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The Determinants of Broadband Access and Usage in Turkey: Do Regions Matter?

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Abstract

The aim of the paper is to examine the determinants of broadband internet access in Turkey, and in particular, whether the probability of adopting broadband access varies by region. This study also attempts to find out whether there are regional disparities in engaging in various online activities. The 2012 ICT Household Survey that was conducted and administered by TURKSTAT is used. Probit model of probability of adopting broadband access is estimated and results are consistent with the earlier studies: Education, gender, age and household size matter. Besides this, the probability of adoption in West and Central Turkey is higher than the Eastern Turkey. In the second stage of the paper, conditioned on the availability of access, probability of using various online activities is estimated. The results confirm the existence of the regional disparities: Being in the West increases the probability of using online activities that require relatively advanced skills such as searching information and e-banking, while the probability of using time-required entertaining activities is higher for the individuals in the East.

1 Introduction

Broadband internet is widely considered as the crucial element of economic and social development (OECD, 2013). Thus, many governments are creating policies to increase broadband penetration and to stimulate regular internet usage. The most notable one is the Digital Agenda for Europe which defines the targets for the deployment and penetration of broadband access for EU countries (Commission, 2010). Digital Agenda's targets include covering the entire EU with high speed broadband access, increasing regular internet usage among disadvantaged people, encouraging populations to buy online, and increasing the use of e-Government.[1]

Government policies and regulatory strategies are expected to shape the market structure and determine the broadband penetration. However, besides these policy factors, there are various factors which affect broadband penetration and broadening internet usage. As shown by The Berkman Center for Internet and Society (2010), variables such as geography, population density, education, employment, and income are more influential than the policy factors on the broadband performance.

Turkey has experienced both technological change and a considerable deregulation in the telecommunications industry since 2000. Its obligations to streamline EU's "acquis communautaire" have speeded up to establish new institutions (e.g. National Regulatory Authority) and to adopt new legislations (e.g. Electronic

[1] https://ec.europa.eu/digital-agenda/en/our-goals (accessed on November 16, 2013)

Telecommunications Act, e-Government act, etc.). With the partial privatization of the state owned incumbent company (Turk Telekom) and with accompanying regulations, slow but steady competition has begun in the fixed broadband provision market. On one side, new regulations opened up a service-based competition through allowing alternative internet service providers to provide access over Turk Telekom's wired network. On the other side, divestiture of cable TV network from the incumbent and emerging fiber deployment by an alternative operator, Turkcell Superonline, has initiated a facility-based competition in the fixed-broadband market. Moreover, mobile broadband services have been available since 2009 and have a considerable competition between three mobile operators; Turkcell, Vodafone, and Avea.

Nevertheless, more than ten years after the deregulation in the telecommunications industry, Turkey still has the least penetrated broadband market in Europe.[2] Thanks to Turk Telekom's countrywide fixed network, fixed-broadband access subscription had increased rapidly in the early 2000s. However, starting from 2010, the growth rate of broadband subscription has decreased sharply. The fixed broadband penetration rate was set to a 10% level, which is considerably lower than EU 25 average (OECD, 2013).

The determinants of broadband access have been widely studied in the literature (Chaudhuri et al., 2005; Cerno & Amaral, 2006; Moutafides & Economides, 2011;

[2] By the end of 2013 broadband penetration in Turkey is 11%. (OECD Broadband Portal, http://www.oecd.org/internet/broadbandandtelecom/oecdbroadbandportal.htm, accessed on 10 January 2013)

Hargittai & Shafer, 2006; Hargittai & Hinnant, 2008; Goldfarb & Prince, 2008).[3] Prior studies conclude that income, education, demographic characteristics and price are the main determinants in the adoption of broadband access (Chaudhuri et al., 2005, Cerno & Amaral, 2006, Moutafides & Economides, 2011). Additionally, some studies have argued that socioeconomic and demographic factors also influence users' online activities and their online behaviors (Hargittai & Shafer, 2006; Hargittai & Hinnant, 2008; Goldfarb & Prince, 2008). In their study for the United States, Hargittai & Shafer (2006) discuss the role of gender and argue that women's lower self-assessment on their web-use skills may affect the extent of their online behavior. Moreover, in an expanded study, Hargittai & Hinnant (2008) state that people with higher levels of education and resource-rich background pursue capital-enhancing online activities.

