



Does the economic freedom hinder the underground economy? Evidence from a cross-country analysis

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Abstract

We evaluate the impact that the economic freedom exerts on the shadow economy for a sample of 152 countries from 1995 to 2017. In order to solve endogeneity issues, we rely on an instrumental variable approach and find that a change in the economic freedom index, induced by the level of independence of financial markets from government actions, adversely affects the hidden economy. To corroborate the interpretation of our results we also show how each subcomponent of the economic freedom index explains the downward change registered in the shadow economy. Further, the negative effect is mainly found in countries characterized by a low level of democracy and strong corruption, whereas in more democratic and less corrupt countries the economic freedom positively affects the size of the shadow economy. Consistent with these findings, we also highlight that the effect of the composite indicator of economic freedom on the hidden economy is U-shaped and this relationship is exclusively driven by both business regulation and the freedom in the legal system and property rights.

Keywords Shadow economy · Economic freedom · Democracy · TSLS

JEL classification P10 · O17 · C23

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1 Introduction

The shadow economy corresponds to the legal economic and productive activities that are deliberately hidden from official authorities and that, if recorded, would contribute to GDP growth (Schneider, 2005, 2007; Schneider and Williams, 2013; Hassan and Schneider, 2016). Furthermore, it is well debated among policy-makers that a large size of these informal activities produces serious negative externalities both on the society and on the economy of each country as a whole. Indeed, there is a strong evidence that a large size of the shadow economy over GDP translates into (1) lower revenues for the public budget and, in turn, in fewer public goods; (2) higher unemployment rates and weaker working conditions; and (3) lower firm investments in research and development (Schneider, 2007; Porta and Shleifer, 2008).

The size of the shadow economy is still significant in many European countries and tends to represent a much higher percentage of the national GDP in emerging economies compared to advanced economies (Schneider, 2000, 2010; Dell'Anno and Solomon, 2014; Hassan and Schneider, 2016): it is not surprising that among the main drivers of the shadow economy a central role is played by the institutional quality, such as a weak tax enforcement and governance, corruption (Dreher and Schneider, 2010; Enste, 2010; Berdiev and Saunoris, 2018), low human capital - crucially affected by migration - and low GDP productivity (Torgler and Schneider, 2007; Porta and Shleifer, 2008).

In this paper we study the effect that a composite measure of the quality of political-economic institutions, i.e. the economic freedom, produces on the size of the shadow economy for a sample of 152 countries over the period 1995–2017. The economic freedom index is designed to measure how free people are in making their personal choices, that is to say, whether a (competitive) market economy works properly. Our results confirm Berdiev et al. (2018) conclusion that the economic freedom produces a negative effect on the shadow economy. Precisely, by taking into account unobserved time-invariant characteristics of countries and by controlling for some country features that might affect the size of the shadow economy, we find that a one standard deviation increase in the economic freedom index leads to a downward change in the hidden economy by 0.51% points.

We handle endogeneity problems relying on an instrumental variable approach. In particular, we use the independence of financial markets from government actions as an instrument for the economic freedom that is likely to be uncorrelated to other unobserved determinants of the hidden economy. In order to understand the main channels driving our results we also replicate our analysis in which we replace the aggregate measure of economic freedom with its subcomponents, i.e. (1) legal system and property rights, (2) business regulation, (3) sound money, (4) freedom to trade internationally and (5) taxation, and highlight how all of the aforementioned subcomponents, apart from freedom to trade internationally, negatively affect the size of the shadow economy.

Starting from these preliminary findings, our further step and main contribution to the existing literature is to investigate whether the impact of the economic freedom on the hidden economy is heterogeneous according to the institutional environment, here represented by the indicators of democracy and corruption. The results high-

light that in countries characterized by a level of democracy below (resp. above) the median value an improvement of the economic freedom index is helpful (resp. dangerous) in reducing the size of the shadow economy. Similarly, in countries where the corruption index is above (resp. below) its median value the economic freedom shows a negative (resp. positive) effect in reducing the size of the shadow economy.

Although the result itself is striking, it warns that when institutions work very well, viz. when the democracy index (resp. corruption index) is high enough (resp. low enough), increasing the economic freedom beyond a crucial (already high) level does not make individuals freer, but only decreases the vigilance of the central government on how individuals exercise their freedom. As a result, this may translate in a higher but less effective economic freedom (Smith, 1776) which, in turn, makes shadow economy surprisingly increase.

To corroborate the interpretation of our empirical findings we implement a bunch of robustness checks. First, we go deeper in explaining the relationship between the economic freedom and the shadow economy and by implementing the test proposed by Lind and Mehlum (2010) we find a U-shaped relation that is exclusively driven by two subcomponents of the EF indicator, i.e. business regulation and freedom in the legal system and property rights. Last but not least, we use an alternative instrument to solve the endogeneity problems affecting our empirical model, that is the central bank independence as suggested by Garriga (2016). Nothing of notes changes with respect to our main results.

The paper is structured as follows. Section 2 links the work to the literature. Section 3 describes the theoretical hypotheses, Sect. 4 is devoted to the description of the sample, Sect. 5 and Sect. 6 present the empirical methodology and the main results respectively, whereas Sect. 7 highlights some robustness checks. Section 8 concludes.

2 Literature review

Our paper contributes to the huge literature investigating the determinants of the shadow economy. It is well known that its size increases with the tax rate and decreases with the efficiency of the tax enforcement system (Hassan and Schneider, 2016). Moreover, there is evidence that a more intensive regulation discourages entrepreneurship entry and, in turn, makes the shadow economy increase (Johnson et al., 1998). Similarly, trade barriers and labor market frictions are crucial factors which reduce the freedom for economic agents working in the official market (Dell'Anno et al., 2007; Schneider et al., 2010). At the same time, there is evidence that the self-employment rate positively affects the size of the shadow economy (Dell'Anno et al., 2007): self-employed are more likely to employ unofficial workers and to bargain with their customers to conclude tax-free transactions, given the less strict auditing control they are subject compared to large organizations.

