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On the effects of e-participation on shadow economy: A worldwide empirical analysis*

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Abstract

This paper explores the relationship between the e-participation attitude of citizens and the size of the shadow economy, whose consequences could be detrimental to countries' economic development. We exploit a rich panel dataset for 149 countries characterized by a large digital divide within their public sectors, different levels of both income and democratic institutions at work over years 2003–2015. Using the instrumental variables approach to address potential endogeneity issues, we find that e-participation significantly contributes to reducing the shadow economy. Due to its interactive nature for both businesses and citizens, it positively affects the individuals' behavior against informal economic activities by creating a more collaborative environment between the government and its stakeholders.

JEL Classification: E26; O17; O38; O57

Keywords: shadow economy; citizens' e-participation; digital government; economic development; democratic institutions

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1 Introduction

The concept of *e-government* starts with the evolution of Information and Communication Technologies (ICT) combined with the analysis of their impacts and diffusion within the public sector (Contini and Lanzara, 2009; Chun et al., 2010; Khazaeli and Stockemer, 2013). Its definition moved from an initial vision focused exclusively on office automation to a more attentive approach focused on the interaction with the private sector, mainly to provide online services to citizens and businesses.¹

The interest of economists, international organizations and policy-makers to the *e-government* diffusion depends on the fact that it can contribute significantly to the economic development of a country. First, the *e-government* activity might increase the public sector productivity and allow cost savings by reallocating resources for alternative productive use. Second, by improving the supply of public services to citizens and businesses, it might support the private sector productivity as well. Third, supporting the idea of increased business competitiveness and innovative environment due to *e-government*, a positive impact of digital government on the economic activity of firms is likely to arise. As a matter of fact, strengthening *e-government* services and further developing telecommunication infrastructure rank the highest priorities for governments in 2017 (OECD, 2017).

Public policies to promote *e-government* issues for individuals and firms are aimed overall at bringing governmental services for citizens online such as the possibility of paying taxes, submitting various documents and updating their personal information, so reducing the administrative burden for both firms and governments.² In this framework, facilitating information

¹In 2016, the use of them by individuals is quite unevenly developed across member countries of the Organization for Economic Cooperation and Development (OECD), while the available data on businesses (referred to 2013) reveal growing interactions with public authorities. In detail, the former ranges from less than 25% of individuals using government websites (Chile, Italy and Mexico) to more than 80% (Denmark, Iceland and Norway); the latter shows that 95% of large firms and 88% of small ones have interacted with public authorities in 2013, on average, in OECD countries (OECD, 2017).

²In this context, the online tax services is by far the most common policy directed towards businesses. Other examples of *e-forms* specifically for firms include *e-invoicing* for government suppliers; all paperwork to be completed electronically for official registration as a legal entity; online tax declaration, including value-added tax (VAT) and customs declaration; portals directed towards business users which contain more specialised information related to

access for enhanced citizen participation through the public sector's use of the most innovative technologies could be an important tool also to shrink the size of illegal and informal activities as well as the development of corruption episodes (Shim and Eom, 2008; Andersen, 2009; Elgin, 2013; Veiga and Rohman, 2017; Elbahnasawy, 2014, 2021).

In this paper, we focus on a specific new aspect of *e*-governance, which is the *e*-participation attitude of citizens, and explore empirically the relationship between the latter and the size of shadow economy for a rich panel dataset of 149 countries including developed, developing and transitional economies over the period 2003–2015. In detail, the *e*-participation issue deals with several dimensions: enabling individuals' participation by providing citizens with public information and access to information without or upon demand; engaging citizens in contributions to and deliberation on public policies and services; empowering citizens through co-design of policy options and co-production of service components and delivery modalities (United Nations, 2016).

We offer new empirical evidence at a national level considering a large sample of countries characterized by large digital divide within their public administrations, different level of both economic development and democratic institutions at work, which could affect the investigated relationship. As a matter of fact, political instability and autocratic regimes are more likely associated with larger informal sectors (Elbahnasawy et al., 2016). At the same time, the beneficial effects of democracy in reducing illegal activities and corruption appear to be more effective in high-income countries, showing higher levels of gross domestic product (GDP) per capita (Jetter et al., 2015).

Beyond considering all those elements, we also take into account endogeneity concerns as they could represent a crucial issue when analyzing the impact of *e*-participation on shadow economy. Indeed, when informality is highly extended, countries could experience a lower citizens' participation at all levels of the economic and social life, including the access to online information and services. Moreover, confounding unobservable factors might contribute to determine the establishment and registration of a legal business entity with links to access the required online forms.

both variables and affect their relationship. To address these issues, we adopt an instrumental variables (IVs) approach that uses external exogenous variables to identify causal relationship between shadow economy and e-participation. As external instruments we used the number of distinct, publicly-trusted transport layer security/secure sockets layer (TLS/SSL) certificates and the international internet bandwidth per internet user, assuming that they determine the quality and the capacity of online connections necessary to guarantee citizens' e-participation (Howard and Mazaheri, 2009). We first use these instrumental variables to identify the causal relationship. They are exogenous as they involve the security of the Internet connection and the contracted capacity between countries to have international connections for the transmission of Internet traffic, contrary to other instruments based on individuals using ICTs or subscriptions to broadband that appear to be significantly correlated to shadow economy (Elgin, 2013).

Our empirical analysis shows that *e*-participation significantly contributes to reduce the size of shadow economy and the results are robust to different specifications and to the use of alternative definitions of the dependent variable. This main finding is in line with a general argument according to which digital government and related tools can create significant benefits for citizens, governments and businesses around the world (Jaeger and Thompson, 2003; Akman et al., 2005; Chadwick, 2006; Blix, 2017), including the chance to shrink the diffusion of informal and illegal economic activities. The main results hold when we focus on the role played by both the economic development and the presence of democratic institutions possibly affecting the investigated relationship.

The rest of the paper is articulated as follows. Section 2 describes the theoretical background and discusses the testable hypotheses, after reviewing the related literature. Section 3 presents data and the empirical strategy. Section 4 provides the IVs estimation results and some robustness checks. Section 5 focuses on the role played by the economic development and democratic institutions for the investigated relationship. Section 6 briefly concludes.

2 The theoretical background and related literature

The attempts of governmental policies aimed at curbing the extent of the shadow economy involve different public domains such as the promotion of economic growth and financial development, the strengthening of institutional quality and regulatory issues, and the maintenance of political stability and democratic structures as pointed out by the previous literature (Dreher et al., 2009; Feld and Schneider, 2010; Blackburn et al., 2012; Teobaldelli and Schneider, 2013; Elbahnasawy et al., 2016; Goel and Nelson, 2016).

