The Effect of ICT Usage on the Tax Evasion

Hüseyin Safa Ünal[1]

[1]Department of Economics, Bilecik Şeyh Edebali University, Turkey, hsafa.unal@bilecik.edu.tr

Abstract: This study investigates the effect of information and communications technology (ICT), which has been developing especially in the last twenty years, on the size of the tax evasion. Mobile cellular phone subscriptions and individuals using the internet as percentage of the population are treated as the indicators of ICT for the purposes of this research. It is expected that improvement and the usage of the ICT would decrease the tax evasion. For this aim, cross dependency checks and then second-generation unit root tests are conducted based on the cross dependency between panels. Panel ARDL models give evidence for a negative relationship between ICT usage and the size of the tax evasion in the long run.

Keywords: ICT, mobile cellular phone, internet usage, tax evasion, Panel ARDL.

1. Introduction

As the globalization prevails globalization especially in the last decade of the 20th century, economies have become more integrated with each other. Financial system and economies have penetrated into a worldwide transformation and become similar. Politics, health, education, and economics are all subject to this conversion. Technological developments such as enlargement of the internet infrastructure and the expansion of its use, and the widespread use of mobile cellular phones have expedited all the changes in the societies. With the effective utilization of information and communication technologies (ICT), political discourse gives its results swiftly. Any policy change in the health and education transforms the sectors in time of a finger snap. ICT usage also defragments markets and economies globally. Transactions have become faster and the number of transactions has increased as well. Therefore, the volume of the currency has raised enormously. Moreover, it makes those transactions more detectable due to the fact that they leave audit trails for financial authorities. Hence, widely use of ICT makes economic agents more visible in an economy. That is why this research asserts that the ICT usage decreases the size of tax evasion.

According to the World Bank (2002), ICTs include hardware, software, networks, and media. Media is used for collection, storage, processing, transmission, and presentation of information (voice, data, text, images) (World Bank Group, 2002: 3). In terms of taxation system, ICTs can be used as a regulation method by the governments. Especially the use of the internet makes taxation system more systematic. Filing tax returns online, making tax payments online, filling electronic tax forms create footsteps for each and every document or any transaction on the internet. So, tax authorities are able to reach information about those activities without any difficulty if the administrative structure is integrated. Thus, it is possible that governments can utilize ICTs as a tool to prevent any leak in the taxation system. On the other hand, ICTs may be used by agents in the economy to cover illicit activities at the expense of leaving foot prints of transactions. So, the use of ICT may result in an increase in tax evasion if this path of logic is followed. Inevitable development of the ICTs might also compel people to use ICTs, albeit reluctantly. While using a traceable means of transaction, they might feel they are monitored by the authorities and engage less in the illegal economic activities or informal sector of the economy. As a result, the size of the tax evasion decreases if the agents follow this path. Hence, there is not a unique connection between ICTs usage and the tax evasion. The characteristics of the relationship between the two differs depending on the approach adopted by the researcher. This paper favors the idea based on the negative relationship between the use of ICTs and the size of the tax evasion.

Almiron (2007) examines the relationship between financial crime and the use of ICTs. She finds that ICTs are important for the fight against crime and for the increase of transparency. According to her, the effects of the use of ICTs on the knowledge and economic productivity are widely examined, but the potential role of ICTs in democratization by ensuring the transparency that politics, economy, and the society need remains unexplored. For her, tax havens, which are the international centers for tax

evasion, are formed as a result of ICTs. Yet, especially computing and telecommunications technology in the second half of the 20th century have made it possible to control and record every transaction in the electronic registers (Almiron, 2007). So, the problem is not to trace transactions, but is the use of ICTs to manipulate financial records for the sake of one's own benefit. Denning and Baugh (1997) claim that by using encryption and anonymity services in the internet, some web sites provide services for off-shore tax evasion (Denning and Baugh, 1997: 85).

Although, ICTs can be utilized as a tool for financial fraud, there are examples of ICT usage that provide convenience in the government services, and technological improvements in public administrations. For instance, Greek Tax Information System (TAXIS) is regarded as the new integrated information system and the biggest project of information technology of Greece. The main aim of the project is to increase effectiveness of the tax system and to improve the quality of the tax system. But, the most important objective is to provide tax compliance and loyalty of the citizens to the taxation system (Floropoulos et al., 2010: 49; Terpsiadou and Economides, 2009). In this way, it is possible to expect a decrease in the size of the tax evasion. Thus, ICT usage can be utilized as a regulation mechanism for taxation and restrict evasion.