Another key determinant of the shadow economy is the institutional quality, such as the government inefficiency and corruption, which discourages firms from hiring workers (Dabla-Norris et al., 2008, Dell'Anno and Teobaldelli, 2015; Torgler et al., 2011) and offers a reason to prefer the informal market. A suggestive hypothesis links the increase in the size of the shadow economy to the political system of the country:

according to this view, a federal system should contrast the informal economy more than a unitary system because competition among federal jurisdictions forces governments to take choices closer to citizens' needs and preferences (Friedman et al., 2000; Torgler et al., 2010). In turn, this should reflect in fair taxation rates and in an efficient provision of public goods. Not surprisingly, the shadow economy is also negatively affected by the tax morale which is recognized as an intrinsic motivation to pay taxes and, therefore, to prefer the formal market to the informal economy (Torgler and Schneider, 2009; Feld and Larsen, 2009).

We add to this literature by investigating the causal effect that the economic freedom produces on the size of the shadow economy at the country level. A first attempt in analyzing such relationship is made by Berdiev et al. (2018) who show that each component of the economic freedom index adversely affects the shadow economy in more than a hundred countries in the world. Our analysis differentiates in many ways. First, in order to solve endogeneity issues Berdiev et al. (2018) rely on internal instruments, i.e. on lagged values (at time $t-2$ and $t-3$) of the economic freedom indicator. In this case, the exclusion restriction is not likely to hold as the past values of the EF indicator might directly affect the size of the current shadow economy; conversely, we use an external instrument that strongly correlates with the endogenous variable and affects our outcome only through the level of economic freedom. Second, to check whether such relation is linear or not, we do not only add a quadratic polynomial of the economic freedom as they do, but we also implement the test suggested by Lind and Mehlum (2010) and find dissimilar findings, i.e. a U-shaped link between the variable of interest and the size of the hidden economy. Third, we provide more evidence about how the political regime shapes the relationship between the economic freedom and the shadow economy.

Nevertheless, the relationship between the economic freedom and the shadow economy deserves a deeper analysis which focuses on the quality of institutions measured in terms of democracy and corruption. Our main contribution, then, relies on the huge debate in the literature about which political regime (autocratic vs. democracy) is more suited to introduce liberalization measures. On the one hand, there is evidence that autocratic regimes are more likely to implement policies which lead to short-term costs and long-term benefits (Fernandez and Rodrik, 1991). On the other hand, supporters of democratic regimes argue that only governments with some legitimacy will be able to implement and sustain policies that may bear high short-term costs and that many of the institutional characteristics of a democracy, like an independent legal system, are also required for a successful liberalization (North, 1993; Przeworski and Limongi, 1993; de Haan and Siermann, 1996). Our results show that increasing the economic freedom in less democratic countries reduces the shadow economy; on the contrary, democratic countries may experience an opposite effect.

The paper also relates to the literature investigating the effects of the economic freedom on other economic outcomes. Whilst we focus on the causal effect of economic liberalization on the hidden economy, economists have long analyzed the relationship between the wealth of a country and its economic freedom, finding evidence that a society with a high level of economic freedom could improve the effectiveness of the market in terms of resource allocation. On the one hand, there is evidence

that the economic freedom exerts a negative effect on poverty (Gwartney and Connors, 2010; Dorian and Stratman, 2021) and corruption (Paldam, 2002; Graeff and Mehlkop, 2003); on the other hand, a branch of the literature has highlighted a positive impact that the economic freedom produces directly (Compton et al., 2011; Doucouliagos et al., 2006; Akinici et al., 2015; Apergis and Katsali, 2018) and indirectly - through the effects of foreign investments - on economic growth (Azman-Sain et al., 2010). Conversely, there is less evidence on the effects of the economic freedom on income inequality (Berggren, 1999; Scully, 2002; Carter, 2007; Apergis et al., 2014).¹

Finally, a few studies have also highlighted the positive impact that the economic freedom has on the quality of life (Esposto and Zaleski, 1999). In particular, King et al. (2012), by focusing on developing countries, show higher returns to both schooling and work experience in economically free countries. Cebula and Mixon Jr. (2014) underscore the critical role that the economic freedom plays in protecting the environment by boosting sustainability and investments in energy, R&D and infrastructure. Finally, Huang et al. (2022) recently find that the economic freedom positively affects the speed of the COVID-19 pandemic control.

3 Theoretical hypotheses

The effect that the economic freedom, to be understood as a proxy for the overall quality of institutions, produces on the size of the shadow economy depends on all those aspects that have an impact on citizens' decisions to enter or leave the shadow market (see Loayza, 2016; Kaufmann, 1997). This crucial decision takes into account both the costs and benefits associated with the choice of producing in formal/informal markets and, for this reason, is influenced by how burdensome the tax system and regulations are perceived (Johnson et al., 1997; Schneider and Enste, 2000). Hence, we believe that a higher institutional quality reduces the size of the shadow economy.

H1: The economic freedom negatively affects the size of the underground economy.

It has already been said that the economic freedom is a composite measure of the quality of political-economic institutions. Going into more details, it consists of some sub-components, namely (1) legal order and property rights, (2) business regulation, (3) sound money, (4) freedom to trade internationally and (5) taxation. At this point, it is important to understand the theoretical rationale for how each sub-component of the EF indicator relates to the shadow economy. First, a strong legal system capable of ensuring a private property protection and contract enforcement may increase both the benefits citizens get from participating in the legal economy and the opportunity cost incurred to carry out an activity in the hidden market (Loayza et al., 2009; Schneider, 2010; Dreher and Schneider, 2010; Berdiev and Saunoris, 2018). Indeed, according to Gwartney and Lawson (2003) if institutions do not support the legal structure, then the free market economy is usually undermined.

¹ A few papers focus on the indirect effect of economic freedom on education and health as a result of its positive effect on investment in human capital (Hall et al., 2010). Similarly, Stroup (2007) finds that higher levels of economic freedom are associated to longer life expectancy and better disease prevention. Putting all these findings together, there are some attempts in the literature to assert a positive relationship between economic freedom and happiness (Gropper et al., 2001).

H1a: A more efficient legal system that ensures property protection negatively affects the shadow economy.

Second, strict regulations could, e.g., increase production costs in the formal sector thereby limiting the freedom of economic agents in formal businesses and labor markets. It is therefore not surprising that in these cases agents tend to look for alternatives in the hidden sector (Schneider and Enste, 2000; Gwartney and Lawson, 2003).

H1b: Less stringent regulations decrease the size of the shadow economy.

