DIGITAL INCLUSION EFFECT ON QUALITY OF LIFE IN TRANSITION AND POST-TRANSITION COUNTRIES

by

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Abstract

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The interconnected digital realm has already heavily embedded into our lives, so constantly growing digital inclusion creates unprecedented shifts at all levels. Despite numerous studies, there is still no firm and complete evidence of how digital inclusion (DI) enhances the quality of life (QoL), particularly for transition countries. Thus, this empirical study aims to fill this gap by comparing DI effect on QoL at the individual level across 25 countries with transition and post-transition economies. The research relies on cross-sectional data from Life in Transition Survey III, carried in 2016 by EBRD and WB.

The results revealed a highly statistically significant positive relationship: on average, people who have Internet access at home are 4.7 p.p. more satisfied with their lives. Further analysis discovered a divergence of the digital inclusion effect for a different group of countries. While the DI effect was large and positive for countries that completed transition (10 p.p.) during all the analysis, there was a negative association between Internet use intensity and happiness in transition countries (-2.8 p.p.). However, the later negative effect turns into positive (4%-7.6%) once we control for the various quality indicators of the governance.

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LIST OF ABBREVIATIONS

EBRD. European Bank for Reconstruction and Development

IMF. International Monetary Fund

IV. Instrumental variables

CEE. Central and Eastern Europe

LiTS III. Life in Transition Survey III, the third wave of the household survey conducted by European Bank for Reconstruction and Development and World Bank in 2016

UAH. Ukrainian hryvnia, the national currency of Ukraine

USD. United States dollar, the national currency of USA and other countries

WB. World Bank

QoL. Quality of life

DI. Digital inclusion

2SLS IV. Two-stage instrumental variables method

Chapter 1

INTRODUCTION

The world has significantly changed since it turned from mechanical and analogue electronic technology to digital computing. This technology adoption has revolutionized information flow and finally made possible a quantum technology leap that initiated the Third industrial revolution, also called Digital.

Nowadays, the interconnected digital realm is heavily embedded into individuals and communities' lives at all levels. And there is one thing everyone is confident about: the world tomorrow will be more digital than today (McKinsey 2020).

The process of enhancing digital technologies has a profound impact on different economic agents (World Bank 2016). Indeed, globalization boosts robust digital empowerment in various socio-economic domains under a common sheath of sustainable development leading to better life quality.

For recent decades, digitalization has given a great boom to the corporate, financial, and administrative sectors, which has exponentially extended services with one-click access, developed facilities in healthcare and public administration, and created educational opportunities for the less privileged cohorts. Furthermore, the effect is enhancing with the increasing interconnection of urban and rural societies. Onwards with this social upliftment, inclusive economic growth occurs, which positively affects well-being. On the verge of such a framework also raises a digital age progeny: learners, thinkers, reformers, participators, and agents of change and growth moving ahead on sustainable development (Bhutani and Paliwal 2015).

At the same time, as a vast digital realm is growing at all levels, the more injurious becomes the volatility of digital inclusion, which creates not evenly distributed privilege and exclusion (Livingstone and Helsper 2007).

The digital success stories of developed countries such as Belgium, Denmark, Finland, Ireland, Luxembourg, the Netherlands, Norway, and Sweden (so-called Digital Frontiers), suggest that digital technologies' proliferation could provide a common platform to millions of people to defeat poverty and illiteracy and ensure their rights and inclusive. Such a digital surge is beneficial to manage the growth even faster and to narrow the gap even further on the macro level. Furthermore, these countries are at the top-30 of the Quality-of-life rating (2019).

Digitalization also plays an important role in the CEE region. Notably, Estonia, so-called "The Baltic Tiger", is a post-transition country that became a STEM education powerhouse and experienced technological leapfrogging by proactive diffusion of digital solutions in governance, taxation, real estate (E-stonia), banking, and other sectors (Stephany 2019; Krysovatyi and Vasylchyshyn 2017). In 2019, Estonia was rated 14th in the Quality-of-life index, which was mainly urged on leadership in the "Digital life" category (1st among 64 countries).

With a strong talent base, high-quality digital infrastructure, and vibrant technology ecosystem, the CEE Digital Challengers (Bulgaria, Croatia, the Czech Republic, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia) are becoming a hub for digital fintech, cybersecurity clusters, e-health and digital education centers, gaming, and software development houses with the fastest-growing companies in the region. Furthermore, executives in traditional industries are starting to follow the suit, successfully adopting digital solutions (McKinsey 2019).

McKinsey (2019) estimated that digitalization could be the next new sustained growth engine for the CEE region, with €200 billions of additional GDP by 2025 at stake with a digital economy up to 16 percent of the GDP. Otherwise, slow, or poor digital technologies adoption can cause the countries to fall behind in the global landscape.

The experience of transition economies demonstrates that economic and political upheaval, uncertainty, and unrest at the national and individual level not only take a heavy toll on the quality of life but can also alter the impact of various factors on it (Samoilenko and Osei-Bryson 2013; Dedrick 2014; Skoglund 2017; Guriev 2018; Obrizan 2018). One of these forces is digital inclusion, which role is evolving from the backdrop to the frontline for the last years.

Should the conclusion of the McKinsey Institute be extended to countries, who are still in the transition process? To what extend digital inclusion improves the citizen's quality of life given ICT's ubiquity and uneven internet access in transition and non-transition countries.

To address these questions, our study aims to compare the effect of digital inclusion on the quality of life of households in countries with transition and non-transition economies. Considering a digital divide of transition and non-transition countries in this empirical analysis, we would test whether digitalization significantly enhances the quality of life in each group of countries and whether the impact of digital inclusion in transition countries is higher/lower than in post-transition.

The research relies on the cross-national Life in Transition Survey conducted by the European Bank for Reconstruction and Development (EBRD) in collaboration with the World Bank (WB) across 25 countries.

This master thesis extends the discussion among academic and policy researchers about digital inclusion effect of well-being and provide the evidence basis for government officials and policymakers when considering use of public and private funds to boost digital penetration.

The structure of the thesis proceeds as follows. Section 2 provides a comprehensive summary of theoretical and empirical findings about digital inclusion effect on the quality of life, including the review of available research methodologies. Section 3 introduces the methodology we use for testing the hypothesis of our research. Section 4 explains how we prepared the data and provides a data description. Section 5 summarizes empirical estimation results and addresses the key research question, whereas Section 6 concludes on key findings and provides policy suggestions based on the outcomes of the conducted research.

Chapter 2

LITERATURE REVIEW

Theoretical and empirical literature on the relationship of digital inclusion and the quality of life at the individual-, household-, and country-level is quite extensive. Despite the numerous studies, the evidence of digital contribution to the population well-being in transition countries is still scarce. The examined studies serve as a backbone of empirical strategy for measuring the quality of life and digital inclusion. Below we proceed by first discussing papers devoted to measures of digitalization and well-being considered in various studies. Afterward, we review the empirical evidence for different countries and economies.

2.1 Measures of digitalization and well-being

Digitalization refers to the use of digital computing technologies and mediums to access, share, and harness information in a very cost-effective, speedy, and user-friendly manner. Digitalization has been measured mostly by looking at the access to different type of technologies and frequency of its use which capture extensive and intensive margins of digitalization.

Using Australian household-level longitudinal data Ali et al. (2020) employed the simultaneous equations system with the two-stage instrumental variables (2SLS IV) and the full-information maximum likelihood (FIML) methods with several control variables. The authors measure QoL as a composite index which consists of four domains: physical health, psychological health, level of education achieved, and personal annual disposable income. Also, a dummy variable for health conditions and a dummy variable for alcohol addiction were included as separate

factors in the QoL equation. For the Digital inclusion, the scholars used a dummy variable for the access to broadband Internet at home. Furthermore, Ali et al. identified the significant determinants of the QoL: socio-economic advantages, remoteness, rural-urban divide, and lifestyle. The authors emphasize that both supply-side issues and demand-side (i.e., affordability and digital skills enhancement) contribute to digital inclusion.

Nevado-Peña et al. (2019) carry out a thorough study of 79 European NUTS_2 regions (basic regions for the application of regional policies) of the relationship between ICT use (and capacity) and four-dimensioned citizens' quality of life. Using an extraction method based on principal components analysis, they have identified four indicators of European citizens' perceived quality of life: (1) Life satisfaction, trust and security/safety, and environmental conditions in terms of pollution and cleanliness in both the neighborhood and city of residence; (2) Mobility, culture and sports activities, and available spaces; (3) Integration of foreigners and social sustainability (environmental commitments and affordable housing); (4) Public services (welfare state) which capture quality and efficiency of the public administration. Taking into account the technological heterogeneity, the authors found relationship between digital inclusion and quality of life at the local and regional levels: the digital citizen, who make up a technological society, feels happier and prefers living in regions/cities which invest in R&D, accumulate technological capacity, and are committed to sustainable and inclusive development.

Both evaluative (the Cantril ladder question on the best possible life) and hedonic (three binary variables: smiling yesterday, experiencing stress yesterday, experiencing anger yesterday) measure of well-being were considered by Graham and Nikolova (2019). The authors applied logistic and ordered logistic regression models to the pooled cross-sectional data from the Gallup World Poll (2009–2011).

Roztocki and Weistroffer (2016) considered ICT as the usage of the Internet, mobile telephony, geographic positioning systems, wireless technology, capacity, and speed of computing resource to understand the socio-economic effects at the individual and at the macro level for transition and developing countries.

Bahrini and Qaffas (2019) demonstrated that mobile phone, Internet usage, and broadband adoption are the main drivers of economic growth in 45 developing countries in the Middle East and North Africa region and the Sub-Saharan Africa (SSA) region over the recent period 2007–2016.

