicator of the digital divide across urban and rural areas with data from the 2009 SYPE survey. By applying an ordered probit model to a sample of 15,029 individuals, we find that the level of urbanization is a significant predictor of the digital divide. In light of the EBA analysis, this result seems to be consistent with previous results. We also find that other factors such as gender, wealth, and age groups are associated with the digital divide. The present research paper may be extended for a wider sample to assess if the results can be generalized, and to allow for a comparison with the evidence of other MENA countries.

On the other hand, other variables may be included as determinants of the digital divide as well. Moreover, the analysis may be replicated by employing data at the regional level to explore ICT diffusion across Egyptian regions, as well as to empirically assess the determinants for variations across regions in ICT diffusion. The youth in urban locations benefit more from ICT technologies compared to the rural youth. To overcome the digital divide in Egypt, policy recommendations can be given for both the demand and the supply sides of the market. On the demand side, creating more content and encouraging the youth to be part of this process is a vital way to overcome the digital divide, especially among the rural young population. In addition, social media can play an important role in overcoming the existing digital divide. By encouraging the young population to use the social networks, such as Facebook , which is indeed becoming very popular in Egypt, the access to the Internet would become more prevalent. On the supply side, public points of access are very suitable means of access to the Internet, especially in rural areas. Increasing their number and supplying these public points of access with the necessary infrastructure to meet the demand of the young population in rural areas is also important. More attention should be given to the universal access policies targeting rural and underserved areas, especially low-income areas.

In particular a universal service scheme that includes universal broadband coverage as a target is also necessary to reach the social inclusion objective and consequently to overcome the digital divide. Thus, the national regulator has an important role to play in this respect. Universal service guarantees individual access to all citizens to those services that are considered basic (mainly voice services). An adequate infrastructure is a necessary condition for usage. In Egypt, the Telecom Law (10/2003) clearly establishes the universal service principle in Article 2. The Law stipulates that the universal service cover both voice and data services; however this has not yet materialized on the ground.

The access gap that is found in rural areas (World Bank 2009) requires considering public subsidies to access the Internet. For example, Castellano (2102) finds that public ownership of infrastructure under a private management policy, and subsidies for the private telecommunication operator have effects on reducing the broadband digital divide in Spain.

Another important dimension of the digital divide is the change in technology from dial up or narrow band Internet access, to high speed Internet access i.e. broadband. In addition, the introduction of new business models for mobile services such as pre-paid services, together with the access to Internet using 3G technology (namely the mobile broadband), can reduce the digital divide.

The current developments in the telecom sector have enabled a larger group of young people to access the Internet via their mobile handsets in an affordable way, namely through the pre-paid services. Thus, as discussed in the current status of the ICT sector in Egypt, the access mode to the Internet has changed quite substantially giving way to the mobile Internet in recent years. Therefore, it is expected that in rural areas it will become easier and more affordable to a larger share of the young people to use data and voice services.

In this respect, it is worth mentioning that the SYPE survey was conducted before Egypt's 25th of January Revolution. This is a drawback and a caveat that has to be kept in mind, since Internet penetration rates per se, and especially among young people, have increased dramatically since then. For this purpose, a second round of the SYPE survey is currently underway. The panel data that will be available after this round will give us a chance to conduct another round of this study using panel data.

Finally, although the ICT technologies are not the panacea for solving all problems in developing countries, they may contribute to increasing social gender equality, economic growth, and access to health care and education. In rural areas, users access the Internet through their mobile phones resulting in a higher cost of usage for them. Therefore, the rural population needs assistance in order to overcome the issue of affordability. Reducing the rural/urban gap may entail providing the necessary equipment, such as personal computers in public points of access or Internet cafes etc., to ensure Internet access.