Goldfarb & Prince (2008) analyze the issue a bit further and examine the online time consumption by income and education groups. They find people with higher income and education level adopt the internet more than other groups but they spend much less time online. The authors interpret this result as the low-income individuals might have lower opportunity cost of time, higher marginal benefits from the internet use, more time or higher value for the internet.

Studies that deal with the regional differences in internet use are very scarce, and to our knowledge, none of them is conducted in Turkey. A report prepared by Spooner et

[3] See, Srinuan & Bohlin (2013) for a recent and detailed review of literature.

al. (2003) for the Pew Research Center examines the regional disparities of internet use in the United States. The report states that the penetration rate among regions is uneven; and education and income are the two main factors behind this variation. The report also examines the types of internet usage and finds that some basic activities such as emails are uniformly common in all regions, while activities such as online shopping, obtaining news and information, searching for health information have regional variations. The report concludes that each region has its own characteristics and online activities in the region are in line with these characteristics.

The purpose of this paper is to investigate the determinants of broadband adoption and usage of households in Turkey. Our main motivation is to examine the influence of socioeconomic, demographic and geographic factors on broadband access and online activities. The main contribution of the paper is to analyze the effect of these factors on online activities emphasizing the regional disparities in Turkey. We classify the online activities in three categories: "*Advanced"* includes the activities that require relatively advanced internet skills such as uploading content, streaming media, searching information, getting health appointments, making a trip reservation, e-trade and e-banking; "*entertaining"* includes the activities that require excessive time use such as social networking, voice/video calling, online gaming, downloading

and "*conventional"* includes the basic activities that doesn't require advanced skills such as sending/receiving e-mail and getting news. To our knowledge, no other academic study classifies the services. In addition, this study is the first that analyzes the determinants of broadband access and usage in Turkey.

Our empirical results strongly verify that the demographic factors are the main determinants of broadband adoption in Turkey as well. Our data does not have any information on income and price; therefore our study cannot control the impact of these two factors. Our findings support Spooner et al. (2003) and strikingly set out how online activities change by region consistent with the regional characteristics. Our findings also support that males are more likely to use the online activities and better educated people are more likely to use *advanced* activities. Although our data does not have the appropriate income and time consumption information, we show that individuals who have a job and have a higher educational degree are more likely to adopt broadband access and use more *advanced* activities.

The closest study to our research was carried out in Thailand, where Srinuan & Bohlin (2013) investigated the determinants of online activities conditioned on the availability of broadband at home. Their findings show that the availability of fixed infrastructure and various demographic variables affect the existence of broadband access at home, and moreover, each factor has a different impact on specific online activities. Although we use the same method to estimate the determinants and get comparable results, our research differs in these distinctive points: We focus on the regional disparities in broadband use and examine how the use of categorized online activities differs by region.

The rest of the paper is organized as follows: The next section exhibits the regional panorama of Turkey. Section 3 introduces the data and the methodology. Section 4 presents the findings. And, Section 5 delivers a discussion of the findings

2 Regional Panorama of Turkey

Turkey has been divided into three statistical regions to be comparable with EU countries: NUTS1 (12 regions), NUTS2 (26 regions) and NUTS3 (81 regions). The data we employ in this study is representative at the NUTS1 level. There are 3 to 9 provinces in each region except Istanbul. TURKSTAT states that the proximity and population as well as culture are key factors in the selection criteria of regions.[4]

