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Corruption and the shadow economy : an empirical analysis

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CORRUPTION AND THE SHADOW ECONOMY: AN EMPIRICAL ANALYSIS

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CORRUPTION AND THE SHADOW ECONOMY: AN EMPIRICAL ANALYSIS

Abstract

This paper analyzes the influence of the shadow economy on corruption and vice versa. We hypothesize that corruption and shadow economy are substitutes in high income countries while they are complements in low income countries. The hypotheses are tested for a cross-section of 120 countries and a panel of 70 countries for the period 1994-2002. Our results show that the shadow economy reduces corruption in high income countries, but increases corruption in low income countries. We also find that stricter regulations increase both corruption and the shadow economy.

JEL Code: D73, H26, O17, O5.

Keywords: corruption, shadow economy, regulation, tax burden.

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1 Introduction

As corruption and shadow economy activities are a fact of life around the world, most societies attempt to control their activities through various measures like punishment, prosecution, or education. To gather information about the extent of corruption and the shadow economy or who is engaged in corrupt or underground activities, the frequencies with which these activities are occurring, and the magnitude of them is thus crucial for making effective and efficient decisions. Unfortunately, neither corruption nor the shadow economy easily lend themselves to measurement. It is thus rather difficult to get correct information about the extent of corruption and shadow economy activities in the goods and labour market, because all individuals engaged in those activities wish not to be identified, of course. Hence doing research in these two areas can be considered as a scientific passion for knowing the unknown.

In this paper we explore the relationship between the shadow economy and corruption. We thereby combine two strands of the literature. The first deals with the impact of corruption on the shadow economy; the second with the influence of the shadow economy on corruption. In both strands there are important gaps. Regarding the impact of corruption on the shadow economy, first, previous studies employ rather small samples. For example, Johnson et al. (1997) find that corruption affects the shadow economy positively (and the official economy negatively) – in a cross section of, however, only 15 countries. Similar results are presented in Johnson et al. (1998), with 39 countries in the relevant equation. Employing instrumental variables techniques and even reliable control variables was thus infeasible.

Second, the few studies investigating the impact of corruption on the shadow economy focus on rather heterogeneous country samples. There is no separation of high income and low income countries, the exception being Friedman et al. (2000), distinguishing Latin America, OECD and transition countries. However, Friedman et al. (2000) have only 15, 20 and, respectively, 7 observations in their sample, so their results are far from reliable. Indeed, there is good reason to expect the relationship between corruption and the shadow economy to differ in high and low income countries. In high income countries, bribing government officials when detected engaging in the shadow market is rarely an option. Corruption might thus be independent of the size of the shadow economy. As Choi and Thum (2004) and Dreher, Kotsogiannis and McCorriston (2005a) show, however, the shadow economy can mitigate government-induced distortions, so that corruption and the shadow economy could also be substitutes. Clearly, in high income countries entrepreneurs do not have to pay the bribes demanded by officials as they could always bring the corrupt officials to court.

Consequently, they can choose by themselves whether to pay a bribe or operate underground. In low income countries, to the contrary, entrepreneurs engaging in the shadow economy can reasonably expect to escape prison when their illegal engagement is detected. Officials collude with entrepreneurs and taxpayers in exchange for a bribe (e.g. Hindriks et al. 1999). To what extent corruption and the shadow economy are complements or substitutes is thus likely to vary among high and low income countries.

Third, the existing evidence is contradictory and insufficient. Friedman et al. (2000) claim "corruption is associated with more unofficial economy". However, in the relevant instrumental variables regression, when controlling for the income level, this holds for only three out of eight indices employed (p. 480). Further investigation – with a greater sample of countries – is needed.

Turning to the impact of the shadow economy on corruption, empirical evidence is virtually non-existent and the literature is not developed beyond the postulation of formal models. The exception is Dreher, Kotsogiannis, McCorriston (2005a), employing structural equations modeling to empirically confirm the negative impact from the shadow economy to corruption (in a sample of 18 OECD countries).

