Give me liberty, or I will produce underground: Effects of economic freedom on the shadow economy

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Abstract

This paper examines the impact of economic freedom on the shadow economy. Using panel data on over 100 countries from 2000 to 2015, we find that economic freedom is effective at reducing the spread of the shadow economy. Moreover, after disaggregating economic freedom into its five main components, the results suggest that all aspects of economic freedom significantly mitigate shadow activities with freedom from regulation exhibiting the largest impact. Overall, these findings are robust after accounting for alternate measures of the shadow economy, simultaneity, outliers, and nonlinearities. Thus, countries aiming to combat the spread of shadow activities would benefit from policies that support economic freedom.

Keywords: Economic freedom; Shadow economy; Panel data

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1. Introduction

There has been growing attention towards understanding the sheer size of the underground, or shadow, economy among many countries (see Gërxhani 2004; Johnson, Kaufmann and Shleifer 1997; Schneider, 2011; Schneider and Enste 2000; Schneider 2005; Tanzi 1982).[1] Developing as well as developed countries house a relatively large sector of the economy that goes unnoticed and has become a topic of considerable research and debate (Schneider and Enste 2000). Although the data show a declining trend in the size of the shadow economy from 1991-2015 only to be interrupted by the recent global recession in 2008 (Medina and Schneider 2017), the magnitude of the shadow economy is still a major concern. The average size of the shadow economy worldwide is estimated to be about 30 percent of GDP with significant variation across countries (Medina and Schneider 2017). For example, several countries appear to have a majority of their production underground with a shadow economy estimated to be in excess of 60 percent of GDP (e.g., Zimbabwe, Bolivia, and Georgia), whereas for other countries less than 10 percent of their GDP is underground (e.g., United States, Austria, and Switzerland) (see Medina and Schneider 2017). What drives this incredible difference in the size of shadow economies across countries?

The decision to move underground, and, therefore, out of sight of public authorities and forgo access to formal sector benefits has attracted much attention by researchers and policy makers alike. Among the main determinants identified in the literature as root causes of the spread of the shadow economy include high taxes and burdensome regulations (see, e.g., Johnson, Kaufmann and Shleifer 1997; Loayza 1996; Schneider and Enste 2000; Gërxhani 2004). However, what can explain the steady decline of the shadow economy over the past 25 years? Although countries have experimented with changes in taxes and regulations over time,

[1] The shadow economy represents market-based economic activity that is unregistered in the official sector.

the degree of economic freedom experienced by many countries has steadily increased. Since the Fraser Institute started tracking economic freedom with their index in 1995, average economic freedom scores have improved 5 percentage points (Gwartney, Lawson, and Hall 2017). That is, following the fall of the Berlin wall in 1989 the world has seen a remarkable shift towards embracing economic freedom by relying more on personal rather than government decision making, voluntary exchange among individuals, open and free markets, and private property rights (Gwartney, Lawson, and Hall 2017). According to Gwartney, Lawson, and Hall (2017), countries with more economic freedom experience relatively greater prosperity, enhanced human development, increased access to education, and reduced rates of poverty, to name a few; however, it remains an open question as to the impact of economic freedom on the decision to engage in the shadow economy.

It is thus no coincidence that as countries continue to remove the shackles of government by allowing individuals to act freely within a market setting, they have less of a need to escape burdensome government and engage in underground activities. Nevertheless, concrete evidence relating these two phenomena is almost completely absent from the extant literature with few exceptions (see, e.g., Britton, Ford, and Gay 2004; Sweidan 2017). Additionally, whereas the effects of institutional quality on the shadow economy are widely documented in prior research (see, e.g., Torgler and Schneider 2009; Dreher, Kotsogiannis, and McCorriston 2009; Schneider 2010; Teobaldelli and Schneider 2013), whether and to what extent institutions that support economic freedom impact the shadow economy is less forthcoming. Therefore, in this paper we seek to understand the effect of economic freedom on the shadow economy. We contribute to this literature in a number of ways. First, we examine the effect of economic freedom for over 100 countries using a recent measure of the shadow economy that covers the global recession.

Second, because economic freedom is multidimensional, we use a disaggregate measure of economic freedom to examine differences of each sub-component of economic freedom (i.e., size of government; legal system and property rights; sound money; freedom to trade internationally; and regulation of credit, labor, and business) on the shadow economy. Third, we compare the effectiveness of political freedom versus economic freedom in curbing shadow activities. Fourth, we allow for a heterogeneous effect of economic freedom (and its sub-components) across levels of development. Finally, we consider potential nonlinearities in the relationship between economic freedom and the shadow economy. Employing panel data for over 100 countries over the period 2000 to 2015, our evidence suggests that economic freedom is effective at deterring underground activities. Moreover, we find that all components of economic freedom reduce the spread of the shadow economy with freedom from regulation having the largest impact. Overall, these results stand up to a battery of robustness checks including to alternate measures of the shadow economy, accounting for simultaneity, correcting for outliers, and nonlinearities.

The paper proceeds as follows: the next section documents the theoretical considerations; Section 3 describes the data and defines the empirical model followed by the results described in Section 4; and Section 5 gives concluding remarks.

2. Theoretical considerations

The interaction between economic freedom and the prevalence of the shadow economy can be best explained by examining the relative (perceived) costs and benefits of participating in the formal sector versus the informal sector (see Loayza 1996, 2016; Kaufmann 1997; Rauch 1991). Economic agents may choose to produce in the formal sector or move to the shadow sector in response to, for example, burdensome taxes and regulations associated with entering and staying

in the formal sector (see, e.g., Loayza 1996; De Soto 1989; Schneider and Enste 2000; Gërxhani 2004; Schneider 2011; Loayza, Servén, and Sugawara 2009; Johnson, Kaufmann and Shleifer 1997). Nevertheless, informal participants may face financial costs as a result of apprehension and possibly experience restricted access to public resources such as police and private property protection (Schneider 2010; Dreher and Schneider 2010; Loayza 1996; Loayza, Servén, and Sugawara 2009). Following the extant literature, we argue that institutional quality impacts the relative costs and benefits of participating in the two sectors (see, e.g., Torgler and Schneider 2009; Dreher, Kotsogiannis, and McCorriston 2009; Schneider 2010; Teobaldelli and Schneider 2013). In particular, improvements in the quality of institutions as a result of greater economic freedom influences the choice to engage in each sector.

Economic freedom represents economic activity that is based on "personal choice, voluntary exchange, open markets, and clearly defined and enforced property rights" (Gwartney, Lawson, and Hall 2017, p. 1). Berggren (2003, p. 194) notes that economic freedom is enhanced when economic agents engage in "voluntary contracts within the framework of a stable and predictable rule of law that upholds contracts and protects private property, with a limited degree of interventionism in the form of government ownership, regulations, and taxes." In this line, institutions that promote economic freedom establish sound incentives for economic agents to participate in the formal sector – e.g., lower taxes raise the after-tax return of formal sector production (Berggren 2003). A lack of economic freedom in countries where entrepreneurial decision making is replaced by bureaucratic decision making and the allocation of goods and services is driven by government edict rather than markets and the price system lead to inefficiencies and red tape that drive individuals underground. Thus, to the extent that the shadow sector is a response to over-regulation and heavy taxes (e.g., De Soto 1989; Loayza

1996; Johnson, Kaufmann and Shleifer 1997; Schneider and Enste 2000), institutions that promote economic freedom may entice economic agents to produce in the formal sector. That is, greater economic freedom through for example private property protections with limited government and regulations may encourage participants to transition from the informal sector to the formal sector. Saunoris and Sajny (2017) for example argue that entrepreneurial activity flows from the informal sector to the formal sector in response to increases in economic freedom. Additionally, Berdiev and Saunoris (2018b) note that the shadow economy offers entrepreneurs refuge from corrupt governments. This leads us to our first main hypothesis:

H1: Greater economic freedom is associated with a smaller shadow economy, ceteris paribus.