Interregional disparities have always been a concern for the Turkish economy. The regional disparities and its effect on economic growth have been much studied (Doğruel & Doğruel, 2003; Karaca, 2004; Gezici & Hewings, 2004). The western part of the Turkey has a higher population density and is always considered as more "developed" relative to the eastern part (Özarlan et al. 2006). In this section, we attempt to show the disparities among regions. First, we congregate four NUTS1 regions to construct one region. Our selection criterion is completely geographic[5]. Then, by using the main indicators, we show whether the regional disparities between our assembled regions exist. According to our classification, we obtain three geographical regions as shown in Figure 1:

1. West - Istanbul, West Marmara, Aegean, and East Marmara regions

[4] http://tuikapp.tuik.gov.tr/DIESS/SiniflamaSurumDetayAction.do?surumId=164 (accessed on November 29, 2013)

[5] When the main indicators are taken into account, NUTS1 regions in each category (West/Central/East) show similar characteristics. Therefore, we had chosen a completely geographical classification rather than cultural or social grouping.

2. Central – West Anatolia, Mediterranean, Central Anatolia, and West Black Sea regions
3. East – East Black Sea, Northeast Anatolia, Middle East Anatolia, and Southeast Anatolia regions

Figure 1 Regions in Turkey (NUTS1 level & West-Central-East)

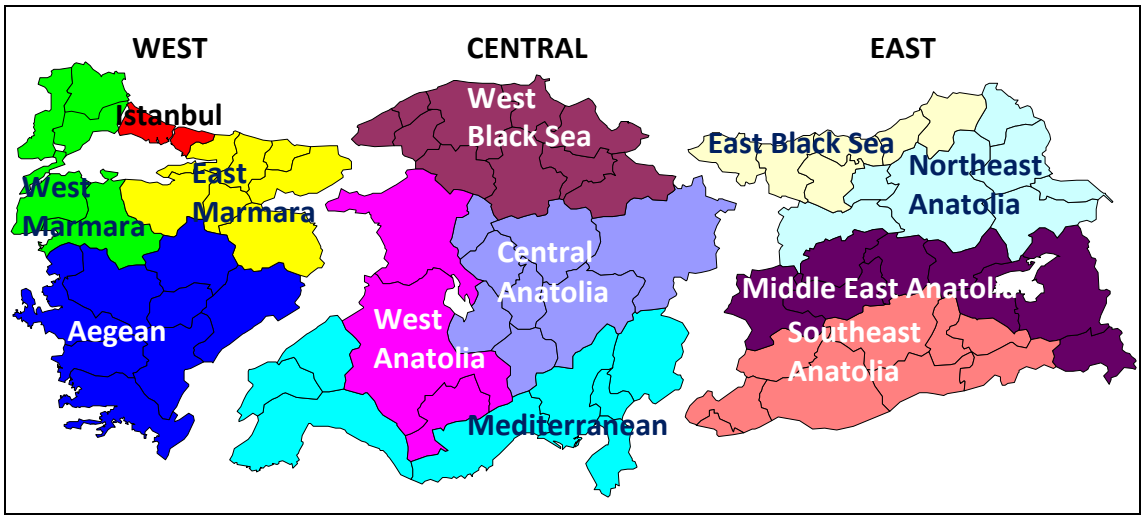

Table 1 shows the regional disparities among our regions. The western part of the Turkey has higher per capita income, a lower unemployment rate and lower poverty rate and higher educational attainment than the eastern part of Turkey. Similarly, Central Turkey has better indicators in comparison to Eastern Turkey.