Among the mechanisms through which government could affect the economic activities in the shadow, a special attention has been paid to the tax regulation and tax compliance. In particular, regulatory reforms are likely to make the tax system more efficient, flexible, and simple (OECD, 1997). Nowadays, the role of information technology becomes an important tool for achieving the goal of better regulation, diminishing manual burdens via simplification of procedures and data-sharing (OECD, 2007). Therefore, adopting an *e-tax* system that includes *e-filing* and *e-payment* systems might increase tax compliance, reduce tax evasion and, ultimately, shrink the size of illegal economic activities. In this regard, recent studies provide support to this argument finding that the introduction of the *e-tax* system, as part of *e-government* implementation, increases enterprises' tax compliance (Night and Bananuka, 2019) and facilitates taxpayers' income tax declarations and payments (Uyar et al., 2021). More generally, Veiga and Rohman (2017) report that the implementation of *e-government* tools allows reducing the administrative burden costs, reduce tax evasion, and allow citizens to act as whistleblowers. All these actions can contribute to lower the size of the informal activities.

Generally speaking, higher interaction and communication between private and public agents can stimulate and enforce the formalization of business activities by relying on innovative approaches developed to compliance management and to achieve better control of cash transactions (Awasthi and Engelschalk, 2018). Moreover, accessing taxpayer data and matching information from various public and private online sources could help governments in limiting the shadow

economy.

Another way through which government could favour the activities in the formal sector *versus* the informal one is by increasing accountability and transparency of public organizations and their agents. In this framework, digitalization can play a relevant role as *e-government* tools work as an essential component in the modernization of any tier of government, functioning as a means to enhance good governance, and thus making the public sector more efficient and effective (Porumbescu, 2016; Pérez-Morote et al., 2020). By ensuring simplification and reducing complexity, successful *e-government* initiatives might meet the expectations of citizens/taxpayers, businesses and private organizations on increasing government transparency, accountability, and efficiency that finally leads to a reduction in the shadow economy.

Our work is related to the recent strand of literature investigating the impact of digital government on economic outcomes and, particularly, on illegal activities, corruption and informal economy. For instance, Shim and Eom (2008) show that *e-government* has a consistently positive impact in reducing corruption and promoting good governance by enhancing relationships with citizens and by more effectively controlling and monitoring employees' behaviors. In a similar fashion, Andersen (2009) estimates the impact of *e-government* on the control of corruption finding a positive and economically interesting effect of the former on the latter for 149 countries fixing two time-points (i.e. 1996 and 2006). More recently, Nam (2018) finds that *e-government* service maturity has a significant influence on controlling corruption in a cross-country perspective. However, disparities in political, economic, and cultural conditions across countries influence the variation in the impact of *e-government* on corruption control.

Overall, the concept of *e-government* encompasses several dimensions reflecting different initiatives being implemented across countries to achieve widespread themes such as transparency, performance, accountability, and participation. Concerning the latter, research into the phenomenon of electronic participation, or *e-participation*, is relatively new, especially from a theoretical point of view (Susha and Grönlund, 2012). We contribute to the previous literature on the related topic by focusing on a specific behavioural aspect of the government's digitalization

reforms, such as the citizens' online participation and their interaction with the public administration being able to positively affect the economic life and enhance legal activities within the country.

2.1 Shadow economy and *e*-participation: the testable hypotheses

Given the aforementioned arguments developed by the previous literature on the relationship between *e*-government and shadow economy, we propose the following hypothesis:

H1: Digitalization of government services and *e*-participation initiatives should reduce the shadow economy, *ceteris paribus*.

The intuition is that due to its truly interactive nature for both businesses and individuals, online participation could enhance public accountability as well as the possibility for citizens to become active contributors to public policy (Thomas and Streib, 2003; Irvin and Stansbury, 2004). Accordingly, individuals could prefer to work honestly and avoid the engagement in illegal activities. As for firms, increasing online participation can stimulate the development of new products, services and markets, and overcome the barrier related to high administrative costs for an effective access to policy information (West, 2004; Lee et al., 2011; Rowley, 2011), leading them to operate into the formal sector.

In fact, all *e*-participation dimensions could positively affect the individuals' behaviour against informal and illegal activities by enhancing active citizenship and creating a more collaborative environment between governments, citizens, and businesses (Lironi, 2016; Drobiazgiewicz, 2018). In this context, individuals and firms could be more prone to operating within the law, having also new possibilities to communicate their preferences and actively engage in the decision-making process. The new relationships in online interactions between public administrations and private sectors could also contribute to creating new business opportunities within the formal sector, so reducing the size of shadow economy.

From a more general theoretical perspective, economic and political rules, being defined as formal institutions (Feige, 1990), might be not neutral but able to stimulate or hinder the economic development process and, in turn, the spread of underground and informal sectors. Accordingly, the investigated relationship might interact with the level of economic development given that the effect of online tools and *e*-participation initiatives on informal economy is potentially heterogeneous in developing and developed countries (Elgin, 2013). There could be a role of country's income level in affecting such relationship since if countries are, for instance, sufficiently poor, individuals face limited job and income opportunities in the (productive) formal sector, even in presence of enhanced citizens' online participation. At the same time, richer countries typically experience a better allocation of resources within the economy (La Porta and Shleifer, 2014), also favouring the provision of high-quality online services and the expansion of official labour supply via web instruments and platforms. In this context, richer countries could also benefit from higher productivity in the formal sector due to digital reforms and *e*-participation initiatives and, finally, face smaller informal sectors. However, a perverse effect might also arise given that the benefits of increasing online tools and interactions could be exploited by private agents (i.e. individuals and firms) to maximize their utility by resorting to the informal sector, where goods and services could be obtained at more convenient economic conditions.

To better explore this channel, we analyse the effect of *e*-participation on informal economy conditional on the level of economic development across countries according to the following hypothesis:

H2: The extent of H1 could depend on countries' income level.

Another factor potentially influencing the investigated relationship is the political environment and, more precisely, the presence of democratic institutions that could affect the governments' ability to detect informal production and their incentive to limit the diffusion of under-

ground activities. As shown by Elbahnasawy et al. (2016), more democratic political systems are associated with a smaller informal economy for a sample of 161 countries over the period 1950–2009, but only if the former guarantee the absence of political instability. Supporting this argument, Goel and Nelson (2016) find that greater democracy reduces shadow economy in developed nations only, using a large sample of developing and developed countries for a cross-sectional analysis. Nam (2018), in turn, finds that affluent democracies have also been found to control corruption more effectively through *e*-government initiatives than other countries.