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Figure 1: The Natural Cut -Offs in the PCA Index

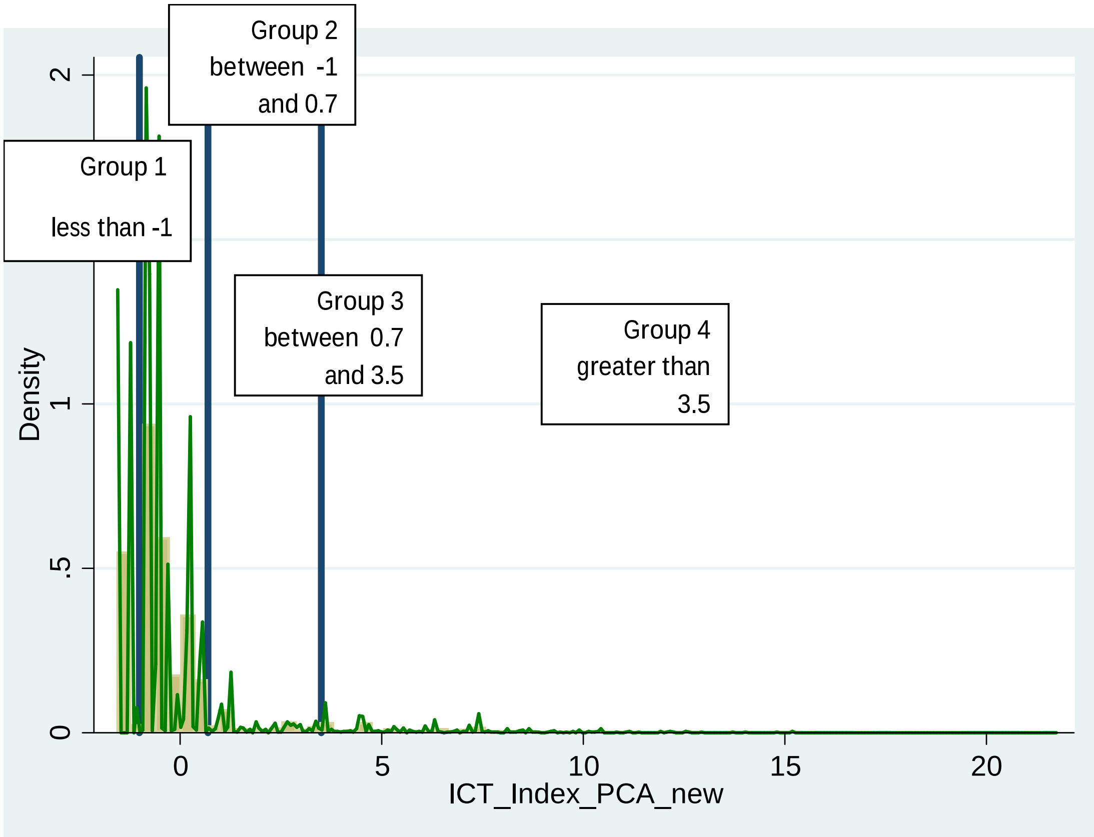

Table 1: Percentage of Individuals using the Internet by Urban/Rural Latest Available Year

Country	Reference Year	Rural	Urban	Difference Rural - Urban
Australia	2009	69.3	76.9	-7.6
Azerbaijan	2010	23.4	47.1	-23.7
Belarus	2010	14.5	37.8	-23.2
Benin	2007	1.2	20.7	-19.5
Botswana	2007	2.9	7.9	-5.0
Brazil	2010	16.0	45.4	-29.4
Burkina Faso	2007	0.5	18.7	-18.2
Cameroon	2007	3.9	21.5	-17.6
Canada	2009	72.9	82.6	-9.7
Chile	2009	16.6	42.0	-25.4
Colombia	2009	9.9	36.2	-26.3
Costa Rica	2008	18.4	41.8	-23.4
Côte d'Ivoire	2007	1.8	11.9	-10.1
Ecuador	2010	12.0	37.6	-25.7
Egypt	2009	14.3	30.7	-16.5
El Salvador	2009	3.1	17.0	-13.9
Ethiopia	2007	0.0	4.0	-4.0
Ghana	2007	2.2	10.0	-7.8
Honduras	2008	2.5	18.0	-15.5
Indonesia	2010	3.8	16.1	-12.3
Iran (I.R.)	2009	3.0	15.0	-12.0
Israel	2009	76.3	62.0	14.3
Japan	2009	76.0	81.3	-5.2
Kenya	2007	13.5	20.9	-7.4
Korea (Rep.)	2009	69.4	84.3	-14.9
Lithuania	2010	51.5	70.1	-18.6
Mauritius	2008	21.9	19.9	2.0
Mongolia	2010	2.5	16.4	-13.9
Morocco	2010	40.4	75.6	-35.2
Mozambique	2007/8	0.0	4.3	-4.3
Namibia	2007	4.1	18.5	-14.4
New Zealand	2009	79.1	79.8	-0.7
Nigeria †	2007	10.3	22.3	-12.0
Paraguay	2008	3.1	21.8	-18.7
Peru	2008	7.8	38.9	-31.2
Russia	2009	27.7	48.0	-20.3
Rwanda	2007	0.4	9.6	-9.2
Senegal	2009	2.2	18.2	-15.9
South Africa	2007	4.6	21.8	-17.2
Switzerland	2010	82.5	84.5	-2.0
Tanzania	2007/8	1.8	3.3	-1.5
Thailand	2010	16.5	35.1	-18.5
Turkey	2010	22.1	47.3	-25.2
Uganda	2007	1.6	8.1	-6.5
Ukraine	2009	5.2	20.6	-15.5
United States	2009	64.9	69.3	-4.4
Zambia †	2007/8	5.1	3.3	1.8

