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DiGiX: The Digitization Index

Noelia Cámara and David Tuesta

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Noelia Cámara and David Tuesta

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Abstract

The Digitization Index (DiGiX) assesses the factors, agents' behavior and institutions that enable a country to fully leverage Information and Communication Technologies (ICTs) for increased competitiveness and well-being. It is a composite index that summarizes relevant indicators on 100 countries' digital performance. The DiGiX is structured around six principal dimensions: infrastructure, households' adoption, enterprises' adoption, costs, regulation and contents. Each dimension is in turn divided into a number of individual indicators, adding up to a total of 21.

Keywords: digitization, principal component analysis, Internet

JEL classification: C43, O3.

1. Introduction

The digital economy is an essential part of the architecture of the Fourth Industrial Revolution. The Digitization Index (DiGiX) assesses the factors, agents' behaviour and institutions that enable a country to fully leverage Information and Communication Technologies (ICTs) for increased competitiveness and well-being. It is a composite index that summarizes relevant indicators on 100 countries' digital performance. The DiGiX is structured around six dimensions: infrastructure, households' adoption, enterprises' adoption, costs, regulation and contents. Each dimension is in turn divided into a number of individual indicators, adding up to a total of 21.

There are two main approaches in the literature to measure the degree of digitization at country level. Firstly, the Networked Readiness Index (NRI) created by the World Economic Forum and measures the propensity for countries to exploit the opportunities offered by information and communications technology. It measures, the performance of 139 economies in leveraging information and communications technologies to boost competitiveness, innovation and well-being. The NRI the computation of the overall NRI score is based on successive aggregations by simple averaging of scores: individual indicators are aggregated to obtain pillar scores, which are then combined to obtain subindex scores. Subindex scores are in turn combined to produce a country's overall NRI score. Secondly, the Digital Economy and Society Index (DESI) developed by European Commission is a composite index that summarizes relevant indicators on Europe's digital performance and tracks the evolution of EU member states in digital competitiveness. The overall index and dimensions, weights are attributed exogenously and reflect the European Union digital policy priorities.

We build on this literature and propose the DiGiX. Our contribution to the literature is in several ways. First, we assign the weights endogenously, according to the data structure. Second, we create an index that captures a narrower concept of digitization. Third, we create an index that is robust to redundant information.

The rest of the paper is organized as follows. Section 2 presents the structure of the DiGiX 2016. Section 3 shows the methodology. Section 4 presents the results for 2016 and Section 5 summarizes the main findings.

2. Data and index structure

We measure digitization based on demand and supply. The structure of the index is as follows. There are 21 indicators that are divided in 6 dimensions or subindices: infrastructure, costs, regulation, contents, households' adoption and enterprises' adoption. At the same time each dimension summarizes information of several individual indicators (from 1 up to 6). The demand-side information is captured by the so-called output indicators that correspond to the dimensions: households', enterprises' and government adoption (contents). This group measures the degree of engagement of the different economic agents households, firms and government with the digitization. The supply-side information is included in the infrastructure, costs and regulation dimensions. They represent inputs that enable the digitization process.

