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The Effects of Economic Sanctions on the Informal Economy

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Abstract. *Countries often use economic sanctions to coerce other countries to change certain policies of which they do not approve. However, if sanctioned countries smuggle goods over the border, use informal financial intermediaries, and develop black markets to trade sanctioned goods, sanctions end up having a smaller impact, sanctioned countries have little incentive to modify their policies, and sanctions are more likely to fail. This paper is the first study to test empirically whether sanctions affect informality. I compile data from different studies about the size of the informal market for 147 countries over 46 years. I use these data to analyze the relationship between the size of the informal market adjusted by the size of the population and economic sanctions. I also estimate at the impact of economic sanctions on other activities associated with informal activities. I find that informal markets increase when a country is being sanctioned and the effects are larger when the economic sanction has strong international support. I also find that the type of sanction, trade or financial, is not an important determinant of the informal market size and that sanctions also lead to increases in robbery rates and corruption.*

Keywords: *shadow economy, economic sanctions, crime.*

Introduction

Anecdotal evidence shows that informal markets flourish in sanctioned countries. An *Economist* article describes the thriving black market trade between the sanctioned North Korea and China (The Economist, 2013). *The New York Times* describes how Iraq helped Iran skirt sanctions by facilitating illegal transfers through hawala houses (unofficial global networks of money traders), laundering money, and smuggling of oil (Risen and Adnan, 2012). In addition, according to a *Washington Post* article, economic sanctions led to the emergence of black markets for milk, foreign movies, and satellite dishes in Cuba (Roig-Franzia, 2006).

Why do we observe such an increase in informal markets? When sanctioning countries (senders) cut trade, aid or financial transactions to sanctioned countries (targets), sometimes sanctioned goods are being smuggled over the border, sanctioned goods are being illegally produced in the target, and the number of underground financial transactions increases.

Also, sanctions lead to an increase in crimes associated with the informal activities, such as robberies. In addition, running an informal business and smuggling goods over the border could encourage corruption because more officials are bribed to close their eyes to those activities.

Despite this anecdotal evidence, there are no empirical or theoretical papers describing the link between informal markets and economic sanctions. This paper fills this gap by estimating empirically the impact of various types of sanctions on the informal market size, crime rates, and corruption. This study finds that economic sanctions increase informality and other activities that are related to black or gray markets. This impact of economic sanctions is larger when sanctions have significant international support.

This paper adds to the literature on the economic impact of sanctions and on the literature on the determinants of informal markets. The economic impact of sanctions literature is concentrated mostly on the effects of sanctions on trade. Evenett (2002) shows that United States' Comprehensive Anti-Apartheid Act reduced bilateral imports from South Africa by a third. In addition, Hufbauer et al. (1997) study the impact of economic sanctions on bilateral trade flows and find that extensive sanctions have a large impact on bilateral trade flows. Unlike all these previous studies, my paper focuses on economic outcomes other than trade and tries to explain how sanctions affect the formal and informal economies.

Many studies find the multilateral sanctions have stronger economic effects than unilateral sanctions. Yang et al. (2009) find that multilateral sanctions that involve both the US and the EU have a negative impact on EU trade (imports, exports, and total trade), but US unilateral sanctions have a negative and significant effect only on the total EU trade. Caruso (2003) estimates the impact of economic sanctions on trade using a gravity model and shows that sanctions have a large negative impact on bilateral trade when they are extensive and comprehensive[1], but not when they are limited and moderate. Similar to these studies, in my paper, sanctions with international cooperation have a more pronounced effect on the informal economy than the ones without international cooperation.

This paper also adds to the literature on the determinants of informal markets. Ingram et al. (2007) find that the incidence of formality is negatively correlated with the rate of taxation. In addition, a United Nations

[1] Sanctions involving financial and trade sanctions (cuts in aid, financial relations, imports and exports).

study (United Nations. ECLAC and Department for International Development, 2003) finds that high taxes contributed to informal activity and encouraged firms to hire workers informally. Many businesses are not able to survive if they operate strictly according to the law when the state imposes high taxes, and ultimately, they are led to operating informally. However, according to Capasso and Jappelli (2013), high levels of taxation explain little of the informal activity. In my paper, I also control in the regression analysis for three tax rates: the highest personal income tax rate, the highest corporate income tax rate, and various tariff rates.

Capasso and Jappelli (2013) show that institutional failures such as poor contract enforcement and judicial inefficiency reduce the incentive for firms and individuals to reveal their revenues. Dabla-Norris, Gradstein and Inchauste (2008) claim that the quality of the legal framework is crucially important in determining the size of the informal sector, whereas the significance of taxes, regulations, and financial constraints is reduced in the context of a well-functioning legal system. Legal quality is the primary determinant of informality. They also find that legal obstacles induce informality among larger firms. Ulyssea (2010) finds that increasing enforcement levels of institutions is an effective policy to reduce informality. In my paper, I also control for some institutions such as law and order, a variable measuring the strength and impartiality of the legal system and the popular observance of the law.

Regulations affect informality because burdensome regulations condemn entrepreneurs to stay in the informal sector, according to Loayza, Oviedo and Serven (2005). Fialova and Schneider (2011) also mention regulatory distortions as an important determinant of the size of the informal market. Heavy regulations represent both direct costs for businesses, such as fees for the regulatory agencies or bribes to avoid the fees, and indirect costs, such as lost time figuring out complicated regulations. These costs lead to lower economic growth and higher informal sectors. Leibfritz (2011) shows that heavy regulations on businesses, such as administrative burdens on start-ups firms and restrictive labor laws, reduce the number of jobs in the formal economy and encourage firms to hire on the black market. Loayza, Oviedo and Serven (2005) also explain how excessive regulatory burden reduces growth and increases informality. My study also controls for a measure of regulations from the "Economic Freedom of the World" report (Frasier Institute 2012), but it does not find that it has a significant effect on the size of the shadow economy.