Third, governments that favor access to hard cash, e.g. through price stability, can increase the beneficial effects of producing in the economy. Conversely, unstable inflation rates alter the prices of goods and services and, in turn, lead to manipulations of legal agreements, hampering formal economic activities (Gwartney and Lawson, 2003).

H1c: The size of the shadow economy is negatively affected by a large access to sound money.

Last but not least, trade restrictions, such as tariffs, lead to an increase in transaction costs and push economic agents to enter the informal sector (Mishkin, 2009; Buehn and Farzanegan, 2012; Saunoris and Sajny, 2017). On the other hand, governments, through heavy taxes, can entice economic agents to move to the informal sector (Schneider and Enste, 2000; Gërkhani, 2004), as they experience higher costs to enter and stay in the legal economy (Loayza, 1996).

H1d: A higher freedom to trade internationally reduces the shadow economy.

H1e: Not burdensome taxes reduce the shadow economy.

We then test whether and how the quality of institutions, here represented by the level of corruption and democracy, shapes the effect that the economic freedom produces on the shadow economy. That is to say, is an increase of the economic freedom more effective in reducing the shadow economy in high-corrupted (viz. low-democratic) countries?

Corruption and lack of democracy are generally seen as destructive features, which also go together with the shadow economy, by “sanding the wheels” of the economic growth and development, at least in poor countries (Dreher and Schneider, 2010). On the other hand, there is empirical evidence supporting the opposite view that corruption may help firms avoiding a too strict regulation, also referred to as “greasing the wheels” (Beck and Mahler, 1986; Sahakyan and Stiegert, 2012). Accordingly, Djankov et al. (2002) find evidence that reducing the economic freedom, intended as a stricter entry regulation, increases both corruption and shadow economy.

In light of these views, what we expect is that in countries characterized by a high corruption and/or low democracy levels the negative effect that the economic freedom produces on the shadow economy is confirmed and emphasized more than in countries showing low corruption and/or high democracy levels. Conversely, we expect a lower effect in countries showing high institutional performances: the economic system as a whole already benefits from a low corruption and/or high democracy level, so that increasing the economic freedom is like “adding sugar in a sweet food”. Too much freedom may still be beneficial, but should not make the difference.

H2: The negative effect of the economic freedom on the shadow economy is confirmed and emphasized in countries characterized by high corruption and/or low democracy levels.

Table 1 Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Shadow Economy/GDP	3,080	30.08	13.03	5.40	70.57
<i>EF components</i>					
Economic Freedom (EF)	3,080	60.87	10.33	21	91
Legal System and Property Rights EF	3,079	49.57	24.04	5	97
Business Regulation EF	3,080	65.51	15.25	18	100
Sound Money EF	3,080	73.79	13.88	0	95.4
Freedom to Trade EF	3,074	70.26	14.56	13	95
Taxation EF	3,080	72.71	14.40	30	100
<i>Control variables</i>					
GDP growth rate	3,080	3.85	4.05	-36.39	34.47
Unemployment rate (%)	3,080	7.70	5.61	0.14	33.29
Government spending per capita	3,080	15.34	5.24	0.95	43.48
Population size/1,000,000	3,080	45.58	153.82	0.21	1,386.4

Source: The Shadow Economy is taken from Medina & Schneider (2017); information of the EF index is provided by Heritage Foundation and all the control variables are taken from the World Bank website.

H3: The negative effect of the economic freedom on the shadow economy may not be confirmed in countries characterized by low corruption and/or high democracy levels.

4 Data description

In our analysis we have adopted different sources of data and the descriptive statistics of the main variables used in the empirical exercise are reported in Table 1. First, in order to build our outcome variable, i.e. *Shadow Economy*, we rely on the measure proposed by Medina & Schneider (2017) which covers 158 countries over the period 1991–2017. In particular, they adopt the MIMIC (multiple indicators and multiple causes) technique that exploits covariance information from observables which are classified as either “indicators” or “causal” variables nested in simultaneous equations to estimate the latent hidden economy. The structural model included in the simultaneous equations links the latent outcome variable with its causal variables (trade openness, GDP per capita, unemployment rate, government consumption as a percentage of GDP, and rule of law), and the measurement model links the shadow economy with a set of indicator variables (currency, labor force participation, and growth rate of GDP).

Second, information on our main variable of interest, i.e. *Economic Freedom (EF)* is collected from the *Heritage Foundation*. This is a comprehensive EF dataset that provides ratings for all countries in the world over the period 1995–2019. More specifically, the economic freedom index that is a proxy of the institutional quality is measured on a 100-point scale (with 0 standing for no EF and 100 for the maximum

EF) and is a weighted average of all area components: (1) Legal System and Property Rights, (2) Business Regulation, (3) Sound Money, (4) Freedom to Trade Internationally and (5) Taxation, that is a proxy of the government size.²

As regards the control variables, we hinge on the literature investigating the determinants of the shadow economy (see Johnson et al., 1997; Friedman et al., 2000; Schneider and Enste, 2000; Gërkhani, 2004; Schneider, 2005) and include the growth rate of GDP with a mean of 3.85 and a standard deviation of 4.05, the unemployment rate (mean: 7.70, std. dev.:5.61), the government spending as a percentage of GDP (mean: 15.34, std. dev.: 5.24) and the population size/1,000,000 (mean: 45.58, std. dev.:152.82). All the control variables are taken from The World Bank website. We end up with an unbalanced sample of 152 countries (3,080 observations) from 1995 to 2017.

For a visual inspection, we report in Figure A1 in the Appendix of the paper the average level of both the economic freedom – Panel (a) – and the shadow economy – Panel (b) – by countries in the world. We can notice that the EF index is higher in the US, in Australia and in the northern countries of Europe, such as Sweden and the United Kingdom, whereas the shadow economy seems to be dramatically prevalent in Russia and in countries located in both Africa and The Latin America. Moreover, Figure A1 depicts a potential negative correlation, on average, between the EF index and the hidden economy, since countries characterized by a high level of EF are in the bottom of the shadow economy distribution.³

5 Empirical methodology

In order to recover the causal effect that the economic freedom exerts on the hidden economy of the countries, we estimate the following model by means of a Two-Stage-Least-Squares (TSLS) approach:

$$Y_{ct} = \beta_0 + \beta_1 \text{EconomicFreedom}_{ct} + \beta_2 X_{ct} + \mu_c + \lambda_t + \epsilon_{ct} \quad (1)$$

$$\text{EconomicFreedom}_{ct} = \alpha_0 + \alpha_1 \text{FinancialIndependence}_{ct} + \alpha_2 X_{ct} + \mu_c + \lambda_t + \pi_{ct} \quad (2)$$

where in Eq. (1) Y_{ct} is our outcome variable as measured by the size of the shadow economy normalized by GDP for country c at time t , while the main variable of interest is the level of economic freedom in country c at time t . We also add X_{ct} that is a vector of country characteristics potentially correlated with the shadow economy, i.e. the growth rate of GDP, the unemployment rate, the government spending per capita

² See Table A1 for a full description of the economic freedom indicators.