Because economic freedom is multidimensional, it is important to discuss how each dimension of economic freedom may influence the shadow sector. That is, what is the most important facet of economic freedom at reducing the shadow economy? Our measure of economic freedom, which comes from Gwartney, Lawson, and Hall (2017), measures the degree of freedom in the following five areas:

(1) Size of government

(2) Legal system and property rights

(3) Sound money

(4) Freedom to trade internationally, and

(5) Regulation of credit, labor, and business.

As can be seen, each area above assesses a distinct aspect of economic freedom (see also, for a discussion, Gwartney and Lawson 2003; Berggren 2003; Gwartney, Lawson, and Hall 2017). We therefore turn next to discussing how each component of economic freedom may impact the prevalence of the shadow economy.

Government size may influence the decision to engage in the formal versus the informal sector through for example high taxation. Larger governments may represent government overreach through burdensome taxes, thereby enticing economic agents to move to the informal sector (see, e.g., Johnson, Kaufmann, and Shleifer 1997; Schneider and Enste 2000; Gërxhani 2004). In particular, institutions that support polices to raise taxes suggests that economic agents experience higher costs of entering and staying in the formal sector (Loayza 1996). Because high taxes increase the cost of production in the formal sector, it encourages entrepreneurs and laborers to operate in the shadow sector or move from the formal to the shadow sector. Schneider and Enste (2000) note that in addition to influencing labor-leisure decisions, taxes also impact the decision to supply labor in the informal sector. To the extent that economic agents observe a large disparity between labor costs in the formal sector and net income from labor, they may choose to circumvent this disparity by supplying labor in the informal sector (Schneider and Enste 2000).

Nevertheless, it is also possible that larger governments may deter the prevalence of the informal sector. In particular, larger governments may allocate more resources to tackle the development of shadow activities. That is, public provision of greater resources through such things as increased checks and balances may deter the spread of informal ventures (Goel and Nelson 2006; Berdiev and Saunoris 2018a). Additionally, tax revenues that are used to provide value-added public goods and public inputs as opposed to redistributing income might reduce the incentive to engage in the shadow economy. In other words, underground participants are more likely to transition to the official economy where they can experience the benefits of improved public goods and services. Lastly, if more government consumption is associated with the public sector purchasing goods and services especially from small businesses, then it may be

advantageous for economic agents to operate in the formal sector.[2] Consequently, there is no clear-cut hypothesis *H2* related to the impact of government size on the shadow economy.

Additionally, a sound legal system that encompasses a strong law and order, police and private property protection, contract enforcement and a court system increases the benefits of participating in the formal sector or, simply put, increase the opportunity cost of engaging in the shadow sector (see, e.g., Schneider 2010; Dreher and Schneider 2010; Loayza 1996; Loayza, Servén, and Sugawara 2009; Berdiev and Saunoris 2018b). According to Gwartney and Lawson (2003), institutions that neglect to support the legal structure through for example contract enforcements and property rights protection weakens the free market economy. Specifically, to the extent that economic actors "lack confidence that contracts will be enforced and the fruits of their productive efforts protected, their incentive to engage in productive activity will be eroded (Gwartney and Lawson 2003, p. 414)." For example, corrupt public officials may hinder entrepreneurial activities through bribery (see, e.g. Shleifer 1997; Williams, Shahid, and, Martínez 2016; Williams and Nadin 2014). As a result, instead of participating in the official economy with an ineffective legal system, economic actors may resort to the shadow sector to avoid corrupt public agents (Johnson, Kaufmann, and Shleifer 1997; Hindriks, Keen, and Muthoo 1999; Friedman et al. 2000; Torgler and Schneider 2009; Hibbs and Piculescu 2005; Berdiev and Saunoris 2018b). Put differently, higher quality institutions through for example higher government effectiveness provide incentives for entrepreneurs and businesses to leave the informal sector (Dreher, Kotsogiannis, and McCorriston 2009).[3] Shadow participants are

[2] We thank an anonymous referee for this suggestion.

[3] It is important to note that it is possible for the quality of the legal system to positively influence the shadow economy. For example, for countries with weak institutional quality, "increased monitoring due to better institutions drives firms underground and thus into a corrupt environment, instead of allowing them to stay in the official economy where they remain corrupt but willing to pay higher bribes the sooner they are monitored (Bjørnskov, 2011, p. 141)."

therefore more likely to migrate to the official economy in nations that support the legal system. This leads us to the following testable hypothesis.

H3: The stronger the legal system and protection of property rights, the smaller the shadow economy, ceteris paribus.

Next, institutions that support access to sound money through price stability may raise the benefits of producing in the formal sector. Unstable inflation rates misrepresent the relative prices of goods and services and distort the essential elements of legal agreements, which, in turn, hinder formal economic activity (Gwartney and Lawson 2003). Additionally, volatile inflation rates may impact informality by deteriorating real income (Crane and Nourzad 1986; Bittencourt, Gupta, and Stander 2014). For example, because inflation reduces real net earnings from labor, economic participants regain purchasing power by evading taxes (Crane and Nourzad 1986). Additionally, to the extent that inflation raises the costs of operation in the formal sector, firms are more likely to relocate to the informal sector where they may lower their costs by not paying taxes (Goel and Nelson 2016). Employing a monetary overlapping generations production economy, Bittencourt, Gupta, and Stander (2014) show that when economic agents notice a decline in real deposits maintained at their financial institutions as a result of high inflation, they choose to hide a larger share of their earnings, thereby contributing to the prevalence of the shadow economy. Another component of sound money is freedom to access foreign bank accounts, which entails access to capital from additional financial institutions, which has been shown to lower the incidence of the shadow economy (see Straub (2005), Capasso and Jappelli (2013) and Berdiev and Saunoris (2016) for a discussion on financial development and the shadow economy). Therefore, hypothesis 4 is:

H4: Greater access to sound money is negatively associated with the shadow economy, ceteris paribus.

Freedom to trade internationally captures numerous elements of trade restrictions such as tariffs, regulatory trade barriers, capital restrictions, and exchange rate controls (see Gwartney, Lawson, and, Hall 2017). These trade barriers entice economic actors to migrate to the informal sector to avoid for example burdensome compliance costs associated with exporting and importing artifacts. In other words, to the extent that high regulatory trade barriers amplify the costs (e.g., transaction costs) to participate in the official sector, these trade restrictions may encourage shadow participants to deliver potentially curbed merchandise using the shadow sector through for example smuggling (Buehn and Farzanegan 2012; Mishkin 2009; Saunoris and Sajny 2017). Thus, institutions that remove onerous barriers to international trade inhibit these prospects for underground agents and therefore may deter the prevalence of the shadow economy (Schneider and Enste, 2000; Berdiev and Saunoris 2018a). Consequently, institutions that support freedom to trade internationally raises the benefits of producing in the official sector or increases the opportunity costs of underground activities, thereby enticing shadow participants to transition to legitimacy. This discussion sets up the following testable hypothesis:

H5: The more freedom to trade internationally, the smaller the shadow economy, ceteris paribus.

Closely related to regulatory trade barriers is the regulation of business, credit and labor markets. Government regulations that limit the freedom to engage in formal credit and labor markets entice economic participants to seek out alternatives in the informal sector (see, e.g., De Soto 1989; Loayza 1996; Johnson, Kaufmann, and Shleifer 1997; Schneider and Enste 2000; Enste, 2010). This is because burdensome regulations contribute to higher production costs (e.g., labor costs) in the formal sector (Gwartney and Lawson 2003; Schneider and Enste 2000). To the

extent that these costs are transferred to labor suppliers, economic agents circumvent these costs by choosing to supply their labor in the informal sector (Schneider and Enste 2000). Government regulations that also constrain competition through, such things as, high regulatory barriers to start a business, encourage participants to move to the shadow sector in order to compete. Gërxhani (2004, p. 274) argues that economic actors decide to move to the shadow economy where they enjoy more flexibility, freedom and autonomy; namely, with "the freedom of operating their own business; they have flexibility in determining hours or days of operation; they can use and develop their creativity." Accordingly, institutions that limit heavy regulations increase the benefits of formality and therefore invite informal agents to participate in the formal sector. This leads us to our final testable hypothesis:

H6: Greater freedom from regulation is associated with a decrease in the shadow economy, ceteris paribus.