Finally, the use of perceptions based indices of corruption has recently been challenged. As one problem with these indices, it is not obvious, what they actually measure. According to Mocan (2004) perceived corruption is completely unrelated to actual corruption once other relevant factors are controlled for. Similarly, Weber Abramo (2005) shows that perceived corruption is not related to bribery.[1] Analyzing the relationship between corruption and shadow economy using a measure of corruption that is not based on perceptions is thus clearly warranted.

This paper makes an attempt to fill these gaps. For the first time in the literature, we employ a huge number of estimates of the size of the shadow economy based on the same method and all coming from the same source. We employ a cross-section of 120 countries over the period 1999-2002 to empirically analyze the relationship between corruption and the shadow economy.[2] We employ an index of actual corruption in addition to the usual perceptions based indices. The index has been developed in Dreher, Kotsogiannis and McCorriston (2005b) and is based on a structural model. A panel of about 100 countries is also analyzed. The country sample is split in high and low income countries in order to get additional insights about the relationship between corruption and the shadow economy.

[1] See Andvig (2005) and Søreide (2005) for further criticism of perceptions based indices of corruption.
[2] Appendix D contains a list of countries included in the empirical analysis.

The paper is organized as follows. In section 2, we derive our hypotheses, while section 3 discusses the data and method of estimation. In the fourth section, we present the empirical results. Finally section 5 gives a summary and draws some conclusions.

2 Hypotheses

Theoretically, corruption and the shadow economy can be either complements or substitutes. Choi and Thum (2004) present a model where the option of entrepreneurs to go underground constrains a corrupt official's ability to ask for bribes. Dreher, Kotsogiannis and McCorriston (2005a) extend the model to the explicit specification of institutional quality. The model shows that corruption and shadow economy are substitutes in the sense that the existence of the shadow economy reduces the propensity of officials to demand grafts.

Johnson et al. (1997), to the contrary, model corruption and the shadow economy as complements. In their full-employment model, labour can be either employed in the official sector or in the underground economy. Consequently, an increase in the shadow economy always decreases the size of the official market. In their model, corruption increases the shadow economy, as corruption can be viewed as one particular form of taxation and regulation (driving entrepreneurs underground). Hindriks et al. (1999) also show that the shadow economy is a complement to corruption. This is because, in this case, the tax payer colludes with the inspector so the inspector underreports the tax liability of the tax payer in exchange for a bribe.[3]

Theoretically, the relationship between corruption and the shadow economy is thus unsettled. There is, however, reason to believe that the relationship might differ among high and low income countries. In high income countries, the official sector provides public goods like the rule of law, enforcement of contracts, and protection by an efficient police. Usually, only craftsmen or very small firms have (or take) the option of going underground. In this case, the shadow economy is hidden from tax inspectors and other officials. In other words, there are no bribes necessary or possible to buy the way out of the official sector. In high income countries – typically showing comparably small levels of corruption – individuals confronted with a corrupt official always have the choice to bring the official to court. Moreover, in high income countries corruption quite often takes place, for example, to bribe officials to get a (huge) contract from the public sector (e.g. in the construction sector). This contract is then handled in the official economy and not in the shadow economy. Hence, corruption in high income countries can be a means to achieve certain benefits which make

[3] See Dreher and Siemers (2005) for a formalization of this argument.

work in the official economy easier, e.g., winning a contract from a public authority, getting a licence (e.g. for operating taxes or providing other services or getting the permission to convert land into "construction ready" land, etc.). In high income countries people thus bribe in order to be able engaging in more official economic activities. As Schneider and Enste (2000) point out, at least two thirds of the income earned in the shadow economy is immediately spent in the official sector. The shadow economy and the official sector might thus be complements. The corresponding increase in government revenue and strengthened institutional quality is likely to decrease corruption. The prediction of a negative (substitutive) relation between corruption and the shadow economy is in line with the models of Choi and Thum (2004) and Dreher, Kotsogiannis and McCorriston (2005a).[4]