Table 1 Regional indicators

Indicators	West	Central	East
Per capita gross value added in 2011 (US Dollar)[i]	12 068	9 314	4 948
Population density (person per square kilometer) [i]	181	76	62
Fixed Telephony penetration – per 100 person [ii]	23	16,7	8.8
Operator Capacity for Fixed Telephony – per 100 person [ii]	62.8	47.8	35.6
Fixed-broadband penetration - per 100 person [ii]	13.6	9.8	4.4
Mobile-broadband penetration - per 100 person [ii]	20.4	14.2	9.9
Fiber network length (km) [ii]	85 252	75 022	50 013

Distribution of Poor [iii] (2010) [i]	23.3	28.9	47.8
Unemployment rate [i, iv]	11.3	11.0	13.6
Average years of schooling [i]	5.03	4.55	3.53

[i] NUTS2 level Gross Value Added data and Address Based Population Registration System data were taken from TURKSTAT Regional Statistics Database, calculations were made by the authors
[ii] Data source: ICTA (2013)
[iii] The distribution of poor among regions. Poor is defined as the person who is under the national relative poverty line.
[iV] Nonagricultural unemployment rate for the population above age 15

3 Data and methodology

We use the Household Information and Communication Technology (ICT) Usage Survey, administrated annually by TURKSTAT, in accordance with the regulations of the EU. The sampling is representative at the national and regional level (NUTS1). Since there are some modifications in questions over the years, we take the most recent year available. The 2012 survey consists of 10,605 households with 39,361 individuals. We only take individuals who are above 15 years old, which reduces our sample to 29,061 individuals. 40% of our sample is from the West, 34% is from Central Turkey and 26% of our sample is from the Eastern part of Turkey.

The respondents, who state that they had used the internet in the last 3 months, were asked to answer multiple questions about their internet use, specifically the activity they performed in the last 3 months. In our analysis, we use various demographic variables, i.e., age, gender, education; household information, household size, number of children or the number of children in elementary school; and variables associated with the broadband usage. We also added the length of fiber network to the first stage to create an indicator for the investment in that region.

Due to the fact that the income information is unavailable in the ICT survey, we are not able to control for economic conditions of a household. In order to capture the effect, we utilize a proxy variable that provides information about an individual's employment.

Table 2 presents the information about all variables and descriptive statistics by region. One notable result from Table 2 is that the indicators in the west are significantly better than the east, which is consistent with the regional disparity presented in previous section. For example, households in the west have, on average, fewer household members with fewer kids. In being consistent with Section 2, broadband connections are significantly higher in the west.