Most of the research in the literature focuses on the ICT utilization and its ability to make governance arrangements to fight back taxation fraud and tax evasion. However, ICT usage of tax payers is not addressed adequately. A study conducted by Deen-Swarray et al. (2013) reveals the fact that the main communication method used in the informal sector is face-to-face interaction in Africa. Actually, the only ICT that is widely used in the informal sector is mobile phones. Moreover, very basic kinds of ICTs such as fixed lines, computer and the internet are not preferred by the informal businesses (Deen-Swarray et al., 2013: 64). Although, ICT usage might be seen as a factor stimulating economic development, its absence can also be regarded as a factor in the potential existence of a vulnerable taxation system. That is so because transactions and accounting are open to fraud without any electronical financial foot print left by the business in the system. It is very hard to detect tax evasion if the transaction is made by using paper currency and exchange is done face to face without any communication and trade evidence between the parties. Yet, ICTs leave behind some proof of the exchange in one way or another, so it deters both parties to evade tax.

An interesting study written by Elgin (2013) shows that the effect of internet usage on the size of the shadow economy depends on the economies' development condition. For developing countries, internet usage causes productivity to increase thereby decreasing the size of the shadow economy. On the other hand, internet usage raises tax evasion which results in an increase in the size of the shadow economy (Elgin, 2013). So, his main assertion is that the impact of internet usage on the tax evasion is blurry depending on the development level of the economy. However, there are also some research on the same topic which come to contrary conclusions. Internet usage can be seen as the potential source of future electronic payments. In addition, the study in which A.T. Kearney and Schneider (2013) examine the structure of the shadow economy in Europe and put forward some measures to decrease it maintains that if the electronic payments were increased 10 per cent annually for four years consecutively, then the shadow economy would decrease by up to 5 per cent (A.T. Kearney and Schneider, 2013: 18). But, Tropiana (2016) claims that digital technologies can be used as tools to transfer money from any illegal source, namely corruption, embezzlement, crime, and tax evasion. So, ICTs might decrease or increase the size of the shadow economy and the tax evasion. Thus, there is no consensus on how the ICTs affect informal sector and the tax evasion.

As is seen from the summary above, while a group of researchers see ICT usage as a factor shrinking the volume of the shadow economy, another group counts ICT usage as an indicator increasing the size of the informal sector and illegal economic activities. By this way, it is believed that ICT usage might both decrease and increase the size of the tax evasion. What is certain is that the literature on the ICT usage and the tax evasion focuses on the effects of governments' ICT usage on the problems about taxation. Ultimate users' ICT utilization is neglected whether because of difficulty to find individual level data because it is not deemed significant. However, while the government constitutes one side of the picture, the end users constitute the other. The disregard of either sides leaves the analyses one-armed. In this regard, this research is filling this gap and tries to find the characteristics of the relationship between ICTs and tax evasion.

The rest of the paper is designed as follows. The second part is a summary of the data and the methodology utilized in the study. The third part shows the characteristics of the result and the discussion. The last part concludes the study.

2. The Data and the Methodology

2.1. The Data

Data for the size of the shadow economy as percentage of the GDP are provided by Friedrich Schneider. Shadow economy data for OECD countries cover the period between years 1996 and 2017. Tax evasion data are generated by multiplication of the size of the shadow economy and corporate income tax rate. The part of the shadow economy which is supposed to be paid as corporate income tax should give the size of the evaded tax because corporate income tax is the part of taxation system open to evasion. So, the product is regarded as the indicator of the size of the tax evasion. For this purpose, combined corporate income tax rate is utilized. It shows "the basic combined central and sub-central (statutory) corporate income tax rate given by the central government rate (less deductions for sub-national taxes) plus the sub-central rate" (OECD, 2019). Corporate income tax data is available for the period between 2000 and 2018. So, the tax evasion data is generated for the overlapping periods of shadow economy and corporate income tax which is from 2000 to 2017.