2.2. Positive effect

There is a considerable body of literature that confirmed a significant positive impact of ICT diffusion on different indicators of well-being, both at the macro and individual levels.

Numerous studies report a positive effect of digital technologies, predominantly in developed countries. Notably, Waqar (2015) affirms that ICT has a strong positive correlation and causal relationship with real GDP per worker, with an elasticity of 0.4 in 41 European countries during 1996-2010 and IV 2SLS model with confidence in the justice system as an instrument for ICT. This result is similar to Aghaei and Rezagholizadeh (2017) findings that 1 percent of ICT investment increase causes 0.52 percent economic growth in the Organization of Islamic Cooperation (OIC) countries for 1990–2014, using the dynamic and static panel data approaches within a growth model framework.

DI has a strong positive effect on sustainable development in transition and developing countries by Roztocki and Weistroffer (2016). Noteworthy culture, the existing infrastructure, and government regulations may alter the type and magnitude of the impact of ICTs at the regional level in transition and developing

countries. These results are consistent with the findings of Bahrini and Qaffas (2019).

Similarly, many studies demonstrate positive effect at the individual level. Ali et al. (2020 found that digital inclusion has a profound positive effect on the quality of life (QoL) and vice versa. Graham and Nikolova (2019) demonstrate that access to information technology has a positive effect on well-being in general, and mobile banking intensifies financial inclusion. Although, there are diminishing marginal returns for the users who already have much access and negative hedonic effect on new users.

The study Aly (2020) revealed that digital transformation increases Gross National Income (GNI) per capita as well as labor productivity in developing countries. Besides, the author showed that artificial intelligence, rapid technological advances, and digital transformation benefit developing countries. These results are essential to confirm the need to enhance digital ubiquity and digital literacy for the human capital, invest in the technology-intensive sectors, and finally generate the appropriate environment for digital market makers.

These findings also supported Cohen et al. (2017), who analyzed the 2013 Quality of Life survey in the Gauteng City-Region of South Africa rely upon individual-level data. The authors exhibited that digitally connected individuals report higher scores on most quality-of-life indicators than individuals without access. This study emphasizes that 95% of individuals without access are households with below-median monthly income, while the odds accessing the Internet are almost ten times higher for individuals with above-median income.

Finally, Gao et al. (2017) and Siegel and Dorner (2017) suggested that assistive ICTs can significantly contribute to all attributes of the quality of life of physically disabled people or people with long-term health conditions.

2.3. Negative effect

In contrast to numerous studies showing a positive effect of ICT, many studies reveal mixed evidence, especially for developing countries. This challenges common assumptions that digital inclusion is unquestionably beneficial.

Pohjola (2002) investigated the nexus between ICT investment and economic growth using data for 42 countries over the period 1985-1999. According to this study, there is no statistically significant correlation between investment and economic growth, for the subsamples of industrial or high-income countries either, due to the poor accessibility and availability of communications technology and technology-based products in many developing countries, and low investments in complementary infrastructure (education and skills).

More recently, Albiman and Sulong (2016) investigated the impact of ICT on economic growth for 45 Sub-Saharan Africa countries in the long-run period from 1990 to 2014. They used ICT aggregated measures (fixed telephone lines, mobile phone users, and Internet users per 100 inhabitants). The results indicated positive effect and that the main growth-enhancing transmission channels of ICTs use in the economy were human capital, institutional quality, and domestic investment. In contrast, considering a nonlinear effect analysis, the authors discovered that mass penetration of ICT proxies slows economic growth in the SSA region.

A number of cross-sectional studies report adverse effect regarding subjective well-being (Gao et al. 2017; Lachmann et al. 2016; Longstreet and Brooks 2017). The scholars maintain that life satisfaction has an inversed relationship with ICT for people with Internet or social media addiction and a mediate effect in case of smartphone addiction. Besides, Chern and Huang (2018) report significantly lower quality of life of Taiwan college students with Internet access in terms of physical, psychological, social, and environmental aspects.

While Roy and Samaddar (2016) found that a science and technology progress (binary variable) have a positive impact on health, education, and personal and economic security, increased reliance on technologies negatively affects social relationships and emotional well-being.

2.4. Potential explanations

At least some mixed results might be explained by the endogeneity since digitalization and well-being are jointly determined and, thus, should be modelled simultaneously.

Asongu and Le Roux (2017), who used the Tobit model for 49 SSA countries, concluded that access to the Internet and mobile penetration has a heterogeneous effect on life satisfaction because the adoption and penetration rate of ICT can be influenced by policy to achieve sustainable and inclusive goals. Bartikowski et al. (2018) also supported these mixed results demonstrating that mobile Internet has a lower positive effect on ethnic minorities.

The literature suggests that 'traditional' sources of the well-being heterogeneity (age, education, and socio-economic status) also play a role for the digital inclusion. Indeed, youngsters might be keener and more skilled users of Internet or, at least, have more occasions to use ICT. Particularly, Pawluczuk (2020) argues that youth digital inclusion is linked to employment and education and a set of more extensive, systematic, continually evolving, and critical engagement practices. ICT only tangentially benefits the older generation in their daily lives (Damant et al. 2016; Hirani et al. 2014; Cruz-Jesus et al. 2013). These studies on digital inclusion demonstrate mixed empirical evidence of the effects of ICT usage on the mainstream and remote care for older "digital immigrants". The effect varies

depending on the digital skills of the individual and the sectors where digitalization has been implemented.

In contrast, Rogers and Fisk (2006) confirmed the benefits of ICT education for older adults. The authors point to the older generation is changing through the digital opportunities in terms of cognitive support, including learning, communication, or leisure.

Some of the inconsistencies can occur since the digitalization benefits vary by education. Livingstone and Helsper (2007) mapped the frequency of internet use to a progression of young people (from basic to all-around users) in the take-up of online opportunities. They suggested that it is a staged process in which digital inclusion benefits embrace new opportunities and meet individual and social goals depend on sophisticated use, digital skills, and self-efficacy.

The empirical findings of Máté et al. (2020) affirmed that the Internet use at schools, fixed broadband penetration, and the latest available technologies positively related to productivity (GDP and employment). In contrast, the mobile broadband subscription has an inversed effect in emerging markets. Thus, more extensive Internet access in education, the improved fixed Internet broadband, and the absorption of technology advancements can make emerging markets more competitive and sustain productivity growth in the long-run perspective, which implies improvement of life quality in individual and country levels.

2.5. Digitalization and life quality in transition countries

Since digital inclusion depends on social and economic inclusion (Cohen et al. 2017), DI may halt the inequalities in society, stimulate poverty alleviation, intensify development of healthcare and education which in their turn improve people's quality of life.

However, the experience of transition economies demonstrates that relative to developed and developing world well-being in post-communist countries has been lower (Samoilenko and Osei-Bryson 2013; Dedrick 2014; Skoglund 2017; Guriev 2018; Obrizan 2018). One of these forces may be digital inclusion.

Many authors (Niebel 2018; Eggleston et al. 2002; Steinmueller 2001; Hoskisson et al. 2000) compared digital inclusion effect for different countries and confirmed the positive link between DI and well-being. They showed that the ICT coefficients in emerging countries are slightly larger than in developing and developed countries.

Despite the numerous studies, there is still no firm and complete evidence why the quality of life in transition countries can be contributed or even "leapfrogging" by digital inclusion growth and what are sufficient factors that create a difference between the economies. Our study covers this gap.

Chapter 3

METHODOLOGY

The most relevant paper for this study is Ali et al. (2020) conducted on the household-level longitudinal Australian data. The scholars have used the simultaneous equation system based on 2SLS IV and FIML methods for the household-level data. While the latest EBRD and WB survey round LiTS III, which was carries in 2016, offers the benefits of the analysis at the level of individuals, this comes at the cost of cross-sectional nature of the data. Thus, we address the simultaneity with IV method.

The structure of this chapter is the following. In the first part, the two-stage instrumental variables model for the analysis of the digital inclusion effect on the quality of life is introduced. In the second part, the description of variables follows.

3.1. Model description

The goal of this study is to estimate the effect of digital inclusion on the quality of life in 14 countries in transition and 11 countries which already completed transition. Thus, our dependent variable is the quality of life (QoL). As suggested by the literature, explanatory variables included in this analysis are key individual's characteristics, i.e., age, gender, education (after-school), urban residency, socio-economic status (SE status), total net monthly income of the household (in USD), income inequality measured as the presence of the gap between rich and poor (i.e., income gap), and self-development priority, self-assessed health status dummy and a country transition status dummy (TC). The main variable of interest is the digital inclusion (DI) dummy.

The specification is the following:

$$
\begin{aligned}
QoL = \beta_0 + \beta_1 \cdot DI + \beta_2 \cdot age + \beta_3 \cdot age^2 + \beta_4 \cdot gender \\
+ \beta_5 \cdot education + \beta_6 \cdot urban\ residence \\
+ \beta_7 \cdot SE\ status + \beta_8 \cdot net\ monthly\ income \\
+ \beta_9 \cdot income\ gap + \beta_{10} \cdot employment\ status \\
+ \beta_{11} \cdot self development\ priority + \beta_{12} \cdot health\ status \\
+ \beta_{13} \cdot \mathrm{TC} + \beta_{14} \cdot (\mathrm{TC} \cdot \mathrm{DI}) + \varepsilon_i
\end{aligned}
$$

where i – household; z_{DI} – instrumental variables; ε_i– error term.