Looking at our case, the concept of *e*-participation is something new and sometimes included into the digital democracy framework, i.e. as a part of the *e*-democracy issue. However, the latter is less pervasive and more focused on offering greater electronic community access to political processes and policy choices instead of providing citizens with information about public services as specifically made by the *e*-participation tools (Chadwick, 2009; Lee et al., 2011; Meier and Terán, 2012). Insofar, a more comprehensive approach is needed and, accordingly, our analysis extends the importance of democratic institutions in explaining the *e*-participation-informality link across countries of the globe by testing the following hypothesis:

H3: The extent of H1 could depend on countries' democratic institutions at work.

3 The empirical strategy

3.1 Data and main variables

We investigate the nexus between shadow economy and *e*-participation on a sample of 149 countries over the period 2003–2015. The full list of countries used in the empirical analysis is reported in Table 1.

Shadow economy data used in this paper are based on the estimates provided by Medina and Schneider (2017). In detail, the shadow economy series cover all market-based legal production

of goods and services that are deliberately hidden from public authorities: to avoid payment of income, value added or other taxes; to avoid payment of social security contributions; having to meet certain legal labour market standards (such as minimum wages, maximum working hours, safety standards); complying with certain administrative procedures, such as completing statistical questionnaires or administrative forms. The approach used is based on the theory of unobserved variables, which considers multiple causes and indicators of the phenomenon to be measured. In detail, it explicitly considers multiple causes leading to the existence and growth of the shadow economy as well as the multiple effects of the shadow economy over time.

A Multiple Indicators Multiple Causes (MIMIC) model - a Structural Equation Model (SEM) with one latent variable - is used for estimating the size of shadow economy in many countries (Buehn and Schneider, 2012; Dybka et al., 2019). The MIMIC approach belongs to the indirect macromethods for measuring shadow economy and it is suitable to compare the sizes of shadow economies across many countries or periods of time as in our case.³ This approach also avoids to rely only on one indicator of the effects of the informal economy, as the effects of the informal economy likely impact production, the labor market, and the money market, among others, so its full effect might not be adequately captured by a single indicator.

The e-participation indicator is provided by the United Nations (2016). It combines three dimensions: i) e-information sharing that means to provide information by governments to citizens; ii) e-consultation that means interaction with stakeholders; iii) e-decision-making that refers to the engagement in decision-making processes. In short, each one includes some forms of interaction among governments, citizens and stakeholders. The United Nation definition is general enough as it captures the usage of polls, surveys, blogs, newsgroups and even social networks, beside other interactive platforms of communication, to facilitate engagement. Overall, the index outlines whether, and to what extent, different countries are using online tools to promote interaction mechanisms between citizens and the government and among citizens as well,

³Other possibilities for getting shadow economy series concern the use of direct methods, which are based on direct micro-level observations such as income audits or surveys. This approach is more useful to get detailed information on the structure of the shadow economy across different sectors, regions, enterprises and individuals. For further details see Putnigš and Sauka (2015).

for the benefit of all. In a cross-country perspective, as that in our study, the index attempts to capture the e-participation performance of counties relative to one another at a particular point in time.

[Insert Table 1]

3.2 The baseline model

The panel data approach is used to assess the effects of e-participation on shadow economy. The empirical model specification is represented by Equation (1), where the dependent variable $Shadow_{i,t}$ corresponds to the shadow economy as a percentage of official GDP in country i in year t as provided by Medina and Schneider (2017) and described above; $Epart$ is the key-regressor of e-participation, and $x'_{i,t}$ is a $K \times N$ matrix of control variables. The model also includes country fixed-effects $\mu_{i,t}$ to remove effects due to unobserved country-level heterogeneity and year dummies τ to account for time varying shocks. An intercept α and error term ϵ are also included in Equation (1).

$$Shadow_{i,t} = \alpha + \delta Epart_{i,t} + x'_{i,t}\beta + \tau_t + \mu_{i,t} + \epsilon_{i,t} \quad (1)$$

To better analyze the relationship between shadow economy and e-participation, and to fulfill as best as possible the *ceteris paribus* conditions, we use some control variables capturing demographics, socio-economic and institutional dimensions as done by previous studies (Frey and Weck-Hanneman, 1984; Schneider and Enste, 2000; Gerxhani, 2004; Teobaldelli and Schneider, 2013; Elgin and Oyvat, 2013; Elbahnasawy, 2021): the population density (*density*); the share of female over the total population (*female*); the share of 65 years old and older over the total population to account for either older workers and even non-working age group (*pop65*); the annual growth rate of real GDP per-capita (*GDPcgr*); the KOF index of actual economic flows (*econflow*) that includes data on trade, foreign direct and portfolio investment; the KOF index

of social globalization (*socglob*) that includes interpersonal, informational and cultural globalization; the inflation rate based on annual consumer prices (*infl*); the degree of countries' fiscal freedom (*fiscfree*), measured through a composite index that reflects the weight of marginal tax rates on both personal and corporate incomes, where higher values denote high fiscal freedom; an index of business (*busfree*) freedom, which measures the stringency of regulation in the business sector; an index for the rule of law (*rulelaw*) measuring the extent to which agents have confidence in and abide by the rules of society, where higher values indicate that citizens perceive greater compliance with the rules; an index of judicial independence, measured by the degree to which courts are not subject to undue influence from other branches of government, especially the executive (*judind*). Variables definition, descriptive statistics, and data sources are reported in Table 2. The correlation matrix among explanatory variables is reported in Table A.1 in the Appendix.

[Insert Table 2]

3.3 Identification issues

In estimating Equation (1), potential endogeneity issues, including reverse causality between *Shadow* and *Epart*, could arise. As for the latter, it should be noted that, however, some previous studies provide robust evidence on the causal relationship between the more general concept of *e-government* and illegal activities as proxied by corruption measures, which conclusively runs from *e-government* to corruption, but not the other way round. In our case, individuals may have fewer incentives to participate in social and economic life through official online tools when the spread of the informal sector is high and they are used to operate in the shadow. Moreover, people who work in the underground have fewer restrictions on working hours (Frey and Schneider, 2000) and devoted more time to provide for informal jobs, thus reducing leisure time even for online participation activities (Buehn et al., 2009).