Mobile cellular phone subscriptions and individuals using the internet are considered as the indicators of ICT usage. Both of the series for OECD countries are retrieved from the World Bank (World Bank, 2018a). Mobile cellular phone subscriptions per 100 people are available for the period between 1996 and 2017, while individuals using the internet as percentage of the population is between 1996 and 2016. The former are subscriptions to a public mobile telephone service which provides access to the public switched telephone network (PSTN) using cellular technology. The latter covers the individuals who have used the internet via a computer, mobile phone, personal digital assistant, games machine or digital TV in the last three months from any location (World Bank, 2018b). Considering all the variables for only 2000-2016 period does not miss any data in general. Only the internet usage data are interpolated for the years 2002, 2003, and 2004 for Australia. Because the missing data period is short, linear interpolation is preferred over log-linear, catmull-Rom spline or cardinal-spline interpolation methods. Linear interpolation basically computes an approximation using previous non-missing value and the next non-missing value. By using a weight for the distance to the both non-missing values, it linearly approximates the missing values. Because there are only three observations missed, interpolation is not believed to change any statistical information in the analysis, but it provides convenience for interpretation. It is crucial to fill the missing data because Granger causality test does not allow for missing observations. However, shadow economy data for Lithuania are not available although corporate income tax data are. So, a recent OECD member Lithuania is dropped from the analysis because tax evasion cannot be generated without any corresponding shadow economy data.

2.2. The Methodology

Panel ARDL analysis is conducted to explain the effect of the ICT usage on the size of the tax evasion for OECD countries except Lithuania. For the effect of mobile cellular phones, the period between 2000 and 2017 is used, while the years between 2000 and 2016 are taken into account for the effect of internet usage. First the cross-section dependency is checked between the panels. The existence of cross-sectional dependency makes the use of first-generation panel unit root tests. Then, second-generation panel unit root tests should be conducted in case of dependency. The null hypothesis claims that there is no cross-section dependence, where alternative is the existence of cross-section dependence.

After the cross-section dependency check, stationarity of the series is tested. Stationarity and the integration order of the series are important because integration order higher than 1 is not allowed in the cointegration tests. So, the series should be either I(0) or I(1), but not I(2). Then, by utilizing Schwarz information criteria the lag order of the ARDL models are determined. The model having the lowest information criteria would be chosen as the optimal one. After the lag order of the ARDL model is determined, then it is possible to estimate the corresponding model to check long-run coefficients and short-run coefficients. Last but not least, Granger causality tests of Dumitrescu & Hurlin give idea about what the direction of the relationship is.

3. Result and Discussion

Table 1 shows the test results of cross-section independency. For both ICT indicators, i.e. for mobile cellular phones and individuals using the internet, cross-section independency is rejected. So, first generation unit root tests cannot be conducted because of correlated cross-sections. That is why the analysis directly passes to second unit root test results.

Table 1: Cross-Section Dependence

Panel A: Mobile Cellular Phone Subscriptions		
	Size of the Tax Evasion	**Mobile Cellular Phone Subscriptions**
Test	**Statistic**	**Statistic**
Breusch-Pagan LM	4987.825***	8988.395***
Pesaran scaled LM	127.3416***	243.3124***
Bias-corrected scaled LM	126.3122***	242.283***
Pesaran CD	58.94796***	94.57642***
Observations	630	630
Panel B: Individuals Using the Internet		
	Size of the Tax Evasion	**Individuals Using the Internet**
Test	**Statistic**	**Statistic**
Breusch-Pagan LM	4474.798***	8916.084***
Pesaran scaled LM	112.4697***	241.2162***
Bias-corrected scaled LM	111.376***	240.1224***
Pesaran CD	57.61196***	94.25773***
Observations	595	595
*** p<0.01		

Pesaran panel unit root test is conducted, and results are reported in table 2. In the period 2000-2017, the size of the tax evasion is non-stationary. But it becomes stationary after the first difference. It is the same for the mobile cellular phone subscriptions. The results are valid at 1% level of significance. In the panel B of the table 2, results for the tax evasion and internet usage are listed. Tax evasion is still non-stationary, but again its first difference is stationary at 1 %significance level. Variable individuals using the internet is not stationary at 5% level of significance, but its first difference is stationary at 1% significance level. Panel unit root tests imply that all variables are I(1) and therefore we conduct cointegration tests in the following part.