Ali et al. (2020) used exclusively in the DI equation: (1) dummy variable indicating whether or not there is a child aged 14 or under in the respondent's house, (2) household annual expenditure on telephone rent, calls and internet charges. (3) a composite index that measures three key aspects or dimensions of inclusion of digital access (availability of Internet access points, access to digital devices & Internet technology, and availability of Internet data allowance).

However, we altered from Ali et al. (2020) by employing the frequency of Internet usage dummy and digital opportunities dummy as instrumental variables for the DI, to controls for endogeneity. Following Obrizan (2018) and Guriev (2018) we use robust standard errors.

3.2. Variables

Following Guriev (2018), for QoL variable we use the responses to the statement "All things considered, I am satisfied with my life now" with the five options:

"strongly disagree", "disagree", "neither agree nor disagree", "agree", and "strongly agree", which is a five-point scale. Thus, we created a dummy equal to one if the respondents are satisfied with their quality of life ("agree" or "strongly agree") and zero otherwise.

The key variable, *digital inclusion*, is a dummy constructed from the question "Do you have access to internet at home, inclusively on a smartphone?", where answer "Yes" is equal to one and zero for the negation.

Digital opportunities dummy (instrument) is equal to one (zero otherwise) if a respondent or anyone in the household possess the computer, laptop, or tablet.

Frequency of Internet usage variable use the responses to the statement: "People use different sources to learn what is going on in their country and the world. For each of the following sources, please indicate how often you use it (Internet, Email)". If a respondent uses Internet or email about once a week or more frequently, it is equal to one and zero otherwise.

Transition country dummy is another variable of interest and is equal to one (zero otherwise) if a respondent is living in transition country (according to the IMF classification in 2019).

Among the control variables, *age* is measured as self-reported age of the primary respondent and varies from 18 to 95 years given the audience of the survey.

The *gender* of the respondent takes the value of one if an individual is identified as male.

In the Life in Transition survey, the *education* variable is reflected as a question on the highest education level achieved. Hence, observing the education level we divided respondents into two educational categories: respondents with secondary education or less (taking values of "No degree / No education", "Primary

education", "Lower secondary education", "(Upper) secondary education") and respondents who obtained post-secondary non-tertiary education or above (taking values of "Post-secondary non-tertiary education", "Tertiary education (not a university diploma)", "Bachelor's degree or more", "Master's degree or PhD"). Using these categories, we constructed a dummy with *after-school education* being equal to one, zero otherwise.

The dummy variable indicates a *socio-economic status* depending on household income: if a respondent evaluated himself above median (5 or higher), it is equal to one and zero otherwise.

The *total net monthly income* of households was converted into USD using yearly average currency exchange rates published by IMF for the 2016 year when the survey was taken. For the further analysis this variable was divided by 100, it reflects how additional 100 USD effect the QoL (in percentage).

The dummy of *gap between rich and poor* is equal to one (zero otherwise) if a gap between rich and poor became smaller or stayed the same in the past 4 years.

Also, the dummy of *self-development priority* is equal to one if "intelligence and skills or hard work and efforts are the most important factors to succeed in life" in this country and zero for "political connections", "by breaking the law" or "other".

The dummy for *urban residence* of the respondent is equal to one (zero otherwise) if a respondent a resident of an urban area.

For the *employment status* we have chosen the self- reported employment status reflected as a dummy with the value of one if a person has been working for the past twelve months and zero otherwise. We have chosen this notion due to constraints of the survey, which does not reflect non-standard employment. That is why, this variable reflects self- reported employment, which does not include an informal one.

Although, we created the dummy variable for *health status*. Notably, this is not a formal measure of individuals' health. In this survey, this variable is measured as self-rated health which can be estimated as "very good", "good", "medium", "bad" and "very bad". Similarly to the QoL variable, if a respondent assessed their health as "very good", "good", and "moderate", it is equal to one, and respondents with "bad" or "very bad" health get zero.

Table 1. The list of the dependent and independent variables

Variable	Description	Type
Dependent variable		
Quality of Life	Self-estimated quality of life status	dummy
Independent variables		
Digital inclusion	Access to Internet at home, inclusively on a smartphone	dummy
Transition country	A dummy indicating that a respondent is living in transition country	dummy
Age	Age of the respondent	years
Gender	Male gender of the respondent	dummy
After-school education	What is the highest educational level attained?	dummy
Socio-economic status	Socio-economic status depending on household income	dummy
Total net monthly income	What is the total net monthly income of your household at present?	USD
Gap between rich and poor	Did gap between rich and poor become smaller?	dummy
Self-development priority	Intelligence and skills or hard work and efforts are the most important factors to succeed in life in the country now	dummy
Urban residency	Coded settlement type	dummy
Employment status	Are you employed now or not?	dummy
Health	Self-identified health status	dummy
Instruments for DI		
Frequency of Internet usage	Frequency of Internet usage	dummy
Digital opportunities	Computer / laptop / tablet possession	dummy

3.3 Instrumental variables validity

The endogeneity issue is intensely debated within the well-being literature regarding the causal relationship between digital technology and well-being (Esping-Andersen and Przeworski 2001).

In Chapter 2, we have described that Ali et al. (2020), in their similar study based on the Australian household-level data, have found that digital inclusion and the quality of life are jointly determined. This means that an endogeneity issue potentially occurs and would yield biased coefficients and inconsistent estimates.

These instruments are significant predictors of digital inclusion, but specification tests in most cases failed to reject the null hypothesis that digital inclusion is exogenous in explaining the quality of life. Therefore, concerns regarding the potential endogeneity of digital inclusion are supported by this empirical analysis for endogeneity. Analyzing this jointly determined relationship for post-transition countries, a higher QoL and socio-economic profile of individuals significantly increased digital inclusion, whereas digital inclusion concurrently positively affects QoL. In contrast, this positive causal relationship is unilateral for transition countries.

The most widely applied remedy for endogeneity in a causal modelling framework is the usage of instrumental variables technique which intuitive appeal when cast as a two-stage estimation framework (2SLS method in our case): on the first stage, the endogenous explanatory (dependent) variable is regressed on the exogenous regressors and IVs to obtain the fitted values; on the second stage, the fitted values replacing the exogenous variables are employed to estimate the regression model (Ali et al., 2020).

The IVs included in the digital inclusion equation should meet the following criteria: (1) the instruments are uncorrelated with the error in the QoL equation,

which must rely on economic theory and solid reasoning, (2) the instrument must be strongly correlated with the DI which can be tested.

The hypothesized variables to influence digital inclusion but are otherwise uncorrelated with quality of life include the digital opportunities and the frequency of Internet usage. Digital opportunities dummy reveals a possessing (or usage) of the computer, laptop, or tablet. The frequency of Internet usage variable reflects how often an individual uses the Internet to learn what is going on in his/her country and the world.

Nai et al. (2016) suggest that beneficial outcomes for individuals' subjective well-being do not necessarily arise from how frequent they use the Internet but instead may result from user motivations and their subjective perceptions of such usage. That means that the QoL chiefly depends on the reasons for using the Internet and the extent to which individuals feel that their Internet use is displacing other activities. Hence, intensive Internet use is only significantly associated with higher digital inclusion, not necessarily with higher subjective well-being.

Among people who own computers, tablets and smartphones, the intentions and attitude differ, namely: computers are used for more practical tasks, tablets for entertainment and smartphones for social and on-the-go activities (Anderson 2017). Similar to the previous case, altogether with the age determinant and unseen subjective factors, the digital access distribution (possessing of digital devices) is defined, which signifies digital engagement. Since there is no clearly defined positive or negative causal relationship between digital access and the QoL, which indicate the relevance of the instrument.

Therefore, rely on the previous studies, we can conclude these variables exogenous variables and are appropriate IVs for this research.

Chapter 4

DATA

4.1 Data description

The analysis is conducted at the individual level using answers of respondents in two sets of countries. The first group includes countries that are yet in transition from a planned to a market-driven economic system. The second group includes countries that completed their transition.

This paper combines the data from a cross-nation survey data to analyze the quality of life with a subjective measure of economic well-being.

The study relies upon use of the publicly available third wave of Life in Transition Survey (LiTS III) by the European Bank for Reconstruction and Development (EBRD) and the World Bank (WB). The LiTS III is a cross-national survey that represents people's values and beliefs and includes their socio-demographic characteristics. All countries employ random probability representative samples of the adult population, which overall covers 51 000 households of 34 countries, most of them are transition countries in Central and Eastern Europe.

4.2 Sample construction

For the purposes of this study, we draw data for two subsamples. In accordance with the definition of the International Monetary Fund for this classification, we include respondents from 14 former communist countries which are yet in transition and 11 countries, which completed transition. Countries with incomplete

information are excluded. Specifically, we do not include Tajikistan, Turkmenistan, and Kosovo.

Finally, after merging the dataset, the data screening and cleaning processes were conducted to check for missing data and outliers which was excluded. Therefore, the finalized sample has 25 countries and 29,747 observations:

- 14 countries in transition (16,787 observations)
- 11 countries completed transition (12,960 observations)

Countries that are included in the study (number of observations defined in the brackets) are listed in Table 2.