To address endogeneity issues, Equation (1) is estimated by using the two-stage least squares (2SLS) method. Two external variables are used to instrument *Epart*: the former is the inter-

national internet bandwidth per internet user measured in bit per second (*bandwidth*); the latter is the number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Server Survey (*server*) named as “Secure Internet Servers per 1 million people”. They are both provided by the World Bank through the World Development Indicators (WDI) dataset. The instrumental variable *bandwidth* is also integrated with data provided by International Telecommunication Union. They are assumed to affect the quality and the capacity of the internet connections through which citizens actively participate in online government consultations and use related services. More generally, they belong to the various technologies that form the infrastructural basis of modern information societies, being also able to positively affect the global digital divide as highlighted by Howard and Mazaheri (2009).

In detail, international internet bandwidth captures the ability to create international connections between countries for the transmission of internet traffic. Thus, improving it would boost the quality of internet connections, making it easier for citizens to participate and use electronic government related services without a face-to-face interactions. Accordingly, we expect a positive relationship between *bandwidth* and *Epart*.

At the same time, citizens’ e-participation requires secure internet connections for the protection and integrity of personal data. Those issues are captured by the second instrument that is *server*. Indeed, technical infrastructures must be implemented by governments to ensure security in the transfer of official certificates (e.g., passport, driving license) to citizens and in the protection of citizens’ personal data transfer to the government from any attacks from hackers (Yang et al., 2019). These could be the basis for increasing citizens’ participation in online government consultations and their access to electronic services (Zissis and Dimitrios, 2011). However, strengthening the security in internet connections could lead to some privacy violations given that the use of more secure online tools could make citizens more easily traceable and subject to greater control by governmental authorities with the collection of sensitive information. This could, actually, result in greater citizens’ concerns in relying on government web portals, so making online participation less attractive. Moreover, increasing security inter-

net connections might require more complex registration and authentication procedures, which could be too complicated and not user-friendly for citizens, thus also discouraging them to actively *e-participate*. Overall, mixed effects may be expected between *server* and *Epart*, preserving the validity of the instrument for our potentially endogenous variable.

4 Baseline results

In this section, we present our main results based on the estimation of Equation (1) that is used to test H1. Table 3 shows our main results based on the standard 2SLS approach. In columns (1)–(3), we use a single instrument (i.e. *server*) for our endogenous variable having a *just identified* model, while in columns (4)–(6) a set of instruments is considered (i.e. *server* and *bandwidth*), thus making the model *over-identified* and getting more than just one way to compute a consistent estimator for the parameters. For each block, we present different specifications with a common group of socio-economic, demographic, and institutional variables as controls that could affect the size of shadow economy across countries. Country and year fixed-effect are always included. Standard errors are robust to heteroskedasticity.

We find a persistent and robust effect of *Epart* on *Shadow*. The coefficients on *Epart* is negative and statistically significant across specifications and identification strategies. This means that a higher level of citizens' *e-participation* – which goes beyond just providing feedback and comment – contributes to shrink the size of shadow economy, by favoring a more cooperative environment between citizens and governments, strengthening the partnership between the private and the public sector, reducing the administrative costs and increasing public administration transparency. All of these virtuous aspects might induce citizens to operate in the formal sector, avoiding the engagement in informal and illegal activities. Hence, H1 is verified.

[Insert Table 3]

In terms of magnitude, shadow economy decreases significantly by about -0.221 points in the most comprehensive specification of column (3), when citizens are involved in online con-

sultations, services, information and active decision-making process. The magnitude of the estimated coefficient of *Epart* is slightly reduced to -0.186 points in column (6), where two instruments are used in the first-stage regression.

On the econometric side, the soundness of the 2SLS estimates is confirmed by the first-stage regressions where the Kleibergen-Paap Wald *F*-statistic is always above to the threshold of 10, as reported at the bottom of Table 3. As suggested by the literature on weak instruments (Staiger and Stock, 1997; Stock and Yogo, 2002), we reject the hypothesis of weak instruments for our IVs estimates. We can also reject the null-hypothesis of under-identification at the 1% level of significance as proved by (the *p*-value) of the Kleibergen-Paap LM statistic (Kleibergen and Paap, 2006). Finally, the Hansen *J* test (Hansen, 1982) of over-identifying restrictions does not reject the null hypothesis meaning that the excluded instruments are appropriately independent of the error process for columns (4)–(6), where two instruments are used. The coefficients of the instruments in the first-stage are both statistically significant for *Epart*.⁴

By using exogenous external instruments, we are able to well-identify the correlation between shadow economy and e-participation, providing more robust results with respect to previous studies adopting similar variables (Veiga and Rohman, 2017; Elbahnasawy, 2021). Moreover, our main results are in line with some previous findings, stressing the role played by information and communication technologies in limiting the spread of shadow economy and illegal activities (Shim and Eom, 2008; Andersen, 2009; Elgin, 2013; Uyar et al., 2021).

Among the control variables, an economic boom, reflected by positive GDP per capita growth rates, leads to a significant contraction of the shadow economy in favor of the official market as proved by the coefficient on *GDPcgr* across specifications. On the other hand, during economic recession normally hitting the demand of legal goods and services, people likely look for job activities in the informal sector to compensate for the loss of income in the formal one. The same holds for the openness degree to international trade and investment (*econflow*) and social globalization (*socglob*) since higher levels of both can lead many small and medium

⁴Estimates of the first-stage regressions are not reported for the sake of space and available upon request.

firms as well individuals to operate in the official sector, so decreasing the size of underground economy (Berdiev et al., 2018).

Among the demographics, the share of female population (*female*) has a negative and highly statistically significant coefficient, so reducing *Shadow*. This could be explained by a lower participation rate of women in informal economic activities as documented by Bonnet et al. (2019), highlighting that informality is mostly a greater source of employment for men than for women around the world. On the other hand, a higher share of elderly population contributes to increase the size of shadow economy possibly because the unofficial sector can represent a social buffer for older workers with lower opportunities in the official labor market as depicted by the positive and highly statistically significant coefficient on *pop65* across columns. In a similar fashion, higher population density (*density*) seems to increase the size of shadow economy, even though its coefficient is slightly statistically significant (at 10% level) and only in columns (4)–(6). The uncertainty about future prices and their actual trend as proxied by the variable *infl* does not seem to affect people's decisions to undertake or not informal activities (Elbahnasawy, 2014).