In low income countries, to the contrary, we expect different mechanisms to prevail. Instead of working partly in the official sector and offering additional services underground as in high-income countries, enterprises completely engage in underground activity. Examples for enterprises operating completely underground are restaurants, bars, or haircutters – and even bigger production companies. As one reason for this, the public goods provided by the official sector are in many developing countries less efficient as compared to high income countries. Big companies, however, are comparably easy to detect and – in order to escape taxation and punishment – they have to bribe officials, thereby increasing corruption. Corruption often takes place in order to pay for activities in the shadow economy, so that the shadow economy entrepreneur can be sure not to be detected by public authorities. Here, shadow economy and corruption are likely to reinforce each other, as corruption is needed to expand shadow economy activities and – at the same time – underground activities require bribes and corruption. To get some additional income from the shadow economy entrepreneur, it is natural for public officials to ask for bribes and thus benefit from the shadow market. In low income countries, we therefore expect a positive (complementary) relation between corruption and the shadow economy. This corresponds to the predictions of the models of Hindriks et al. (1999) and Johnson et al. (1997).

In summary we expect:

Hypothesis 1: In low income countries, shadow economy activities and corruption are complements.

Hypothesis 2: In high income countries, shadow economy activities and corruption are substitutes.

[4] Consequently, Dreher, Kotsogiannis and McCorriston (2005a) test their model employing data for OECD countries only.

Regarding our control variables, we follow Johnson et al. (1997, 1998) and Friedman et al. (2000). Our covariates thus belong to three groups: tax rates and government revenues, measures of regulation, and proxies of institutional quality. Johnson et al. (1997, 1998) argue that the shadow economy is expected to be higher when there is more regulation and thus more discretion for officials. Politicians might use the right to regulate to pursue their own interest, such as supporting allies. Politicians can also use the right to regulate to enrich themselves by offering relief from regulation in exchange for bribes (Shleifer and Vishny 1993, Dreher and Siemers 2005):

> **Hypothesis 3**: The more intensive the official economy is regulated, the higher is the shadow economy.
>
> **Hypothesis 4**: The more intensive the official economy is regulated, the higher is corruption.

As firms in the unofficial sector largely escape taxation, a higher share of the informal sector should be correlated with lower tax revenue (in percent of GDP). However, a heavy fiscal burden is likely to drive enterprises underground, a result obtained by Loayza (1996) for Latin America and by Johnson et al. (1997) for transition economies. When other relevant determinants of the shadow economy are controlled for we thus expect:

> **Hypothesis 5:** A huge fiscal burden increases the size of the shadow economy.

Regarding corruption, bribes are paid to avoid paying taxes or following regulations, so that a high fiscal burden is hypothesized to increase corruption.

> **Hypothesis 6:** The higher the fiscal burden, the higher is corruption.

Better institutional quality, finally, increases the benefits entrepreneurs can derive from operating in the official sector, most likely leading to a reduction of the unofficial sector. Almost by definition, better institutions also imply lower levels of corruption. We therefore hypothesize:

> **Hypothesis 7:** Better institutional quality reduces the size of the shadow economy.
>
> **Hypothesis 8:** Better institutional quality reduces corruption.

The next section outlines our method of estimation and presents the data.

3. Data and Estimation Technique

We start with estimating regressions for a cross-section of countries. The equations take the following form:

$$Y_i = \alpha + \beta_1 X_i + \beta'_2 Z_i + \varepsilon_i \ , \qquad (1)$$

where Y and X represent either corruption or, respectively, the shadow economy and Z is a vector of control variables.

In order to increase the number of observations, all data are averages over the period 2000-2002. Data for the shadow economy are taken from Schneider (2005a). Schneider calculates the size and development of the shadow economy of 145 countries, including developing, transition and highly developed OECD countries over the period 1999 to 2003 employing the dymimic and currency demand estimation technique.[5] The average size of the shadow economy as a percent of official GDP in 2002/03 in 96 developing countries was 38.7%, in 25 transition countries 40.1%, in 21 OECD countries 16.3%, and in 3 communist countries 22.3%.