Henley, Arabscheibani and Carneiro (2008) conclude that urban residents are less likely to operate in the informal market than those in rural areas. In

my paper, I also control for the share of urban population in case countries with large urban populations will have lower levels of informality.

According to Oviedo (2009), informality is also correlated with income and development. Hazans (2011a, b) show that the level of GDP per capita has a positive effect on the prevalence of informal employment in Eastern and Southern Europe and an opposite effect in Western and Northern Europe. In my paper, economic sanctions affect the informal economy also through the formal economy.

Enste (2003) finds that quality of governance and public services increases the benefits of contributing to the public system and working in the formal sector and thus, gives extra incentives to work in the formal sector. Fialova and Schneider (2011) discuss other factors of informality such as the incompetence of the state, the distrust of the population in the public institutions, and overall acceptance of informal work. In addition, Capasso and Jappelli (2013) find that low levels of tax morale and institutional distrust increase the size of the informal economy. In my study, I investigate how economic sanctions affect the ability of the sanctioned state to provide goods and services to its citizens, alter the level of trust people have in their state and how sanctions influence the informal economy through these channels. In addition, when I include government expenditures as a share of GDP in the regression analysis, the effects of sanctions on the size of the shadow economy are smaller. This result confirms that the ability of the government to provide goods and services to the taxpayers affects the size of the informal economy.

Bosch (2006) shows that in states where the opportunity cost of employing people informally is small, there is a fall in formal employment and an increase in unemployment. In another paper, Bosch, Goni and Maloney (2007) find that a reduction in job finding rates in the formal market leads to an increase in the informal market. In my study, economic sanctions affect informal labor through the formal labor markets, by raising the unemployment rate and reducing the participation rate.

Johnson et al. (2000) explain how corruption, measured through firms' reporting of extralegal payments for services or government licenses, is correlated with the percentage of sales unreported for tax purposes. Ingram, Ramachandran and Desai (2007) find that the incidence of formality is negatively correlated with corruption. Fialova and Schneider (2011) say that corruption and overall acceptance of black and gray work affect the level of informal markets in the Eastern Europe region. In my paper, I also look at the effects of sanctions on corruption to test whether

more bribes are being paid to cover and facilitate the informal activity in sanctioned states.

The study is organized as follows: the next chapter presents the channels through which sanctions influence the level of informality in a target country, the next one describes the datasets, the method I used to calculate the shadow economy, and the econometric model. The following chapter shows the estimates for the effects of economic sanctions on the shadow economy and on other measures of informal activity, and the final chapter draws the main conclusions.

Economic sanctions and informality

Sanctions affect the informal economy directly and indirectly, through the formal economy and through other channels. Informal activities that are affected by economic sanctions can be divided into two broad categories: criminal such as smuggling, drug counterfeiting, etc. and noncriminal such as not reporting wages, underreporting self-employment income, or informal production of legal goods.

Financial sanctions involve cuts in development aid, freezes of assets, or denying access to banks. These types of sanctions can reduce the number of official financial transactions which, in turn, can lead to an increase in underground financial transactions and to higher informal market activity. Reduced access to assets and even cuts in aid could reduce the ability of some firms to produce in the formal sector. If it more difficult to function in the formal market than in the informal market, then more companies will move into the informal market and the informal economy will increase.

Aid is known to reduce the efficiency of certain sectors such as manufacturing and to reduce the profitability of investment (Rajan & Subramanian 2007), thus it is possible that economic sanctions involving cuts in development aid could increase firms' productivity in the formal sector. These companies will be less likely to function in the informal market.

Previous literature is split on whether development aid increases or not the quality of the institutions. If we believe Casey, Glennerster and Miguel (2012), then development aid increases the quality of institutions. Under this assumption, when sanctions are imposed, institutions weaken, companies and individuals operate easier in the informal market and shadow activity flourishes. If aid affects negatively the quality of institutions

(Selaya & Thiele 2010; Rajan & Subramanian 2007; Bjornskov 2010; and Djankov, Montalvo & Reynal-Querol, 2008), then the effects of sanctions on informality are negative.

Aid also increases the investment in human capital (Celasun & Walliser, 2008), so if sanctions involve cuts in aid, they will reduce the investment in human capital. In this way, people are not productive enough for the formal sector and are more likely to work in the informal labor markets, thus leading to an increase in the informality (Ovideo, 2009).

Sanctions can involve cuts in trade between targets and senders. Such sanctions can increase informality by encouraging the smuggling of sanctioned goods.

Trade is known to decrease unemployment and to increase official employment, labor force participation and wages in certain sectors (Helpman & Itskhoki, 2010; Hasan et al., 2012; Dutt, Mitra & Ranjan, 2009; Helpman, Itskhoki & Redding, 2010). A cut in trade due to sanctions could lead to fewer people working in the formal sector, smaller labor force participation in the formal markets, more labor participation in the informal markets and thus, more informality. However, some studies claim that trade could lead to higher unemployment and lower official employment in some sectors (Helpman & Itskhoki, 2010; Hasan et al., 2012; Attanasio, Goldberg and Pavcnik, 2004; Menezes, Aquino & Muendler, 2007), and if this is the case, the effects of sanctions on informality will be negative.