Table 2 Descriptive Statistics

		TURKEY	**WEST**	**CENTRAL**	**EAST**
Variable	**Description**	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**	**Mean (SE)**
EDULESSHIGH	= 1 if less than high school degree	0.88 (0.32)	0.86 (0.35)	0.88 (0.33)	0.93 (0.25)
EDUMOREHIGH	= 1 if more than high school degree	0.12 (0.32)	0.14 (0.35)	0.12 (0.33)	0.07 (0.25)
AGELESS35	= 1 if age less than 35	0.42 (0.49)	0.39 (0.49)	0.39 (0.49)	0.49 (0.50)
AGE3555	= 1 if age between 35 and 55	0.36 (0.48)	0.38 (0.49)	0.38 (0.49)	0.32 (0.47)
AGEMORE55	= 1 if age more than 55	0.22 (0.41)	0.22 (0.42)	0.23 (0.42)	0.20 (0.40)
MALE	= 1 if male	0.49 (0.50)	0.50 (0.50)	0.49 (0.50)	0.49 (0.50)
HHSIZE	The size of the household	4.71 (2.39)	3.93 (1.67)	4.32 (1.90)	6.14 (2.99)
PUPIL	= 1 if kid(s) in elementary school at home	0.49 (0.50)	0.40 (0.49)	0.48 (0.50)	0.62(0.49)
EMPLOYMENT	= 1 if individual is working	0.43 (0.49)	0.44 (0.50)	0.43 (0.50)	0.39 (0.49)
FIXED	= 1 if individual has fixed telephone at home	0.42 (0.49)	0.53 (0.50)	0.43 (0.50)	0.26 (0.44)
MOBILE	= 1 if individual has a mobile phone	0.95 (0.21)	0.95 (0.21)	0.96 (0.20)	0.95 (0.22)
BROADBAND	= 1 if individual has broadband access	0.16 (0.37)	0.24 (0.43)	0.16 (0.37)	0.07 (0.26)
EMAIL	= 1 if individual is using the activity	0.18 (0.39)	0.23 (0.42)	0.18 (0.38)	0.12 (0.32)
NEWS		0.20 (0.40)	0.26 (0.44)	0.21 (0.41)	0.12 (0.32)
SOCIAL NETWORKING		0.11 (0.32)	0.15 (0.36)	0.10 (0.30)	0.08 (0.27)
VOICE/VIDEO CALL		0.12 (0.32)	0.15 (0.35)	0.11 (0.32)	0.08 (0.28)
ONLINE GAME		0.08 (0.27)	0.09 (0.29)	0.08 (0.27)	0.06 (0.24)
DOWNLOAD		0.13 (0.34)	0.16 (0.37)	0.14 (0.35)	0.09 (0.28)
UPLOAD CONTENT		0.09 (0.29)	0.11 (0.32)	0.11 (0.31)	0.05 (0.22)
STREAMING MEDIA		0.11 (0.31)	0.14 (0.35)	0.11 (0.32)	0.05 (0.22)
SEARCH INFO		0.17 (0.37)	0.23 (0.42)	0.18 (0.38)	0.08 (0.27)
HEALTH APPOINTMENT		0.05 (0.22)	0.08 (0.28)	0.05 (0.21)	0.01 (0.11)
TRIP PLAN		0.05 (0.22)	0.07 (0.26)	0.06 (0.23)	0.02 (0.14)
E-TRADE		0.02 (0.14)	0.02 (0.15)	0.03 (0.16)	0.01 (0.09)
E-BANKING		0.05 (0.21)	0.06 (0.25)	0.05 (0.23)	0.01 (0.11)
Observation		**39 361**	**14 599**	**13 277**	**11 485**

In our empirical estimation, we follow Srinuan & Bohlin (2013) with a slight distinction. Similarly, we first assume that individuals must have broadband access to use the internet. Thus, we first estimate the probit model of the availability of broadband connection on various individual and household level characteristics. Unlike Srinuan & Bohlin (2013), where availability of fixed broadband connection at home is estimated, we add mobile connections. It is mostly because of the increasing usage of cell phones in Turkey (Torlak et al., 2011). In the first stage our estimation is;

$$Prob\ (Y_i = 1|\mathrm{Z}) = \Phi(\mathrm{Z}\,\gamma) \tag{1}$$

where Y_i is a binary variable that takes the value 1 if broadband connection is available, and 0 otherwise, Y_i is the vector of individual and household level characteristics, γ is a vector of unknown parameters, and Φ is the cumulative distribution function of the standard normal distribution.

After the first stage estimation, we adopt Heckman correction for sample selection (Heckman, 1979). In the second stage, we estimate the probability of activity types separately, by eliminating some variables that we used in the first stage. The assumption is that they are affecting the availability of the broadband connection, however, not the type of activity.

$$Prob\ (Y_i^*|\ \mathrm{X},\ Y_i\ = 1) = \mathrm{X}\beta + \varepsilon \tag{2}$$

where Y_i^* is the binary variable that takes the value of 1 if the individual using internet

for that particular activity does so conditioned on the availability of broadband connection, $\mathbf{X}$ is a vector of individual and household characteristics, leaving out the availability of kids at school age, mobile connection and fiber length and fixed telephone subscription, and ε is the error term.