Table 2. List of sample countries with number of observations

Countries in transition		Countries completed transition	
1	Albania (1165)	1	Bulgaria (1228)
2	Armenia (1355)	2	Croatia (1141)
3	Belarus (1123)	3	Czech Republic (1160)
4	Bosnia and Herzegovina (991)	4	Estonia (1364)
5	Georgia (1418)	5	Hungary (1126)
6	Kazakhstan (1226)	6	Latvia (1317)
7	Kyrgyz Republic (1348)	7	Lithuania (1332)
8	Moldova (1315)	8	Poland (890)
9	North Macedonia (1214)	9	Romania (1197)
10	Montenegro (1185)	10	Slovak Republic (1089)
11	Russian Federation (1151)	11	Slovenia (1116)
12	Serbia (981)		
13	Ukraine (995)		
14	Uzbekistan (1320)		

Note: The number of countries in this sample is conditioned by data availability

4.3 Descriptive statistics

For the analysis, we have chosen as a dependent variable dummy for whether the individual is satisfied with his or her quality of life and a number of independent variables, including the variable of interest – digital inclusion, and dummy for living in a country with the transition status as controls. The final sample includes 29,747 observations.

The cleaned data set has descriptive statistics, which are presented in Table 3.

Table 3. Statistical properties of the whole sample

Variable	Type	Mean	Min	Max	SD
Dependent variable					
Quality of Life	dummy	0.71	0	1	0.45
Independent variables					
Age	years	50.46	18	95	17.67
Gender	dummy	0.42	0	1	0.49
Digital inclusion	dummy	0.62	0	1	0.48
Transition country	dummy	0.56	0	1	0.49
After-school education	dummy	0.27	0	1	0.45
Socio-economic status	dummy	0.51	0	1	0.49
Total net monthly income of household	USD	640.67	0	33,585	746.79
Gap between rich and poor	dummy	0.27	0	1	0.45
Self-development matters	dummy	0.66	0	1	0.47
Urban residency	dummy	0.56	0	1	0.49
Employment status	dummy	0.49	0	1	0.49
Health status	dummy	0.84	0	1	0.37
Instruments for DI					
Frequency of Internet usage	dummy	0.48	0	1	0.49
Digital opportunities	dummy	0.63	0	1	0.48

In this study, the dependent variable is QoL dummies. The independent variables are DI, age, gender, after-school education, urban residency, socio-economic status, total net monthly income of household (in USD), income gap, self-development priority and transition status. The comparative descriptive statistics of transition and post-transition countries is presented in the Table 4.

Table 4. Comparative statistics of subsamples

	(1) in transition process (N = 16,787)				(2) completed transition (N = 12,960)			
Variable	Mean	SD	Min	Max	Mean	SD	Min	Max
Dependent variable								
Quality of Life	0.68	0.47	0	1	0.75	0.43	0	1
Independent variables								
Age	47.87	16.97	18	95	53.82	17.99	18	95
Gender	0.43	0.49	0	1	0.42	0.49	0	1
Digital inclusion	0.60	0.49	0	1	0.65	0.48	0	1
After-school education	0.32	0.47	0	1	0.21	0.41	0	1
Socio-economic status	0.52	0.5	0	1	0.50	0.5	0	1
Total net monthly income of household	429.5	668.9	0	33,585	914.2	753.7	1	16,666
Gap between rich and poor	0.29	0.45	0	1	0.25	0.43	0	1
Self-development priority	0.68	0.47	0	1	0.63	0.48	0	1
Urban residency	0.55	0.5	0	1	0.58	0.49	0	1
Employment status	0.48	0.5	0	1	0.50	0.50	0	1
Health	0.84	0.36	0	1	0.84	0.37	0	1
Instruments for DI								
Frequency of Internet usage	0.45	0.5	0	1	0.53	0.5	0	1
Digital opportunities	0.61	0.49	0	1	0.65	0.48	0	1

Our dependent variable QoL varies across countries from 41% in Armenia to 85% in Czechia, with the average value for the dataset around 71% of households. However, citizens of post-transition countries on average report higher values – 75% versus 68% relative to countries with incomplete transition.

In terms of digitalization, on average, respondents in post-transition countries indicate a slightly higher digital inclusion than in the transition countries (65% and 60%), which ranges from 22% (Uzbekistan) to 75% (Czechia). Noteworthy that the highest rates of individuals using the Internet in 2016 were Estonia (87%), Latvia (80%) and Czechia (76%) due to the WB data.

Similarly, digital opportunities that reflect digital device possession are higher by 5% in the post-transition countries, as well as for the frequency of Internet usage the gap amounts to 13%.

To some extent this difference in quality of life and digital inclusion may be explained by other factors, such as age, income, inequality, and residency.

The age of the respondents varies from 18 to 95 years with the mean of 51 years among the countries, which can be explained that the is a major part of the respondents are heads of the household. The average respondent from the post-transition countries is about 6 years older. According to the latest AARP survey aimed at measuring and identifying technology use and attitudes among American adults of age 50-plus, 91% of tech owners use devices to keep in touch with family and friends, with subtle differences between age group regarding the owning (usage) different devices. Notably, the Internet use in age of 60 years and older becomes very limited and heterogeneous regarding to motives (Nie et al., 2016). In our sample the rate of Internet use participation among people aged above 60 years old is 32% (9,521 observation).

The average monthly net income of a household is 914 USD while the median is 722 USD for the post-transition countries and for the transition – 430 USD and 306 USD, respectively. In general, it varies across countries from 156 USD in Ukraine and Moldova to 1053 USD in Czechia, with the average value for dataset 640 USD. Also, we should understand the next imperfection of the survey that individuals might underreport their true income, due to different kinds of biases, or conversely, they can report a total income and not a taxable income as required.

Likewise, on average self-estimated socio-economic status is barely higher in the respondents from the transition countries. Notably, that GDP per capita (in current USD) is 4 times (307%) higher for the countries competed transition, and this gap remains stable throughout the last 10 years.

Out of 29,747 observations included in the analysis, a pretty low number of individuals reported employed - about 50% of respondents have been working for the past twelve months. Partially, this can be explained by the high percentage of women in the sample (58%). Globally, the female unemployment remains to be higher (5.5% for women and 5.9% for men in 2016, using WB data).

Ali et al. (2020) have founded the rural-urban divide significantly influence QoL and digital inclusion. In our sample, the urban residence is about 56%. Consistent with the literature, these people are more optimistic when assessing their current health and life conditions.

Furthermore, the rate of the after-school education of respondents in the transition countries is 1.4 times higher than in the completed transition countries (32% and 21% respectively), but it is considerably low. Hence, a small percentage of the educated population, especially from rural areas, leads to lower digital engagement, preventing further digital inclusion.

Besides, 68% of respondents from the transition countries believe that intelligence and skills or hard work and efforts are more significant factors than political connections and illegal activities to succeed in their country, which is higher than for post-transition countries (63%).

In the next chapter we will describe in detail obtained results. Additionally, we will answer whether digital opportunities and frequency of Internet usage could serve as strong instruments for digital inclusion to understand its effect on the quality of life in transition and port-transition countries.

Chapter 5

ESTIMATION RESULTS

This chapter provides a discussion on the introduced estimation results based on the OLS and IV-2SLS methods using an intercept of control variables for the full sample to investigate the effect of digital inclusion on the quality of life. Additionally, to understand the impact of digital inclusion across subsamples, the IV-2SLS and OLS methods were employed to see whether the magnitude of the effect changes for transition and post-transition countries.

In the second part of the chapter, the instrumental variables (digital opportunities and frequency of Internet usage) were tested to whether they could serve the digital inclusion control variable.

However, the specifics of the data, analyzed in Chapter 4, brought several significant insights on some variables that could distort the effect of digital inclusion on the quality of life. Thus, we approached and analyzed two cases (age and education, and governance characteristics) in the third part of this chapter.

5.1 Empirical results

We estimated the regression for the whole sample (29,747 observations) and two subsamples of transition (16,787 observations) and post-transition countries (12,960 observations) with a dummy for DI using linear and two-stage instrumental variables estimates for regression specification.

5.1.1 Full sample analysis

Our analysis reveals a statistically significant positive association between DI and self-rated QoL.

As shown in Table 5, the main variable of interest, DI, is statistically significant and positive in both specifications for the two-stage method (IV) and OLS (column 2-4). However, the (Wu-)Hausman test for endogeneity failed to reject the H0 (p-value = 0.671) that the variable of concern is uncorrelated with the error term, indicating that the variable of DI is already exogenous in the original OLS model. Hence, there is no need for an instrument, which explain why the estimation results are almost the same in OLS and IV.

This finding indicates that the QoL of people with Internet access is 4.7 p.p. higher than that of people who do not have Internet access at home. This result implies that DI significantly predicts the QoL, and this relationship is highly statistically significant at $p < 0.01$, holding all other variables constant in the model.

Most of the estimation results for the common explanatory variables (after-school education, health status, income, SE status, employment, age, urban residence, and gender) are consistent with the prior studies and theoretical frameworks.

Notably that the dummy of the self-rated health status (20.2 p.p.), socio-economic status (17.3 p.p.) and self-development priority, which indicates the importance of knowledge and efforts to succeed in life (10.5 p.p.), have the highest magnitude. This is an intuitively expected outcome since these factors are necessary to let an individual lead a life.