Relaxing regulation in the business sector (*busfree*) does not impact on the size of *Shadow*, whereas increasing rule of law (*rulelaw*) reduces the shadow economy given that citizens would perceive greater efficiency of the public sector leading to more compliance with the rules in their country and, thus, limiting their action in the shadow (Dreher et al., 2009; Teobaldelli and Schneider, 2013). On the other hand, the judicial independence index (*judind*) is positively and significantly correlated with *Shadow*. Even though this could be somehow unexpected, it might be indirectly explained by the lower popularity and confidence that citizens usually have in the judiciary courts and, more generally, in the legal system in some countries, especially when those are central and national institutions (Torgler et al., 2010; Askvik et al., 2011). Accordingly, this kind of distrust could contribute to increase the size of underground economy (Dreher and Schneider, 2010; Feld and Schneider, 2010; Capasso and Jappelli, 2013).

4.1 Robustness checks

We test the soundness of our results using a different definition of the dependent variable. In Equation 1, we replace the dependent variable with the indicator *Shadow2*, as provided by Elgin and Oztunali (2012), that is based on the calibration of a two–sector dynamic general equilibrium (DGE) model to match macroeconomic data and then solve for the size of the informal economy.⁵

In detail, they use the DGE models where households allocate labor between formal and informal sectors within each period with possible changes in this allocation changes over time. This methods allows for comprehensive country–year coverage (Ihrig and Moe, 2004; Loayza, 2016). It is worth noting that the correlation between the two dependent variables calculated over the whole period is very high (about 0.94) and statistically significant (at 1% level).

Results are reported in Table 4 for all the specifications included in Table 3. Not surprisingly, they are confirmed for each set of regressions. In detail, the coefficient on *Epart* is negative and statistically significant with a lower magnitude with respect to findings in Table 3.

[Insert Table 4]

5 The interaction models

In this section, we directly test H2 and H3 (as described in sub-section 2.1) by exploiting the huge heterogeneity in our sample regarding income levels and the presence of democratic institutions at work. Accordingly, we propose two interaction models to re–estimate Equation (1) conditional on the role of economic development on the one hand, and on the presence of democracy on the other hand. The interaction models and the related results are reported and discussed in the following sub–sections.

⁵The extended series until year 2016 (included) was courtesy of the authors who have shared their data with us. The full list of countries is reported in Table 1.

5.1 The role of economic development

To test H2, we estimate Equation (2) where the key-variable $Epart$ is interacted with the dummy variable $UMHincome$.

$$\begin{aligned} Shadow_{i,t} = & \alpha + \gamma_1 Epart_{i,t} + \gamma_2 UMHincome_{i,t} + \gamma_3 Epart_{i,t} \times UMHincome_{i,t} + \\ & + x'_{i,t} \beta + \tau_t + \mu_{i,t} + \epsilon_{i,t} \end{aligned} \quad (2)$$

$UMHincome$ is computed considering the income classification provided by the World Bank (WB) that is based on GNI per capita in current USD of the previous year and then coded in four categories yearly assigned to each country: *low income*; *lower middle income*; *upper middle income*; *high income*. In detail, we build our dummy assuming value 1 for the *high* and *upper middle* income countries and zero otherwise (i.e. for *low* and *lower middle* income countries).

Equation (2) is estimated by the 2SLS approach using *server* and *bandwidth* as instruments in order to have the model *over-identified*. Table 5 shows estimation results, where columns (1)–(3) refer to estimates with $Shadow$ as the dependent variable and columns (4)–(6) refer to estimates with $Shadow2$.⁶ The instruments perform well according to Kleibergen–Paap tests statistics. The Hansen J test suggests that the two instruments are valid overall.

Some regularities emerge. In particular, the coefficient on $Epart$ is negative and highly statistically significant across specifications and the same occurs for the coefficient on $UMHincome$ meaning that countries with higher income levels experience a lower size of shadow economy. The overall state of an economy, including the level of economic prosperity, might reduce the incentives to operate in the shadow (Gerxhani, 2004; Autio and Fu, 2015). As countries develop, informality becomes less important as it can be better addressed in high-income countries than

⁶Estimates are also performed using the 2SLS approach based on one instrument, i.e. *server*, only and the main results are confirmed. Results are available upon request.

in low-income ones (La Porta and Shleifer, 2014). For instance, strengthened checks and balances against illegal activities could be more easily implemented in wealthier nations where, at the same time, greater job and income opportunities in the formal sector may arise, thus making shadow operations relatively less attractive (Goel and Nelson, 2016).

On the other hand, the interaction term between $Epart$ and $UMHincome$ has a positive and statistically significant coefficient. This would suggest that the joint effect of the two variables might contribute to increase - instead of decrease - the shadow economy. The fact that increasing e -participation tools in high income countries could have a perverse effect on the spread of informal economic activities could be explained by a different role and use of internet in developed *versus* developing societies (Indjikian and Siegel, 2005). In more developed societies, individuals and firms are likely to have more competences and skills to access and exploit virtual resources that can be used, actually, to find the best strategy to avoid tax payments, escape the legality, reduce the probability of being caught and penalized and, ultimately, act in the shadow.

However, the overall effect of $Epart$ on $Shadow$ (and on $Shadow2$) remains negative and statistically significant as proved by the estimated coefficient in Table 5 obtained by summing $\hat{\gamma}_1$ and $\hat{\gamma}_3$ when $UMHincome$ is equal to 1, but with a lower magnitude than before. Overall, H2 is verified even for high income countries, where e -participation initiatives could be also used in an unexpected way. Our result is consistent with the findings by Elgin (2013) showing a negative correlation between internet usage and informal activities for a panel data of 152 countries over the 1999-2007 period, where such relationship strongly interacts with GDP per capita, i.e. as GDP per capita increases, the negative correlation is lower.

[Insert Table 5]

5.2 The role of democratic institutions

We investigate if democracy makes a difference for the impact of e -participation on shadow economy by estimating Equation (3) that includes the interaction term between $Epart$ and dem among the regressors. The variable dem assumes value 1 if the political regime of a country

is defined democratic along some dimensions (such as representative government, fundamental rights, checks on government, impartial administration, participatory engagement) and zero otherwise (i.e., for countries with autocratic or hybrid regimes). In detail, we derive information on democratic regimes from the Global State of Democracy (GSoD) indices dataset released by the International Institute for Democracy and Electoral Assistance.⁷

$$\begin{aligned} Shadow_{i,t} = & \alpha + \phi_1 Epart_{i,t} + \phi_2 dem_{i,t} + \phi_3 Epart_{i,t} \times dem_{i,t} + \\ & + x'_{i,t} \beta + \tau_t + \mu_{i,t} + \epsilon_{i,t} \end{aligned} \quad (3)$$

The main results are displayed on Table 6. As before, estimates are performed with the 2SLS approach by using the two external variables, *server* and *bandwidth*, to instrument our endogenous variable.⁸

On the econometric side, the soundness of estimates is confirmed by the Hansen *J* test of overidentifying restrictions across specifications, suggesting that the excluded instruments are valid overall. The Kleibergen–Paap tests statistics also confirm that the instruments perform well.