† Not nationally representative, but extrapolation was adjusted to reflect the national level.
e: ITU World Telecommunication/ICT Indicators database and Research ICT Africa (RIA).

Source: ITU (2001).

Table 2: The PCA Weights in Urban and Rural Areas

Urban		
Component	Eigenvalue	Cumulative
Comp1	4.95623	0.2065
Comp2	2.38847	0.306
Comp3	1.95667	0.3876
Comp4	1.63625	0.4557
Comp5	1.43691	0.5156
Comp6	1.34591	0.5717
Comp7	1.07946	0.6167
Comp8	1.02412	**0.6593**
Comp9	0.971778	0.6998
Comp10	0.899517	0.7373
Comp11	0.842452	0.7724
Comp12	0.804753	0.8059
Comp13	0.76983	0.838
Comp14	0.656943	0.8654
Comp15	0.650655	0.8925
Comp16	0.567227	0.9161
Comp17	0.561144	0.9395
Comp18	0.52571	0.9614
Comp19	0.392676	0.9778
Comp20	0.211932	0.9866
Comp21	0.198841	0.9949
Comp22	0.106971	0.9994
Comp23	0.015058	1
Comp24	0.000507	1

Rural		
Component	Eigenvalue	Cumulative
Comp1	3.97168	0.1805
Comp2	2.14297	0.2779
Comp3	1.84055	0.3616
Comp4	1.79337	0.4431
Comp5	1.40709	0.5071
Comp6	1.23927	0.5634
Comp7	1.17497	0.6168
Comp8	**1.03147**	**0.6637**
Comp9	0.951766	0.707
Comp10	0.918658	0.7487
Comp11	0.8894	0.7891
Comp12	0.846284	0.8276
Comp13	0.734374	0.861
Comp14	0.693093	0.8925
Comp15	0.631376	0.9212
Comp16	0.564558	0.9469
Comp17	0.551389	0.9719
Comp18	0.289263	0.9851
Comp19	0.251401	0.9965
Comp20	0.059682	0.9992
Comp21	0.01738	1
Comp22	0	1

Table 3: Estimate of the Ordered Probit Model

Variable	Coefficient	Standard Error	P-value
Wealth _2	0.52***	0.03	0
Wealth_3	1.07***	0.03	0
Wealth_4	1.39***	0.04	0
Wealth_5	2.11***	0.04	0
Education_2	0.02	0.06	0.75
Education_3	0.28***	0.05	0
Education_4	0.42***	0.05	0
Education_5	1.16***	0.06	0
Education_6	0.6***	0.05	0
Education_7	0.9***	0.09	0
Education_8	1.2***	0.06	0
Sex_2	-0.53***	0.02	0
Urbam_2	1.17***	0.16	0
agegrp_2	0.24***	0.04	0
agegrp_3	0.32***	0.04	0
agegrp_4	0.37***	0.05	0
Metropolitan_2	-0.26***	0.04	0
Metropolitan_3	-0.22	0.16	0.16
Metropolitan_4	-103**	0.04	0.02
Metropolitan_5	-0.02	0.16	0.92
Metropolitan_6	-0.45***	0.11	0
cut1	1.76***	0.07	
cut2	2.01***	0.07	
cut3	2.986***	0.07	

Notes: Reset test: 1.57 [p value = 0.209]. Number of observations = 15,029. Likelihood ratio (zero slope) = 6877.14 [p-value = 0.000]. Log likelihood value = -15174.073. Pseudo R-squared = 0.1847

Table 4: Impact of Urbanization on the Digital Divide Index

Outcome	Marginal effect
1	-0.439
2	0.0003
3	0.1814
4	0.258
Sum of the marginal probabilities	≈ 0

Table 5: Extreme Bound Analysis (EBA)

	Coefficients	P- value	95% Confidence interval
Min Beta	-0.4871	0.0333	[-0.8109 -0.1634]
Max Beta	-0.3353	0.0464	[-0.6464 -0.0242]

Note: A total of 20 combinations of the 1 regressor from 20 were used

Appendix

Table A1: Variable Definitions and Summary statistics (N = 15, 029).