If firms in the target cannot produce goods for export, then formal workers will be fired and will be forced to use their skills in the informal sector. In addition, the former trading firms will likely use their capital and labor in related informal sectors, when they cannot operate any more in the formal sector due to the cut in exports. In both cases, informality increases as a result of sanctions.

A cut in imports could affect formal firms if the sanctioned goods are inputs, substitutes or complements for the goods these firms are producing. If the sanctioned goods are inputs or complements, then the firm faces higher costs of production and might hire more informal workers to reduce the labor costs or move into the informal sector if the costs are too high or it is impossible to produce without the sanctioned input. If the sanctioned good is a substitute, then the firm benefits from the sanction and it is less likely to operate in the informal sector. Similarly, cuts in imported goods could affect the informal markets directly and not only through the formal markets. The sanctioned goods could be substitutes, complements or inputs for the goods already produced in the informal markets at the time the sanctions are

imposed. Thus, these old informal markets could be affected positively or negatively by trade sanctions depending on the type of sanctioned good.

Sanctions could lead to a deterioration of social services (Government Accountability Office, 2002). As people can no longer rely on welfare programs and unemployment insurance, the benefits to activate in the formal sector decline and people are more likely to activate in the informal markets. Similarly, if countries relied on aid excessively and not on their own revenues, then after sanctions are imposed, countries might not be prepared to collect taxes and properly administer the revenues. People might become disillusioned with the authorities' use of tax money, the tax morale will decrease and more taxpayers will join the informal economy (Torgler & Schneider, 2007). These conditions could lead to general distrust and dissatisfaction in the government and general acceptance of informality that leads to an increase in the shadow economy (Enste, 2003; Hazans, 2011a). According to three studies, Capasso and Jappelli (2013), Hazans (2011b) and Loayza et al. (2005), sanctions increase the inefficiency of public institutions and lower quality of public goods provided to the citizens by the state. These two are well-known determinants of the opportunity costs of functioning in the shadow economy and thus, of the size of the shadow market.

If sanctions involve cuts in technology aid or technology trade, they could also increase informality, as low access to technology is known to keep many firms informal and forces them to hire in the informal labor markets (United Nations. ECLAC and Department for International Development, 2003).

Sanctions are also known to reduce press freedom because the target governments attempt to restrict the country's interactions with the outside world (Peksen, 2010). If the press is not free, it is less likely to shed light on large informal operations and thus, it is easier for individuals and firms to produce underground. Also, a press that is not free can make the government less transparent and less accountable to its citizens, which can translate into more distrust in the public institutions and more willingness to operate underground, break the national laws, and evade taxes.

However, not all economic sanctions can have large effects on the shadow economy. Sanctions that impose large costs on the formal markets are more likely to increase the size of the informal market.

Datasets and econometric methodology

This paper uses shadow economy data, data that measure the size of the overall informal market, economic sanctions data, and other macroeconomic data. The shadow economy dataset is compiled from various studies using similar methods of estimating the size of the shadow economy in a particular country[2]. The sanctions data come from a seminal book, Hufbauer et al. (2007) and it is completed with data points taken from the Peterson Institute website[3]. These data cover economic sanctions imposed between the years 1914 to 2012 on targets from all around the globe. Finally, the macroeconomic data is compiled from Freedom of the World (Frasier Institute, 2012), Global Competitiveness Report (World Economic Forum, 2011), International Country Risk Guide (PRS Group 2013), Petrescu (2012), United Nations Office on Drugs and Crime (2012) and the World Development Indicators (World Bank, 2013). Table 1 shows the summary statistics.

Table 1. Summary statistics

Variable	Obs	Mean	Std. Dev	Min	Max
shadow	1291	11.08	1.43	7.41	13.73
shadow1	1952	11.10	1.37	7.41	13.73
robbery	676	116.06	262.53	0.1	2859.7
kidnapping	569	1.99	3.39	0	21.2
drugs	413	143.85	210.76	0.1	1493.1
burglary	568	388.72	405.99	0	1939.2
sexual	438	29.74	35.72	0	205.6
corruption tax	383	3.60	1.62	1	7.6
corruption contract	383	4.82	1.72	1.3	8.35
corruption trade	383	3.88	1.64	1.15	7.9
sanction	12052	0.17	0.38	0	1
cooperation	2099	2.30	.95	1	4
gnp ratio	2099	1130.10	4757.89	.04	50869
financial	11979	0.14	0.34	0	1
comprehensive	11979	0.04	0.21	0	1
high cooperation	11819	0.05	0.21	0	1
high gnp ratio	11983	0.13	0.33	0	1
urban	10680	48.79	25.28	2	100
corporate	3694	30.99	13.08	0	75

[2] 1. Arvate et al. (2005) 2. Bajada and Schneider (2003) 3. Chattopadhyay, Chaudhuri and Schneider (2005) 4. Dell'anno and Schneider (2003) 5. Mummert and Schneider (2002) 6. Schneider (2000), Schneider (2002a) 7. Schneider (2002b) 8. Schneider (2003) 9. Schneider (2004) 10. Schneider (2005) 11. Schneider and Enste (2000) 12. Schneider and Savasan (2005).