In the next section, we describe the data and develop the empirical model to test these six hypotheses.

3. Data and empirical model

The dataset used in the analysis is a panel consisting of over 100 countries observed from 2000 to 2015 – see Table 1A for a list of countries. Our main variable of interest includes a measure of the size of the shadow economy (*Shadow (MS)*) by Medina and Schneider (2017). Of course, measuring the shadow economy is inherently difficult due to its secretive nature, thus Medina and Schneider (2017) rely on statistical methods of unobservable variables to measure its size.[4] Specifically, they employ the multiple indicators and multiple causes (MIMIC) method which uses covariance information from observables variables classified as either "indicators" or

[4] See Frey and Weck-Hannemann (1984), Restrepo-Echavarria (2015), and Schneider and Buehn (2013) for more on the difficulties in estimating the shadow economy.

"causal" variables within a simultaneous equations model to estimate the latent shadow economy. The simultaneous equations include a structural model which links the latent shadow variable with its causal variables, and the measurement model links the shadow economy with a set of indicator variables. Medina and Schneider (2017), in their main specification, considered the following causal variables: trade openness, GDP per capita, unemployment rate, government consumption as a percentage of GDP, and rule of law. For indicators, they included currency, labor force participation and growth rate of GDP per capita. This measure is an improvement, both in estimation and time frame, on the widely used measure of the shadow economy estimated by the MIMIC method from Schneider, Buehn, and Montenegro (2010).

In particular, Medina and Schneider's (2017) measure of the shadow economy covers 158 countries from 1991 to 2015, whereas the Schneider, Buehn, and Montenegro (2010) measure captures slightly more countries (162) but from only 1999 to 2007. Furthermore, the use of GDP as an indicator and causal variable as well as the calibration techniques of the MIMIC method have been criticized (see, e.g., Breusch 2016; Schneider 2016). Medina and Schneider (2017) show the robustness of the MIMIC method to replacing the indicator GDP with a measure of economic activity using the light intensity approach and to calibrating their model using predictive mean matching. According to the Medina and Schneider (2017) measure the average size of the shadow economy is roughly 27% of GDP in our sample; however, the shadow economy varies widely across countries. For instance, Switzerland has the smallest shadow economy at roughly 8% of GDP and Bolivia the largest at just over 70% of GDP.

Although the Medina and Schneider (2017) measure of the shadow economy is an improvement on the widely used Schneider, Buehn, and Montenegro (2010) measure, we use the latter to test the robustness of our results. However, both measures use the MIMIC method to

estimate the shadow economy; therefore, we consider an additional measure of the shadow economy from Dau and Cuervo-Cazurra (2014). Specifically, Dau and Cuervo-Cazurra (2014) estimate an informal economy index based on the electricity consumption method from Kaufmann and Kaliberda (1996). The underlying assumption of this method is that electricity consumption captures all economic activity, whereas official GDP only captures official economic activity; thus, the difference between these two measures provides an estimate for informal economic activity (see Dau and Cuervo-Cazurra (2014) for details).[5] The correlation between the Medina and Schneider (2017) and Schneider, Buehn, and Montenegro (2010) measure of the shadow economy is not surprisingly high with a correlation of 0.99, while the correlation between these two measures and the Dau and Cuervo-Cazurra (2014) measure is high albeit considerably smaller with a correlation of around 0.50. The difference in correlation suggests that these measures are possibly capturing somewhat different aspects of the shadow economy.

Our next variable of interest includes institutional quality, which we measure using economic freedom. The Fraser Institute measures the degree of economic freedom based on five major areas including: (1) the size of government; (2) the legal system and property rights; (3) sound money; (4) freedom to trade internationally; and (5) regulation of credit, labor, and business (see Gwartney, Lawson, and Hall 2017). Each of these indexes are also made up of several sub-indexes for a total of 42 different variables used to construct the overall economic freedom index.[6] The overall measure of economic freedom along with each of its sub-components is measured on a scale from zero to ten with higher values denoting more freedom. According to

[5] The electricity consumption method for estimating the size of the shadow economy has also been criticized, for example, because not all shadow activities require electricity, and technological progress makes production and use of electricity more efficient over time (Schneider and Enste 2013).

[6] For more information on the composition of economic freedom see https://www.fraserinstitute.org/economic-freedom/approach.

this measure, Venezuela is the least economically free and Hong Kong the most economically free. The correlation between economic freedom and the size of the shadow economy is fairly large and negative with a correlation coefficient of -0.54 – see Table 1. The correlation between *Government Size* and several other sub-components of economic freedom is negative, but positive and insignificantly correlated with *Regulation Freedom*.

Each sub-component measures a different dimension of economic freedom, thus we are able to differentiate the important institutional qualities most relevant at curbing the spread of the shadow economy. In what follows, we describe each aspect of economic freedom following Gwartney, Lawson, and Hall (2017). First, the size of government sub-component measures the extent to which personal choice and markets, as opposed to government and political decision making, determine prices and the allocation of goods and services. Countries with a large government sector and high marginal tax rates receive lower scores. Second, the legal system and property rights describe the degree to which private property rights are protected and countries with secure law and order that enforces contracts. Strong private property rights and contract enforcement are essential ingredients to a well-functioning market economy that encourages investment. Third, countries that enjoy relatively low inflation and stable prices as well as ease in the use of foreign currencies in domestic and foreign banks receive higher scores in the area of sound money. Fourth, freedom to trade internationally captures the many restraints placed on trade including tariffs, quotas, and controls on capital and exchange rates that prevent freedom of exchange internationally. Thus, countries that have limited restraints on the movement of capital (both physical and human capital) receive higher scores. Finally, countries with lower scores on regulation tend to have stringent regulations on labor and capital markets and businesses which restrict entry and inhibit competition.

To control for other aspects that might influence the size of the shadow economy, we follow the literature and include a series of control variables (see Johnson, Kaufmann, and Shleifer 1997; Friedman et al. 2000; Schneider and Enste 2000; Gërxhani 2004; Schneider 2005). In particular, we account for the degree of political freedom (*Political Freedom*) measured using the sum of the index of civil liberties and political rights (Goel and Nelson 2005).[7] Democratic institutions offer individuals a "voice" option to vote corrupt politicians out of office as opposed to the "escape" option offered by the shadow economy (Teobaldelli and Schneider 2013). Next, more prosperous countries, measured by economic growth (*Growth*), offer more opportunities in the official sector and reduces the incentive to move underground. Of course, an income effect suggests that demand from the growing official sector could boost the demand in the shadow sector. In addition, countries with large investment in human capital, specifically in tertiary education (*Education*), raises the return in the official sector and thus minimizes the gains to be made underground (Loayza, Servén, and Sugawara 2009; Gërxhani and van de Werfhorst 2013; Buehn and Farzanegan 2013; Berdiev, Pasquesi-Hill, and Saunoris 2015). Finally, strength and quality of bureaucracy (*Bureaucratic Quality*) also reduces incentive to move production underground by, for example, reducing exploitation of public officials. The definitions, data sources and summary statistics for all the variables are presented in Table 2A.