Variable	Definition	Mean	Std. Dev.
Reference category is wiq==1	Reference category = Lowest level		
wiq==2	Second	0.2057	0.4042
wiq==3	Middle	0.2187	0.4134
wiq==4	Fourth	0.1992	0.3994
wiq==5	Highest	0.1771	0.3818
Reference. category is educ==1 Illiterate			
educ2==2	Read & Write	0.1519	0.3589
educ2==3	Elementary school	0.2312	0.4216
educ2==4	Middle school	0.1723	0.3777
educ2==5	General high school	0.0840	0.2775
educ2==6	Vocational_high_school	0.2061	0.4045
educ2==7	Post-econdary_institute	0.0163	0.1266
educ2==8	University & above	0.0710	0.2568
Reference category sex==1 male			
sex==2	1, if the respondent is female, 0 otherwise	0.4893	0.4999
Reference category is urban==1 rural			
urban==2	Rural	0.5887	0.4921
Reference category age group==1 (10-14)			
agegrp==2	(15-17)	0.1610	0.3675
agegrp==3	(18-24)	0.3603	0.4801
agegrp==4	(25-29)	0.1930	0.3947
Metro_region==2	Urban_Lower_Egypt	0.1105	0.3135
Metro_region==3	Rural_Lower_Egypt	0.3154	0.4647
Metro_region==4	Urban_Upper_Egypt	0.0766	0.2659
Metro_region==5	Rural_Upper_Egypt	0.2658	0.4418
Metro_region==6	Frontier_Govs	0.0175	0.1311

Source: SYPE .

Table A2: Pearson Correlation Matrix (number of observations= 15,0259)

Pearson Correlation Matrix:

		Wealth quintiles				education levels							sex	location	Age group			Regions					
	ICT Index	second	middle	fourth	highest	Read&Write	Elementary	Middle_sch	General_hi	Vocational	Post-secon	University	females	rural	age (15-17	(18-24)	(25-29)	Urban_Lowe	Rural_Lowe	Urban_Uppe	Rural_Uppe	Frontier_G	yf2
ICT Index	1																						
second	-0.15	1																					
middle	-0.01	-0.26	1																				
fourth	0.09	-0.26	-0.27	1																			
highest	0.35	-0.24	-0.25	-0.25	1																		
Read&Write	-0.20	-0.01	0.00	-0.01	0.00	1																	
Elementary_school	-0.14	0.05	0.01	-0.04	-0.06	-0.22	1																
Middle_school	-0.01	0.01	0.03	0.01	-0.05	-0.19	-0.25	1															
General_high_school	0.25	-0.08	-0.04	0.04	0.18	-0.12	-0.16	-0.13	1														
Vocational_high_school	0.09	0.03	0.07	0.06	-0.10	-0.21	-0.28	-0.24	-0.15	1													
Post-secondary_institute	0.08	-0.02	-0.02	0.06	0.03	-0.05	-0.07	-0.06	-0.04	-0.07	1												
University&above	0.26	-0.09	-0.07	0.02	0.25	-0.11	-0.15	-0.13	-0.08	-0.14	-0.04	1											
females	-0.18	0.01	-0.01	-0.01	0.00	-0.05	-0.04	-0.03	-0.02	0.00	0.00	0.02	1										
rural	-0.06	0.22	0.10	-0.19	-0.40	0.01	0.03	0.00	-0.11	0.04	-0.03	-0.13	0.02	1									
age (15-17)	-0.02	0.00	0.00	-0.02	-0.01	-0.18	0.08	0.46	-0.06	-0.18	-0.06	-0.12	-0.02	0.02	1								
(18-24)	0.17	0.00	0.00	0.03	-0.01	-0.30	-0.25	-0.03	0.30	0.26	0.06	0.07	0.01	-0.02	-0.33	1							
(25-29)	0.10	0.01	0.00	0.00	0.01	-0.21	-0.11	-0.09	-0.11	0.21	0.08	0.22	0.07	-0.01	-0.23	-0.38	1						
Urban_Lower_Egypt	0.00	-0.11	-0.02	0.12	0.13	-0.02	-0.01	-0.02	0.05	0.00	0.01	0.08	0.00	-0.38	-0.01	0.01	0.01	1					
Rural_Lower_Egypt	0.02	0.13	0.11	-0.01	-0.20	0.00	0.00	-0.02	-0.03	0.09	0.00	-0.04	0.00	0.57	-0.02	0.01	0.02	-0.22	1				
Urban_Upper_Egypt	-0.05	-0.02	0.02	0.03	0.00	0.01	-0.01	0.00	0.00	0.03	-0.02	-0.01	0.01	-0.31	0.00	0.02	-0.02	-0.09	-0.17	1			
Rural_Upper_Egypt	-0.07	0.10	-0.01	-0.18	-0.22	0.01	0.03	0.03	-0.08	-0.05	-0.03	-0.08	0.03	0.49	0.04	-0.02	-0.04	-0.19	-0.35	-0.15	1		
Frontier_Govs	-0.08	-0.01	0.00	0.04	-0.02	0.01	0.01	0.00	-0.02	0.00	-0.02	-0.04	-0.01	-0.08	0.01	-0.02	-0.01	-0.10	-0.19	-0.08	-0.16	1	
yf2	0.60	-0.25	-0.05	0.08	0.61	-0.27	-0.23	-0.06	0.43	0.07	0.13	0.45	-0.26	-0.08	-0.06	0.24	0.16	-0.02	0.04	-0.09	-0.10	-0.13	1