[3] http://www.piie.com/publications/papers/paper.cfm?ResearchID=1821.

personal	3265	35.53	17.91	0	150
law and order	3488	3.71	1.46	0	6
regulation	2009	6.40	1.23	1	9.4
tariff	1703	8.04	10.38	0	254.58
tariff unweighted	1703	9.28	8.42	0	105.36
gdp	7988	6615.54	10671.26	54.50	108111.2
labor	3843	67.83	10.30	39.6	91.3
G	7166	15.94	6.88	1.37	76.22

Shadow economy dataset

The shadow economy indicators created using the DYMIMIC approach are based on a statistical theory of unobserved variables and not on a specific theoretical model relating to shadow markets. Shadow economy tries to calculate "those economic activities and the income derived from them that circumvent [...] government regulation, taxation or observation" (Dell'Anno & Schneider, 2003). It estimates a wide range of unofficial activities, both monetary and nonmonetary transactions, legal and illegal activities (Dell'Anno & Schneider, 2003). Examples include smuggling, bartering with drugs and other illegal goods, unreported income, and barter of legal goods and services.

The shadow economy dataset is compiled from various studies that use different variations of the DYMIMIC method[4]. Figure 1 shows the average size of shadow economy per GDP for six regions of the world over the period of time covered in the sample.

[4] Schneider and Savasan (2005) use survey results from Turkey to estimate the size of the shadow economy. Arvate et al. (2005), Bajada and Schneider (2005), Chattapadhyay, Chaudhuri and Schneider (2006), Dell'Anno and Schneider (2003), Mummert and Schneider (2002) and Schneider and Enste (2000) use the MIMIC approach, another version of the DYMIMIC approach. The DYMIMIC approach has its origin in the more basic MIMIC approach.

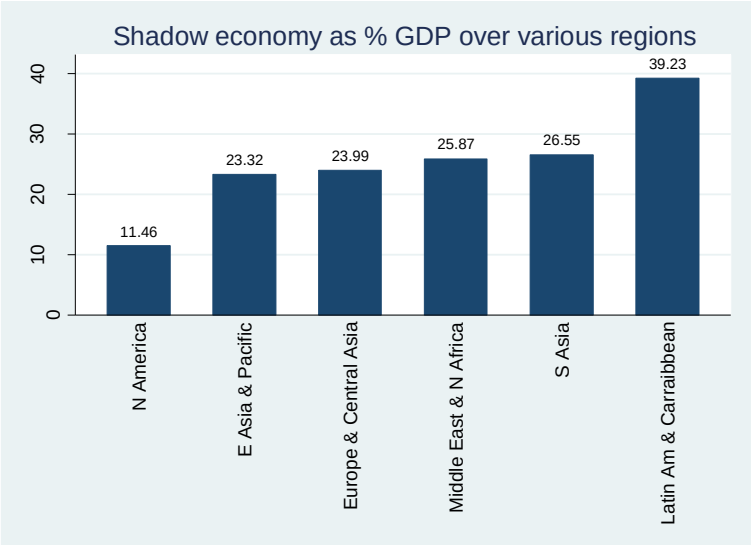

Figure 1. Shadow economy as % GDP over various regions

Figure 2 shows the value of the shadow economy per GDP over time for all the countries in my database. The trend of the shadow economy looks increasing, but the variable increases and decreases over time probably as shadow economies follow the business cycles of formal economies.

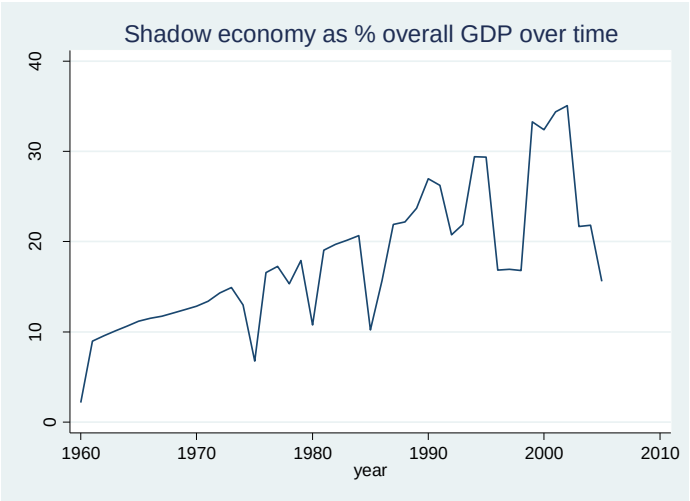

Figure 2. Shadow economy as % GDP over time

I use in the analysis the variable called shadow, which is the logarithm of the shadow economy per capita expressed in constant US dollars. I do not use the shadow economy expressed as a percentage of GDP in the regression analysis because economic sanctions are likely to affect both the

shadow economy and the official GDP and thus, the percentage of shadow economy of the GDP would not be a good dependent variable for this type of regression analysis. The logarithm also allows me to interpret the results as percentages. I also use another variable which I call shadow1 in some robustness checks to the regression analysis. This new variable shadow1 is estimated using the data on shadow economy per GDP from the various studies where these data exist and replacing the missing variables with the mean shadow economy per GDP. Then, all these values are transformed to sizes of shadow economy per capita expressed in constant US dollars. The variable shadow1 is the natural logarithm of this new shadow per capita measure. This variable has a larger number of observations than shadow. The mean of shadow is 11.08% and the mean of shadow1 is 11.10%.