To measure corruption, we employ an index provided by the International Country Risk Guide. This indicator is based on the analysis of a world-wide network of experts.[6] On the original scale, the index has a range from 0 – representing highest corruption – to 6 (no corruption). We rescaled the index, so that higher values represent more corruption. We have 120 countries in our sample for which both data for the shadow economy and corruption are available.

Again following the previous literature, each regression also includes the log of per capita GDP, taken from the World Bank's (2003) World Development Indicators. Measures for institutional quality and regulatory burden are from Gwartney and Lawson (2004), the Heritage Foundation (2005), and Kaufmann et al. (2003). The variables are discussed in more detail when we present the regression results. Appendix B lists all variables with their exact sources and definitions; Appendix C reports descriptive statistics.

After including each explanatory variable individually to our regressions, we follow a general to specific approach eliminating those variables with the smallest t-value until we end up with a model containing only those variables (in addition to per capita GDP, the index of corruption and, respectively, the shadow economy) that are significant at the ten percent level at least.

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[5] See also Schneider (2005b).

[6] Note that the focus of this index is on capturing political risk involved in corruption. Since it is the only perception-based data on corruption providing consistent time series, the index has nevertheless been widely used in empirical studies.

In the full model, we check for the influence of outliers using an algorithm that is robust to them. The robust regression technique weighs observations in an iterative process. Starting with OLS, estimates are obtained through weighted least squares where observations with relatively large residuals get smaller weight. This results in estimates not being overly influenced by any specific observation.

The sample is then split in two income (per capita) groups to test our hypothesis 1 and 2.[7]

Depending on which covariates are included in the regressions, there are between 43-71 countries in the low income group. The number of countries with high income is between 37-48. Due to the substantially reduced number of observations we have to interpret the results of some regressions cautiously.

Clearly, taking corruption and the shadow economy as exogenous determinants of each other contradicts our *a priori* hypotheses. We therefore employ instrumental variables to deal with the potential endogeneity of corruption and the shadow economy. We employ two sets of instruments for each variable. First, the determinants of corruption and the shadow economy identified in the general to specific approach are employed. Second, we use the instruments for corruption suggested by Friedman et al. (2000): Ethnic and religious fractionalization, a country's latitude, and French, socialist, German, and Scandinavian legal origin. The variables have been shown to be correlated with institutional development across a wide range of countries (La Porta et al. 1999). Regarding the shadow economy, a range of variables determining the costs of doing business in a country have recently been developed by the World Bank (Djankov et al. 2002). According to the results of Friedman et al. (2000) entrepreneurs go underground mainly to reduce the burden of bureaucracy. The variables measuring costs and required time to open a business and flexibility with respect to hiring and firing workers thus appear to be natural instruments for the shadow economy. We employ them as our second set. Our second equation takes the form:

$$X_i = \gamma'_1 I_i + \varepsilon_i, \qquad (2)$$

with I representing the vector of instrumental variables. F-tests on the joint significance of our instruments show that they are good predictors of the degree of corruption and, respectively, the shadow economy. In most (but not all) cases, the overidentifying restrictions are also accepted.

[7] Countries are in the first group if their 2004 GNI per capita does not exceed $3,255, and in the second otherwise. We choose to split the sample instead of using interaction terms as specification tests reject most of the regressions including all countries but accept most sub-sample regressions.

Turning to the panel estimations, our data cover the years 1994-2002, for 70 countries. We employ averages over three years for all variables. However, some of the data are not available for all countries or every year. Therefore, our panel data are unbalanced and the number of observations depends on the choice of explanatory variables. Again, we also present results employing instrumental variables. We only employ those instruments that show some variation over time. Equation (1) and (2) transform to:

$$Y_{it} = \alpha + \beta_1 X_{it} + \beta'_2 Z_{it} + \varepsilon_{it} \ , \tag{3}$$

$$X_{it} = \gamma'_1 I_{it} + \varepsilon_{it} \ , \tag{4}$$

The next section presents the results.