Table 5. Estimation results for the sample

	Dependent variable: QoL			
	OLS (1)	OLS (2)	OLS (3)	IV (4)
Digital inclusion (DI)		0.021***	0.047***	0.046***
		(0.006)	(0.009)	(0.014)
After-school education	0.056***	0.054***	0.054***	0.054***
	(0.006)	(0.006)	(0.006)	(0.006)
Health	0.203***	0.202***	0.202***	0.202***
	(0.007)	(0.007)	(0.007)	(0.007)
Socio-economic status	0.176***	0.174***	0.173***	0.173***
	(0.005)	(0.005)	(0.005)	(0.005)
Total net monthly income	0.005***	0.005***	0.005***	0.005***
	(0.0004)	(0.0004)	(0.0004)	(0.0004)
Income gap	0.055***	0.054***	0.054***	0.054***
	(0.006)	(0.006)	(0.006)	(0.006)
Urban residency	-0.026***	-0.028***	-0.027***	-0.027***
	(0.005)	(0.005)	(0.005)	(0.005)
Self-development priority	0.105***	0.106***	0.105***	0.105***
	(0.005)	(0.005)	(0.005)	(0.005)
Employment status	0.029***	0.026***	0.025***	0.025***
	(0.006)	(0.006)	(0.006)	(0.006)
Age	-0.007***	-0.007***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Age^2	0.0001***	0.0001***	0.0001***	0.0001***
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Gender	-0.014***	-0.013***	-0.013***	-0.013***
	(0.005)	(0.005)	(0.005)	(0.005)
Transition country	-0.048***	-0.047***	-0.021**	-0.022**
	(0.005)	(0.005)	(0.009)	(0.011)
I (TC *DI)			-0.040***	-0.039***
			(0.011)	(0.014)
Constant	0.468***	0.455***	0.446***	0.446***
	(0.022)	(0.022)	(0.022)	(0.023)
Observations	29,747	29,747	29,747	29,747
Adjusted R2	0.128	0.128	0.129	0.129

Notes: * if p-value < 0.1, ** if p-value < 0.05, *** p < 0.01.

In contrast, both the country's transition status and the cross-term variables with the DI are negatively associated with the outcome variable (QoL), and these relationships are statistically significant across all the specifications. This negative effect is large enough to offset the positive impact of the DI. Thus, living in a transition country is a crucial factor that reduces subjective well-being and vanishes digital premium.

5.1.2 Subsamples analysis

For further analysis, we estimated two separate regressions with the same determinants for subsamples of 14 countries in transition (16,787 observations) and countries 11 completed transition (12,960 observations). The results are presented in Table 6.

As expected, we found that DI is endogenous for transition and post-transition countries ((Wu-)Hausman test reported p-value less than 0.05). Hence, to avoid biased and inconsistent estimates, we used the IV 2SLS models for further analysis.

All the tests reported the variables of frequency of internet usage and digital opportunities as valid and strong IVs: the specification tests, or J-test, rejected the H0 (p-value < 0.05), meaning that at least one instrument is strong, and the Sargan test on overidentifying restrictions failed to reject the H0 (p-value > 0.05), meaning that all instruments for DI are valid (see Appendix B).

Similarly, there is a significant effect between DI and QoL in transition countries. However, it is negative, with a magnitude equal to - 2.8 p.p. Thus, we can consider DI a significant and negative determinant of the QoL in transition countries.

In contrast, in post-transition, the effect is highly significant and positive (10.3 p.p.). This result signifies that the QoL of a person from a country that completed transition is significantly higher than that of a citizen of transition countries.

Many other insights can be obtained from Table 6. First, we observe significant associations with after-school education that may contribute to QoL. Moreover, the magnitude of the coefficient for transition countries is 3 times higher than for post-transition. Similarly, the self-development priority variable exceeds the estimate for the countries with completed transition 1.6 times. These results suggest that people with higher education are happier in transition countries.

Second, we see the different significance of urban residence. That means that in post-transition countries, people are 3 times less likely to associate their well-being with living in the city or town, while for transition countries individuals are not indifferent – this factor is highly significant and decrease the self-rated life quality by -3.3 p.p., holding all other variables constant.

In addition, gender variable has a negative sign for males in both subsamples but is only statistically significant at $p < 0.1$ for countries that completed transition. This is consistent with The World Happiness Report 2015 which revealed that men from their late teens to late 60s are, on average, marginally more disgruntled than women. Also, the 'Our World in Data statistics' for the countries under analysis in 2016 showed that men are 3.5 times more likely to take their own life. Contrariwise, we see the indifference between gender for individuals in transition countries.

Results obtained so far for other variables are quite similar to the previous findings and are highly consistent with the literature review and the descriptive analysis.

Table 6. Estimation results for two subsamples

	Dependent variable: QoL			
	OLS (tr)	OLS (nrt)	IV (tr)	IV (ntr)
Digital inclusion (DI)	-0.008	0.084***	-0.028**	0.103***
	(0.008)	(0.010)	(0.012)	(0.012)
After-school education	0.063***	0.023**	0.065***	0.021**
	(0.007)	(0.009)	(0.007)	(0.009)
Health	0.204***	0.190***	0.205***	0.189***
	(0.007)	(0.007)	(0.007)	(0.007)
Socio-economic status	0.186***	0.152***	0.188***	0.150***
	(0.007)	(0.008)	(0.007)	(0.008)
Total net monthly income	0.004***	0.007***	0.004***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Income gap	0.052***	0.065***	0.052***	0.066***
	(0.008)	(0.008)	(0.008)	(0.008)
Urban residency	-0.037***	-0.010	-0.034***	-0.011
	(0.007)	(0.007)	(0.007)	(0.007)
Self-development priority	0.114***	0.088***	0.113***	0.088**
	(0.007)	(0.007)	(0.007)	(0.007)
Employment status	0.025***	0.026***	0.028***	0.023***
	(0.008)	(0.009)	(0.008)	(0.009)
Age	-0.003***	-0.009***	-0.003***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Age^2	0.0003***	0.0001***	0.0003***	0.0001***
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Gender	-0.010	-0.014*	-0.010	-0.013*
	(0.007)	(0.007)	(0.007)	(0.007)
Constant	0.373***	0.420***	0.385***	0.410***
	(0.029)	(0.032)	(0.030)	(0.033)
Observations	16,787	12,960	16,787	12,960
Adjusted R2	0.118	0.144	0.118	0.144

Notes: transition countries coded as "tr", post-transition "ntr"; to instrument DI we included digital opportunities and Internet usage dummies in the IV 2SLS equation; the results for Ukraine are close to transition countries' estimates; * if p-value < 0.1, ** if p-value < 0.05, *** p < 0.01.

5.2 Robustness check

We considered two potential explanations for the obtained diverse results for the countries in transition (1) the results are driven by sample composition (in particular, by oversampling respondents with respect to age and education), and (2) the observed outcome is driven by some other important variable (specifically, the quality of governance in countries).

5.2.1 Age and education

In this further analysis of the associations between various reasons for DI and QoL, two key factors are worth considered following the literature discussed above.

Particularly, Pawluczuk (2020), Damant et al. (2016), Hirani et al. (2014) and Cruz-Jesus et al. (2013) argues that impact of digital inclusion is linked to age and education. In our data, the share of respondents with the after-school education is considerably low both in the transition countries and completed transition countries. Similarly, the average age of respondent is 55 years (digital immigrant), and it may lead to the declining value of digital inclusion for aging respondents. Hence, the DI coefficient may be downward biased.

Therefore, we further analyze if age and low education are possible effect-takers of digital inclusion due to lower self-development and self-recognition needs. To check this, we re-estimated our model, dropping the age and education variables. The results are presented in Table 7.

Table 7. Estimation results for subsamples: no age and after-school education

	Dependent variable: QoL			
	OLS (tr)	OLS (nrt)	IV (tr)	IV (ntr)
Digital inclusion (DI)	-0.001	0.044***	-0.013	0.050***
	(0.008)	(0.009)	(0.011)	(0.011)
Health	0.204***	0.167***	0.206***	0.166***
	(0.010)	(0.010)	(0.010)	(0.010)
Socio-economic status	0.190***	0.155***	0.192***	0.154***
	(0.007)	(0.008)	(0.007)	(0.008)
Total net monthly income	0.005***	0.007***	0.005***	0.007***
	(0.001)	(0.001)	(0.001)	(0.001)
Income gap	0.051***	0.062***	0.051***	0.062***
	(0.008)	(0.008)	(0.008)	(0.008)
Urban residency	-0.034***	-0.001	-0.032***	-0.002
	(0.007)	(0.007)	(0.007)	(0.007)
Self-development priority	0.118***	0.097***	0.117***	0.097***
	(0.007)	(0.007)	(0.007)	(0.007)
Employment status	0.025***	-0.036***	0.028***	-0.038***
	(0.007)	(0.009)	(0.008)	(0.009)
Gender	-0.006	-0.017**	-0.006	-0.017**
	(0.007)	(0.007)	(0.007)	(0.007)
Constant	0.305***	0.383***	0.308***	0.382***
	(0.011)	(0.012)	(0.012)	(0.012)
Observations	16,787	12,960	16,787	12,960
Adjusted R2	0.115	0.129	0.115	0.129

Notes: transition countries coded as "tr", post-transition "ntr"; to instrument DI we included digital opportunities and Internet usage dummies in the IV 2SLS equation; * if p-value < 0.1, ** if p-value < 0.05, *** p < 0.01.

For this set of regressions, (Wu-)Hausman tests demonstrate that DI is exogenous both for transition (p-value of 0.148) and post-transition countries (p-value of 0.298), so we use the results of OLS models.

From the Table 7 we can see, the DI effect is lower in both groups and becomes insignificant for transition countries. It suggests that indeed DI has negative effect at least for some age cohorts but the results cannot explain why DI reduces QoL in transition countries. Other estimates are consistent with the previous finding presented in Table 6.

5.2.2 Governance

In the existing literature, some scholars found an evidence in that government regulations may alter the type and magnitude of the positive impact of DI on well-being in transition and developing countries (Roztocki and Weistroffer, 2016; Bahrini and Qaffas, 2019). Therefore, we added additional variables to check whether the influence of political instability and governance is so significant that they downplay the effect of DI on QoL.