³ Furthermore, in Figure A2 we display the pattern of both the EF index and the shadow economy to give an insight on how they changed from 1995 to 2017. As regards the EF, we can notice that it remained stable over the period under analysis, apart from Oceania that registered a dramatic downward shift starting with the 2007–2009 financial crisis. Also, in line with Figure A1, North American and European (African) countries in 2017 are characterized by the highest (lowest) level of EF. Instead, the shadow economy has steadily decreased over time: again, Africa (Europe) is the continent with the highest (lowest) level of shadow economy.

and the population size. μ_c are country fixed effects, whereas λ_t are year dummies. In particular, country fixed effects take into account time-invariant features of countries that might correlate with the level of shadow economy, whilst year dummies are added to control for potential economic shocks that affect the economy of countries in specific years. Finally, ϵ_{ct} is the error term of the model.

Regarding the control variables, we have included in vector X_{ct} *GDP growth rate* as a proxy for the level of development and prosperity of a country. A higher level of development goes together with a greater capacity to pay and collect taxes, as well as a higher relative demand for income elastic public goods and services (Chelliah 1971; Bahl 1971). Moreover, more prosperous countries offer more opportunities in the official sector and reduce the incentive to move underground. Hence, we expect a negative relation between GDP growth and the size of the underground economy.

Moreover, demographic and labor characteristics such as *unemployment rate* or *population size* may also affect the shadow economy. As highlighted by Giles and Tedds (2002) there are two forces that determine the relationship between the unemployment rate and the shadow economy. On the one hand, given that the shadow economy might be positively related to GDP growth rate and this is negatively correlated to unemployment, a decrease in the employment rate might lead to an upward shift in the underground economy. On the other hand, unemployed individuals usually spend some of their time working in the black economy. In line with this view, Tanzi (1999) highlights how the relation between the shadow economy and the unemployment rate is ambiguous due to the fact that the labor force in the hidden economy includes very heterogeneous people, i.e. the unemployed and the non-official labor force and, furthermore, there are people who have an official and unofficial job at the same time. In this sense, the official unemployment rate is weakly correlated with the shadow economy. Although the economic theory is inconclusive about the sign of the effect the unemployment rate generates on the shadow economy, we believe that there is a positive relationship between unemployment and the shadow economy, since when unemployment raises many workers have greater incentives to participate in the underground economy. As far as population size is concerned, as Bahl (2004) points out, in countries with faster growing populations tax systems may lag behind in the ability to capture new taxpayers. This may increase the incentive to be active in the underground economy (Torgler and Schneider, 2007). This suggest that a positive relation between population size and the shadow economy is expected.

The last covariate included in our model is the *government spending per capita*. The relation between government spending and the shadow economy is ambiguous. On the one hand, a large government size might push citizens to enter the informal sector via high taxation (see Johnson et al., 1997; Schneider and Enste, 2000). On the other hand, larger governments may allocate more resources to contrast the development of shadow activities (Goel and Nelson, 2016). Furthermore, tax revenues that are not used for income redistribution purposes but to provide high-quality public goods and services might reduce the incentive to engage in the shadow economy. Consequently, there is no clear-cut hypothesis related to the impact of government spending on the underground economy.

As far as the econometric model is concerned, it should be stressed that the inclusion of country fixed effects in Eq. (1) does not allow us to interpret the coefficient

of *EconomicFreedom_{ct}* in a causal manner. First, there could be an omitted variable in the error term, such as the poverty rate, that correlates with both the economic freedom in a country and its level of hidden economy. In addition, although the economic freedom index come from official data, a measurement error in the main variable of interest could be at play, leading to an overall downward/upward bias in our estimates. Last but not least, our model is potentially undermined by reverse causality issues, since the size of the shadow economy of a country may also impact the economic freedom: for instance, it is reasonable to consider that in countries characterized by high level of shadow economy policy-makers are pushed to adopt more stringent regulations or other mechanisms aimed at boosting the economic freedom.

We solve the aforementioned endogeneity issues by using a TSLS approach. In particular, we rely on the analysis conducted by Berggren and Nilsson (2013) and instrument the economic freedom with *FinancialIndependence_{ct}*, which measures the independence of financial markets from government control. It includes ownership of banks, banking competition, extension of credit to private sector, and presence of interest rate control. This instrument in the First-Stage (Eq. 2) is built by exploiting information provided by The Heritage Foundation and takes values ranging from 0 to 100, with 100 indicating the most negligible government interference in the banking and financial sector. This indicator of the independence of financial markets should be uncorrelated to other unobserved determinants of the hidden economy, therefore reassuring us that the exogeneity of the instrument holds.⁴

6 Main results

In Panel (a) of Table 2 we present the main estimates. In each specification we control for country and year fixed effects and standard errors are robust to heteroskedasticity. In particular, we highlight how a one standard deviation increase of the economic freedom index leads to a downward change in the hidden economy by 0.51% points (see column 1). The effect is significant at the 10% level.

In order to better understand the channels through which the economic freedom negatively affects our outcome variable we also evaluate the impact that each sub-component of the EF indicator produces on the size of the shadow economy. In particular, in column (2), we focus on the freedom in the legal system and property rights and find that *Legal System and Property Rights EF* negatively affects the shadow

⁴ One might argue that the level of independence of financial markets from the government action might be correlated to time-invariant characteristics of the country or to the level of GDP, i.e. it would be expected that more developed countries have less control over the financial system (a high level of financial independence). This is the reason why we always control for country-year dummies and for time-variant characteristics of countries in our econometric model. Although the validity of the instrument cannot be tested directly, i.e. we are not able to assess whether a correlation between the instrument and unobserved characteristics at the country level exists, we perform a placebo test in which we regress the shadow economy on the instrument with and without the full set of controls. The results, not reported and available upon request, show that the coefficient of the instrument is negative, stable across specifications and far from being statistically significant, regardless of the inclusion of covariates potentially correlated with the instrument in the regression.