To test the impact of economic freedom on the shadow economy following the six aforementioned hypotheses, we estimate the following model:

$$Shadow_{it} = \beta_0 + \beta_1 EconFreedom_{it}^{k} + \beta_2 X'_{it} + \mu_i + \tau_t + \varepsilon_{it} \quad (1)$$

[7] Because this measure of political freedom has been criticized for its ambiguity (see Munck and Verkuilen 2002), we also consider an alternate measure originally from Cheibub, Gandhi, and Vreeland (2010) and recently updated by Christian Bjørnskov and Martin Rode.

where *i* and *t* index country and year, respectively. The dependent variable *Shadow* measures the size of the shadow economy; the variable *EconFreedom* corresponds to economic freedom where *k* denotes overall economic freedom (*Economic Freedom*), size of government (*Government Size*), property rights and legal system (*Property Rights*), sound money (*Sound Money*), freedom to trade internationally (*Trade Freedom*) and freedom from regulation of credit, labor, and business (*Regulation Freedom*); *X* represents a vector of control variables shown to influence the prevalence of the shadow economy as discussed above which includes *Political Freedom*, *Growth*, *Education* and *Bureaucratic Quality*; μ_i denotes country-specific heterogeneity; τ_t denotes time specific effects; and ε_{it} is the error term. To estimate equation (1) we use a two-way country and time fixed effects model with robust standard errors. Confirmation of the five hypotheses (*H1* and *H3-H6*) is given by $\beta_1 < 0$ for each economic freedom measure. Theoretically, as discussed in the previous section, the effect of government size on the shadow economy is ambiguous (*H2*).

4. Results

Baseline Results

Our baseline results using two-way country and time fixed effects estimation are reported in Table 2. Models 2.1 to 2.7 include measures of economic freedom without the control variables. To begin, the coefficient on the overall economic freedom is negative and highly statistically significant confirming our main hypothesis (*H1*). The estimated elasticity, which is reported at the bottom of Table 2, shows that a 10 percent increase in the overall economic freedom is associated with a decrease of the shadow economy by 7.5 percent. According to the adjusted R-squared, economic freedom explains 49 percent of the variation in the shadow economy.

Next, we examine the impact of each sub-component of economic freedom on the shadow economy. Due to the possible interdependence of several of the sub-components of the freedom index, we first estimate these variables separately (Models 2.2-2.6). The coefficient on each of the sub-components of economic freedom is negative and statistically significant at the 1% level, confirming hypotheses *H3-H6*. As stated, the impact of government size on the shadow economy is unclear (*H2*); however, the empirical evidence suggests that smaller governments are associated with a smaller shadow economy. This is consistent with informal participants leaving the informal sector in response to policies that remove burdensome taxes (e.g., Johnson, Kaufmann and Shleifer 1997; Schneider and Enste 2000; Gërxhani 2004; Loayza 1996). As can be seen, the estimated elasticities vary somewhat across the different measures of economic freedom. For example, regulation freedom appears to have the greatest effect with an elasticity of about -0.40 and sound money the least with an elasticity of about -0.14. Model 2.7 includes all the sub-components in the same equation. As expected, the magnitude of each coefficients is smaller in absolute value but each remains significant with the exception of sound money. Consequently, once we control for other dimensions of economic freedom, sound money has a limited effect on the shadow economy. The adjusted R-squared suggests that the sub-components of economic freedom explain about 41% to 50% of the variation in shadow activities.

In Models 2.8-2.14, we include a standard set of control variables. As before, the coefficients on economic freedom and its sub-components are all negative and highly statistically significant. Although the magnitude for each measure of economic freedom is slightly less in absolute value (except for sound money), they continue to tell the same story that it is regulation freedom that has the largest impact at curbing the size of shadow activities. Once we include all sub-components of economic freedom together in the same specification, sound money is again

insignificant. Nevertheless, these results continue to support the claim that regulations are a major driver of shadow economic activity (see, for a discussion, Schneider and Enste 2000).[8] We summarize the main results in Table 9.

Accordingly, these findings indicate that economic freedom and its separate dimensions reduce the spread of shadow activities. That is, our findings suggest that institutions that support economic freedom encourage economic actors to leave the informal sector or transition from the underground sector to the official sector. More specifically, greater access to sound money, protection of property rights and legal system, freedom from burdensome taxes and regulation, and freedom from heavy regulatory trade barriers increase the benefits of producing in the official economy, or, in other words, increase the opportunity cost of participating in the shadow economy. Our results are broadly consistent with those of Saunoris and Sajny (2017) who find that economic freedom promotes formal entrepreneurship and deters informal entrepreneurship using a cross-section of 61 countries.

Turning to the control variables, higher economic growth reduces the shadow economy due to more opportunities to exploit in the formal sector. This coincides with the belief that the shadow economy is counter-cyclical by absorbing the excess supply (e.g. labor supply) and demand during recessions (see Bajada and Schneider 2009). The coefficient on education, although negative, is statistically insignificant across all models, except in Model 2.10. The lack of significance in education could be partly due to the high variation of educational quality across countries. Interestingly, the coefficient on political freedom is insignificant across all models suggesting that economic, rather than political, freedom is most important for reducing the prevalence of the shadow economy. Lastly, the negative and significant coefficient on

[8] We also consider an alternate model by using economic growth lagged by one year to assuage concerns of endogeneity and the results remain robust. These results are available by request from the authors.

bureaucratic quality suggests that enhanced government quality raises the opportunity costs of producing underground. These findings are therefore in line with the notion that improvements to the quality of bureaucracy check shadow activities (see Dreher, Kotsogiannis, and McCorriston 2009).

Overall, these results point to the importance of the free enterprise system in thwarting the spread of the shadow economy. Institutions that support economic freedom make it easier for entrepreneurs to innovate and utilize the market economy to expand markets and promote economic growth. However, countries with oppressive institutions that lack economic freedom and make it difficult for entrepreneurs to thrive prompt the development of the underground economy to be used as an escape from poor institutions. Indeed, the existence of the shadow economy prevents the extortive powers of bureaucrats, thus promoting economic freedom in the official sector. The disaggregated measure of economic freedom continues to show that every aspect of economic freedom is beneficial in preventing individuals from migrating underground. In particular, we find that freedom from regulation has the largest impact on the spread of the shadow economy, which is consistent with the extant literature that shows that regulations are a main driver of shadow economic activities (e.g., Schneider and Enste 2000).

Next, to ensure our baseline results are insensitive to changes, we conduct a series of robustness checks. First, we check the sensitivity of our results using alternate measures of the shadow economy. Second, we account for the simultaneity bias caused by reverse causality using instrumental variables and estimate equation (1) using a two-stage least squares. Third, we check the robustness of our results to outliers using robust regression. Fourth, we check for possible nonlinearities in the relationship between the shadow economy and economic freedom. Fifth, we

consider an alternate measure of political freedom. Lastly, we distinguish between developed and developing countries to account for the heterogeneity related to the level of development.

Alternate Measures of the Shadow Economy

Due to the inherent difficulties in measuring economic activity that is deliberately concealed from authorities, considering an alternate measure of the shadow economy is a useful endeavor. To carry out this robustness check, we replace our main dependent variable *Shadow (MS)* with two alternate measures of the shadow economy from Schneider, Buehn, and Montenegro (2010) (*Shadow (SBM)*) and Dau and Cuervo-Cazurra (2014) (*Shadow (DC)*), and re-estimate the Models 2.8-2.13 in Table 2.[9] These results are reported in Table 3. Consistent with our baseline results, economic freedom has a negative and statistically significant effect across both measures of the shadow economy. However, the results for the sub-components are slightly effected using these new, albeit limited measures, of the shadow economy.[10] That is, for the dependent variable *Shadow (SBM)*, the coefficient on each of the sub-components is negative and significant, with the exception of the coefficient on government size. Conceivably, lower scores of government size caused by high tax rates could reduce the spread of the shadow economy if the tax revenues are used to provide beneficial public goods and inputs, or, alternatively, are used to combat the illegal underground activity. Moreover, when *Shadow (DC)* is the dependent variable, the coefficients on sound money and regulation freedom are negative and significant. The differences in the effect of the sub-components across these two measures of the shadow economy and our main measure can be explained by the absence of the Great Recession, and the

[9] We also considered an alternate measure of the shadow economy from Alm and Embaye (2013) that is based on the currency demand method and dynamic panel estimation. Using this alternate measure of the shadow economy, the results confirm our main findings that economic freedom (and its sub-components) reduce the size of the shadow economy; however, government size and regulation freedom are both insignificant. These results are not reported to conserve space, but are available by request from the authors.

[10] Note that the data for *Shadow (SBM)* and *Shadow (DC)* end in 2007 and 2005, respectively.

legislative influences that resulted, in these alternate measures as well as the likelihood that each shadow measure is capturing somewhat different aspects of the shadow economy.