The added binary variables are following: *informal payments*, which indicates if people often do informal payments or gifts (zero if respondent answered "never", and one otherwise); *fighting corruption*, which describe how good government is hanging fighting corruption in government (one if a respondent answered "fairly well" or "very well", and zero otherwise); *local, regional and national government*, which are indicators of people's satisfaction of overall government performance on different levels (one is "neither", "good", "very good" answers, and 0 otherwise); *oligarchy* that describes the influence of wealthy individuals on government in their country (one identifies answers above the median which is from 7 to 10, and zero is for all other options); feeling that there is *peace and stability* in the country (one if respondent agree or strongly agree that peace and stability exist in the country, and zero otherwise). The estimation results are presented in Table 8.

Table 8. Estimation results with governance

	Dependent variable: QoL			
	OLS (tr)	OLS (nrt)	IV (tr)	IV (ntr)
Digital inclusion (DI)	0.041***	0.076***	0.059***	0.090***
	(0.008)	(0.009)	(0.012)	(0.012)
After-school education	0.054***	0.032***	0.052***	0.031***
	(0.007)	(0.010)	(0.007)	(0.010)
Health	0.158***	0.191***	0.156***	0.190***
	(0.010)	(0.010)	(0.010)	(0.010)
Socio-economic status	0.161***	0.157***	0.159***	0.155***
	(0.007)	(0.008)	(0.007)	(0.008)
Total net monthly income	0.003***	0.005***	0.003***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)
Income gap	0.070***	0.066***	0.070***	0.067***
	(0.008)	(0.008)	(0.008)	(0.008)
Urban residency	-0.032***	-0.001	-0.034***	-0.001
	(0.007)	(0.007)	(0.007)	(0.007)
Self-development priority	0.094***	0.085***	0.094***	0.085***
	(0.007)	(0.007)	(0.007)	(0.007)
Employment status	0.026***	0.030***	0.024***	0.028***
	(0.008)	(0.009)	(0.008)	(0.009)
Age	-0.005***	-0.009***	-0.005***	-0.009***
	(0.001)	(0.001)	(0.001)	(0.001)
Age^2	0.0001***	0.0001***	0.0001***	0.0001***
	(0.00001)	(0.00001)	(0.00001)	(0.00001)
Gender	-0.015**	-0.010	-0.015**	-0.010
	(0.007)	(0.007)	(0.007)	(0.007)
Constant	0.335***	0.518***	0.318***	0.507***
	(0.054)	(0.089)	(0.054)	(0.089)
Observations	16,787	12,960	16,787	12,960
Adjusted R2	0.170	0.159	0.170	0.159

Notes: transition countries coded as "tr", post-transition "ntr"; to instrument DI we included digital opportunities and Internet usage dummies in the IV 2SLS equation; * if p-value < 0.1, ** if p-value < 0.05, *** p < 0.01.

TABLE 8 – Continued

	Dependent variable: QoL			
	OLS (tr)	OLS (nrt)	IV (tr)	IV (ntr)
Informal payments	0.314***	-0.167**	0.313***	-0.161**
	(0.028)	(0.068)	(0.028)	(0.068)
Fighting corruption	-0.501***	-0.445***	-0.518***	-0.443***
	(0.082)	(0.063)	(0.083)	(0.063)
Local governance	-1.275***	-0.540***	-1.277***	-0.538***
	(0.102)	(0.068)	(0.102)	(0.068)
National governance	1.671***	0.046	1.695***	0.047
	(0.154)	(0.047)	(0.154)	(0.047)
Regional governance	0.053*	0.411***	0.051*	0.414***
	(0.028)	(0.079)	(0.028)	(0.079)
Oligarchy	0.081***	0.039	0.081***	0.038
	(0.019)	(0.032)	(0.019)	(0.032)
Peace and stability	-0.298***	0.252***	-0.301***	0.250***
	(0.045)	(0.060)	(0.045)	(0.060)
Observations	16,787	12,960	16,787	12,960
Adjusted R2	0.170	0.159	0.170	0.159

Notes: transition countries coded as "tr", post-transition "ntr"; to instrument DI we included digital opportunities and Internet usage dummies in the IV 2SLS equation; * if p-value < 0.1, ** if p-value < 0.05, *** p < 0.01.

As a result, with adding the control variables related to political stability and quality of governance we found the crucial role of governance on people well-being in transition countries. Once we control for the quality of governance the effect of DI on life satisfaction in transition countries becomes positive and comparable in magnitude to the effect in post-transition countries.

Important to notice that informal payments have a positive association with QoL in transition countries. Due to the literature, people who used bribes to speed things up or as a gift reported higher life satisfaction (Hinks 2020; Novikova 2015).

Furthermore, the negative association between fighting corruption in government and QoL can be explained by common among individual's petty corruption in Soviet times. Thus, people who continue this practice may be also less satisfied. Some estimates of governance variables are not fully consistent which requires further investigation, but it is out of focus here.

Thus, holding all other variables constant in the model, on average, digital inclusion leads to a 4.1-5.9 p.p. increase in an individual's self-rated quality of life in transition countries. Notably, with additional controls the DI coefficient for countries that completed transition changes only marginally and is equal 7.6-10.9.

Also, with this specification, the self-related health status obtained lower magnitude in the transition countries compared to post-transition countries. Besides, the significance of gender variable has switched to statistically insignificant in the countries completed transition, and in case of in transition – otherwise. Other explanatory variables' coefficients patterns are consistent with the previous finding presented in this chapter.

Table 9. Diagnostic tests for IV model

Diagnostic tests	Weak instruments	Wu-Hausman	Sargan
Transition countries			
df1, df2	2, 16766	1, 16766	1, NA
statistic	5776.360	3.715	0.413
p-value	<2e-16 ***	0.0539	0.5207
Post-transition countries			
df1, df2	2, 12939	1, 12939	1., NA
statistic	12634.96	4.53	0.32
p-value	<2e-16 ***	0.0333 *	0.5716

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' '

Notably that Wu-Hausman tests (see Table 9) for endogeneity revealed that these additional control variables have different implications across the countries: for countries with completed transition DI remains endogenous (p-value of 0.0539), whereas for countries yet in the transition it becomes exogenous (p-value of 0.148).

Chapter 6

CONCLUSIONS

This study contributes to the literature on well-being by investigating the digital inclusion effect on the quality of life in transition and post-transition countries.

The investigation is conducted at the individual level in the context of transition economies, that is countries that are yet in transition and those that have successfully transitioned from a planned to a market-driven economic system. For the analysis we used the data on 25 countries for the year 2016 from the third wave of Life in Transition survey conducted by the EBRD and WB. To explore and address potential endogeneity of digital inclusion we performed both OLS and IV estimation.

The study yielded the following important findings. Overall, digital inclusion is associated with a 4.7 p.p. increase in QoL. These results suggest that the QoL of people with Internet access is higher than that of people who do not have access to the Internet at home.

However, this positive effect is observed only in post-transition states, while respondents in in transition countries not only less satisfied with their lives per se, but also less happy by using internet. We found a negative association between the access to Internet and happiness, with a magnitude equal to -2.8 p.p. Thus, we can consider DI a significant negative determinant of the QoL in transition countries. In contrast, DI explanatory coefficient for countries that completed transition is equal to 0.10.

We discovered that a negative effect of DI in transition countries is alleviated once we control for the quality of governance. This result implies that the negative association between Internet use intensity and life satisfaction is predominantly driven by institutions: the DI coefficient changed its sign to positive and became highly statistically significant at $p < 0.01$. Hence, self-rated quality of life among persons with DI is on average a 4.1-5.9 p.p. higher relative to individuals without the access to the internet at home, holding all other variables constant.

Another valuable finding of the study is for countries yet in the transition process DI becomes exogenous once we control for the quality of governance.

To boost the population well-being, many actions should be undertaken by the authorities and policymakers, particularly in transition countries. Thus, several policy implications and recommendations are considered.

The adoption of the more transparent system, including e-governance and digitalization of financial sectors, should be encouraged, and enhanced to benefit people. Indeed, the best practices, like Baltics, confirmed that digitalization is powerful in promoting good governance and improving efficiency of public administration. Out study demonstrates that digitalization, particularly when combined with good governance, also has a positive effect on people's life satisfaction.