Table 2 The effect of the economic freedom on the shadow economy. TSLS approach

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy
Panel (a): TSLS						
Economic Freedom (EF)	-0.049*					
	(0.029)					
Legal System and Property Rights EF		-0.054*				
		(0.032)				
Business Regulation EF			-0.073*			
			(0.042)			
Sound Money EF				-0.068*		
				(0.038)		
Freedom to Trade EF					-0.840	
					(1.230)	
Taxation EF						-0.155*
						(0.099)
GDP growth rate	-0.110***	-0.113***	-0.120***	-0.093***	-0.129***	-
	(0.018)	(0.019)	(0.019)	(0.019)	(0.049)	0.103***
Unemployment rate (%)	0.321***	0.332***	0.334***	0.305***	0.178	0.279***
	(0.020)	(0.021)	(0.020)	(0.023)	(0.219)	(0.037)
Government spending per capita	0.300***	0.312***	0.326***	0.297***	0.178	0.265***
	(0.029)	(0.029)	(0.030)	(0.028)	(0.195)	(0.040)
Population size	0.001	0.001	-0.002	-0.002	0.112	-0.003
	(0.001)	(0.001)	(0.002)	(0.002)	(0.164)	(0.003)
Constant	27.48***	24.76***	27.77***	11.30	-3.24	46.18***
	(2.382)	(2.546)	(2.470)	(7.082)	(2.696)	(3.570)
Panel (b): First stage						
Financial Independence	0.207***	0.188***	0.141***	0.152***	0.012	0.066***
	(0.008)	(0.017)	(0.016)	(0.026)	(0.017)	(0.014)
F-stat	598.73	116.07	74.20	34.11	0.55	22.43
p-value	0.000	0.000	0.000	0.000	0.461	0.000
Panel (c): OLS estimates						
Economic Freedom Index	-0.137***	-0.014**	-0.063***	-0.061***	-0.027***	-0.001
	(0.015)	(0.006)	(0.0068)	(0.006)	(0.008)	(0.008)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 2 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Observations	3,068	3,067	3,068	3,068	3,062	3,068
R-squared	0.966	0.964	0.966	0.967	0.802	0.960

Note: TSLS estimates. The dependent variable is on top of each column and is measured by the shadow economy normalized by GDP. We control for country and year fixed effects and we focus on the period from 1995 to 2017. Standard errors are robust to heteroskedasticity and shown in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at 1% level by ***

economy: a one standard deviation increase in this EF subcomponent produces a decrease in the hidden economy by 1.29% points.

Furthermore, in column (3) we focus on business regulation. Again, we find a negative impact of this subcomponent of the economic freedom index on the hidden economy. In column (4) we analyse the link between sound money and the shadow economy. Our results show that the shadow economy is negatively affected by *Sound Money EF*: a one standard deviation increase in *Sound Money EF* generates a negative effect on the shadow economy by 0.94% points.

Finally, in the last two specifications of Table 2 we study whether both freedom to trade internationally and taxation, used as a proxy of government size, affect the hidden economy of a country. Once we handle endogeneity issues, we do not detect any significant impact of the first subcomponent on our outcome variable (see columns 5), whereas a one standard deviation increase in *Taxation EF* generates an adverse effect of 2.23% points on the shadow economy.

All in all, our empirical results confirm the theoretical hypotheses *H1–H1e*, as described in Sect. 3, apart from *H1d*. Among the control variables, as reported in Table 2, GDP growth rate negatively correlates with the level of the shadow economy. Furthermore, as expected we show a positive and statistically significant correlation between the unemployment rate and our outcome variable, in line with the empirical results found, among others, by Schneider and Enste (2000) and Dell’Anno et al. (2007). Our results also show a positive impact of the government spending per capita on the shadow economy in line with Schneider and Enste (2000) findings. Conversely, population size does not relate with the shadow economy: the coefficient is indeed far from being statistically significant.

In addition, in Panel (b) we show that our instrument, i.e. *Financial Independence*, positively correlates positively with both the aggregate *Economic Freedom* indicator and its subcomponents, apart from *Freedom to Trade* index. Moreover, the F-statistic is well above 10, meaning that our estimates do not suffer from the issue of weak instruments. Instead, in Panel (c) of Table 2, we present OLS estimation results when including country fixed effects. When taking into account unobservable time-invariant country heterogeneity, without handling endogeneity issues, the effect of our main variables of interest on the hidden economy is still negative, but the magnitude of the effect for all the subcomponents of the economic freedom index is smaller, implying in turn that OLS estimates are downward biased.

In Table 3 we further study whether the impact of the economic freedom on the hidden economy is heterogeneous according to the institutional environment in which the country operates. In particular, we match our database with *Polity5*

Table 3 Economic freedom and shadow economy. Heterogeneity by democracy level. TSLS approach

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Shadow Economy <i>Polity Index</i> <median	Shadow Economy <i>Polity Index</i> >median	Shadow Economy <i>Democracy Index</i> <median	Shadow Economy <i>Democracy Index</i> >median	Shadow Economy <i>Freedom from corruption</i> <median	Shadow Economy <i>Freedom from corruption</i> >median
Panel (a): TSLS						
Economic Freedom (EF)	-0.096** (0.041)	0.090* (0.050)	-0.106** (0.041)	0.103** (0.049)	-0.111*** (0.031)	0.170*** (0.062)
GDP growth rate	-0.121*** (0.023)	-0.067*** (0.020)	-0.115*** (0.022)	-0.071*** (0.021)	-0.107*** (0.022)	- (0.024)
Unemployment rate (%)	0.241*** (0.034)	0.395*** (0.030)	0.262*** (0.034)	0.398*** (0.030)	0.138*** (0.040)	0.376*** (0.035)
Government spending per capita	0.231*** (0.034)	0.475*** (0.042)	0.221*** (0.033)	0.483*** (0.042)	0.312*** (0.035)	0.326*** (0.045)
Population size	0.013** (0.005)	-0.005*** (0.001)	0.007 (0.005)	-0.005*** (0.001)	0.009** (0.003)	0.005 (0.007)
Panel (b): First stage						
Financial Independence	0.211*** (0.012)	0.176*** (0.012)	0.211*** (0.012)	0.176*** (0.012)	0.237*** (0.012)	0.144*** (0.011)
F-stat	307.47	199.80	301.81	206.29	354.62	172.11
p-value	0.000	0.000	0.000	0.000	0.000	0.000
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,541	1,527	1,505	1,563	1,446	1,622
R-squared	0.949	0.975	0.951	0.975	0.944	0.967