Sanctions data

Economic sanctions are usually defined in the literature as "deliberate, government withdrawal, or threat of withdrawal, of customary trade or financial relations" (Hufbauer et al., 2007). Such sanctions are usually imposed to change a policy of one country of which the sender country does not approve. Alternatively, the sender can simply do nothing, engage in diplomatic discussions with the target country, or initiate a war. Sanctions are imposed for a wide range of reasons from preventing human rights violations to stopping nuclear weapons from being developed. The senders in this dataset are mostly large countries or coalitions of countries such as the League of Nations and the European Union. The targets vary from very large countries such as India and Pakistan to small ones such as Greece and Liberia. Sanctions can involve cuts in imports from the target to the sender (called also import sanctions), cuts in exports from the sender to the target (called export sanctions), and cuts in financial or development aid and/or freezing financial assets (called financial sanctions). These types of economic sanctions are usually imposed in a combination of two or three, almost never alone. There is still debate in the literature on why economic sanctions are lifted. Usually, this happens when the goals of the economic sanctions have been met or when the sender country changed its mind or reevaluated the policy goals of the economic sanctions.

The sanction variables used in this paper are constructed using the sanctions presented in the well-known Hufbauer et al. (2007) dataset. This dataset provides information on economic sanctions imposed on various countries around the world between the years of 1914 and 2007. I updated this dataset using the information on economic sanctions posted on the

Peterson Institute website[5], after the Hufbauer et al. (2007) book was published. While I have information on economic sanctions starting from 1914 up to 2012, I only use sanctions ranging from 1960 to 2012, since the rest of the data on macroeconomic variables is available only for years after 1960. The unit of observation in this analysis is one country-year. The sanction variable in this study equals one, if country i was sanctioned in year t by another country or alliance of countries, and zero, if country i was not sanctioned at all.

The other six sanction variables used in this paper are cooperation, gnp ratio, financial, comprehensive, high cooperation, and high gnp ratio. These six variables are also based on the indicators developed by Hufbauer et al. (2007). Cooperation measures the degree of international support for the economic sanction. It takes value one if there is no cooperation, two if there is minor cooperation, three if there is modest cooperation and four if there is significant cooperation for the economic sanction. No cooperation includes incidents when the sender country took action against a target country and sought no cooperation or sought it, but did not get it. Such examples include the economic sanction imposed by the United States against Brazil in 1962 when the United States sought to destabilize President Goulart. Significant cooperation means that important commercial partners made an important and coordinated effort to limit trade and/or finance with the target. Examples include the sanction imposed by the United Nations against Iraq and Serbia. Also, for the purpose of this paper, if a target country was sanctioned in more than one sanction incident in one year, the cooperation variable is defined as the mean cooperation scores for each sanction incident in that particular year. Gnp ratio is defined as the ratio of sender's GNP to the target's GNP. In my database, it ranges between .04 and 50,869, if economic sanctions are imposed. The average is 1130.10 as many large countries are senders and many small countries are targets. In addition, gnp ratio is defined as the average of the gnp ratio for all sanction incidents, if the target country was sanctioned in multiple sanction incidents in one year. Financial is a dummy variable that takes value one if a country was sanctioned by either freezing assets, cutting development aid, loans or reducing access to banks and zero, if there are no sanctions imposed or other sanctions than financial are imposed. Comprehensive sanctions are sanctions that involve all types of economic sanctions (financial, export and import) at the same time. Comprehensive takes value one if all three types of sanctions are imposed and zero, if no sanctions are imposed, or only one type of sanction is imposed (financial, import or export) or if only two types of sanctions are imposed. High cooperation is another dummy variable that takes value one

[5] http://www.piie.com/publications/papers/paper.cfm?ResearchID=1821.

if the value of cooperation is between three and four (above the median value for cooperation for the countries that are sanctioned in my sample) and zero if cooperation is below three, or there are no sanctions at all. Finally, high gnp ratio is a dummy variable that takes value one if the country was sanctioned by a sender country with a GNP higher or equal to 31 times the GNP of the target country (higher than the median value for the GNP ratio in the sample of countries that were sanctioned) and zero if there are no sanctions at all or there are sanctions with GNP ratio is lower than 31.

Other data

Other dependent variables include robbery rates, kidnapping rates, drug crime rates, sexual assault rates, and three indicators of the level of corruption from the Global Competitiveness Report. The four crime rates are expressed as the number of incidents per 100,000 inhabitants. The three corruption variables are corruption tax (how common are bribes associated with tax payments?), corruption contract (how common are bribes in public contracts?), and corruption trade (how common are bribes in import and export transactions?). These original values from the Global Competitiveness Report were rescaled to vary from one to ten, where one means bribes are rare and ten that they are common. For the sample used in this paper, corruption tax averages 3.6 out of 10, corruption contract 4.82 out of 10, and corruption trade 3.88 out of 10.

Urban rates, GDP per capita, highest personal income tax rate, highest corporate income tax rate, law and order, regulation, tariff, unweighted tariff, labor participation rates and government expenditures per GDP are other controls in the analysis. The tariff rate is the weighted mean of tariffs on all products in one country, while the unweighted tariff is the simple mean of all tariffs in one country. The average tariff is 8.04% and the average for the unweighted tariff is 9.28%. The GDP per capita variable is expressed in constant US dollars. The variable ranges between $54.50 and $108,111.2. The mean is $6,615. The government expenditures, G is the general government final consumption expenditure as a percent of GDP. This variable varies between 1.37% and 76.22%.

Econometric model

This study estimates the impact of sanctions on the shadow economy. In the first econometric estimation of the paper, the logarithm of the shadow economy per capita is the dependent variable and the sanction dummy is an

independent variable. I also control for other country characteristics X and include country and year fixed effects. Equation (1) summarizes this approach:

$$shadow_{it}=\alpha_0+\alpha_1 sanction_{it}+\alpha_2 X_{it}+\delta_i+\tau_t+\varepsilon_{it}, (1)$$

where i is country i, t is year t, δ_i is the country fixed effect, τ_t is the time fixed effect and X_{it} are country characteristics such as urban, corporate rate, personal rate, law and order, tariff, and regulation.