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APPENDIX A

Table 10. Estimation results for OLS models

	Dependent variable: QoL	
	OLS (1)	OLS (2)
Digital inclusion (DI)		0.021***
		(0.006)
After-school education	0.056***	0.054***
	(0.006)	(0.006)
Health	0.203***	0.202***
	(0.007)	(0.007)
Socio-economic status	0.176***	0.174***
	(0.005)	(0.005)
Total net monthly income	0.005***	0.005***
	(0.0004)	(0.0004)
Income gap	0.055***	0.054***
	(0.006)	(0.006)
Urban residency	-0.026***	-0.028***
	(0.005)	(0.005)
Self-development priority	0.105***	0.106***
	(0.005)	(0.005)
Employment status	0.029***	0.026***
	(0.006)	(0.006)
Age	-0.007***	-0.007***
	(0.001)	(0.001)
Age^2	0.0001***	0.0001***
	(0.00001)	(0.00001)
Gender	-0.014***	-0.013***
	(0.005)	(0.005)
Transition country	-0.048***	-0.047***
	(0.005)	(0.005)
Constant	0.468***	0.455***
	(0.022)	(0.022)
Observations	29,747	29,747
Adjusted R2	0.128	0.129
Residual Std. Error	0.424 (df = 29734)	0.424 (df = 29733)
F Statistic (df = 12 (13); 29734 (29733))	362.526***	338.818***

Note: * p < 0.10, ** p < 0.05, *** p < 0.01

Table 11. Estimation results for OLS and IV models with cross-term variable

	Dependent variable: QoL	
	OLS (3)	IV
Digital inclusion (DI)	0.047***	0.046***
	(0.009)	(0.014)
After-school education	0.054***	0.054***
	(0.006)	(0.006)
Health	0.202***	0.202***
	(0.007)	(0.007)
Socio-economic status	0.173***	0.173***
	(0.005)	(0.005)
Total net monthly income	0.005***	0.005***
	(0.0004)	(0.0004)
Income gap	0.054***	0.054***
	(0.006)	(0.006)
Urban residency	-0.027***	-0.027***
	(0.005)	(0.005)
Self-development priority	0.105***	0.105***
	(0.005)	(0.005)
Employment status	0.025***	0.025***
	(0.006)	(0.006)
Age	-0.007***	-0.007***
	(0.001)	(0.001)
Age^2	0.0001***	0.0001***
	(0.00001)	(0.00001)
Gender	0.054***	0.054***
	(0.006)	(0.006)
Transition country	-0.021**	-0.022**
	(0.009)	(0.011)
I (TC *DI)	-0.040***	-0.039***
	(0.011)	(0.014)
Constant	0.446***	0.446***
	(0.022)	(0.023)
Observations	29,747	29,747
R2	0.129	0.129
Adjusted R2	0.129	0.129
Residual Std. Error (df = 297332)	0.424	0.424
F Statistic (df = 13; 29733)	362.526***	

Note: * p < 0.10, ** p < 0.05, *** p < 0.01

APPENDIX B

Table 12. Specification test for transition countries

Residuals:				
Min	1Q	Median	3Q	Max
-2.1727	-0.4718	0.1680	0.3281	0.7705

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.847e-01	2.986e-02	12.884	< 2e-16 ***
Digital inclusion (DI)	-2.829e-02	1.177e-02	-2.403	0.016261 *
After-school education	6.495e-02	7.482e-03	8.681	< 2e-16 ***
Health	2.053e-01	1.026e-02	20.022	< 2e-16 ***
Socio-economic status	1.883e-01	7.084e-03	26.578	< 2e-16 ***
Total net monthly income	4.535e-03	5.278e-04	8.592	< 2e-16 ***
Income gap	5.235e-02	7.521e-03	6.961	3.51e-12 ***
Urban residency	-3.412e-02	7.063e-03	-4.830	1.38e-06 ***
Self-development priority	1.129e-01	7.361e-03	15.342	< 2e-16 ***
Employment status	2.799e-02	7.929e-03	3.530	0.000416 ***
Age	-3.497e-03	1.175e-03	-2.977	0.002918 **
Age^2	3.384e-05	1.200e-05	2.820	0.004811 **
Gender	-1.026e-02	6.964e-03	-1.474	0.140632

Diagnostic tests:				
	df1	df2	statistic	p-value
Weak instruments	2	16773	6566.807	<2e-16 ***
Wu-Hausman	1	16773	5.234	0.0222 *
Sargan	1	NA	0.949	0.3300

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1	
Residual standard error: 0.4379 on 16774 degrees of freedom	
Multiple R-Squared: 0.1186	Adjusted R-squared: 0.118
Wald test: 189 on 12 and 16774 DF	p-value: < 2.2e-16

Table 13. Specification test for post-transition countries

Residuals:				
Min	1Q	Median	3Q	Max
-2.1727	-0.4718	0.1680	0.3281	0.7705

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	4.099e-01	3.252e-02	12.605	< 2e-16 ***
Digital inclusion (DI)	1.033e-01	1.171e-02	8.821	< 2e-16 ***
After-school education	2.092e-02	9.216e-03	2.270	0.0232 *
Health	1.498e-01	7.628e-03	19.640	< 2e-16 ***
Socio-economic status	1.889e-01	1.036e-02	18.227	< 2e-16 ***
Total net monthly income	7.097e-03	5.489e-04	12.929	< 2e-16 ***
Income gap	6.556e-02	8.240e-03	7.957	1.91e-15 ***
Urban residency	-1.118e-02	7.234e-03	-1.545	0.1224
Self-development priority	8.778e-02	7.405e-03	11.853	< 2e-16 ***
Employment status	2.333e-02	9.453e-03	2.468	0.0136 *
Age	-9.119e-03	1.186e-03	-7.690	1.58e-14 ***
Age^2	1.203e-04	1.148e-05	10.479	< 2e-16 ***
Gender	-1.295e-02	7.281e-03	-1.779	0.0752 •

Diagnostic tests:				
	df1	df2	statistic	p-value
Weak instruments	2	12946	8.397	<2e-16 ***
Wu-Hausman	1	12946	8.389	0.00378 **
Sargan	1	NA	1.193	0.27481

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

Residual standard error: 0.4021 on 12946 degrees of freedom	
Multiple R-Squared: 0.1449	Adjusted R-squared: 0. 1449
Wald test: 183.2 on 12 and 12946 DF	p-value: < 2.2e-16

Table 14. Age and education in transition countries: specification test

Residuals:				
Min	1Q	Median	3Q	Max
-2.2313	-0.4789	0.1670	0.3324	0.7410

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.3079479	0.0115963	26.556	< 2e-16 ***
Digital inclusion (DI)	-0.0125709	0.0110076	-1.142	0.253463
Health	0.2059214	0.0099421	20.712	< 2e-16 ***
Socio-economic status	0.1916522	0.0070904	27.030	< 2e-16 ***
Total net monthly income	0.0046628	0.0005287	8.820	< 2e-16 ***
Income gap	0.0513117	0.0075297	6.815	9.78e-12 ***
Urban residency	-0.0321063	0.0070216	-4.573	4.85e-06 ***
Self-development priority	0.1172467	0.0073567	15.937	< 2e-16 ***
Employment status	0.0275846	0.0076007	3.629	0.000285 ***
Gender	-0.0060405	0.0069577	-0.868	0.385307

Diagnostic tests:				
	df1	df2	statistic	p-value
Weak instruments	2	16776	7523.599	<2e-16 ***
Wu-Hausman	1	16776	2.090	0.148
Sargan	1	NA	0.375	0.540

Signif. codes: 0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1	
Residual standard error: 0.4389 on 16777 degrees of freedom	
Multiple R-Squared: 0.1447	Adjusted R-squared: 0. 1442
Wald test: 241.8 on 9 and 16777 DF	p-value: < 2.2e-16

Table 15. Age and education in post-transition countries: specification test

Residuals:				
Min	1Q	Median	3Q	Max
-1.5989	-0.3804	0.1397	0.2827	0.6417

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	0.3817910	0.0115805	32.969	< 2e-16 ***
Digital inclusion (DI)	0.0500734	0.0108053	4.634	3.62e-06 ***
Health	0.1662655	0.0103535	16.059	< 2e-16 ***
Socio-economic status	0.1540264	0.0076867	20.038	< 2e-16 ***
Total net monthly income	0.0074079	0.0005432	13.637	< 2e-16 ***
Income gap	0.0618466	0.0082945	7.456	9.46e-14 ***
Urban residency	-0.0015182	0.0072592	-0.209	0.8343
Self-development priority	0.0967243	0.0074465	12.989	< 2e-16 ***
Employment status	-0.0376862	0.0087245	-4.320	1.57e-05 ***
Gender	-0.0171436	0.0073120	-2.345	0.0191 *

Diagnostic tests:				
	df1	df2	statistic	p-value
Weak instruments	2	12946	15140.504	<2e-16 ***
Wu-Hausman	1	12946	1.084	0.298
Sargan	1	NA	0.006	0.938

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1	
Residual standard error: 0.4056 on 12950 degrees of freedom	
Multiple R-Squared: 0.1295	Adjusted R-squared: 0.1289
Wald test: 213.8 on 9 and 12950 DF	p-value: < 2.2e-16

Table 16. Governance characteristics by country

Country	Informal payments	Fighting corruption	Local governance	National governance	Oligarchy	Peace and stability	Regional governance
Albania	0.37	0.43	0.83	0.78	0.48	0.44	0.81
Armenia	0.67	0.15	0.74	0.53	0.65	0.41	0.66
Belarus	0.39	0.28	0.62	0.60	0.29	0.61	0.16
Bosnia and Herz.	0.52	0.04	0.44	0.32	0.58	0.38	0.36
Bulgaria	0.43	0.09	0.72	0.53	0.42	0.45	0.59
Croatia	0.37	0.17	0.69	0.60	0.45	0.66	0.68
Czech Rep.	0.23	0.16	0.89	0.68	0.64	0.75	0.74
Estonia	0.07	0.23	0.77	0.64	0.59	0.68	0.39
Macedonia	0.34	0.21	0.61	0.56	0.35	0.38	0.00
Georgia	0.08	0.23	0.68	0.60	0.46	0.39	0.15
Hungary	0.27	0.21	0.87	0.48	0.46	0.59	0.56
Kazakhstan	0.36	0.37	0.74	0.73	0.43	0.81	0.29
Kyrgyz Rep.	0.60	0.34	0.75	0.71	0.38	0.56	0.36
Latvia	0.15	0.07	0.87	0.69	0.71	0.61	0.00
Lithuania	0.16	0.13	0.87	0.79	0.69	0.68	0.56
Moldova	0.72	0.08	0.70	0.43	0.44	0.17	0.58
Montenegro	0.28	0.17	0.60	0.55	0.38	0.54	0.56
Poland	0.33	0.29	0.66	0.52	0.59	0.62	0.63
Romania	0.46	0.26	0.65	0.47	0.54	0.56	0.57
Russia	0.38	0.20	0.67	0.58	0.47	0.35	0.64
Serbia	0.40	0.27	0.59	0.59	0.43	0.59	0.54
Slovak Rep.	0.23	0.13	0.83	0.65	0.56	0.78	0.65
Slovenia	0.25	0.08	0.75	0.42	0.62	0.69	0.62
Ukraine	0.49	0.10	0.62	0.48	0.53	0.08	0.19
Uzbekistan	0.18	0.00	0.89	0.76	0.00	0.98	0.80

Note: missing observations for "Fighting corruption" and "Oligarchy" for Uzbekistan, as well as was "Regional governance" for Latvia, were substituted with zeros.