Accounting for Simultaneity

The baseline models assume that economic freedom is exogenous; however, it is reasonable to consider that a larger shadow economy might prompt law makers to crack down on shadow activities through regulations and other mechanisms that undermine economic freedom, thus biasing the baseline results. To account for this simultaneity bias, we re-estimate our baseline models using two-stage least squares and instrument each freedom measure with 2-3 lags of itself (the results are robust to alternate lag structures). These results are reported in Table 4. The coefficient on economic freedom and its components are all negative and highly statistically significant suggesting that the results are robust to simultaneity. In fact, the simultaneity bias appears to be a downward bias; thus, after correction for simultaneity, the effect is even larger. In support of valid and relevant instruments, the Kleibergen-Paap Wald F statistic is highly significant and the Hansen J statistic is insignificant in four of the six models (for details on these tests see Baum, Schaffer, and Stillman 2007). The control variables are overall consistent with the baseline models although bureaucratic quality lacks statistical significance at conventional levels (except in Model 4.4), and the variable education, as expected, is negative and statistically significant in five of six models.

Correcting for Outliers

As an additional robustness check, we account for potential outliers that would otherwise skew the underlying relationship between economic freedom and the shadow economy by estimating the baseline models using robust regression. Robust regression uses Cook's distance less than one and Huber iterations followed by bi-weight iterations to eliminate outliers (see, for

details, Li 1985). The results, reported in Table 5, show that the baseline results are robust to the exclusion of outliers. With the exception of government size which is now positive and statistically significant, the coefficients on economic freedom and its separate components are negative and statistically significant. The positive sign on government size is consistent with the mixed results on government size in the literature (see, e.g., Goel and Nelson 2016). Of course the multi-faceted nature of government size makes it challenging to isolate its effect on the shadow economy.[11] The negative and significant effect of growth and bureaucratic quality are robust to outliers and education is negative and statistically significant across all models. Lastly, political freedom is insignificant except in Model 5.2 where the coefficient is negative and significant.

Nonlinear Effects

Furthermore, we test for a possible non-linear relationship between the shadow economy and economic freedom. For example, it is conceivable that economic freedom has a diminishing effect on the shadow economy. To test for diminishing returns to economic freedom, we include a quadratic term to equation (1) and re-estimate the Models 2.8-2.13 in Table 2. To facilitate interpretation and alleviate problems with multicollinearity, we center each freedom measure by subtracting off its mean. The results are reported in Table 6. For all, except sound money, the coefficient on the linear term is negative and significant reinforcing the baseline results. Turning to the coefficient on the quadratic term, all coefficients are insignificant except for that of trade freedom. That is, the only freedom measure to exhibit diminishing returns is the freedom to trade. The control variables are in line with the baseline findings.

Alternate Measure of Political Freedom

[11] For instance, the size of government is measured based on government consumption as a percentage of total consumption, transfer and subsidies, government enterprises and investment, and top marginal tax rates (see Gwartney, Lawson, and Hall 2017).

Due to the multidimensional nature of political freedom, we consider an alternate measure originally from Cheibub, Gandhi, and Vreeland (2010) that was recently updated by Christian Bjørnskov and Martin Rode.[12] This variable (*Political Freedom2*) is a dummy variable with one denoting democracy and zero otherwise (see Cheibub Gandhi, and Vreeland (2010) for details). Using this alternate measure, we re-estimate models 2.8-2.13 in Table 2 and report the results in Table 7. Based on this set of results, economic freedom and each component remain statistically significant in reducing the shadow economy, whereas the coefficient on *Political Freedom2* is insignificant across all models.

Effect of Economic Freedom across Levels of Development

The underlying assumption thus far has been that economic freedom has the same effect on all countries. This assumption may be too restrictive especially when one thinks about the significant differences between developed and developing countries. For example, the size of the shadow economy differs considerably across development with developed countries having the smallest shadow economy around 8-10 percent of GDP compared to shadow economies in developing countries that at times exceed 70 percent of GDP (Schneider and Enste 2000). The purpose and existence of the shadow economy also varies across levels of development due to the cost-benefit differential that determines the attractiveness of the shadow economy (see, e.g., Gërxhani 2004). The cost-benefit differential stems from differences in institutional development and available opportunities in the formal sector. To examine the heterogeneous response to economic freedom across developed and developing countries, we split the sample based on the median level of per capita real GDP, and report the results in Table 8. Consistent with our baseline model, economic freedom reduces the size of the shadow economy for both developed and developing countries; however, there are some differences related to the type of economic

[12] These data are available at http://www.christianbjoernskov.com/bjoernskovrodedata/.

freedom that is important in curbing shadow activities among developing countries. Specifically, the size of government nor sound money have any significant effect on the size of the shadow economy in developing countries. Again, we find that regulation freedom has the largest impact on the shadow economy in both developing and developed countries. In sum, these results support our main findings; however, the differences in the effect of economic freedom across levels of development warrants further research.

5. Conclusion

Economic freedom has become more accepted over time and its impact has continued to be studied and better understood. In addition, a large and growing shadow economy has also sparked interest in better understanding the main drivers of underground activity (see, e.g., Schneider and Enste 2000; Gërxhani 2004; Loayza 2016). In this paper, we focus on understanding how economic freedom impacts the development of the shadow economy. Using panel data on over 100 countries observed from 2000 to 2015, the results suggest that increases in economic freedom significantly decreases the size of the shadow economy. Numerically, we find that a one percent increase in the economic freedom index results in a decline in the size of the shadow economy by roughly 0.7 percent. In addition, we find that economic freedom rather than political freedom is most effective at curbing shadow activity. These findings are robust after accounting for an alternate measure of the shadow economy, outliers, simultaneity, and nonlinearities.

The reason behind this result is that individuals that are free to cooperate in a market setting with institutions that support strong private property rights and where individuals are not burdened by excessively high taxes and regulations feel less of a need to migrate to the shadow economy. In other words, economic freedom releases the chains of government and allows

individuals to conduct their businesses freely and openly, which greatly increases the opportunity costs of migrating underground. Indeed, one of the main benefits of the shadow economy is the freedom and autonomy that it allows its participants, thus more economic freedom in the formal sector lessens the attractiveness of the underground sector. Accordingly, our evidence highlights that countries that support economic freedom encourage informal participants to leave the shadow sector and transition to legitimacy.

Of course, economic freedom is multidimensional and captures freedom related to such things as the size of government, legal system and property rights, sound money, international trade, and regulation. To better understand which aspect of economic freedom is most important at combating the shadow economy, we extended the baseline models to these different dimensions of economic freedom. Overall, the results show that all aspects of economic freedom significantly decrease the size of the shadow economy. In terms of magnitude, we find that freedom from regulation has the largest impact on reducing the shadow economy, which is consistent with the extant literature that shows the regulation is a main driver of the shadow economy (Schneider and Enste 2000). Formal sector regulations, particularly labor regulations, not only make it difficult to hire works, but also constrains competition among new businesses. Thus in both cases workers and new firms find refuge in the shadow economy.

It is imperative to continue to better understand the causes of underground activities in order to develop policies to prevent individuals from moving underground or support informal agents to migrate to the official sector. Consequently, this paper empirically identifies economic freedom and its various components as important determinants of the shadow economy. Nevertheless, the impact of government size on the shadow economy still requires further attention. Additionally, a deeper exploration on the impact of economic freedom (and its separate

components) on shadow activities in developed and developing countries is warranted. Turning to possible policy implications, it seems clear from this research that countries would benefit from policies that support economic freedom. This is particularly the case for regulation freedom; thus, policies aimed at removing burdensome regulations would mitigate the development of the shadow sector. These policies likely have important spillovers in the shadow economy by preventing individuals from moving underground and also encouraging individuals in the underground economy to legitimize by migrating to the formal sector.