4 Findings

The estimated results to identify the determinants of broadband access and its usage in Turkey are shown in Table 3. Our first stage results associated with the determinants of broadband access adoption are shown in the second column of the table. Broadband access adoption increases with the availability of fixed and mobile phone subscription. Being younger, employed, and having a degree above high school increases the probability of broadband adoption. Moreover, living in the west or the central region increase the adoption rate compared to residing in the east. Likewise individuals living in urban areas are more likely to adopt broadband. While having kid(s) at primary school increases the probability of broadband adoption, having larger families decreases likelihood of the adoption. Fiber network length is insignificant for the adoption.

Results starting on the third column exhibit the outcome of second stage estimation for the usage of online activities. Education, age, gender, and household size variables follow a similar pattern as described in the first stage. Having a degree less than high school decreases the probability of usage in online activities except streaming, downloads and online games. Usage of online games increases with having a degree

less than high school. Being younger increases the usage of online activities but is insignificant to get news online. Being older generally decreases the probability of the usage of the applications; however it does not make any difference to getting news online, searching for information, getting a health appointment, trip planning ore-trade. Males are more likely to use applications than females. But gender does not create any difference to searching for information or to getting health appointments. Household size decreases the usage, but it does not matter for social networking and online games.

Table 3 Estimated results for broadband access adoption and usage of online activities