Table 2: Stationarity

Panel A: Mobile Cellular Phone Subscriptions				
		Critical Valuess		
	Pesaran Panel Unit Root Test			
Variabless	**Statistic**	**10%**	**5%**	**1%**
Size of the Tax Evasion	-1.94	-2.11	-2.2	-2.36
Size of the Tax Evasion (1st diff.)	-3.405***	-2.11	-2.2	-2.36
Mobile Cellular Phone	-1.942	-2.11	-2.2	-2.36
Mobile Cellular Phone (1st diff.)	-3.388***	-2.11	-2.2	-2.36
Panel B: Individuals Using the Internet				
		Critical Values		
	Pesaran Panel Unit Root Test			
Variables	**Statistic**	**10%**	**5%**	**1%**
Size of the Tax Evasion	-2.060	-2.11	-2.2	-2.36
Size of the Tax Evasion (1st diff.)	-3.483***	-2.11	-2.2	-2.36
Individuals Using Internet	-2.187*	-2.11	-2.2	-2.36
Individuals Using Internet (1st diff.)	-3.936***	-2.11	-2.2	-2.36
***p<0.01, **p<0.05, *p<0.1				

There are two cointegration tests utilized in the study. The first one is the Westerlund test for cointegration and the second is the Westerlund's Error Correction Model (ECM) panel cointegration tests. The results of those two are documented below in table 3. For Westerlund test for

cointegration, the null hypothesis is asserting no cointegration, while the alternative claims that all panels are cointegrated. However, the option considering the cointegration of only some panels as an alternative hypothesis is also counted.

Table 3: Cointegration

	Westerlund test	**p-value**	**Westerlund ECM panel test**	**p-value**
Size of the Tax Evasion and mobile cellular phone subscriptions (All panels)	-3.2085***	0.0007	-16.772***	0
Size of the Tax Evasion and mobile cellular phone subscriptions (Some panels)	-3.6674***	0.0001	-3.127***	0
Size of the Tax Evasion and individuals using internet (All panels)	-4.0124***	0	-14.395**	0.014
Size of the Tax Evasion and individuals using internet (Some panels)	-4.0631***	0	-3.278***	0
***p<0.01, **p<0.05, *p<0.1				

Moreover, Westerlund's ECM panel cointegration tests use no cointegration as the null hypothesis. Because all the series that constructs this study are integrated of order 1 according to table 2, cointegration between them can be tested by using the methods listed above. If the order was higher, utilization of the cointegration tests would not be possible. All the test results in table 3 confirm the existence of cointegration. The null hypotheses are rejected at 1% significance level in general.

Figure 1: Evaluated ARDL Models Based on SIC (Mobile Cellular Phone Subscriptions)

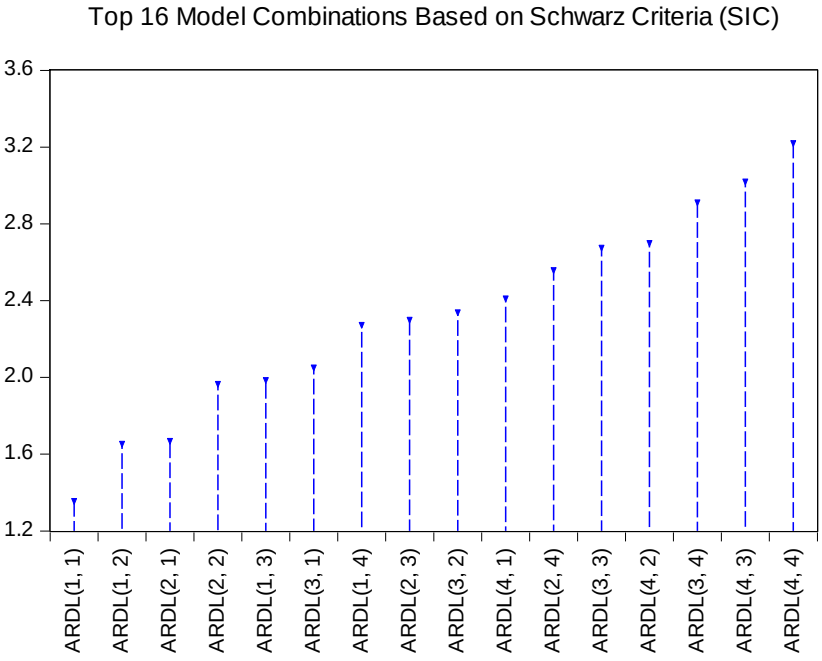

Figure 2: Evaluated ARDL Models Based on SIC (Individuals Using the Internet)