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Table 1: Correlations of Key Variables

	Shadow (MS)	*Economic Freedom*	*Government Size*	*Property Rights*	*Sound Money*	*Trade Freedom*	*Regulation Freedom*
Shadow (MS)	1.000						
Economic Freedom	-0.536	1.000					
	[0.000]						
Government Size	0.246	0.177	1.000				
	[0.000]	[0.000]					
Property Rights	-0.660	0.798	-0.248	1.000			
	[0.000]	[0.000]	[0.000]				
Sound Money	-0.461	0.821	-0.028	0.566	1.000		
	[0.000]	[0.000]	[0.186]	[0.000]			
Trade Freedom	-0.450	0.874	-0.003	0.687	0.727	1.000	
	[0.000]	[0.000]	[0.872]	[0.000]	[0.000]		
Regulation Freedom	-0.455	0.802	0.030	0.664	0.530	0.631	1.000
	[0.000]	[0.000]	[0.164]	[0.000]	[0.000]	[0.000]	

Notes: N=2189. Casewise deletion is used. Probability values are in brackets.

Table 2: Baseline Model (dependent variable: *Shadow (MS)*)

	(2.1)	(2.2)	(2.3)	(2.4)	(2.5)	(2.6)	(2.7)	(2.8)	(2.9)	(2.10)	(2.11)	(2.12)	(2.13)	(2.14)
Economic Freedom	-2.946***							-2.719***						
	(0.560)							(0.543)						
Government Size		-0.991***					-0.711***		-0.871***					-0.623***
		(0.251)					(0.244)		(0.235)					(0.231)
Property Rights			-1.379***				-0.940***			-1.160***				-0.778***
			(0.178)				(0.278)			(0.176)				(0.275)
Sound Money				-0.448***			-0.201				-0.461***			-0.214
				(0.165)			(0.160)				(0.166)			(0.167)
Trade Freedom					-1.408***		-0.801**					-1.298***		-0.765**
					(0.329)		(0.308)					(0.318)		(0.307)
Regulation Freedom						-1.555***	-0.849***						-1.431***	-0.814***
						(0.302)	(0.270)						(0.296)	(0.271)
Growth								-12.066***	-12.118***	-11.412***	-13.739***	-12.353***	-12.082***	-10.854***
								(2.867)	(3.059)	(1.758)	(3.166)	(2.866)	(2.963)	(2.746)
Education								-0.014	-0.016	-0.020**	-0.009	-0.025	-0.018	-0.022
								(0.021)	(0.022)	(0.009)	(0.022)	(0.021)	(0.021)	(0.020)
Political Freedom								-0.002	0.074	-0.006	0.034	-0.001	0.056	-0.007
								(0.161)	(0.170)	(0.072)	(0.162)	(0.169)	(0.146)	(0.162)
Bureaucratic Quality								-2.252**	-2.705***	-3.033***	-3.093***	-2.698***	-3.048***	-2.140**
								(0.902)	(0.990)	(0.514)	(0.949)	(0.931)	(0.941)	(0.928)
Elasticity														
	-0.753***	-0.229***	-0.294***	-0.136***	-0.377***	-0.398***	-----	-0.714***	-0.202***	-0.262***	-0.144***	-0.359***	-0.380***	-----
	(0.147)	(0.059)	(0.039)	(0.050)	(0.089)	(0.078)	-----	(0.145)	(0.055)	(0.042)	(0.052)	(0.089)	(0.081)	-----
Observations	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310	1,310
R-squared	0.490	0.442	0.431	0.416	0.448	0.440	0.503	0.522	0.479	0.469	0.463	0.487	0.482	0.531
Number of Countries	119	119	119	119	119	119	119	119	119	119	119	119	119	119

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using two-way country and time fixed effects. Elasticity estimates are evaluated at the mean for the estimated sample and standard errors are estimated using the Delta method. Robust standard errors are in parentheses. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 3: Robustness Check 1: Alternate Measures of the Shadow Economy

dependent variable:	*Shadow (SBM)*						*Shadow (DC)*					
	(3.1)	(3.2)	(3.3)	(3.4)	(3.5)	(3.6)	(3.7)	(3.8)	(3.9)	(3.10)	(3.11)	(3.12)
Economic Freedom	-0.927***						-4.468*					
	(0.240)						(2.437)					
Government Size		-0.018						-0.140				
		(0.127)						(1.099)				
Property Rights			-0.536***						1.448			
			(0.127)						(1.927)			
Sound Money				-0.224***						-2.040***		
				(0.069)						(0.711)		
Trade Freedom					-0.475***						-0.219	
					(0.130)						(1.252)	
Regulation Freedom						-0.386**						-3.084*
						(0.173)						(1.637)
Growth	-7.952***	-7.944***	-7.712***	-8.414***	-7.590***	-8.034***	-31.739***	-30.691**	-31.468**	-37.285***	-30.676**	-29.880**
	(1.724)	(1.691)	(1.056)	(1.674)	(1.718)	(1.642)	(10.959)	(12.158)	(12.119)	(11.380)	(12.112)	(11.612)
Education	-0.016	-0.025*	-0.025***	-0.019	-0.026**	-0.021	-0.248**	-0.266**	-0.264**	-0.240**	-0.268**	-0.248**
	(0.012)	(0.013)	(0.007)	(0.013)	(0.013)	(0.013)	(0.110)	(0.116)	(0.117)	(0.104)	(0.117)	(0.117)
Political Freedom	0.027	0.063	0.040	0.048	0.056	0.057	-0.285	-0.045	0.039	-0.378	-0.034	-0.055
	(0.098)	(0.106)	(0.046)	(0.103)	(0.102)	(0.100)	(0.779)	(0.837)	(0.855)	(0.740)	(0.839)	(0.808)
Bureaucratic Quality	-0.329*	-0.553***	-0.540**	-0.455**	-0.459**	-0.542***	-2.948	-3.707	-3.765	-2.932	-3.723	-3.662
	(0.189)	(0.195)	(0.222)	(0.211)	(0.184)	(0.187)	(2.278)	(2.551)	(2.525)	(1.897)	(2.506)	(2.778)
Elasticity												
	-0.022***	-0.004	-0.107***	-0.063***	-0.120***	-0.090**	-0.765*	-0.020	0.202	-0.414***	-0.040	-0.522*
	(0.057)	(0.027)	(0.025)	(0.019)	(0.033)	(0.040)	(0.437)	(0.157)	(0.261)	(0.149)	(0.230)	(0.283)
Observations	641	641	641	641	641	641	415	415	415	415	415	415
R-squared	0.625	0.594	0.608	0.610	0.614	0.603	0.109	0.082	0.086	0.133	0.082	0.101
Number of Countries	107	107	107	107	107	107	84	84	84	84	84	84

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using two-way country and time fixed effects. Elasticity estimates are evaluated at the mean for the estimated sample and standard errors are estimated using the Delta method. Robust standard errors are in parentheses. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 4: Robustness Check 2: Accounting for Simultaneity Bias using 2SLS (dependent variable: *Shadow (MS)*)

	(4.1)	(4.2)	(4.3)	(4.4)	(4.5)	(4.6)
Economic Freedom	-4.319***					
	(0.523)					
Government Size		-1.452***				
		(0.259)				
Property Rights			-2.166***			
			(0.436)			
Sound Money				-0.781***		
				(0.233)		
Trade Freedom					-2.518***	
					(0.426)	
Regulation Freedom						-2.975***
						(0.502)
Growth	-8.228***	-10.339***	-7.917***	-12.966***	-10.619***	-8.254***
	(1.936)	(1.849)	(2.037)	(2.008)	(2.071)	(2.079)
Education	-0.026***	-0.023**	-0.022**	-0.012	-0.032***	-0.026**
	(0.009)	(0.010)	(0.011)	(0.010)	(0.011)	(0.010)
Political Freedom	-0.050	0.053	-0.133	-0.067	-0.146	0.009
	(0.092)	(0.074)	(0.095)	(0.094)	(0.103)	(0.096)
Bureaucratic Quality	0.032	-0.783	-0.898	-1.862**	-1.037	-0.888
	(0.903)	(0.812)	(1.094)	(0.890)	(0.807)	(0.964)
Observations	1,041	1,041	1,041	1,041	1,041	1,041
Number of Countries	112	112	112	112	112	112
Kleibergen-Paap rk Wald F statistic	129.9***	95.73***	74.77***	49.25***	51.99***	63.71***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Kleibergen-Paap rk LM statistic	74.01	161.3	74.47	41.46	53.89	82.86
Hansen's J statistic	0.385	2.619	0.576	5.124**	2.470	6.969***
	[0.535]	[0.106]	[0.448]	[0.024]	[0.116]	[0.008]