VARIABLE	1st stage	2nd stage												
	BROADBAND	E-MAIL	NEWS	SOCIAL NETWORKING	VOICE/VIDEO CALL	ONLINE GAME	DOWNLOAD	UPLOAD CONTENT	STREAMING MEDIA	SEARCH INFO	HEALTH APPOINTMENT	TRIP PLAN	E-TRADE	E-BANKING
EDULESSHIGH	-1.1685***	-0.8162***	-0.5593***	-0.0915*	-0.1152**	0.1491***	0.0420	-0.1608***	-0.0660	-0.2876***	-0.1917***	-0.5283***	-0.3684***	-0.7799***
	(0.0293)	(0.0580)	(0.0567)	(0.0493)	(0.0482)	(0.0512)	(0.0486)	(0.0505)	(0.0481)	(0.0500)	(0.0554)	(0.0577)	(0.0743)	(0.0593)
AGELESS35	0.6088***	0.7795***	0.0480	0.5583***	0.4044***	0.5201***	0.5827***	0.6300***	0.4669***	0.0847**	0.1681***	0.1355***	0.1956***	0.0960**
	(0.0217)	(0.0400)	(0.0386)	(0.0360)	(0.0355)	(0.0374	(0.0350)	(0.0373)	(0.0360)	(0.0355)	(0.0394)	(0.0396)	(0.0514)	(0.0418)
AGEMORE55	-1.0002***	-0.3118***	-0.026	-0.3322***	-0.1582**	-0.1922**	-0.3670***	-0.2636***	-0.2013**	-0.1000	-0.0020	-0.0862	-0.0160	-0.2871***
	(.03643)	(0.0818)	(0.0872)	(0.0844)	(0.0791)	(0.0886)	(0.0799)	(0.0877)	(0.0813)	(0.0778)	(0.0896)	(0.0890)	(0.1175)	(0.0956)
MALE	0.2309***	0.2991***	0.2801***	0.2804***	0.1547***	0.4283***	0.3702***	0.1465***	0.0829**	0.0209	-0.0175	0.1108***	0.2172***	0.3327***
	(0.0219)	(0.0377)	(0.0378)	(0.0341)	(0.0334)	(0.0357)	(0.0339)	(0.0345)	(0.0333)	(0.0343)	(0.0372)	(0.0377)	(0.0490)	(0.0413)
HHSIZE	-0.1176***	-0.0776***	-0.0741***	-0.0125	-0.0474***	-0.0196	-0.0440***	-0.0754***	-0.0693***	-0.0574***	-0.0159	-0.1266***	-0.0645***	-0.1547***
	(0.0068)	(0.0127)	(0.0127)	(0.0116)	(0.0114)	(0.0121)	(0.0116)	(0.0120)	(0.0117)	(0.0117)	(0.0132)	(0.0142)	(0.0178)	(0.0155)
EMPLOYMENT	0.1162***	0.1229***	0.0515	-0.0720**	-0.0772**	-0.0345	-0.1040***	0.0685*	0.0462	0.1345***	0.0681*	0.1815***	0.2170***	0.5543***
	(0.0228)	(0.0379)	(0.0382)	(0.0350)	(0.0341)	(0.0365)	(0.0349)	(0.0355)	(0.0342)	(0.0351)	(0.0385)	(0.0391)	(0.0512)	(0.0436)
WEST	0.3376***	-0.1644***	-0.0135	-0.0580	-0.2753***	-0.2199***	-0.0653	-0.0497	0.1448***	0.2405***	0.5719***	0.0890	0.0677	0.4254***
	(0.0474)	(0.0489)	(0.0493)	(0.0490)	(0.0533)	(0.0845)	(0.0504)	(0.0632)	(0.0505)	(0.0489)	(0.0779)	(0.0683)	(0.0349)	(0.0350)
CENTRAL	0.1954***	-0.1933***	0.0643	-0.2515***	-0.2264***	-0.1311***	0.0591	0.1682***	0.2660***	0.3376***	0.3865***	0.1777***	0.3125***	0.5233***
	(0.0320)	(0.0541)	(0.0540)	(0.0494)	(0.0480)	(0.0507)	(0.0493)	(0.0507)	(0.0498)	(0.0497)	(0.0635)	(0.0590)	(0.0771)	(0.0686)
URBAN	0.6558***	0.0401	-0.1492**	-0.0661	-0.2903***	0.1025*	0.0392	-0.0566	-0.0303	0.0466	0.2146***	0.2518***	0.1869**	0.0916
	(0.0257)	(0.0579)	(0.0584)	(0.0536)	(0.0516)	(0.0565)	(0.0536)	(0.0552)	(0.0529)	(0.0531)	(0.0657)	(0.0685)	(0.0888)	(0.0692)
PUPIL	0.2404***													
	(0.0231)													
FIXED	0.9214***													
	(0.0207)													
MOBILE	0.4682***													
	(0.0604)													
FIBERLENGHT	0.0008													
	(0.0023)													
CONSTANT	-1.1718***	1.0055***	1.5127***	-0.2706***	0.6002***	-1.038***	-0.2836***	-0.3291***	-0.0983	0.643443***	-1.2312***	-0.3173***	-1.440***	-0.8463***
	(0.0852)	(0.1097)	(0.1088)	(0.1025)	(0.0972)	(0.1071)	(0.1017)	(0.1054)	(0.1004)	(0.09948)	(0.1239)	(0.1200)	(0.1632)	(0.1299)
rho		-0.1336**	-0.1848***	-0.0992*	-0.2781***	0.0148	-0.0294	-0.1178**	-0.2751***	-0.259912***	-0.1698***	-0.2754***	-0.2090***	-0.0524
		(0.0570)	(0.0568)	(0.0534)	(0.0526)	(0.0555)	(0.0526)	(0.0550)	(0.0526)	(0.053928)	(0.0606)	(0.0610)	(0.0803)	(0.0677)
Chi square		5.55**	10.80***	3.43*	27.61***	0.07	0.31	4.53**	26.83***	23.52***	7.62***	19.25***	6.34***	0.59
Observation	26 805	7 349	7 349	7 349	7 349	7 349	7 349	7 349	7 349	7 349	7 349	7 349	7 349	7 349

The numbers in parenthesis represent the standard deviation. *, ** and *** indicates the significance at the 10%, 5% and 1% levels, respectively.

On the other hand, employment and regional variables vary with purpose of usage. Having a job increases the probability of using email, uploading content, searching information, streaming media, getting heath appointments, e-trade and e-banking; it decreases the probability of using activities such as voice/video call, social networking and downloads. Being employed is insignificant in online games, getting news and streaming media.