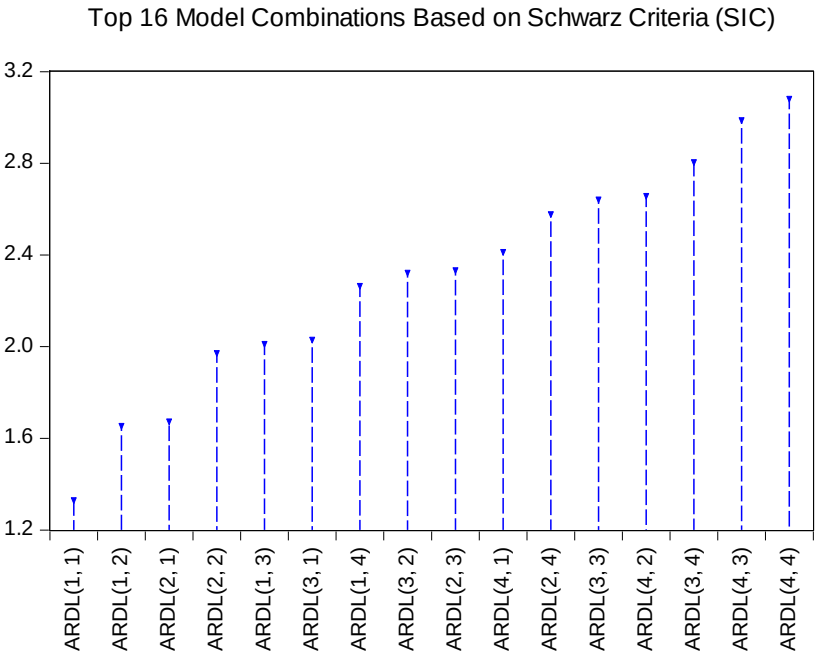

Figure 1 above demonstrates the top 16 model combinations seeking the relationship between the size of the tax evasion and mobile cellular phone subscriptions using Schwarz information criterion (SIC). Among the models tried, ARDL (1,1) has the lowest SIC of 1.35646. Thus ARDL (1,1) model is identified as the optimal choice. Figure 2, on the other hand, demonstrates the top 16 model combinations seeking the relationship between the size of the tax evasion and individuals using the internet based on the Schwarz information criterion (SIC). Among the models tried, ARDL (1,1) has the lowest SIC of 1.329669. Thus ARDL (1,1) model is identified as the optimal choice.

As it is indicated in Table 4, the long run coefficients of the mobile cellular phone subscriptions and individuals using the internet are -0.010473 and -0.00394 respectively. Both are statistically significant. That is, there is a negative relationship between the ICTs and the size of the tax evasion. But this relationship is not maintained in the short run. For both ICT indicators, coefficients are not statistically significant in the short run.

Table 4: Long Term Coefficients of ARDL (1,1) Models

Dependent Variable: Tax Evasion		
Long Run Equation		
Variable	**Coefficient**	**t-Statistic**
Mobile Cellular Phone	-0.010473*** (0.000986)	-10.62361
Short Run Equation		
Variable	**Coefficient**	**t-Statistic**
Error Correction Term	-0.287747*** (0.046366)	-6.20593
ΔMobile Cellular Phone	-0.004277 (0.005156)	-0.829617
Constant	1.55692*** (0.260692)	5.972266

Dependent Variable: Tax Evasion		
Long Run Equation		
Variable	**Coefficient**	**t-Statistic**
Individuals Using the Internet	-0.00394** (0.001828)	-2.155221

Short Run Equation

Variable	Coefficient	t-Statistic
Error Correction Term	-0.269436*** (0.037554)	-7.174639
ΔIndividuals Using the Internet	0.008379 (0.006541)	1.280929
Constant	1.258679*** (0.219287)	5.739872
***p<0.01, **p<0.05		

For both of the ICT indicators, short run equation gives an error correction term which shows the speed of adjustment in case of any deviations from equilibrium in the short run. Negative and significant error correction term guarantees the existence of long-run relationship. For mobile cellular phone subscriptions, deviations from equilibrium in the short run are recovered by 29% in each period to reach the long run equilibrium. This rate is 27% for individuals using the internet. Hence, it is approximately 3 periods to perform full recovery to reach the equilibrium again.