Table A3: Telecom Indicators in Egypt

Item	2008	July 2011
Subscriber base	11.8 million	8.94 million
Fixed line subscribers	53.1/100	11.28 /100
Mobile subscribers	57 million	77.76 million
Capacity of local exchanges	13.9 million	14.6 million line
# of workers	174.5 thousands	205.28 thousands
# of Internet users	12.57 million	26.54 million
# of PCs in clubs	20451(2007)	18.17 million
# of IT clubs	1598 (2007)	2163
Internet penetration rate	16.68%	32.96%
% of HH use Internet	15%	34.65%
Mobile penetration rate	52.70%	96.57%
# of ICT companies	2621	4215
% of Egyptian families own PCs	7%	44.26%

Source: Ministry of Communications and Information Technology (MCIT 2013)

Table A4: Marginal Effects after OProbit for all the Explanatory Variables

Marginal effects after oprobit y = Pr(Qunitiles_PCA_new==1) (predict, o(1)) = .40912198

variable	dy/dx	Std. Err.	Z	P>z	[95% Conf. Interval]		X
_Iwiq_2*	-.1920811	0.0114	-16.85	0	-0.21442	-0.16974	0.205673
_Iwiq_3*	-.3589839	0.00915	-39.22	0	-0.37692	-0.34105	0.218724
_Iwiq_4*	-.4298515	0.00827	-51.97	0	-0.44606	-0.41364	0.199184
_Iwiq_5*	-.5332296	0.00634	-84.16	0	-0.54565	-0.52081	0.177115
_Ieduc~2*	-.0076431	0.02414	-0.32	0.752	-0.05495	0.039667	0.151884
_Ieduc~3*	-.1057667	0.01919	-5.51	0	-0.14337	-0.06816	0.231191
_Ieduc~4*	-.1565145	0.0178	-8.79	0	-0.1914	-0.12163	0.172333
_Ieduc~5*	-.3498617	0.01124	-31.14	0	-0.37188	-0.32784	0.084039
_Ieduc~6*	-.216202	0.01601	-13.5	0	-0.24758	-0.18482	0.206066
_Ieduc~7*	-.2827041	0.01882	-15.02	0	-0.31959	-0.24582	0.016283
_Ieduc~8*	-.3537185	0.01082	-32.7	0	-0.37492	-0.33252	0.070982
_Isex_2*	.2028779	0.00754	26.92	0	0.188107	0.217649	0.489301
_Iurba~2*	-.4391591	0.05371	-8.18	0	-0.54444	-0.33388	0.588712
_Iageg~2*	-.091986	0.01566	-5.87	0	-0.12268	-0.06129	0.160958
_Iageg~3*	-.122029	0.01614	-7.56	0	-0.15367	-0.09039	0.360309
_Iageg~4*	-.1370797	0.01606	-8.54	0	-0.16856	-0.1056	0.193006
_IMetr~2*	.1038367	0.01442	7.2	0	0.075579	0.132094	0.110501
_IMetr~3*	.0885414	0.06295	1.41	0.16	-0.03484	0.211921	0.315402
_IMetr~4*	.0405008	0.0172	2.35	0.019	0.006791	0.07421	0.07658
_IMetr~5*	.006543	0.06248	0.1	0.917	-0.11592	0.129001	0.265846
_IMetr~6*	.1794246	0.04114	4.36	0	0.098789	0.26006	0.017483