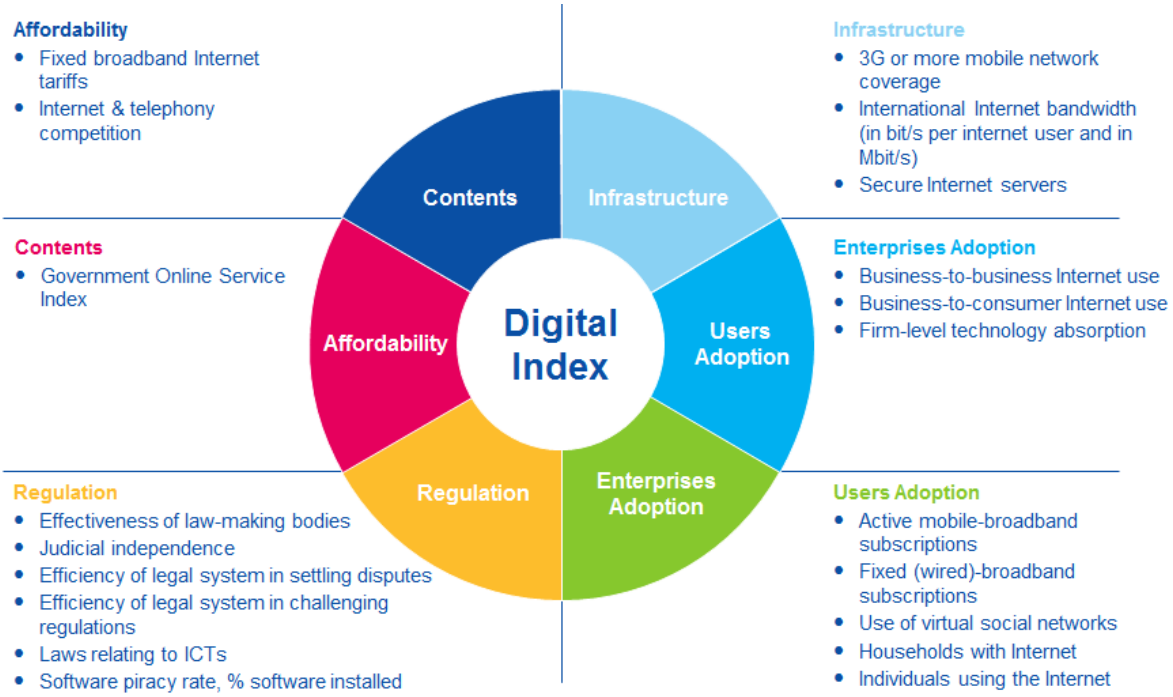
Regarding the theoretical framework of our definition, this index differs from the other indices in the literature in the lack of human capital indicators. We choose a narrower definition and only consider variables directly related to digitization. The human capital is an explanatory variable rather than a variable to define digitization.

The composition of the DiGiX is described in Figure 1 and Table 1 shows descriptive statistics of the 21 indicators.

The indicators are derived from different official sources that are described in the Appendix. DiGiX 2016 summarizes data collected mostly during calendar year 2015.

Figure 1

Digital Index 2016: Composition



Source: BBVA Research

Table 1

Descriptive Statistics						
Variable	**Obs**	**Mean**	**Std. Dev.**	**Min**	**Max**	**cv**
Infraestructure						
3G coverage	100	88.80	16.58	27.00	100.00	0.19
Bandwidth (bit/s) per Internet user	100	218137.90	828653.40	992.20	7186378.00	3.80
Secure Internet Servers	100	509.08	782.04	1.32	3406.66	1.54
Bandwidth (bit/s)	100	1907580.00	4250706.00	4800.00	25800000.00	2.23
Users' adoption						
Mobile-broadband subscriptions	100	63.22	33.07	4.27	144.05	0.52
Fixed (wired)-broadband subscriptions	100	17.53	13.04	0.01	44.79	0.74
Virtual social networks	100	5.81	0.55	3.83	6.79	0.09
Households with Internet	100	60.57	27.14	8.58	98.79	0.45
Individuals using the Internet	100	62.60	23.26	14.40	98.20	0.37
Enterprises' adoption						
B2B	100	5.01	0.66	3.37	6.36	0.13
B2C	100	4.82	0.75	2.90	6.30	0.16
Firm-level technology absorption	100	4.91	0.68	3.35	6.17	0.14
Costs						
Fixed broadband tariffs	100	36.76	23.02	2.65	157.62	0.63
Internet & telephony competition	100	1.77	0.37	0.25	2.00	0.21
Regulation						
Laws relating to ICTs	100	4.25	0.83	2.04	5.94	0.19
Software piracy rate	100	56.68	21.56	18.00	91.00	0.38
Effectiveness of law-making bodies	100	3.78	0.99	1.78	6.16	0.26
Judicial independence	100	4.13	1.32	1.65	6.75	0.32
Efficiency of legal system in settling dispute	100	3.95	0.98	2.02	6.16	0.25
Eff. of legal system in challenging regulations	100	3.59	0.86	1.92	5.57	0.24
Digital content						
Government Online Service Index	100	0.57	0.23	0.08	1.00	0.39

Source: BBVA Research

3. Methodology: weights and aggregation methods

We assume that behind a set of correlated variables, we can find an underlying latent structure that can be identified with a latent variable as is the case of digitization. Two important issues arise in the estimate of any latent variable: the selection of relevant variables and the estimation of parameters (weights). Regarding the first issue, it is not possible to rely on standard reduction of information criterion approaches for the selection of variables. For the second, since digitization is unobserved, standard regression techniques are also unfeasible to estimate the parameters. The weight assignment to the indicators or sub-indices is critical to maximize the information from a data set included in an index. A good composite index should comprise important information from all the indicators, but not be strongly biased towards one or more of these indicators. We

apply two-stage principal components methodology to estimate the degree of digitization as an indexing strategy.