According to the arguments presented in the previous sections, economic sanctions could both stimulate and inhibit the activities in the shadow economy. High rates of the urban population are likely to decrease the shadow economy as the informal activity is more often encountered in rural areas. An increase in any of the three tax rates (highest personal income tax rate, highest corporate tax rate and weighted mean tariff rate) is likely to increase the shadow economy as individuals and companies are less likely to work and operate in the formal economy when the tax burden in their country is very high. Better law and order in a country make breaking the law and operating underground more difficult and thus, it decreases the shadow economy. Burdensome regulations translate into higher costs of doing business in the formal sector that leads firms to move to the informal sector, increasing in this way the size of the shadow economy. Tradition, culture, and history could influence people's tolerance toward informal activities and thus determine the size of the shadow economy. These country-specific characteristics are considered not vary over the time period covered and thus, are controlled through the country fixed effects. (1) includes year fixed effects because the sample analyzed covers a long period of time during which worldwide shocks that are not controlled by the other variables could have affected all countries' shadow activity.

The second specification is similar to (1), but I also control for specific types of sanction. The new estimation is:

$$shadow_{it}=\beta_0+\beta_1 sanction_{it}+\beta_2 sanction_{it}*type\ sanction_{it}+\beta_3 X_{it}+\delta_i+\tau_t+\varepsilon_{it}, (2)$$

where type $sanction_{it}$ can be the different sanctions characteristics such as the international cooperation (cooperation), the GNP ratio between the sender and the target (gnp ratio), financial sanction (financial), and import, export and financial sanction (comprehensive).

If economic sanctions have a large negative impact on the formal economy, then it is likely they will move more people in the informal economy, thus leading to an increase in the shadow economy. Thus, I expect sanctions

imposed by large senders relative to the targets (senders with large GNP relative to the GNP of the target), sanctions with strong international support and comprehensive sanctions which can hurt the official economy of the target the most, to also increase the informal economy of the target. From the arguments presented in the previous sections, I expect the financial and trade sanctions have ambiguous effects on the shadow economy.

In addition to (1) and (2), I also estimate the effects of sanctions on other activities associated with an informal activity such as corruption and crime. I expect that sanctions will increase corruption as more bribes need to be paid to hide the informal activity and will increase some crime rates like robbery rates as informal activity also involves some illegal activity, but not affect crime rates such as kidnapping, drug crimes, burglary or sexual assault rates as they are not related to informal activities caused by sanctions.

Results

Table 2 presents the results of specifications (1) and (2). The specifications are OLS with fixed effects for countries and years. The standard errors are clustered at the country level. Table 2 presents the effects of sanctions and the additional effects of cooperation, gnp ratio, financial and comprehensive. The dependent variable in Table 2 is the variable shadow, the logarithm of shadow economy per capita expressed in constant US dollars. All specifications control for the following variables: urban population, corporate tax rate, personal income tax rate, law and order, regulations, and weighted tariff rate. Column (1) shows that sanctions increase the shadow economy by 9% with all the other variables kept constant. The coefficient is significant at 10% level.

In column (2), I interact for the international cooperation variable and I find that sanctions increase the size of the shadow economy if the international cooperation variable is larger or equal to two (the sanctions have minor to significant international cooperation). If the international cooperation is less than two (sanctions have no international cooperation), then the effect of sanctions on the shadow economy is negative. This result confirms that economic sanctions that cause harm to the official economy can encourage the activity in the informal economy. Sanctions with no international support might decrease the shadow economy because these types of weak sanctions might make the pre-existent shadow markets more vulnerable to shocks and weaken them.

In column (3), I interact the sanction variable with the gnp ratio variable to investigate whether sanctions imposed by larger senders than the target have a larger effect on the informal economy. The effects of economic sanctions on the size of the shadow economy remain positive and statistically significant at 10% and the magnitude is higher than that in the first specification, but the interaction term is not statistically different from zero. One explanation for this result can be that larger senders might not have additional effects on the size of the shadow economy because just being big does not necessarily translate into greater ability to harm the target's formal economy and to encourage its informal economy.

Next, I analyze if trade and financial sanctions have different effects on the shadow economy. I control for the sanctions dummy and for the interaction term between sanctions and the financial sanctions dummy, leaving the interaction between sanctions and trade sanctions as the omitted category. The effects of sanctions remain positive and significant, but the type of sanctions does not have an additional effect. According to the framework described in the previous sections, financial and trade sanctions have both a positive and a negative effect on the informal market and the two effects may cancel each other out.

In the last column, I interact for the comprehensive sanction dummy to see if comprehensive sanctions have an additional effect on the shadow economy. While sanctions still have a positive and statistically significant effect on the size of the shadow economy, the comprehensive sanctions do not affect the shadow economy more than economic sanctions in general. Again, it is possible that this dummy for comprehensive sanctions does not capture correctly the ability of a sanction to hurt the formal economy of the target and implicitly, to encourage the informal economy in the target.