Concerning democracy, the coefficient on *dem* is negative and highly significant across specifications. Hence, more democratic settings contribute to shrink the spread of shadow economy. As the development of the informal sector can be seen as a failure of public democratic institutions in adequately providing public goods and services for citizens, the latter can react by choosing the “exit option” provided by the shadow (Schneider and Enste, 2013; Teobaldelli and Schneider, 2013).

In turn, the coefficient on the interaction term between *Epart* and *dem* is positive and statistically significant. This result is, actually, not surprising since it is consistent with previous

⁷We used Version 5.1 of the GSoD Indices data set available at <https://www.idea.int/gsod-indices/dataset-resources>.

⁸Estimates are also performed by using only *server* as instrument in the first-stage regression. The main results are confirmed and results are available upon request.

findings in Table 5, given that democratic nations usually match richer countries (some exceptions could occur for autocracies that are the major fossil–fuel exporters). Hence, giving more access to *e*-participation tools in more democratic settings could limit the virtuous effect of *Epart* on *Shadow* for the same reasons occurring in more developed and wealthier societies as described above.

Moving from the single interaction term to the overall effect of *Epart* on *Shadow* when *dem* is equal to 1, we note that it remains negative and statistically significant as obtained by the sum of estimated coefficients $\hat{\phi}_1$ and $\hat{\phi}_3$. Hence, a complementarity effect between the extent of democracy and the *e*-participation initiatives could arise to reduce the shadow economy since the latter could allow citizens expressing their freedom of legal association and formal business in more democratic settings (Mulligan et al., 2004).

[Insert Table 6]

6 Conclusions

As recently highlighted by the OECD (2017), policy objectives for the development of society and digital economy are a high priority across all countries. Strengthening *e*-government services and further developing telecommunication infrastructure rank among the highest priorities nowadays as governments' modernization strategies to create public value. In this context, credible and affordable information is essential for maintaining an open dialogue between decision–makers and the civil society in the modern states. The policy participation process is one example and, in the digital era, the electronic participation by citizens can play a crucial role. The outcomes of this application are considerable: open communication, enhanced transparency, increased social inclusion, democratic enrichment and superior governance.

In our contribution, we show that *e*-participation of voters/taxpayers can also reduce the size of shadow economy, *ceteris paribus*, revealing that the former could be a useful instrument in anti–informality efforts, which needs to be recognized by policy–makers. This goes in line

with a more general view according to which digital government can create significant benefits for governmental actors, non-governmental organizations, business community, citizens associations and individuals, supporting the online production of and access to data, services and content. In the end, open government data policies can increase interactions between individuals and public authorities' websites with positive effects on economic outcomes, including the participation in the formal sector.

A crucial element remains how governments can increase the private sector's incentive to participate in the formal economy and one way could be represented by the new mode of citizen-to-government contact founded in information and communications technologies (Morgeson III et al., 2011), including the *e*-participation dimension as our work has highlighted. This likely calls for a more general and stable *e*-government-citizen trust relationship, which should be further investigated in future research.

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Table 1: List of countries in the sample

1	Albania	56	Georgia	111	Peru
2	Algeria	57	Germany	112	Philippines
3	Angola	58	Ghana	113	Poland
4	Argentina	59	Greece	114	Portugal
5	Armenia	60	Guatemala	115	Qatar
6	Australia	61	Guinea	116	Republic of Korea
7	Austria	62	Guinea-Bissau	117	Republic of Moldova
8	Azerbaijan	63	Honduras	118	Romania
9	Bahamas	64	Hungary	119	Russian Federation
10	Bahrain	65	Iceland	120	Rwanda
11	Bangladesh	66	India	121	Saint Lucia (*)
12	Barbados (*)	67	Indonesia	122	Saudi Arabia
13	Belarus	68	Iran	123	Senegal
14	Belgium	69	Ireland	124	Sierra Leone
15	Belize	70	Israel	125	Singapore
16	Benin	71	Italy	126	Slovakia
17	Bhutan	72	Jamaica	127	Slovenia
18	Bolivia	73	Japan	128	South Africa
19	Bosnia and Herzegovina	74	Jordan	129	Spain
20	Botswana	75	Kazakhstan	130	Sri Lanka
21	Brazil	76	Kenya	131	St. Vincent and the Grenadines (*)
22	Brunei Darussalam	77	Kuwait	132	Sudan (Former) (*)
23	Bulgaria	78	Kyrgyzstan	133	Suriname
24	Burkina Faso	79	Lao People's DR	134	Swaziland
25	Burundi	80	Latvia	135	Sweden
26	Cabo Verde	81	Lebanon	136	Switzerland
27	Cambodia	82	Lesotho	137	Syrian Arab Republic
28	Cameroon	83	Liberia	138	TFYR of Macedonia (*)
29	Canada	84	Lithuania	139	Tajikistan
30	Central African Republic	85	Luxembourg	140	Thailand
31	Chad	86	Madagascar	141	Togo
32	Chile	87	Malawi	142	Trinidad and Tobago
33	China	88	Malaysia	143	Tunisia
34	Colombia	89	Maldives	144	Turkey
35	Comoros	90	Mali	145	U.R. of Tanzania
36	Congo	91	Malta	146	Uganda
37	Costa Rica	92	Mauritania	147	Ukraine
38	Croatia	93	Mauritius	148	United Kingdom
39	Cyprus	94	Mexico	149	United States
40	Czech Republic	95	Mongolia	150	Uruguay
41	Côte d'Ivoire	96	Morocco	151	Venezuela
42	D.R. of the Congo	97	Mozambique	152	Vietnam
43	Denmark	98	Myanmar	153	Yemen
44	Dominican Republic	99	Namibia	154	Zambia
45	Ecuador	100	Nepal	155	Zimbabwe
46	Egypt	101	Netherlands		
47	El Salvador	102	New Zealand		
48	Equatorial Guinea	103	Nicaragua		
49	Estonia	104	Niger		
50	Ethiopia	105	Nigeria		
51	Fiji	106	Norway		
52	Finland	107	Oman		
53	France	108	Pakistan		
54	Gabon	109	Panama (*)		
55	Gambia	110	Paraguay		

Notes: Countries are included in both Medina and Schneider's (2017) and Elgin and Oztuanli's (2012) sample. Countries marked with (*) are included only in Elgin and Oztuanli's (2012) sample.