Our dataset contains causal variables which summarize the information for digitization. As explained in the previous section, each causal variable relates to different dimensions that define digitization. The purpose of dividing the overall set of indicators into three sub-indices is twofold. On the one hand, the three sub-indices have a meaning so, we get additional disaggregated information that is also useful for policy making. On the other hand, for methodological purposes, since the sub-indices contain highly inter-correlated indicators, we estimate the sub-indices first, rather than estimating the overall index directly by picking all the indicators at the same time. This is a preferred strategy because empirical evidence supports that PCA is biased towards the weights of indicators which are highly correlated with each other (Mishra, 2007). We minimize this problem by applying two-stage PCA (Nagar and Basu, 2004). In the first stage, we estimate the six sub-indices: infrastructure, households' adoption, enterprises' adoption, costs, regulation and contents, which defined digitization. In the second stage, we estimate the dimension weights and the overall DiGiX by using the dimensions as explanatory variables.

We only retain the information contained in the first component since we consider that it is sufficiently high as to describe the commonalities that we are looking for. Table 2 shows the explained variance by each dimension and indicator.

Table 2

% Explained Variance

	First component
Infraestructure	47%
Costs	58%
Regulation	80%
Users' adoption	80%
Enterprises' adoption	90%
Digital content	100%
BBVA-DiGiX	64%

Source: BBVA Research

Let us postulate that the latent variable DiGiX is linearly determined as follows:

$$\mathrm{DiGiX_i} = \beta_1 * \mathrm{I_i} + \beta_2 * \mathrm{UA_i} + \beta_3 * \mathrm{EA_i} + \beta_4 * \mathrm{C_i} + \beta_5 * \mathrm{R_i} + \beta_6 * \mathrm{Co_i} + \varepsilon_i$$

where subscript *i* denotes the country, and (I, UA, EA, C, R and CO) capture the dimensions (i.e. infrastructure, households' adoption, enterprises' adoption, costs, regulation and digital contents respectively). Thus, the total variation in DiGiX is represented by two orthogonal parts: variation due to causal variables and variation due to error (ε_i). If the model is well specified, including an adequate number of explanatory variables, we can reasonably assume that the total variation in DiGiX can be largely explained by the variation in the causal variables. The relative weights (importance) of each dimension, β_j, in the DiGiX are computed as:

$$\beta_j = \frac{\sum_{j=1} \lambda_j \phi_{jk}}{\sum_{j=1} \lambda_j}$$

where λ_j represents the variance of the *jth* principal component (weights), for our index, the first component and k the number of variables in the overall index or in each dimension. Table 3 presents the weights by indicator and by dimension. Among indicators and dimensions weights are relatively balanced except for the cost dimension. On the one hand, the two indicators in this dimension have a low variance and then, it is more difficult to distinguish countries based on this information. On the other hand, the two indicators have a low correlation so, the common part explained by both indicators is also low.

Table 3

Weights	
Infraestructure	*18%*
3G coverage	21%
Bandwidth (bit/s) per Internet user	26%
Secure Internet Servers	29%
Bandwidth (bit/s)	24%
Costs	*9%*
Fixed broadband tariffs	50%
Internet & telephony competition	50%
Regulation	*18%*
Laws relating to ICTs	16%
Software piracy rate	15%
Effectiveness of law-making bodies	17%
Judicial independence	18%
Efficiency of legal system in settling dispute	18%
Eff. of legal system in challenging regulations	17%
Users' adoption	*19%*
Mobile-broadband subscriptions	19%
Fixed (wired)-broadband subscriptions	20%
Virtual social networks	19%
Households with Internet	21%
Individuals using the Internet	21%
Enterprises' adoption	*19%*
B2B	34%
B2C	33%
Firm-level technology absorption	33%
Digital content	*17%*
Government Online Service Index	100%