Table 17. Governance in transition countries: specification test

Residuals:				
Min	1Q	Median	3Q	Max
-1.7494	-0.4210	0.1401	0.3202	0.8796

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	3.184e-01	5.428e-02	5.867	4.53e-09 ***
Digital inclusion (DI)	5.939e-02	1.236e-02	4.806	1.55e-06 ***
After-school education	5.177e-02	7.472e-03	6.929	4.38e-12 ***
Health	1.562e-01	1.011e-02	15.459	< 2e-16 ***
Socio-economic status	1.594e-01	6.985e-03	22.827	< 2e-16 ***
Total net monthly income	3.120e-03	5.242e-04	5.952	2.70e-09 ***
Income gap	6.982e-02	7.542e-03	9.256	< 2e-16 ***
Urban residency	-3.355e-02	6.877e-03	-4.879	1.08e-06 ***
Self-development priority	9.415e-02	7.348e-03	12.813	< 2e-16 ***
Employment status	2.352e-02	7.712e-03	3.050	0.00229 **
Age	-4.564e-03	1.141e-03	-4.001	6.34e-05 ***
Age^2	5.519e-05	1.168e-05	4.726	2.31e-06 ***
Gender	-1.520e-02	6.779e-03	-2.243	0.02491 *
Informal payments	3.131e-01	2.809e-02	11.143	< 2e-16 ***
Fighting corruption	-5.182e-01	8.277e-02	-6.260	3.94e-10 ***
Local governance	-1.277e+00	1.020e-01	-12.519	< 2e-16 ***
National governance	1.695e+00	1.543e-01	10.987	< 2e-16 ***
Regional governance	5.108e-02	2.799e-02	1.825	0.06805 .
Oligarchy	8.088e-02	1.871e-02	4.323	1.54e-05 ***
Peace and stability	-3.008e-01	4.483e-02	-6.709	2.02e-11 ***

Residual standard error: 0.4248 on 16767 degrees of freedom	
Multiple R-Squared: 0.1709	Adjusted R-squared: 0. 17
Wald test: 182 on 19 and 16767 DF	p-value: < 2.2e-16

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 18. Governance in post-transition countries: specification test

Residuals:				
Min	1Q	Median	3Q	Max
-1.2716	-0.2536	0.1296	0.2737	0.8099

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	5.066e-01	8.940e-02	5.667	1.49e-08 ***
Digital inclusion (DI)	8.998e-02	1.168e-02	7.705	1.40e-14 ***
After-school education	3.085e-02	9.574e-03	3.222	0.00127 **
Health	1.896e-01	1.029e-02	18.423	< 2e-16 ***
Socio-economic status	1.552e-01	7.680e-03	20.212	< 2e-16 ***
Total net monthly income	4.739e-03	5.920e-04	8.006	1.28e-15 ***
Income gap	6.671e-02	8.277e-03	8.060	8.29e-16 ***
Urban residency	-1.386e-03	7.389e-03	-0.188	0.85118
Self-development priority	8.518e-02	7.456e-03	11.424	< 2e-16 ***
Employment status	2.824e-02	9.464e-03	2.984	0.00285 **
Age	-8.697e-03	1.179e-03	-7.379	1.69e-13 ***
Age^2	1.129e-04	1.145e-05	9.861	< 2e-16 ***
Gender	-9.891e-03	7.239e-03	-1.366	0.17184
Informal payments	-1.615e-01	6.810e-02	-2.371	0.01776 *
Fighting corruption	-4.430e-01	6.260e-02	-7.077	1.55e-12 ***
Local governance	-5.378e-01	6.767e-02	-7.948	2.05e-15 ***
National governance	4.652e-02	4.712e-02	0.987	0.32354
Regional governance	4.139e-01	7.874e-02	5.256	1.50e-07 ***
Oligarchy	3.838e-02	3.209e-02	1.196	0.23169
Peace and stability	2.504e-01	6.005e-02	4.170	3.07e-05 ***

Residual standard error: 0.3985 on 12940 degrees of freedom	
Multiple R-Squared: 0.1604	Adjusted R-squared: 0.1592
Wald test: 130 on 19 and 12940 DF	p-value: < 2.2e-16

APPENDIX C

Table 19. Specification test for full sample

Residuals:				
Min	1Q	Median	3Q	Max
-2.4359	-0.4471	0.1594	0.3107	0.7634

Coefficients:				
	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	4.462e-01	2.265e-02	19.702	< 2e-16 ***
Digital inclusion (DI)	4.559e-02	1.445e-02	3.156	0.00160 **
After-school education	5.422e-02	5.772e-03	9.394	< 2e-16 ***
Health	2.023e-01	7.316e-03	27.644	< 2e-16 ***
Socio-economic status	1.735e-01	5.213e-03	33.275	< 2e-16 ***
Total net monthly income	5.301e-03	3.862e-04	13.726	< 2e-16 ***
Income gap	5.443e-02	5.567e-03	9.777	< 2e-16 ***
Urban residency	-2.730e-02	5.050e-03	-5.406	6.51e-08 ***
Self-development priority	1.048e-01	5.239e-03	20.000	< 2e-16 ***
Employment status	2.529e-02	6.063e-03	4.171	3.04e-05 ***
Age	-7.140e-03	8.343e-04	-8.558	< 2e-16 ***
Age^2	8.357e-05	8.385e-06	9.966	< 2e-16 ***
Gender	-1.317e-02	5.055e-03	-2.606	0.00917 **
Transition country	-2.200e-02	1.078e-02	-2.040	0.04133 *
I(TC*DI)	-3.935e-02	1.446e-02	-2.721	0.00650 **

Diagnostic tests:				
	df1	df2	statistic	p-value
Weak instruments	2	29731	9187.689	<2e-16 ***
Wu-Hausman	1	29731	0.010	0.921
Sargan	1	NA	0.017	0.896

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1	
Residual standard error: 0.4237 on 29732 degrees of freedom	
Multiple R-Squared: 0.1295	Adjusted R-squared: 0.129
Wald test: 314.6 on 14 and 29732 DF	p-value: < 2.2e-16

Table 20. Heteroskedasticity Robust Standard Errors test: robust t test

t test of coefficients:				
OLS (3)	Estimate	Std. Error	t value	Pr(>|t|)
(Intercept)	4.4565e-01	2.2050e-02	20.2113	< 2.2e-16 ***
Digital inclusion (DI)	4.6710e-02	9.5887e-03	4.8714	1.114e-06 ***
After-school education	5.4173e-02	5.6603e-03	9.5707	< 2.2e-16 ***
Health	1.7340e-01	5.4538e-03	31.7950	< 2.2e-16 ***
Socio-economic status	2.0223e-01	8.0215e-03	25.2112	< 2.2e-16 ***
Total net monthly income	5.2925e-03	7.7056e-04	6.8684	6.620e-12 ***
Income gap	5.4426e-02	5.3568e-03	10.1601	< 2.2e-16 ***
Urban residency	-2.7333e-02	5.0273e-03	-5.4371	5.459e-08 ***
Self-development priority	1.0478e-01	5.4262e-03	19.3106	< 2.2e-16 ***
Employment status	2.5200e-02	6.1190e-03	4.1183	3.826e-05 ***
Age	-7.1483e-03	8.2811e-04	-8.6320	< 2.2e-16 ***
Age^2	8.3703e-05	8.3603e-06	10.0119	< 2.2e-16 ***
Gender	-1.3160e-02	5.0505e-03	-2.6056	0.009175 **
Transition country	-2.1354e-02	9.4143e-03	-2.2683	0.023320 *
I(TC*DI)	4.0330e-02	1.1065e-02	-3.6448	0.000268 ***

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 21. Heteroskedasticity Robust Standard Errors test: F test

Analysis of Variance Table						
	Res.Df	RSS	Df	Sum of Sq	F	Pr(>F)
OLS (2) model	29734	5341.4				
IV model	29732	5336.5	2	4.914	13.689	1.142e-06 ***

Note: Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Table 22. Confidence Interval for Robust Estimators

OLS (3) model	2.5 %	97.5 %
(Intercept)	4.023556e-01	0.4889488290
Digital inclusion (DI)	2.773204e-02	0.0656878215
After-school education	4.302446e-02	0.0653220209
Health	1.626336e-01	0.1841741343
Socio-economic status	1.864990e-01	0.2179660896
Total net monthly income	3.675906e-03	0.0069091519
Income gap	4.392028e-02	0.0649320345
Urban residency	-3.719193e-02	-0.0174750018
Self-development priority	9.413819e-02	0.1154279652
Employment status	1.317988e-02	0.0372207164
Age	-8.772414e-03	-0.0055241136
Age^2	6.730531e-05	0.0001000996
Gender	-2.306996e-02	-0.0032493519
Transition country	-3.989695e-02	-0.0028112097
I(TC*DI)	-6.211640e-02	-0.0185432272