Table 2. Main effects of sanctions on the shadow economy

	(1) shadow	(2) shadow	(3) shadow	(4) shadow	(5) shadow
sanction	0.09 (0.05)*	-0.21 (0.12)*	0.12 (0.07)*	0.16 (0.09)*	0.13 (0.06)**
sanction* cooperation		0.12 (0.05)**			
sanction* gnp ratio			-0.0001 (0.0003)		
sanction* financial				-0.08 (0.12)	
sanction* comprehensive					-0.11 (0.17)
urban	-0.005 (0.009)	-0.008 (0.007)	-0.006 (0.008)	-0.005 (0.009)	-0.006 (0.008)
corporate	-0.004 (0.003)	-0.006 (0.002)**	-0.004 (0.003)	-0.005 (0.003)	-0.004 (0.003)
personal	-0.0001 (0.002)	0.0009 (0.002)	-0.0001 (0.002)	-0.00003 (0.002)	0.0001 (0.002)
law and order	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*
regulation	0.01 (0.02)	0.03 (0.02)	0.01 (0.02)	0.02 (0.02)	0.02 (0.02)
tariff	-0.001 (0.0009)	-0.0002 (0.0008)	-0.001 (0.001)	-0.001 (0.0009)	-0.001 (0.0009)*
Country FE	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes
R^2	0.9959	0.9961	0.9959	0.9959	0.9960
Observations	322	320	320	320	320

* denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level.

Table 3 presents a number of robustness checks for the main specification in Table 2. In the first four columns, I change the way the sanction variables are defined. In the first column, I control for the high cooperation dummy (high cooperation). Such a sanction increases the size of the shadow economy by 23%, keeping for all the rest of the variables constant. This is consistent with previous results that sanctions with strong international support have stronger positive effects on the shadow economy than sanctions imposed without the support of other countries.

In column (2), I control for the high gnp ratio dummy and find that economic sanctions imposed by senders at least 31 times larger than the target country have a positive and significant effect on the size of the shadow economy. In Table 2, the GNP ratio did not have an additional effect

on the shadow economy when used it as an interaction term. It is possible we find significant results in this specification because of omitted variable bias due to the absence of the sanction dummy. However, these results are not inconsistent with the theory according to which sanctions that have a larger economic impact on the formal economy of the target, also affect the informal economy of the target more strongly.

The next two columns we see that financial sanctions and comprehensive sanctions have positive but insignificant effects, which is consistent with the previous results.

In column (5), I control for three channels through which sanctions can affect the shadow market and find that the coefficient of the sanction variable drops from 9%, in the initial specification, to 8% here, which confirms these are some of the channels through which sanctions affect the informal market.

In the next column, I change the dependent variable from shadow to shadow 1, the logarithm of shadow economy per capita estimated using the data from different sources and the mean shadow economy values for all the missing observations. This specification has a larger number of observations since I have less missing observations for the independent variable, but the effects of economic sanctions remain identical to the ones in the main specification (Table 2 Column (1)) using the variable shadow as an independent variable.

In the last column, I use the unweighted tariff rate as a control instead of the usual tariff variable which is a weighted mean of all the tariff rates in one country. The effects of the sanctions remain positive and statistically significant as they were in the specification using the weighted tariff measure.

Table 3. Robustness checks

	(1) shadow	(2) shadow	(3) Shadow	(4) shadow	(5) shadow	(6) shadow1	(7) shadow
high cooperation	0.23 (0.07)***						
high gnp ratio		0.15 (0.08)*					
financial			0.09 (0.07)				
Comprehensive				0.03 (0.14)			
sanction					0.08 (0.04)**	0.09 (0.05)*	0.08 (0.05)*
gdp					0.00001 (0.00001)		
labor					-0.005 (0.006)		
G					-0.01 (0.007)		
urban	-0.009 (0.007)	-0.006 (0.008)	-0.005 (0.009)	-0.004 (0.01)	0.001 (0.01)	-0.007 (0.009)	-0.005 (0.009)
corporate	-0.006 (0.002)**	-0.004 (0.003)	-0.004402 (0.003)	-0.004 (0.003)	-0.003 (0.002)	-0.004 (0.003)	-0.004 (0.003)
personal	0.0005 (0.002)	-0.0004 (0.002)	-0.0005 (0.002)	-0.0008 (0.002)	-0.001 (0.002)	-0.0003 (0.002)	-0.0001 (0.002)
law and order	0.03 (0.01)**	0.02 (0.01)*	0.02 (0.01)*	0.02 (0.01)*	0.01 (0.01)	0.02 (0.01)*	0.02 (0.01)*
regulation	0.03 (0.02)	0.008 (0.02)	0.009 (0.02)	0.01 (0.02)	0.02 (0.02)	0.01 (0.02)	0.01 (0.02)
tariff	0.000006 (0.0007)	-0.002 (0.001)*	-0.001 (0.0009)	-0.0005 (0.0009)	-0.002 (0.002)	-0.001 (0.001)	
tariff unweighted							-0.0009 (0.0008)
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R^2	0.9960	0.9959	0.9958	0.9957	0.9961	0.9956	0.9959
Observations	317	320	320	320	317	323	322

* denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level

For further robustness checks, I look at the effects of economic sanctions on variables that might be affected positively by an increase in the informal

activity. In the first three columns of Table 4, I look at the effects of sanctions on various measures of corruption. Economic sanctions increase corruption in multiple areas. The magnitude of the effects varies by the type of corruption (tax, contract, or trade related). The largest effects of sanctions are for corruption associated with public contracts. Sanctions increase the score of corruption contract by 1.58. The smallest effect is for corruption associated with tax payments. Sanctions increase this score by .84. This is consistent with the theory according to which sanctions increase the incidence of corruption because more bribes are being paid to officials to close their eyes at the growing informal activity occurring in the target.