Source: BBVA Research

Finally, we apply a min-max transformation, which preserves the order of, and the relative distance between, the scores. Each score in the DiGiX is between 0 and 1, with higher values representing better performance.

$$z_{ij}=\frac{x_{ij}-\min(x_j)}{\max(x_j)-\min(x_j)}$$

4. Results

The DiGiX finds Luxemburg as the highest-placed country in the world when it comes to digitization. United Kingdom remains in second place followed by Hong Kong (3rd), United States (4th) and Netherlands (5th. Making up the rest of the top 10 are the Japan, Singapore, Norway, Finland and Sweden (see Table 4 and Figure 2). According to our results, these countries might define the technological frontier in terms of digitization. The highest scores in this index represent the digital frontier. This is a dynamic concept that helps us to compare countries' performance in our sample.

When it comes to developing countries, the United Arab Emirates remains at 22nd position and it is the leader in the Arab world. Bahrain comes in the 26th position and Malaysia in the 29th.They lead the Emerging Asian ranking mainly, due to strong support received by their governments that are fully committed to the digital agenda. All the above mentioned some developing countries exhibit higher scores than other developed countries such as Spain (30th), Portugal (33th) or Italy (52nd).

The performance range by countries in the Latin America and Caribbean region remains widely dispersed with almost 100 places between Chile (34th) and Nicaragua (98th). Costa Rica, Brazil and Uruguay are the countries with the best performance in this region, all of them above or close to the average (0.48). In order to foster the innovation forces that are key for thriving in the digitized world and the emerging, so called, Fourth Industrial Revolution, many governments in the region will urgently need to reinforce efforts to improve their regulatory and innovation environments (WEF, 2016). Finally, sub-Saharan African countries are among the last positions in the ranking. Algeria and Cameroon are the last ones in the table.

Regarding index heterogeneity, the performance of each country across dimensions is unequal, as can be seen in the Table 5, which displays the coefficient of variation for the scores obtained on each dimension of the DiGIX, for each country present in the sample.

Table 4

Digitalization Index

1	Luxembourg	1.00	46	Kazakhstan	0.47	91	Pakistan	0.16
2	United Kingdom	0.97	47	South Africa	0.47	92	Paraguay	0.15
3	Hong Kong SAR	0.95	48	Slovakia	0.46	93	Zimbabwe	0.13
4	United States	0.92	49	Mauritius	0.46	94	Bangladesh	0.12
5	Netherlands	0.90	50	Colombia	0.45	95	Côte d'Ivoire	0.11
6	Japan	0.88	51	Russian Federation	0.45	96	Zambia	0.10
7	Singapore	0.87	52	Italy	0.44	97	Bolivia	0.07
8	Norway	0.86	53	Azerbaijan	0.44	98	Nicaragua	0.06
9	Finland	0.85	54	Poland	0.43	99	Cameroon	0.05
10	Sweden	0.84	55	Romania	0.43	100	Algeria	0.00
11	Switzerland	0.82	56	Croatia	0.43			
12	Iceland	0.82	57	Montenegro	0.42			
13	Canada	0.81	58	Kuwait	0.41			
14	New Zealand	0.80	59	Mexico	0.41			
15	Australia	0.79	60	Greece	0.40			
16	Germany	0.78	61	Armenia	0.40			
17	Denmark	0.77	62	Georgia	0.40			
18	Korea, Rep.	0.76	63	Panama	0.40			
19	Estonia	0.76	64	Macedonia FYR	0.39			
20	France	0.76	65	China	0.39			
21	Austria	0.73	66	Thailand	0.38			
22	United Arab Emirates	0.71	67	Morocco	0.38			
23	Belgium	0.69	68	Philippines	0.37			
24	Ireland	0.68	69	Sri Lanka	0.35			
25	Israel	0.68	70	Egypt	0.34			
26	Bahrain	0.65	71	Indonesia	0.33			
27	Lithuania	0.65	72	Bulgaria	0.33			
28	Malta	0.64	73	Moldova	0.33			
29	Malaysia	0.63	74	Tunisia	0.33			
30	Spain	0.62	75	Argentina	0.33			
31	Qatar	0.61	76	Kenya	0.32			
32	Saudi Arabia	0.59	77	Peru	0.32			
33	Portugal	0.59	78	El Salvador	0.32			
34	Chile	0.58	79	Serbia	0.31			
35	Latvia	0.55	80	Dominican Rep.	0.31			
36	Czech Republic	0.52	81	Vietnam	0.31			
37	Oman	0.51	82	Honduras	0.30			
38	Turkey	0.50	83	India	0.29			
39	Costa Rica	0.49	84	Albania	0.26			
40	Jordan	0.49	85	Senegal	0.24			
41	Cyprus	0.48	86	Guatemala	0.24			
42	Hungary	0.48	87	Ukraine	0.22			
43	Uruguay	0.48	88	Botswana	0.21			
44	Brazil	0.48	89	Nigeria	0.18			
45	Slovenia	0.47	90	Lebanon	0.18			