Note: TSLS estimates. The dependent variable is on top of each column and is measured by the shadow economy normalized by GDP. We control for country and year fixed effects and we focus on the period from 1995 to 2017. Standard errors are robust to heteroskedasticity and shown in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at 1% level by ***

dataset,⁵ and by using the *Polity* variable that takes values ranging from -10 (if the country is strongly autocratic) to +10 (if the country is strongly democratic) we evaluate the effect of interest below and above the median value of the distribution of this variable. We can notice that, the coefficient of *Economic Freedom* is negative and significant at the 5% level for those countries lying below the median (see column 1), whereas our variable of main interest attracts a positive coefficient for countries characterized by a high level of democracy (see column 2).

⁵ *Polity5* project codes the authority characteristics of states in the world system for purposes of comparative and quantitative analysis.

Similar results are found in specifications reported in columns (3) and (4) in which we split the sample according to the median value of the *Democracy* index (taking values between 0 and 10). The operational indicator of democracy is a weighted average of three factors, i.e. the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive. Again, for countries with a low level of democracy (below the median) a one standard deviation increase in the economic freedom indicator leads to a decrease in the size of the shadow economy by about 1.09% points. Conversely, for more democratic countries, in which the level of economic freedom (shadow economy) is already large (low) enough, we do detect a positive impact on our outcome variable.

Finally, in the last specifications of Table 3 we evaluate whether the effect that the economic freedom index has on the shadow economy is heterogeneous with respect to the *Freedom from corruption* index (below/above the median). This variable, derived primarily from Transparency International's Corruption Perceptions Index, takes values from 0 to 100 where higher index values denote lower levels of corruption. The results are in line with those highlighted in columns (1)–(4): the economic freedom index produces an adverse impact on the level of shadow economy only in more corrupt countries (below the median).

Overall, our empirical findings confirm the theoretical hypotheses *H2* and *H3*. These results are striking: high democratic countries are not usually keen to put limits to freedom and blindly conceive it as a mere good for individuals. However, high democratic and low corrupt countries are also those where institutions work well. In fact, institutions are also evaluated according to the quality of the rules they issue: good institutions are those issuing high-quality rules. If, on the one hand, any sort of regulation is itself a limit to individual freedom, on the other hand, some rules are necessary to ensure that individual freedom is effective (Smith, 1776). This classic reasoning helps explain why increasing the economic freedom beyond a crucial (already high) level does not make individuals freer, but only decreases the vigilance of the central government on how individuals exercise their freedom. As a result, this may translate in a higher but less effective economic freedom which, in turn, makes shadow economy surprisingly increase.

7 Robustness checks

As a first robustness, we check whether the impact of the economic freedom on the shadow economy is non-linear. In particular, we replicate specifications reported in Table 2 in which we further add among regressors a quadratic term of both the EF index and each subcomponent. We instrument the linear and quadratic polynomial of EF (and of its sub-components) with a first and second-order polynomial of *Financial Independence*. The results are displayed in Table 4. In column (1) we show that the quadratic term of EF is positive and statistically significant at the 1% level. The same findings hold true for *Legal system and property rights* and *Business regulation* indicators (see columns 2–6). Moreover, the F-statistic in the First-stage regression that tests the joint significance of our two instruments (*Financial Independence* and *Financial Independence*²) suggests that both of them are strongly correlated with the

Table 4 U-shaped relationship between economic freedom and shadow economy. TSLS approach

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy
Panel (a): TSLS						
Economic Freedom (EF)	-0.796***					
	(0.215)					
Economic Freedom (EF) ²	0.006***					
	(0.001)					
Legal System and Property Rights EF		-0.316***				
		(0.097)				
Legal System and Property Rights EF ²		0.003***				
		(0.001)				
Business Regulation EF			-2.184**			
			(1.010)			
Business Regulation EF ²			0.015**			
			(0.007)			
Sound Money EF				1.374		
				(1.477)		
Sound Money EF ²				-0.011		
				(0.012)		
Freedom to Trade EF					0.145	
					(0.880)	
Freedom to Trade EF ²					-0.004	
					(0.006)	
Taxation EF						5.703
						(5.086)
Taxation EF ²						-0.038
						(0.033)
GDP growth rate	-0.104***	-0.102***	-0.123***	-0.192*	-0.126***	-
	(0.016)	(0.020)	(0.028)	(0.102)	(0.024)	0.136***
Unemployment rate (%)	0.328***	0.383***	0.318***	0.359***	0.266***	0.252**
	(0.020)	(0.030)	(0.033)	(0.086)	(0.045)	(0.126)
Government spending per capita	0.298***	0.291***	0.284***	0.389***	0.254***	0.080
	(0.026)	(0.032)	(0.046)	(0.116)	(0.044)	(0.217)

Table 4 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Population size	0.002 (0.002)	-0.001 (0.002)	-0.020* (0.011)	0.008 (0.010)	0.018 (0.063)	0.012 (0.017)
Panel (b): First stage						
Financial Independence	0.322*** (0.034)	0.437*** (0.064)	0.161** (0.065)	0.247** (0.113)	0.169** (0.071)	0.019 (0.056)
F-stat	313.04	63.08	37.20	17.91	3.28	13.52
<i>p-value</i>	0.000	0.000	0.000	0.000	0.038	0.000
Panel (c): U-shape test						
Slope Lower Bound	-0.783	-0.283	-2.026	1.374	0.034	4.937
Slope Upper Bound	0.382	0.322	0.978	-0.849	-0.666	-1.948
<i>p-value</i>	0.001	0.017	0.023	0.176	0.481	0.132
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,068	3,067	3,068	3,068	3,062	3,068
R-squared	0.967	0.960	0.909	0.827	0.942	0.752

Note: TSLS estimates. The dependent variable is on top of each column and is measured by the shadow economy normalized by GDP. We control for country and year fixed effects and we focus on the period from 1995 to 2017. Standard errors are robust to heteroskedasticity and shown in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at 1% level by ***

endogenous explanatory variables of interest. Nevertheless, in order to better understand if this relationship is simply non-linear monotonic or U-shaped we implement the test proposed by Lind and Mehlum (2010) in Panel (c) of Table 4 and reject the null hypothesis of monotonic or reverse U-shaped relationship only for the composite economic freedom indicator and for the aforementioned EF subcomponents.