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Computing marginal effects after oprobit for Qunitiles_PCA_new == 2
Marginal effects after oprobit y = Pr(Qunitiles_PCA_new==1) (predict, o(1) = .09686967

variable	dy/dx	Std. Err.	Z	P>z	[95%	C.I.]	X
_Iwiq_2*	-.0123995	0.00131	-9.46	0	-0.01497	-0.00983	0.205673
_Iwiq_3*	-.03417	0.00195	-17.54	0	-0.03799	-0.03035	0.218724
_Iwiq_4*	-.04976	0.00232	-21.44	0	-0.05431	-0.04521	0.199184
_Iwiq_5*	-.0762194	0.00257	-29.64	0	-0.08126	-0.07118	0.177115
_Ieduc~2*	-.0002168	0.00073	-0.3	0.765	-0.00164	0.001207	0.151884
_Ieduc~3*	-.0047946	0.00127	-3.78	0	-0.00728	-0.00231	0.231191
_Ieduc~4*	-.0095619	0.00179	-5.36	0	-0.01306	-0.00606	0.172333
_Ieduc~5*	-.0482803	0.00344	-14.03	0	-0.05503	-0.04154	0.084039
_Ieduc~6*	-.0150112	0.00194	-7.72	0	-0.01882	-0.0112	0.206066
_Ieduc~7*	-.037416	0.00518	-7.22	0	-0.04757	-0.02726	0.016283
_Ieduc~8*	-.0512407	0.00356	-14.39	0	-0.05822	-0.04426	0.070982
_Isex_2*	.0049986	0.00058	8.57	0	0.003855	0.006142	0.489301
_Iurba~2*	-.0003242	0.00168	-0.19	0.847	-0.00363	0.002978	0.588712
_Iageg~2*	-.0043498	0.00111	-3.93	0	-0.00652	-0.00218	0.160958
_Iageg~3*	-.0045848	0.00085	-5.36	0	-0.00626	-0.00291	0.360309
_Iageg~4*	-.0074918	0.0014	-5.34	0	-0.01024	-0.00474	0.193006
_IMetr~2*	.0001239	0.00044	0.28	0.777	-0.00073	0.000981	0.110501
_IMetr~3*	.0014275	0.00043	3.3	0.001	0.000581	0.002274	0.315402
_IMetr~4*	.0006354	0.00014	4.58	0	0.000364	0.000907	0.07658
_IMetr~5*	.0001678	0.00154	0.11	0.913	-0.00285	0.003188	0.265846
_IMetr~6*	-.0047503	0.00324	-1.47	0.142	-0.01109	0.001592	0.017483