Source: BBVA Research

In order to compare our index with some variables of interest and alternative approaches in the literature, we compute some correlation analysis. Firstly, we observe that the correlation between the DiGiX and per capita income is relatively strong, 70%. Secondly, we compare our index with other in the literature such as the NRI. We compute standard and rank correlations to compare the two indices calculated with different methodologies. Table 5 shows the Pearson and Spearman correlations. Since the scores in our index have no direct interpretation, we focus on Spearman correlation between rankings. This coefficient gauges the correlation extent between two variables according the hierarchy or range within a sample. Its main advantage lies in the fact that is a non-parametric technique, which makes it independent from the statistical distributions of the subject variables of study. In this case, it is appropriate to assess the extent of coincidence between two rankings: DiGiX and the Networked Readiness Index. It is equivalent to the Pearson Correlation applied to the range of two variables within their sample set.[1] Given the degree of coincidence between both rankings, the Spearman coefficient suggests a similar conclusion. Only for Africa, it is slightly below 0,9.

Considering the individual analysis of each dimension, it is interesting the lower correlation between the cost dimensions. One potential explanation might be the lack of the prepaid mobile cellular tariffs in the DiGix, which is included in the NRI. The exclusion of this variable in the DiGix is due to the scarce use of this kind of tariffs in several countries in the sample, specially developed countries. Thus, we consider these data as non-representative of the service supply.

Table 5

Spearman and Pearson Correlation Coefficients

	World		OECD		Latam		África		Asia	
	Pearson	Spearman	Pearson	Spearman	Pearson	Spearman	Pearson	Spearman	Pearson	Spearman
OVERALL INDEX	0.97	0.97	0.95	0.95	0.94	0.95	0.92	0.88	0.97	0.98
INFRAESTR	0.72	0.89	0.52	0.80	0.62	0.63	0.70	0.65	0.65	0.93
USERS ADOPTION	0.99	0.99	0.97	0.96	0.96	0.92	0.96	0.94	0.99	0.98
ENPERPRISES ADOPT	0.88	0.94	0.83	0.86	0.95	0.93	0.86	0.81	0.88	0.95
COST	0.68	0.57	0.45	0.31	0.46	0.67	0.74	0.76	0.72	0.59
REGULATION	0.97	0.96	0.97	0.97	0.93	0.86	0.97	0.93	0.97	0.97
CONTENT	0.85	0.86	0.79	0.77	0.89	0.84	0.75	0.73	0.88	0.89

Source: BBVA Research

5. Conclusions

The DiGiX assesses the factors, agents' behaviour and institutions that enable a country to fully leverage information and communication technologies (ICTs) for increasing adoption of digital services, competitiveness and well-being. The DiGiX measures, on a scale from 0 (worst) to 1 (best), the digital performance of 100 countries, including developed and less developed countries. It is made of 21 indicators grouped in 6 dimensions and it is computed on annual basis. Due to the dynamic nature of the fields considered in the DiGiX, small changes are possible in future editions of the index due to technology variations.

1: The Pearson correlation coefficient shows a strong relation between the DiGiX and the NRI (see Table XX). If we divide our sample into regions, for most of them, this coefficient is near 1, and in any case is greater than 0.9.