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using two-stage least squares with two-way country and time fixed effects. All freedom variables (Government Size, Economic Freedom, Property Rights, Sound Money, Trade Freedom, and Regulation Freedom) are treated as endogenous and instrumented using "internal" instruments by using their own lags back two and three periods. Robust standard errors are in parentheses and probability values are in brackets. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1. The critical values for the Kleibergen-Paap rk Wald F statistic are in Stock and Yogo (2005).*

Table 5: Robustness Check 3: Accounting for Outliers using Robust Regression (dependent variable: *Shadow (MS)*)

	(5.1)	(5.2)	(5.3)	(5.4)	(5.5)	(5.6)
Economic Freedom	-3.045***					
	(0.194)					
Government Size		0.675***				
		(0.184)				
Property Rights			-1.235***			
			(0.167)			
Sound Money				-0.439***		
				(0.080)		
Trade Freedom					-1.353***	
					(0.132)	
Regulation Freedom						-1.341***
						(0.161)
Growth	-11.300***	-25.020***	-12.066***	-14.567***	-12.118***	-12.199***
	(1.573)	(6.468)	(1.669)	(1.682)	(1.618)	(1.653)
Education	-0.022**	-0.060***	-0.032***	-0.023**	-0.040***	-0.029***
	(0.009)	(0.012)	(0.009)	(0.009)	(0.009)	(0.009)
Political Freedom	-0.047	-0.380***	-0.030	0.048	-0.047	0.072
	(0.065)	(0.090)	(0.068)	(0.069)	(0.067)	(0.068)
Bureaucratic Quality	-2.140***	-6.922***	-3.016***	-3.121***	-2.626***	-2.985***
	(0.468)	(0.299)	(0.487)	(0.494)	(0.479)	(0.486)
Observations	1,310	1,310	1,310	1,310	1,310	1,310
Number of Countries	119	119	119	119	119	119
R-squared	0.981	0.492	0.979	0.979	0.980	0.979

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using robust regression controlling for two-way country and time fixed effects. To eliminate outliers Cook's Distance (less than one) and Huber iterations followed by biweight iterations are used (Li, 1985). Standard errors are in parentheses. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 6: Robustness Check 4: Nonlinear Relationship between the Shadow Economy and Economic Freedom (dependent variable: *Shadow (MS)*)

	(6.1)	(6.2)	(6.3)	(6.4)	(6.5)	(6.6)
Economic Freedom	-2.984***					
	(0.558)					
Economic Freedom²	-0.369					
	(0.295)					
Government Size		-0.851***				
		(0.235)				
Government Size²		0.085				
		(0.110)				
Property Rights			-1.183***			
			(0.328)			
Property Rights²			-0.023			
			(0.093)			
Sound Money				-0.277		
				(0.208)		
Sound Money²				0.068		
				(0.047)		
Trade Freedom					-1.979***	
					(0.354)	
Trade Freedom²					-0.444***	
					(0.101)	
Regulation Freedom						-1.359***
						(0.306)
Regulation Freedom²						0.139
						(0.149)
Growth	-11.991***	-12.195***	-11.508***	-13.691***	-12.374***	-11.967***
	(2.865)	(3.041)	(3.125)	(3.167)	(2.753)	(2.955)
Education	-0.009	-0.017	-0.020	-0.010	-0.009	-0.017
	(0.021)	(0.022)	(0.023)	(0.023)	(0.019)	(0.021)
Political Freedom	0.006	0.064	-0.006	0.033	0.018	0.056
	(0.161)	(0.162)	(0.161)	(0.161)	(0.176)	(0.147)
Bureaucratic Quality	-2.317***	-2.788***	-3.041***	-3.033***	-2.338***	-3.000***
	(0.865)	(1.002)	(1.074)	(0.990)	(0.865)	(0.965)
Observations	1,310	1,310	1,310	1,310	1,310	1,310
R-squared	0.525	0.481	0.469	0.466	0.519	0.483
Number of Countries	119	119	119	119	119	119

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using two-way country and time fixed effects. Each economic freedom variable is centered by subtracting off its corresponding mean. Robust standard errors are in parentheses. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 7: Robustness Check 5: Alternate Measure of Political Freedom (dependent variable: *Shadow (MS)*)

	(7.1)	(7.2)	(7.3)	(7.4)	(7.5)	(7.6)
Economic Freedom	-2.731***					
	(0.530)					
Government Size		-0.867***				
		(0.233)				
Property Rights			-1.157***			
			(0.295)			
Sound Money				-0.462***		
				(0.165)		
Trade Freedom					-1.298***	
					(0.314)	
Regulation Freedom						-1.433***
						(0.296)
Growth	-12.045***	-12.225***	-11.409***	-13.793***	-12.357***	-12.156***
	(2.873)	(3.069)	(3.107)	(3.161)	(2.864)	(2.960)
Education	-0.014	-0.017	-0.020	-0.009	-0.025	-0.018
	(0.021)	(0.023)	(0.023)	(0.022)	(0.021)	(0.021)
Political Freedom2	-0.248	-0.041	0.034	0.087	0.086	-0.093
	(1.031)	(1.043)	(0.908)	(0.921)	(0.947)	(0.940)
Bureaucratic Quality	-2.253**	-2.696***	-3.034***	-3.085***	-2.697***	-3.039***
	(0.903)	(0.992)	(1.074)	(0.949)	(0.932)	(0.945)
Observations	1,310	1,310	1,310	1,310	1,310	1,310
R-squared	0.522	0.479	0.469	0.463	0.487	0.481
Number of Countries	119	119	119	119	119	119

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using two-way country and time fixed effects. Robust standard errors are in parentheses. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 8: Robustness Check 6: The Effect of Economic Freedom on the Shadow Economy Conditional on Development (dependent variable: *Shadow (MS)*)

	Developed Countries						Developing Countries					
	(8.1)	(8.2)	(8.3)	(8.4)	(8.5)	(8.6)	(8.7)	(8.8)	(8.9)	(8.10)	(8.11)	(8.12)
Economic Freedom	-2.649***						-2.044**					
	(0.810)						(0.948)					
Government Size		-0.873**						-0.436				
		(0.415)						(0.313)				
Property Rights			-1.274***						-0.796***			
			(0.255)						(0.234)			
Sound Money				-0.838***						-0.046		
				(0.240)						(0.245)		
Trade Freedom					-1.239**						-0.763**	
					(0.618)						(0.324)	
Regulation Freedom						-1.640***						-1.074**
						(0.439)						(0.427)
Growth	-11.084**	-10.572**	-11.096***	-12.713**	-10.529**	-10.576**	-11.405***	-11.416***	-10.237***	-11.731***	-12.073***	-11.257***
	(4.648)	(5.108)	(2.424)	(4.817)	(4.571)	(4.649)	(3.724)	(3.921)	(2.468)	(3.983)	(3.746)	(3.735)
Education	-0.023	-0.033	-0.032***	-0.017	-0.033	-0.030	-0.046	-0.037	-0.050***	-0.043	-0.051	-0.047
	(0.020)	(0.022)	(0.010)	(0.021)	(0.022)	(0.020)	(0.040)	(0.049)	(0.019)	(0.049)	(0.043)	(0.044)
Political Freedom	0.266	0.351	0.292*	0.395	0.330	0.301	-0.061	-0.010	-0.063	-0.030	-0.062	-0.017
	(0.315)	(0.337)	(0.153)	(0.318)	(0.343)	(0.319)	(0.197)	(0.199)	(0.081)	(0.200)	(0.202)	(0.183)
Bureaucratic Quality	-1.826	-2.037	-2.230***	-2.160	-2.171	-2.099	-1.063	-1.761	-1.823**	-1.992	-1.677	-1.940
	(1.315)	(1.525)	(0.628)	(1.452)	(1.449)	(1.334)	(1.971)	(1.624)	(0.806)	(1.681)	(1.605)	(1.701)
Observations	723	723	723	723	723	723	587	587	587	587	587	587
R-squared	0.481	0.403	0.392	0.442	0.410	0.423	0.629	0.614	0.617	0.608	0.617	0.621
Number of Countries	59	59	59	59	59	59	60	60	60	60	60	60