Table 2: Descriptive statistics, variable definition and data source

Variable	Obs.	Mean	Std. Dev.	Min	Max	Variable definition	Source
Shadow	1,788	0.289	0.124	0.062	0.690	All legal economic activities hidden from official authorities for tax and social security burden, regulatory, and institutional reasons (% of official GDP).	Medina and Schneider (2017)
Shadow2	1,851	0.305	0.119	0.079	0.668	Informal economy estimates based on a two-sector dynamic general equilibrium model (% of official GDP).	Elgin and Oztunali (2012)*
Epart	1,788	0.280	0.255	0.000	1.000	It measures the use of online services to facilitate provision of information by government to citizens; interaction with stakeholders and engagement in decision-making processes.	United Nations (2016)
density	1,788	0.192	0.625	0.002	7.807	Population (1000) on total surface area.	WDI
female	1,788	50.098	2.827	23.927	54.209	Female population (% of total).	WDI
pop65	1,788	0.082	0.056	0.010	0.260	Population ages 65 and above (% of total).	WDI
GDPcgr	1,788	0.026	0.042	-0.368	0.330	GDP per capita growth (annual %).	WDI
infl	1,788	0.055	0.063	-0.358	0.982	Inflation, consumer prices (annual %).	WDI
econflow	1,788	0.635	0.192	0.108	1.000	Actual flow index ranges from 0 (low) to 100 (high).	Dreher (2006); Savina et al. (2019)
socglob	1,788	0.518	0.230	0.106	0.933	Social globalization index ranges from 0 (low) to 100 (high).	Dreher (2006); Savina et al. (2019)
fiscree	1,759	0.752	0.128	0.298	0.999	Fiscal freedom index ranges between 0 (low) and 100 (high).	HF(2017)
busfree	1,759	0.658	0.156	0.200	1.000	Business freedom index ranges from 0 (low) to 100 (high).	HF(2017)
rulelaw	1,788	0.028	0.986	-1.823	2.100	Rule of law index ranges from 0 (low) to 100 (high).	Kaufmann et al. (2010)
judind	1,676	0.536	0.202	0.083	1.000	Judicial independence index ranges from 0 (lowest independence) to 1 (highest independence).	IIDEA(2020)
UMH income	1,788	0.532	0.499	0.000	1.000	Dummy equals to 1 if the country is an upper-middle income or high-income and 0 otherwise.	Authors' elaboration on WDI
dem	1,676	0.651	0.477	0.000	1.000	Dummy equals to 1 if the regime statute of the country is democracy and 0 otherwise.	Authors' elaboration on IIDEA(2020)
server	1,788	303.800	847.429	0.000	9728.852	The number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Sever Survey (secure internet servers per 1 million people).	WDI
bandwidth	1,608	207.696	3450.914	0.073	94289.810	International internet bandwidth bit/s per internet user.	ITU (2010, 2012), WDI

Legend: HF(2017)= The Heritage Foundation (2017). Index of Economic Freedom; IIDEA(2020)=International Institute for Democracy and Electoral Assistance, The Global State of Democracy Indices-Version 5.1 (2020); ITU= International Telecommunication Union; WDI= World Development Indicators, The World Bank Washington DC, 2016; *Data until year 2016 was courtesy of the authors.

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Table 3: The baseline results (the Medina & Schneider index)

	(1)	(2)	(3)	(4)	(5)	(6)
Epart	-0.207*** (-3.81)	-0.215*** (-3.93)	-0.221*** (-4.24)	-0.176*** (-4.18)	-0.182*** (-4.26)	-0.186*** (-4.46)
density	0.022 (1.19)	0.024 (1.22)	0.029 (1.44)	0.034* (1.83)	0.036* (1.84)	0.037* (1.94)
female	-0.009*** (-4.10)	-0.010*** (-4.34)	-0.012*** (-5.40)	-0.009*** (-4.31)	-0.009*** (-4.31)	-0.010*** (-5.45)
GDPcgr	-0.134*** (-5.40)	-0.144*** (-5.66)	-0.146*** (-5.95)	-0.145*** (-5.92)	-0.157*** (-6.07)	-0.152*** (-6.09)
econflow	-0.041*** (-2.99)	-0.046*** (-3.09)	-0.048*** (-3.08)	-0.028** (-2.01)	-0.034** (-2.34)	-0.033** (-2.21)
infl	0.026 (1.08)	0.005 (0.18)	-0.006 (-0.24)	0.028 (1.29)	-0.002 (-0.09)	-0.006 (-0.26)
pop65	0.855*** (5.27)	0.823*** (4.92)	0.929*** (5.25)	0.628*** (4.19)	0.622*** (4.02)	0.746*** (4.69)
socglob	-0.071** (-2.38)	-0.063** (-2.05)	-0.059** (-1.96)	-0.055** (-1.99)	-0.054* (-1.89)	-0.050* (-1.81)
fiscfree		0.010 (0.47)	0.014 (0.68)		0.035* (1.80)	0.034* (1.80)
busfree		-0.017 (-1.05)	0.002 (0.15)		-0.005 (-0.34)	0.002 (0.16)
rulelaw			-0.054*** (-6.73)			-0.048*** (-6.09)
judind			0.168*** (5.30)			0.140*** (5.05)
Country fixed-effects	yes	yes	yes	yes	yes	yes
Year fixed-effects	yes	yes	yes	yes	yes	yes
F-test	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk LM stat. (<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk Wald F stat	15.76	16.21	17.55	11.76	11.78	12.01
Hansen J test (<i>p</i> -value)				0.129	0.134	0.142
Country No	149	149	139	140	139	133
Obs. No	1,788	1,759	1,667	1,608	1,584	1,543

Notes: The instrument used in columns (1)-(3) is the number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Server Survey (*server*); in columns (4)-(6), *server* and international internet bandwidth per internet user in bit per second (bit/s) (*bandwidth*) are used as instrumental variables. A constant term is included in each regression. *t*-value in brackets and standard errors robust to heteroscedasticity. Significant at level ***1%, **5%, *10%.