As a final robustness check, we adopt in a TSLS setting a different instrument to solve the endogeneity problems related to the economic freedom indicator, i.e. the central bank independence (CBI), taken from Garriga (2016). CBI is an index that combines 16 legal attributes that affect central bank independence following Cukierman (1992) criteria.⁶ The index ranges from 0 (minimum) to 1 (maximum) and is available from 1995 to 2012. The results are reported in Table 5. Again, we find that the economic freedom negatively affects the size of the shadow economy, and from Panel (b) we can notice that the CBI instrument is not weak, as it strongly correlates with the EF indicator and its subcomponent, apart from *Freedom to trade*, consistent with the findings previously discussed.

⁶ The index weighs variables coding the appointment and tenure of the bank's governor, the central bank's objectives, its participation in monetary policy, and limitations on lending to the government.

Table 5 The effect of the economic freedom on the shadow economy. TSLS approach with CBI as an instrument

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy	Shadow Economy
Panel (a): TSLS						
Economic Freedom (EF)	-0.384** (0.161)					
Legal System and Property Rights EF		-0.222** (0.103)				
Business Regulation EF			-0.237** (0.111)			
Sound Money EF				-0.260* (0.156)		
Freedom to Trade EF					-2.109 (5.680)	
Taxation EF						-0.318* (0.175)
GDP growth rate	-0.107*** (0.022)	-0.110*** (0.027)	-0.110*** (0.026)	-0.018 (0.037)	-0.127 (0.186)	- (0.021)
Unemployment rate (%)	0.289*** (0.030)	0.332*** (0.033)	0.327*** (0.031)	0.290*** (0.045)	0.060 (0.725)	0.270*** (0.047)
Government spending per capita	0.282*** (0.034)	0.364*** (0.046)	0.380*** (0.047)	0.263*** (0.053)	0.043 (0.763)	0.280*** (0.045)
Population size	-0.003 (0.002)	-0.001 (0.002)	-0.013* (0.007)	-0.014* (0.007)	0.327 (0.885)	-0.010 (0.008)
Constant	31.36*** (2.567)	35.96*** (3.222)	32.55*** (3.095)	29.39*** (3.250)	4,071 (30,613)	43.78*** (9.270)
Panel (b): First stage						
Central Bank Independence (CBI)	3.398*** (0.834)	5.779*** (1.658)	5.501*** (1.675)	5.015** (2.267)	0.605 (1.595)	4.103*** (1.403)
F-stat	16.65	12.18	10.76	10.27	0.08	15.37
<i>p-value</i>	0.000	0.000	0.000	0.000	0.714	0.000
Controls	Yes	Yes	Yes	Yes	Yes	Yes
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Table 5 (continued)

	(1)	(2)	(3)	(4)	(5)	(6)
Observations	2,136	2,135	2,136	2,136	2,130	2,136
R-squared	0.972	0.964	0.966	0.956	0.956	0.956

Note: TOLS estimates. The dependent variable is on top of each column and is measured by the shadow economy normalized by GDP. We control for country and year fixed effects and we focus on the period from 1995 to 2012. Standard errors are robust to heteroskedasticity and shown in brackets. Significance at the 10% level is represented by *, at the 5% level by **, and at 1% level by ***

8 Policy implications and concluding remarks

Mario Draghi, in a talk delivered in front of the Italian Parliament as President of the European Central Bank in 2015, pointed out that in many countries both businesses and households are penalized by regulations and high tax rates. Then, he suggested that the only remedy was ensuring stable rules, an effective legal enforcement system, contract compliance, the efficiency of the public administration, the proper functioning of the labor market, and the promotion of competition.

The lesson we can draw from his speech is that regulations cannot solve all the issues affecting the economy and the society as a whole, but can create a large set of opportunities, and there is no greater opportunity than freedom.

The right way to promote the economic freedom is through a law-enforcement system that, first, protects property rights and enforce contracts and, second, refrains from interfering with personal choices. When citizens and firms feel they bear a heavy burden coming from strict regulations that replace voluntary exchange and market activities, then the economic freedom collapses and opting for the underground activities becomes a more attractive and profitable choice for economic agents.

The results of our paper confirm this view and assess a negative and significant relationship between economic freedom and shadow economy. In addition, we find that the institutional environment of the country, measured both in terms of democracy and corruption, does play a role in shaping the way the economic freedom impacts the hidden economy: precisely, an increase in the economic freedom indicator reduces the size of the shadow economy in countries characterized by low levels of democracy or high levels of corruption, whereas an opposite effect arises in more democratic and less corrupt countries, usually characterized by high levels of economic freedom. Indeed, our findings show that when institutions work well, the legal economy cannot gain from higher levels of economic freedom, to be intended as higher degrees of government neutrality from the economy, especially applied to key sectors like sound money and the legal system and property rights.