*Notes: See Table A2 for variable details. Constant included but not reported. All models are estimated using two-way country and time fixed effects. Robust standard errors are in parentheses. Asterisks denote significance at the following levels: *** p<0.01, ** p<0.05, * p<0.1.*

Table 9: Summary of the Empirical Findings

Hypothesis	**Description**	**Sign of effect**	**Elasticity**
H1	Greater economic freedom is associated with a smaller shadow economy, ceteris paribus	Negative	-0.714
H2	There is no clear-cut hypothesis on the impact of government size on the shadow economy.	Negative/Positive	-0.202
H3	The stronger the legal system and protection of property rights, the smaller the shadow economy, ceteris paribus.	Negative	-0.262
H4	Greater access to sound money is negatively associated with the shadow economy, ceteris paribus.	Negative	-0.144
H5	The more freedom to trade internationally, the smaller the shadow economy, ceteris paribus.	Negative	-0.359
H6	Greater freedom from regulation is associated with a decrease in the shadow economy, ceteris paribus.	Negative	-0.380

Table 1A: Countries in the Analysis

Albania	Ecuador	Korea, Rep.	Qatar
Algeria	Egypt, Arab Rep.	Kuwait	Romania
Angola	El Salvador	Latvia	Russian Federation
Argentina	Estonia	Lebanon	Saudi Arabia
Armenia	Ethiopia	Lithuania	Senegal
Australia	Finland	Luxembourg	Sierra Leone
Austria	France	Madagascar	Singapore
Azerbaijan	Gabon	Malawi	Slovak Republic
Bahrain	Gambia, The	Malaysia	Slovenia
Bangladesh	Germany	Mali	South Africa
Belgium	Ghana	Malta	Spain
Botswana	Greece	Mexico	Sri Lanka
Brazil	Guatemala	Moldova	Sweden
Brunei Darussalam	Guinea	Mongolia	Switzerland
Bulgaria	Guinea-Bissau	Morocco	Tanzania
Burkina Faso	Guyana	Mozambique	Thailand
Cameroon	Honduras	Myanmar	Togo
Canada	Hungary	Namibia	Trinidad and Tobago
Chile	Iceland	Netherlands	Tunisia
China	India	New Zealand	Turkey
Colombia	Indonesia	Nicaragua	Uganda
Congo, Dem. Rep.	Iran, Islamic Rep.	Niger	Ukraine
Congo, Rep.	Ireland	Nigeria	United Kingdom
Costa Rica	Israel	Norway	United States
Cote d'Ivoire	Italy	Pakistan	Uruguay
Croatia	Jamaica	Paraguay	Venezuela, RB
Cyprus	Japan	Peru	Vietnam
Czech Republic	Jordan	Philippines	Yemen, Rep.
Denmark	Kazakhstan	Poland	Zimbabwe
Dominican Republic	Kenya	Portugal	

Notes: $N = 119$

Table 2A: Variable definitions, sources and summary statistics

Variable	Description [observations; mean; standard deviation]	Source
Shadow (MS)	Prevalence of the shadow economy measured as a percent of GDP. Estimates are based on the MIMIC method. [1310; 27.45; 11.32]	Medina and Schneider (2017)
Shadow (SBM)	Prevalence of the shadow economy measured as a percent of GDP. Estimates are based on the MIMIC method. [1270; 32.89; 12.75]	Schneider Buehn, and Montenegro (2010)
Shadow (DC)	Informal economy index based on the electricity consumption method described in Kaufmann and Kaliberda (1996). [630; 50.79; 46.63]	Dau and Cuervo-Cazurra (2014)
Economic Freedom	A summary index of the five areas including (1) size of government; (2) legal system and security of property rights; (3) sound money; (4) freedom to trade internationally; (5) regulation. The index ranges from 0 to 10 with higher numbers denoting more economic freedom. [1310; 6.86; 0.85]	Fraser Institute (2017)
Government Size	An index of freedom associated with the size of government. This index is composed of four sub-components including: (1) government consumption; (2) transfer and subsidies; (3) government enterprises and investment; (4) top marginal tax rate (top marginal income tax rate and top marginal income and payroll tax rate. The index ranges from 0 to 10 with higher numbers denote the country relies more on personal choice and markets and less on government and political decision making. [1310; 6.25; 1.29]	Fraser Institute (2017)
Property Rights	An index of freedom associated with the legal system and property rights. This index is composed of nine sub-components including: (1) judicial independence; (2) impartial courts; (3) protection of property rights; (3) military interference in rule of law and politics; (4) integrity of the legal system; (5) legal enforcements of contracts; (6) regulatory costs of the sale of real property; (7) reliability of police; (8) business costs of crime. The index ranges from 0 to 10 with higher numbers denote effective enforcement of the laws and secure property rights essential for an efficient allocation of resources. [1310; 5.65; 1.65]	Fraser Institute (2017)
Sound Money	An index of freedom associated with sound money. This index is composed of four sub-components including: (1) money growth; (2) standard deviation of inflation; (3) inflation; (4) freedom to own foreign currency bank accounts. The index ranges from 0 to 10 with higher numbers denote countries with low and stable inflation rates and allow for alternative currencies to be used. [1310; 8.24; 1.44]	Fraser Institute (2017)
Freedom to Trade	An index of freedom associated with international trade. This index is composed of four sub-components including: (1) tariffs (revenue from	Fraser Institute (2017)

	trade taxes, mean tariff rate, and standard deviation of tariff rates); (2) regulatory trade barriers (non-tariff trade barriers and compliance costs of important and exporting); (3) black market exchange rates; (4) controls of the movement of capital and people (foreign ownership and investment restrictions, capital controls, and freedom of foreigners to visit). The index ranges from 0 to 10 with higher numbers denote countries more favorable to free trade and less protectionist. [1310; 7.26; 1.06]	
Regulation Freedom	An index of freedom associated with international trade. This index is composed of three sub-components including: (1) credit market regulations (ownership of banks, private sector credit, interest rate controls and negative real interest rates); (2) labor market regulations (hiring regulations and minimum wage, hiring and firing regulations, centralized collective bargaining, hours regulations, mandated costs of worker dismissal, and conscription); (3) business regulations (administrative requirements, bureaucracy costs, starting a business, extra payments bribes and favoritisms, licensing restriction, and costs of tax compliance. The index ranges from 0 to 10 with higher numbers denote countries that allow markets to determine prices and have less regulations. [1310; 6.91; 1.00]	Fraser Institute (2017)
Political Freedom	An index measuring the degree of political freedom based on the sum of civil liberties and political rights. [1310; 5.57; 3.53]	Freedom House
Political Freedom2	A dummy variable equal to one if the country is democratic and zero otherwise. [1310; 0.73; 0.44]	Cheibub, Gandhi, and Vreeland (2010) & Bjørnskov and Rode
Education	Gross enrollment ratio (%) in tertiary education. [1310; 41.67; 26.49]	World Bank (2016)
Bureaucratic Quality	An index measuring the strength and quality of bureaucracy on a scale of 0 to 4 with higher numbers denoting better outcomes. [1310; 2.48; 1.07]	International Country Risk Guide (2016)
Growth	Percent change in GDP per capita in PPP constant 2011 international dollars. [1310; 0.025; 0.39]	World Bank (2016)

Notes: Summary statistics includes all available data for 119 countries from 2000 to 2015.