Table 4: The baseline results (the Elgin & Oztuanli index)

	(1)	(2)	(3)	(4)	(5)	(6)
Epart	-0.144*** (-3.57)	-0.134*** (-3.69)	-0.129*** (-3.82)	-0.105*** (-3.96)	-0.105*** (-3.95)	-0.104*** (-4.00)
Controls	yes	yes	yes	yes	yes	yes
Country fixed-effects	yes	yes	yes	yes	yes	yes
Year fixed-effects	yes	yes	yes	yes	yes	yes
F-test	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk LM stat. (<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk Wald F stat	13.48	14.84	16.19	11.34	11.43	11.68
Hansen J test (<i>p</i> -value)				0.152	0.161	0.161
Country No	155	154	142	146	144	136
Obs. No	1,851	1,805	1,699	1,647	1,615	1,569

Notes: The instruments used are the number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Server Survey (*server*) and international internet bandwidth (bit/s) per internet user (*bandwidth*). A constant term is included in each regression. Controls are those used in Table 3. *t*-value in brackets and standard errors robust to heteroscedasticity. Significant at level ***1%, **5%, *10%.

Table 5: The effect of e-participation on shadow economy in UM-H income countries

	Shadow			Shadow2		
	(1)	(2)	(3)	(4)	(5)	(6)
Epart	-0.287*** (-5.85)	-0.297*** (-6.07)	-0.301*** (-6.36)	-0.183*** (-5.77)	-0.182*** (-5.85)	-0.179*** (-5.80)
UMH income	-0.058*** (-6.41)	-0.059*** (-6.36)	-0.060*** (-6.50)	-0.035*** (-6.45)	-0.035*** (-6.45)	-0.035*** (-6.40)
Epart*UMH income	0.229*** (5.63)	0.238*** (5.88)	0.240*** (6.10)	0.151*** (5.70)	0.151*** (5.81)	0.148*** (5.70)
$\hat{\gamma}_1 + \hat{\gamma}_3$	-0.058*** (-4.96)	-0.059*** (-5.01)	-0.060*** (-5.38)	-0.032*** (-4.82)	-0.031*** (-4.66)	-0.031*** (-4.79)
Controls	yes	yes	yes	yes	yes	yes
Country fixed-effects	yes	yes	yes	yes	yes	yes
Year fixed-effects	yes	yes	yes	yes	yes	yes
F-test	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk LM stat. (<i>p</i> -value)	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk Wald F stat	21.98	22.52	23.04	21.46	21.97	22.59
Hansen J test (<i>p</i> -value)	0.258	0.349	0.428	0.330	0.445	0.469
Country No	140	139	133	146	144	136
Obs. No	1,608	1,584	1,543	1,647	1,615	1,569

Notes: The instruments used are the number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Server Survey (*server*) and international internet bandwidth (bit/s) per internet user (*bandwidth*). A constant term is included in each regression. Controls are those used in Table 3. *t*-value in brackets and standard errors robust to heteroscedasticity. Significant at level ***1%, **5%, *10%.

Table 6: The effect of e-participation on shadow economy in democratic countries

	Shadow			Shadow2		
	(1)	(2)	(3)	(4)	(5)	(6)
Epart	-0.344*** (-4.89)	-0.351*** (-5.03)	-0.368*** (-5.19)	-0.221*** (-5.17)	-0.219*** (-5.29)	-0.227*** (-5.30)
dem	-0.035*** (-3.39)	-0.039*** (-3.69)	-0.038*** (-3.54)	-0.027*** (-3.79)	-0.028*** (-4.08)	-0.028*** (-3.98)
Epart*dem	0.271*** (4.36)	0.279*** (4.52)	0.292*** (4.65)	0.190*** (5.01)	0.191*** (5.18)	0.198*** (5.18)
$\hat{\phi}_1 + \hat{\phi}_3$	-0.074*** (-5.83)	-0.072*** (-5.81)	-0.076*** (-6.18)	-0.031*** (-4.67)	-0.028*** (-4.41)	-0.029*** (-4.35)
Controls	yes	yes	yes	yes	yes	yes
Country fixed-effects	yes	yes	yes	yes	yes	yes
Year fixed-effects	yes	yes	yes	yes	yes	yes
F-test	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk LM stat. (p-value)	0.000	0.000	0.000	0.000	0.000	0.000
K-P rk Wald F stat	17.09	18.61	18.58	16.54	18.13	18.11
Hansen J test (p-value)	0.146	0.182	0.186	0.143	0.200	0.199
Country No	133	133	133	137	136	136
Obs. No	1,546	1,543	1,543	1,574	1,569	1,569

Notes: The instruments used are the number of distinct, publicly-trusted TLS/SSL certificates found in the Netcraft Secure Server Survey (*server*) and international internet bandwidth (bit/s) per internet user (*bandwidth*). A constant term is included in each regression. Controls are those used in Table 3. *t*-value in brackets and standard errors robust to heteroscedasticity. Significant at level ***1%, **5%, *10%.

Appendix

Table A.1: Correlation matrix, independent variables

	Epart	density	women	GDPcgr	econflow	infl	pop65	socglob	fiscfree	busfree	rulelaw	judind	UM-H income	dem
Epart	1													
density	0.188	1												
female	-0.004	-0.054	1											
GDPcgr	-0.097	0.012	0.126	1										
econflow	0.340	0.182	-0.048	-0.077	1									
infl	-0.167	-0.058	0.049	0.092	-0.231	1								
pop65	0.517	0.041	0.351	-0.033	0.435	-0.188	1							
socglob	0.579	0.177	-0.075	-0.144	0.603	-0.301	0.761	1						
fiscfree	-0.167	0.102	-0.321	0.094	-0.125	0.114	-0.375	-0.197	1					
busfree	0.532	0.209	0.020	-0.121	0.505	-0.224	0.574	0.693	-0.139	1				
rulelaw	0.560	0.185	-0.036	-0.114	0.558	-0.314	0.672	0.815	-0.328	0.758	1			
judind	0.424	-0.030	0.210	-0.086	0.387	-0.257	0.597	0.578	-0.430	0.573	0.772	1		
UMH income	0.467	0.106	-0.119	-0.168	0.545	-0.164	0.576	0.758	-0.088	0.590	0.655	0.454	1	
dem	0.301	-0.085	0.293	-0.020	0.224	-0.157	0.492	0.378	-0.243	0.343	0.472	0.671	0.309	1