9 Appendix

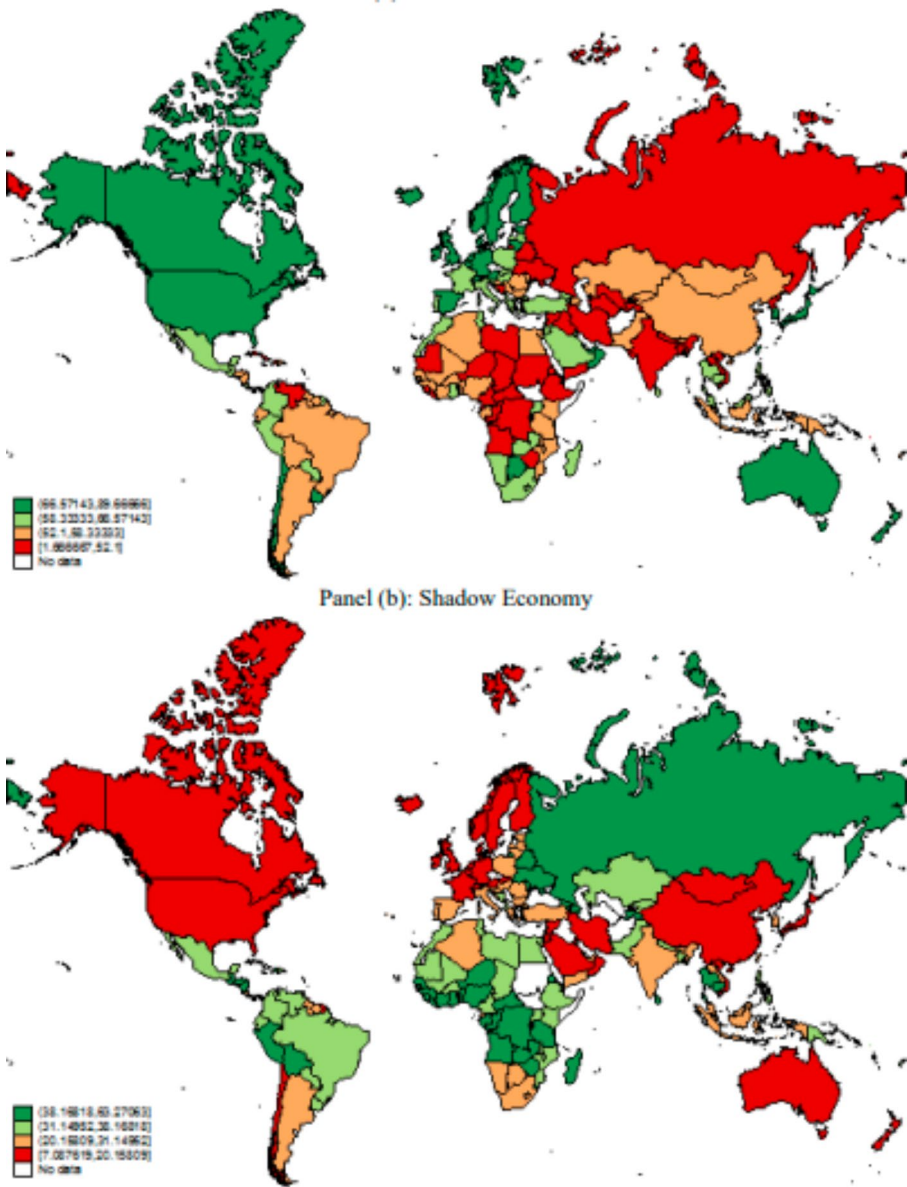


Figure A1 Economic Freedom and Shadow Economy in the World
Panel (a): Economic Freedom.

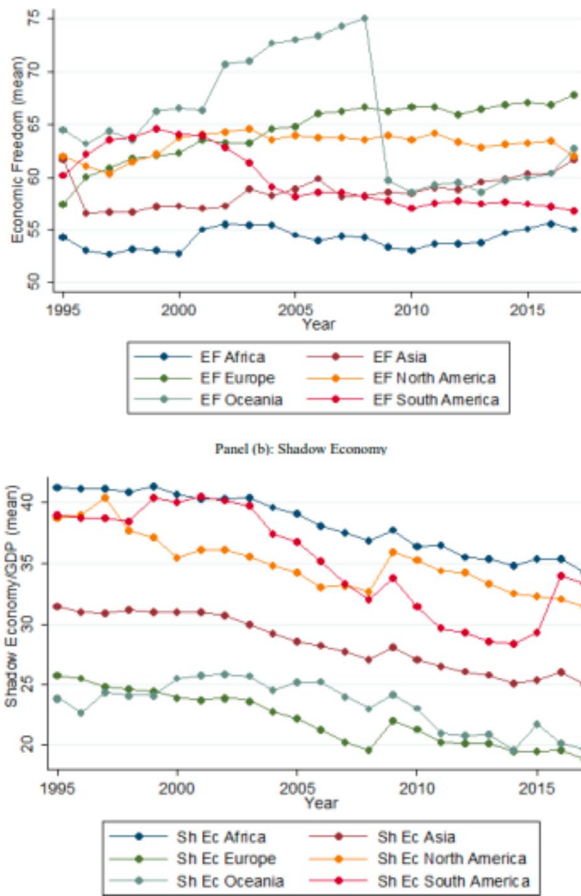


Figure A2 Economic Freedom and Shadow Economy over time

Table A1 Definition of Economic freedom index and its subcomponents

Variables	Definition	Source
Economic Freedom (EF)	The Overall index of Economic Freedom has ten components grouped into four broad categories: Rule of Law; Limited Government; Regulatory Efficiency and Open Markets. The overall economic freedom is scored on a scale of 0 to 100, where 100 represents the maximum freedom.	The Heritage Foundation
<i>Subcomponents</i>		
Legal System and Property Rights	The Legal System and Property Rights index measures the degree to which a country’s laws protect private property rights and the degree to which its government enforces those laws. It also assesses the likelihood that private property will be expropriated and analyzes the independence of the judiciary, the existence of corruption within the judiciary, and the ability of individuals and businesses to enforce contracts. Higher index values denote more certain legal protection of property.	The Heritage Foundation

Table A1 Definition of Economic freedom index and its subcomponents

Variables	Definition	Source
Business Regulation	The Business Regulation index is based on 10 indicators, using data from the World Bank's Doing Business study: Starting a business—procedures (number), time (days), cost (% of income per capita), and minimum capital (% of income per capita); Obtaining a license—procedures (number), time (days), and cost (% of income per capita); Closing a business—time (years), cost (% of estate), and recovery rate (cents on the dollar).	The Heritage Foundation
Sound Money	The score for the Sound Money index is based on two factors: the weighted average inflation rate for the most recent three years and price controls. Higher index values denote price stability without microeconomic intervention.	The Heritage Foundation
Freedom to Trade	The freedom to Trade index is based on two indicators: the trade-weighted average tariff rate and non-tariff barriers (including quantity, price, regulatory, customs and investment restrictions, and direct government intervention).	The Heritage Foundation
Taxation	The Taxation index measures the tax burden imposed by government. It is composed of three quantitative factors: the top marginal tax rate on individual income, the top marginal tax rate on corporate income, and the total tax burden as a percentage of GDP.	The Heritage Foundation

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