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Table A4: Continued

Computing marginal effects after oprobit for Qunitiles_PCA_new == 2							
Marginal effects after oprobit y = Pr(Qunitiles_PCA_new==1) (predict, o(1))= .33416107							
variable	**dy/dx**	**Std. Err.**	**z**	**P>z**	**[95%**	**C.I.]**	**X**
_Iwiq_2*	.0583916	0.00283	20.65	0	0.05285	0.063933	0.205673
_Iwiq_3*	.0651394	0.00352	18.52	0	0.058247	0.072032	0.218724
_Iwiq_4*	.0330895	0.00512	6.46	0	0.023055	0.043124	0.199184
_Iwiq_5*	-.0772923	0.00676	-11.44	0	-0.09053	-0.06405	0.177115
_Ieduc~2*	.0030363	0.0095	0.32	0.749	-0.01559	0.021661	0.151884
_Ieduc~3*	.0378367	0.00603	6.28	0	0.026024	0.049649	0.231191
_Ieduc~4*	.0495093	0.0041	12.07	0	0.041469	0.057549	0.172333
_Ieduc~5*	.0073149	0.00868	0.84	0.399	-0.0097	0.024329	0.084039
_Ieduc~6*	.0623094	0.00311	20.06	0	0.056223	0.068396	0.206066
_Ieduc~7*	.0196284	0.01063	1.85	0.065	-0.0012	0.040458	0.016283
_Ieduc~8*	-.0039522	0.00978	-0.4	0.686	-0.02313	0.015224	0.070982
_Isex_2*	-.0804052	0.00347	-23.15	0	-0.08721	-0.0736	0.489301
_Iurba~2*	.1814325	0.02094	8.66	0	0.140392	0.222473	0.588712
_Iageg~2*	.032552	0.0048	6.78	0	0.023145	0.041959	0.160958
_Iageg~3*	.0456811	0.00568	8.04	0	0.034546	0.056816	0.360309
_Iageg~4*	.0457591	0.0043	10.65	0	0.037338	0.054181	0.193006
_IMetr~2*	-.0464481	0.0071	-6.55	0	-0.06036	-0.03254	0.110501
_IMetr~3*	-.0372059	0.02755	-1.35	0.177	-0.0912	0.01679	0.315402
_IMetr~4*	-.0171015	0.00762	-2.24	0.025	-0.03204	-0.00216	0.07658
_IMetr~5*	-.0026358	0.02529	-0.1	0.917	-0.05221	0.04694	0.265846
_IMetr~6*	-.0877127	0.02294	-3.82	0	-0.13267	-0.04276	0.017483

(*) dy/dx is for discrete change of dummy variable from 0 to 1

Computing marginal effects after oprobit for Qunitiles_PCA_new == 2							
Marginal effects after oprobit y = Pr(Qunitiles_PCA_new==1) (predict, o(1)) = .15984728							
variable	**dy/dx**	**Std. Err.**	**z**	**P>z**	**[95%**	**C.I.]**	**X**
_Iwiq_2*	.146089	0.01045	13.99	0	0.125616	0.166562	0.205673
_Iwiq_3*	.3280145	0.01165	28.17	0	0.305191	0.350838	0.218724
_Iwiq_4*	.446522	0.01289	34.63	0	0.421253	0.471791	0.199184
_Iwiq_5*	.6867414	0.01143	60.1	0	0.664346	0.709136	0.177115
_Ieduc~2*	.0048236	0.01536	0.31	0.754	-0.02529	0.034932	0.151884
_Ieduc~3*	.0727247	0.01448	5.02	0	0.044336	0.101114	0.231191
_Ieduc~4*	.1165671	0.01571	7.42	0	0.085767	0.147367	0.172333
_Ieduc~5*	.3908272	0.02203	17.74	0	0.347655	0.433999	0.084039
_Ieduc~6*	.1689038	0.01553	10.87	0	0.138457	0.19935	0.206066
_Ieduc~7*	.3004917	0.034	8.84	0	0.233852	0.367131	0.016283
_Ieduc~8*	.4089114	0.02283	17.91	0	0.364174	0.453649	0.070982
_Isex_2*	-.1274713	0.00493	-25.84	0	-0.13714	-0.1178	0.489301
_Iurba~2*	.2580509	0.03189	8.09	0	0.195541	0.320561	0.588712
_Iageg~2*	.0637838	0.01203	5.3	0	0.040215	0.087353	0.160958
_Iageg~3*	.0809327	0.01138	7.11	0	0.05863	0.103236	0.360309
_Iageg~4*	.0988123	0.01333	7.42	0	0.072695	0.12493	0.193006
_IMetr~2*	-.0575124	0.00708	-8.12	0	-0.07139	-0.04364	0.110501
_IMetr~3*	-.0527629	0.03577	-1.47	0.14	-0.12288	0.017353	0.315402
_IMetr~4*	-.0240347	0.00967	-2.49	0.013	-0.04299	-0.00508	0.07658
_IMetr~5*	-.0040751	0.03873	-0.11	0.916	-0.07998	0.071827	0.265846
_IMetr~6*	-.0869616	0.01516	-5.74	0	-0.11668	-0.05725	0.017483

(*) dy/dx is for discrete change of dummy variable from 0 to 1