Most importantly usage varies with the region. People living in the west and in central Turkey are more likely to use *advanced* online applications such as searching for information, getting health appointment, e-banking, and streaming media. They are less likely to use some applications such as, email, voice/video call, online games compared to those in the east. Living in urban areas also increases usage of e-trade, trip planning, health appointments, online games; and decreases voice/video calls and getting news online compared to rural areas.

5 Discussion and implications

This paper examines the determinants of the broadband access and broadband usage in Turkey. Findings of the paper strongly verify the results in the earlier literature; the regional approach and the categorization of online activities create notable contributions.

Our main findings related with the determinants of the broadband access are in line with the earlier studies. Education, age, gender, employment, and availability of fixed

and mobile telephony are significant determinants. Our regional approach, which is based on congregating NUTS1 level regions into West-Central-East, indicates significant differences among the regions. We verify that the interregional disparities also exist in the probability of broadband adoption. Individuals living in the west and in central Turkey are more likely to adopt broadband access compared to those in the east. The availability of fixed networks might be considered as a barrier, but as described in Table 1, there exists an excess capacity for fixed telephony network. A possible explanation for the lower probability could be the relatively higher cost in the east. In Turkey, fixed and mobile operators offer identical prices for their own access services in all regions. Considering the regional differences in income, adopting broadband access in the east with those undifferentiated prices becomes relatively costly. Creating incentives by the national regulatory authority (ICTA) for the operators to differentiate their prices regionally could be a policy implication of this result.

Furthermore we find that having kid(s) at primary school at home increases the probability of broadband adoption. In a number of studies it was suggested that children, teenagers may facilitate internet adoption and influence online behaviors of family members (Hargittai, 2003; Kiesler et al., 2000; Kraut et al., 1996). However, this finding has a particular importance for Turkey. The government has just initiated a countrywide investment project (FATiH project)[6], which is based on providing ICT

[6] See, http://fatihprojesi.meb.gov.tr/tr/english.php (accessed on November 28, 2013).

equipment to classes, distributing computers to students and teachers in order to achieve the ICT supported teaching until the end of 2014. Our finding supports the implementation of such a project in terms of its interactive effect on the broadband access adoption. Specifically, this program could reduce the regional gap by providing computers to school-aged children which gives incentive to adopt broadband access at home.

Findings related with the usage of online activities are also in line with the previous literature. We confirm that being younger or having a degree above high school increases the probability of using online activities. We verify that males are more likely to use the activities than females. Furthermore, we find that having a job decreases the probability of using entertaining activities such as, social networking, voice/video call, and downloads.

Most importantly, our categorization of online activities as *advanced*, *entertaining* and *conventional* activities, and their usage among regions create an empirical contribution to the literature. We find that conventional activities such as, sending or receiving emails and getting news, are common in all regions or more likely to be used in the east compared to the west or the central. Nevertheless, *advanced* activities such as uploading content, searching information, streaming media, getting health appointments, trip planning, e-trade, and e-banking, are more likely to be used in the central region compared to the east. Most of those mentioned activities (except uploading content, trip planning and e-trade) are also to be used with higher probabilities than in the east. Moreover, entertaining online activities such as social

networking, voice/video calling, and online gaming, are more likely to be used in the east than in the west and in the central.

In fact, those findings strikingly set out how online activities change across regions consistent with regional characteristics. One possible explanation of this variation could be the lower opportunity cost of time in the east, owing to a higher unemployment rate and lower income, which increases the likelihood of participating in entertaining / time consuming activities.

Individuals in the West have a noticeably higher probability in engaging in *advanced* activities, even after education, gender, age, and household size are controlled. We suspect the financial literacy as well as experience in such activities plays an important role in this variation. Unfortunately, we are unable to find the basis of this difference due to unavailability of necessary information. Still, region specific policies such as providing training in such activities or encouraging the use of e-government might overcome the regional disparities.

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