In column (4), I estimate the effects of sanctions on the robbery rates. I find that economic sanctions increase the variable robbery rate by 32 per 100,000 inhabitants keeping for all the other variables constant. This is consistent with the theory presented above according to which certain types of crimes such as robberies are likely to increase when other illegal activities occur in sanctioned countries.

Table 4. Effects of sanctions on other aspects of informal activity

	(1) corruption tax	**(2) corruption contract**	**(3) corruption trade**	**(4) robbery**
sanction	0.84 (0.32)***	1.58 (0.44)***	1.35 (0.34)***	32.47 (13.67)**
urban	0.07 (0.10)	0.18 (0.14)	0.14 (0.11)	5.16 (10.05)
corporate	0.01 (0.009)*	0.01 (0.01)	0.01 (0.009)	0.006 (0.41)
personal	0.0006 (0.01)	-0.002 (0.01)	0.01 (0.01)	0.41 (0.47)
law and order	-0.01 (0.06)	-0.09 (0.07)	-0.02 (0.07)	-0.45 (8.38)
regulation	0.09 (0.15)	0.23 (0.17)	0.07 (0.16)	-2.64 (8.38)
tariff	0.02 (0.03)	0.02 (0.02)	0.03 (0.01)	-1.03 (1.59)
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.9499	0.9446	0.9554	0.9755
Observations	308	308	308	326

* denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level.

Table 5 shows several placebo tests. First, I estimate at the effects of economic sanctions on crime rates that should not be correlated with an informal market activity that is created by the economic sanctions. The

impact of economic sanctions on kidnapping, drug activity, burglary and sexual assaults should be zero. There is no reason to believe that more people are being kidnapped, houses are burglarized more often or that more women are being raped if sanctions are imposed. Drug production depends on the type of drugs that can be grown in that country and trafficking depends on the existent networks and thus, these drug-related activities do not emerge only because sanctions are imposed. The results in this table confirm these theories and show that economic sanctions do not have a statistically significant effect on these types of criminal activities.

Table 5. Placebo tests

	(1) kidnapping	**(2) drugs**	**(3) burglary**	**(4) sexual**
sanction	-0.36 (0.62)	22.27 (146.83)	-68.34 (50.7)	-0.13 2.66
urban	0.0004 (0.23)	-9.03 (7.42)	62.81 (21.62)***	-0.06 (2.13)
corporate	0.02 (0.01)*	1.20 (1.24)	-0.71 (3.71)	0.07 (0.09)
personal	0.02 (0.02)	0.72 (0.92)	-1.35 (1.81)	0.27 (0.26)
law and order	-0.28 (0.48)	2.01 (9.81)	56.78 (52.60)	1.07 (1.72)
regulation	-0.41 (0.30)	-2.29 (17.06)	37.64 (25.73)	-5.05 (2.32)**
tariff	0.02 (0.04)	-3.08 (2.94)	-1.35 (5.09)	-0.28 (0.47)
Country FE	Yes	Yes	Yes	Yes
Time FE	Yes	Yes	Yes	Yes
R^2	0.9280	0.9801	0.9733	0.9511
Observations	267	252	280	234

* denotes significant at 10% level, ** denotes significant at 5% level and *** denotes significant at 1% level.

Conclusion

This paper compiles data on the size of shadow economy as percentage of GDP for 147 countries spanning 46 years from different studies and updates the data from the well-known Hufbauer et al. (2007) with newer economic sanction data from the Peterson Institute for International Economics website. It uses these data to estimate the effects of economic sanctions on the shadow economy per capita, corruption, robbery, kidnapping, drug crime, burglary, and sexual assault rates. It finds that economic sanctions increase the size of the shadow economy per capita by approximately 9%.

The effects are larger for sanctions with strong international support. The GNP ratio between target and sender or the type of sanction (import, export, or financial) do not alter the magnitude of the effect. Sanctions increase robbery rates by 32.47 per 100,000 inhabitants, but it does not affect kidnapping, drug crime, burglary and sexual assault rates. Sanctions also increase corruption related to tax collection, public contracts, and trade.

There are two main implications of these results. First, given that criminals do not reform easily, we can conclude that people starting criminal activities during the sanctioned period are not likely to take a job in the official labor market after the economic sanctions end. In addition, workers from the informal sector in non-criminal activities have difficulty to move to the formal sector (Nelson & De Bruijn, 2005), informality in the labor sector persists over time and it is a substitute for formal labor in many sectors (Williams & Round, 2008). Thus, it is conceivable that informal workers might not move into the formal labor markets after the sanctions are lifted. Informal workers also do not invest in their own education and in the education of their children, thus increasing the likelihood that they will find jobs only on the black labor market (Oviedo, 2009). According to Enste (2003), informality can lead to more acceptance of illegal work and thus, to a continuation of these black market activities. Thus, it is likely that the black market workers and their children are more likely to stay in the black labor markets even after the end of the sanctions. Finally, corruption exhibits a high degree of persistence (Damania, Fredriksson & Mani, 2004; Hauk & Saez-Marti 2002; Mishra 2006). Since sanctions increase corruption in target countries, we can expect that corruption will continue to be a problem in these countries long after the sanctions are lifted. Overall, it seems that sanctions could have long run effects on the targets' informal economies.

Second, since sanctions lead to more informal activity and people can obtain sanctioned goods from black markets and through smuggling, can conduct financial transactions through informal financial intermediaries, and can produce sanctioned goods underground, sanctions could have a smaller impact on the population than previously thought. Thus, policymakers should consider the emergence of these informal markets when designing optimal sanctions that are supposed to put enough pressure on the target population and the government to change the desired policies.

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