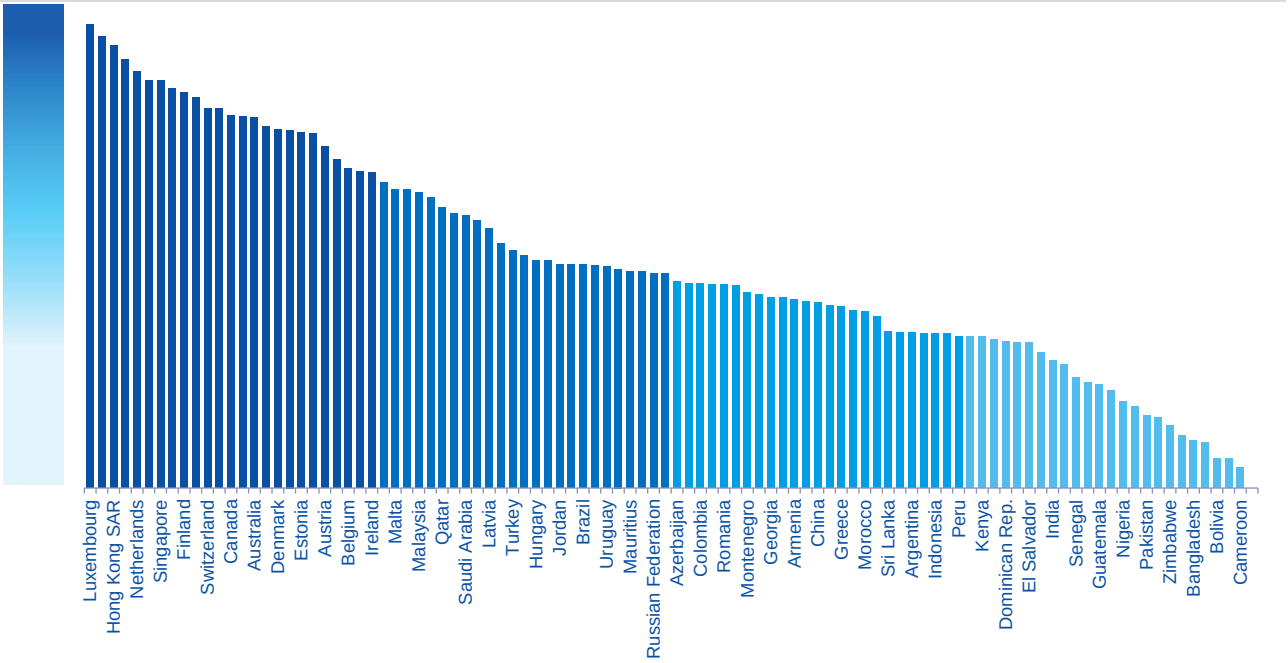
The computation of the DiGiX is based on the common information aggregations of individual indicators, from the indicator level (i.e., the most disaggregated level) to the overall DiGiX score (i.e., the highest level).

Our index allows several types of analysis such as comparative analysis among countries (regions) and individual analysis by dimension, which is useful for policy making. Measuring the economic and social impact of the digital economy is important for making appropriate policy decisions in both developed and developing economies.

The limitation of our index now is comparability with previous years since the usage of new technology-related indicators, such as 3G technologies, was only recently adopted by some countries.

Figure 2

DiGiX: Comparison among countries



Source: BBVA Research

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7. References Appendix A: Data Sources

- World Telecommunication/ICT Indicators database (ITU) 2016

  The World Telecommunication/ICT Indicators database contains time series data for the years 1960, 1965, 1970 and annually from 1975 to 2014. These data are available for over 200 economies; however the availability of data for the different indicators and years can vary. The data are collected from an annual questionnaire sent to official economy contacts, usually the regulatory authority or the ministry in charge of telecommunication and ICT. Additional data are obtained from reports provided by telecommunication ministries, regulators and operators and from ITU staff reports.

- World Development Indicators - World Bank 2016

- Executive Opinion Survey (World Economic Forum)

  The World Economic Forum has conducted its annual Survey for over 30 years, making it the longest-running and most extensive survey of its kind. The Survey is administered each year in over 140 economies. It captures valuable information on a broad range of factors that are critical for a country's competitiveness and sustainable development and for which data sources are scarce or, frequently, nonexistent on a global scale. Among several examples of otherwise-unavailable data are the quality of the educational system. indicators measuring business sophistication. and labor market variables such as flexibility in wage determination

- Doing Business 2016

  Launched in 2002, looks at domestic small and medium-size companies and provides objective measures of business regulations and their enforcement across countries and selected cities at the subnational and regional level. These reports provide data on the ease of doing business, rank each location, and recommend reforms to improve performance in each of the indicator areas. The first Doing Business report, published in 2003, covered 5 indicator sets and 133 economies. This year's report covers 11 indicator sets and 189 economies.