Since, our variables contain cross-section dependency, instead of conventional causality tests, we utilize Dumitrescu & Hurlin's Granger causality test, which accounts for cross-section dependency. Optimal lag selection is automatically conducted via Schwarz's Bayesian Information Criteria (SIC). The test results are listed in Table 5 below. According to Dumitrescu & Hurlin's Granger causality test, both of the ICT indicators Granger cause tax evasion, and tax evasion Granger causes them as well. In other words, there is bi-directional causality among variables.

Table 5: Granger Causality (Dumitrescu & Hurlin, 2012)

	Test Statistic (SIC)	p-value	Optimum number of lags (SIC)
H_0: Mobile cellular phone subscriptions does not Granger-cause tax evasion.			
H_1: Mobile cellular phone subscriptions does Granger-cause tax evasion for at least one panelvar.	7.2947***	0	1
H_0: Tax evasion does not Granger-cause mobile cellular phone subscription.			
H_1: Tax evasion does Granger-cause mobile cellular phone subscription for at least one panelvar.	2.3290**	0.0199	4
H_0: Individuals using internet does not Granger-cause tax evasion.			
H_1: Individuals using internet does Granger-cause tax evasion for at least one panelvar.	5.9833***	0	1
H_0: Tax evasion does not Granger-cause individiuals using internet.			
H_1: Tax evasion does Granger-cause individiuals using internet for at least one panelvar.	3.4905***	0.0005	1
***p<0.01, **p<0.05, *p<0.1			

4. Conclusion

In this research, the long-run and short-run relationship between the ICT usage and the size of the tax evasion is analyzed. For this purpose, OECD economies' mobile cellular phone subscriptions for the period 2000-2017, and individuals using the internet for the period between 2000 and 2016 are used as the ICT indicators. ARDL model estimation results show that there is a negative relationship in

the long run. However, the coefficients are not statistically significant in the short run. While the relationship is not valid in the short run, deviations from equilibrium are recovered in approximately 3 periods. Moreover, the causality test results reveal that relationship is bilateral between ICT usage and tax evasion.

Acknowledgement

I would like to thank Prof. Dr. Yalçınkaya Koyuncu for useful suggestions.

References

Almiron, N. (2007). ICTs and financial crime: an Innocent Fraud?. *International Communication Gazette*, *69*(1), 51-67.

A.T. Kearney & Schneider, F. (2013). The shadow economy in Europe, 2013. *Johannes Kepler Universitat, Linz*.

Deen-Swarray, M., Moyo, M., & Stork, C. (2013). ICT access and usage among informal businesses in Africa. *info*, *15*(5), 52-68.

Denning, D. E., & Baugh, W. E. (1997). Encryption and evolving technologies: Tools of organized crime and terrorism. Trends in Organized Crime, 3(1), 84-91.

Elgin, C. (2013). Internet usage and the shadow economy: Evidence from panel data. *Economic Systems*, *37*(1), 111-121.

Floropoulos, J., Spathis, C., Halvatzis, D., & Tsipouridou, M. (2010). Measuring the success of the Greek taxation information system. *International Journal of Information Management*, *30*(1), 47-56.

OECD. (2018). OECD Tax Database. Retrieved on September 27, 2018, from https://stats.oecd.org/index.aspx?DataSetCode=TABLE_II1

OECD. (2019). OECD iLibrary. Retrieved on February 28, 2019, from https://www.oecd-ilibrary.org/taxation/data/corporate-income-tax/corporate-income-tax-rates_7cde787f-en

Tropina, T. (2016). Do Digital Technologies Facilitate Illicit Financial Flows?. *Background Paper for the World Development Report 2016 Digital Dividends*. The World Bank.

Terpsiadou, M. H., & Economides, A. A. (2009). The use of information systems in the Greek public financial services: the case of TAXIS. *Government Information Quarterly*, *26*(3), 468-476.

World Bank Group (2002). Information and Communication Technologies: A World Bank Group Strategy". *Washington DC: World Bank Group*.

World Bank. (2018a). World Development Indicators Database. Retrieved on September 27, 2018, from http://databank.worldbank.org/data/reports.aspx?source=world-development-indicators#

World Bank. (2018b). World Bank Data Catalog. Retrieved on February 28, 2019, from https://datacatalog.worldbank.org