- United Nations (UN)

- Business Software Alliance (BSA)

- International Monetary Fund (IFS, IMF)

Appendix B: Variable descriptions

Infrastructure subindex:

- ***I1_3gcoverage:*** *ITU - Percentage of the population covered by at least a 3G mobile network.* Percentage of the population covered by at least a 3G mobile network refers to the percentage of inhabitants that are within range of at least a 3G mobile-cellular signal; irrespective of whether or not they are subscribers. This is calculated by dividing the number of inhabitants that are covered by at least a 3G mobile-cellular signal by the total population and multiplying by 100.
- **I2_bandwidth:** *ITU - International Internet bandwidth (bit/s) per Internet user.* International Internet bandwidth refers to the capacity that backbone operators provide to carry Internet traffic. It is measured in bits per second per Internet users.
- **I3_secservers**: *WB - Secure Internet servers (per 1 million people).* Secure servers are servers using encryption technology in Internet transactions.
- **I4_bandwidth2:** *ITU- International Internet bandwidth in Mbit/s.* International Internet bandwidth refers to the total used capacity of international Internet bandwidth in megabits per second (Mbit/s). It is measured as the sum of used capacity of all Internet exchanges (locations where Internet traffic is exchanged) offering international bandwidth. If capacity is asymmetric (i.e. more incoming (downlink) than outgoing (uplink) capacity) then the incoming (downlink) capacity should be provided.

Households' adoption subindex:

- **AU1_mbroadband:** *ITU - Active mobile-broadband subscriptions per 100 inhabitants*. Active mobile-broadband subscriptions refer to the sum of standard mobile-broadband and dedicated mobile-broadband subscriptions to the public Internet. It covers actual subscribers not potential subscribers. even though the latter may have broadband enabled-handsets.
- **AU2_fbroadband:** *ITU - Fixed (wired)-broadband subscriptions per 100 inhabitants*. Refers to subscriptions to high-speed access to the public Internet (a TCP/IP connection) at downstream speeds equal to or greater than 256 kbit/s. This includes cable modem DSL fibre-to-the-home/building and other fixed (wired)-broadband subscriptions. This total is measured irrespective of the method of payment. It excludes subscriptions that have access to data communications (including the Internet) via mobile-cellular networks. It should exclude technologies listed under the wireless-broadband category.
- **AU3_socnetworks:** *UN - Use of virtual social networks (1-7).* In your country. how widely used are virtual social networks (e.g.. Facebook. Twitter. LinkedIn)? [1 = not used at all; 7 = widely used]
- **AU4_inthomes:** *ITU - Percentage of households with Internet.* Refers to the percentage of households with Internet access at home.
- **AU5_intpeople:** *ITU - Percentage of individuals using the Internet.* Refers to the proportion of individuals that used the Internet in the last 12 months.

Enterprises' adoption subindex:

- **AE1_bbint:** *UN - Business-to-business Internet use (1-7).* In your country to what extent do businesses use ICTs for transactions with other businesses? [1 = not at all; 7 = to a great extent]
- **AE2_bcint:** *UN - Business-to-consumer Internet use (1-7).* In your country to what extent do businesses use Internet for selling their goods and services to consumers? [1 = not at all; 7 = to a great extent]
- **AE3_firmtech:** *UN - Firm-level technology absorption (1-7).* In your country to what extent do businesses adopt new technology? [1 = not at all; 7 = adopt extensively]

Cost subindex:

- **C1_fbroadband:** *UN - Fixed broadband Internet tariffs. PPP $/month.* Monthly subscription charge for fixed (wired) broadband Internet service (PPP $)Fixed (wired) broadband is considered any dedicated connection to the Internet at downstream speeds equal to or greater than 256 kilobits per second using DSL. The amount is adjusted for purchasing power parity (PPP) and expressed in current international dollars. PPP figures were sourced from the World Bank's [i]World Development Indicators Online[i] (December 2014) and the International Monetary Fund's [i]World Economic Outlook[i] (October 2014 edition). After computing the indicator, we divide by county GDP per capita in order to make it comparable across countries. This variable is divided by the GDP pc PPP in order to make it comparable.
- **C2_intelcompetition:** *ITU - Internet & telephony competition, 0–2 (best).* This variable measures the degree of liberalization in 17 categories of ICT services, including 3G/4G telephony, international long distance calls, and international gateways. For each economy, the level of competition in each of the categories is assessed as follows: monopoly, partial competition, and full competition. The results reflect the situation as of 2013 for the majority of countries (for others, data are available as of 2012 or earlier years). The index is calculated as the average of points obtained in each of the 17 categories for which data are available. Full liberalization across all categories yields a score of 2, the best possible score. For more information, consult http://www.itu.int/ITU-D/ICTEYE/Reports.aspx.

Regulation subindex:

- **R1_ict**: *UN - Laws relating to ICTs (1-7)*. How developed are your country's laws relating to the use of ICTs (e.g., electronic commerce, digital signatures, consumer protection)? [1 = not developed at all; 7 = extremely well-developed].
- **R2_softpiracy**: *UN - Software piracy rate, % software installed*. This measure covers piracy of all packaged software that runs on personal computers (PCs), including desktops, laptops, and ultra-portables, including netbooks. This includes operating systems; systems software such as databases and security packages; business applications; and consumer applications such as games, personal finance, and reference software. The study does not include software that runs on servers or mainframes, or software loaded onto tablets or smart phones.
- **R3_effectlaw:** *UN - Effectiveness of law-making bodies, 1-7 (best).* How effective is your national parliament/congress as a law-making institution? [1 = not effective at all—among the worst in the world; 7 = extremely effective—among the best in the world].

- **R4_judindep:** *UN - Judicial independence, 1-7 (best).* In your country, to what extent is the judiciary independent from influences of members of government, citizens, or firms? [1 = heavily influenced; 7 = entirely independent].
- **R5_effilegalsystem1:** *UN - Efficiency of legal system in settling disputes, 1-7 (best).* In your country, how efficient is the legal framework for private businesses in settling disputes? [1 = extremely inefficient; 7 = extremely efficient].
- **R6_effilegalsystem2:** *UN - Efficiency of legal system in challenging regs, 1-7 (best).* In your country, how easy is it for private businesses to challenge government actions and/or regulations through the legal system? [1 = extremely difficult; 7 = extremely easy].
- **R7_ndayscontract:** *UN - No. days to enforce a contract.* Time is recorded in calendar days, counted from the moment the plaintiff decides to file the lawsuit in court until payment. This includes both the days when actions take place and the waiting periods between.
- **R8_judicialquality:** *DB - Quality of judicial processes index (0-18).* The quality of judicial processes index measures whether each economy has adopted a series of good practices in its court system in four areas: court structure and proceedings, case management, court automation and alternative dispute resolution. The index is the sum of the scores of the four areas and ranges from 0 to 18, with higher values indicating better and more efficient judicial processes.

Digital content subindex:

- **CO1_gov:** *UN - Government Online Service Index. 0–1 (best).* The Government Online Service Index assesses the quality of government's delivery of online services on a 0-to-1 (best) scale. According to the United Nations' Public Administration Network the Government Online Service Index captures a government's performance in delivering online services to the citizens. There are four stages of service delivery. "Emerging". "Enhanced". "Transactional" and "Connected". Online services are assigned to each stage according to their degree of sophistication from the more basic to the more sophisticated. In each country, the performance of the government in each of the four stages is measured as the number of services provided as a percentage of the maximum services in the corresponding stage. Examples of services include online presence, deployment of multimedia content, governments' solicitation of citizen input, widespread data sharing and use of social networking. For more information about the methodology: www2.unpan.org/egovkb/datacenter/CountryView.aspx.

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Contact details:
BBVA Research
Azul Street, 4
La Vela Building - 4 and 5 floor
28050 Madrid (Spain)
Tel.: +34 91 374 60 00 and +34 91 537 70 00
Fax: +34 91 374 30 25
bbvaresearch@bbva.com
www.bbvaresearch.com