4. Empirical Results

4.1 Stepwise Regression Results

Before we present the results of the full model, we turn to the regressions including one explanatory variable at the time. Results for the shadow economy are reported in Tables A-1 to A-6 in the Appendix. Except for the index of corruption, we have kept the original signs on the variables, so that different organizations' ratings differ in whether a high numerical value corresponds to "better" values. The Heritage Foundation measure of fiscal burden refers to average and marginal corporate and income taxation. Its index of tariff and non-tariff barriers to trade captures international trade taxation and regulation. A higher score (on a scale of 1-5) implies a higher burden of taxation, i.e. higher average and marginal tax rates and, respectively, higher taxes on trade. The Fraser Institute's measures of taxes (Gwartney and Lawson 2004) show higher scores for countries with lower tax rates, on a scale of 1-10. We employ their indices for the top marginal income tax rate and taxes on international trade. In addition, we employ tax revenue and overall revenue (both in percent of GDP) from the World Bank's (2003) World Development Indicators.

The results show, surprisingly, that our measures of tax burden are not correlated with the shadow economy at the five percent level of significance (when we control for per capita GDP). There is thus no support for our hypothesis 5. However, at the ten percent level of significance higher fiscal burden is associated with less unofficial activity. This is in line with the results of Friedman et al. (2000) for a cross section of 69 countries, showing that higher tax rates imply a smaller shadow market and Johnson et al. (1998).

According to our results – and contrary to hypothesis 6 – corruption is significantly more severe in countries with smaller fiscal burden. Higher barriers to trade significantly

increase corruption. This is in line with the theoretical model and empirical evidence presented in Dreher and Siemers (2005) for capital account restrictions: Economic agents facing more severe restrictions engage in bribery to pursue their business anyway.

Turning to the importance of regulations, we employ seven measures produced by the Heritage Foundation and the Fraser Institute. Again, the Fraser Institute's measures range from 0 to 10, where higher values indicate less regulations. The indices refer to regulations in the credit market, minimum wage regulation, price regulation, administrative procedures, and the time to spend with government bureaucracy. We take two indices from Heritage. The first measures wage and price regulation, the second is an overall measure of the degree of regulations in the economy. Again the scale ranges from 1 to 5, with higher values indicating regulations that are worse for business.

As can be seen in the tables, at the five percent level at least, the shadow economy expands with fewer regulations in the credit market, higher minimum wages and stricter administrative procedures. While the first result is surprising, the latter two are in line with hypothesis 3. At least at the five percent level of significance, corruption is more severe with stronger regulation in the credit market, stronger wage and price regulations, and the overall Heritage index of regulations, supporting hypothesis 4.

Regarding institutional quality, we employ three indices constructed by the Fraser Institute, and two from the World Bank (Kaufmann et al. 2003). On the scale of the Fraser indices (0-10), higher values imply a "better" legal system. We employ their indices for judicial independence, impartial courts, and the integrity of the legal system. The World Bank's government effectiveness and rule of law indicators range from -2.28 to 2.59 and, respectively, -2.04 to 2.36, with higher scores showing "better" environments.

The results are straightforward: both corruption and the shadow economy are significantly smaller with better rule of law, greater government effectiveness, more judicial independence, impartial courts, and higher integrity of the legal system, supporting hypotheses 7 and 8.

So far, the results also show that corruption is rarely a significant determinant of the shadow economy. In those regressions where its coefficient is significantly different from zero, higher corruption implies a higher shadow economy. Similarly, the shadow economy is significantly associated with more corruption in some regressions. However, corruption and the shadow economy are never significant when variables controlling for the quality of institutions are included. Clearly, without the inclusion of additional control variables the regressions showing a significant effect of the shadow market or, respectively, of corruption,

are likely to be misspecified. The RESET test indicates that relevant variables are not included. In most regressions, there is also evidence that the residuals are not normally distributed.

4.2 Regression Results of the Full Model

Table 1 presents the results of the full model explaining the size of the shadow economy. As can be seen, only three variables turned out to be robust determinants of the unofficial sector. The shadow market shrinks with stronger regulations in the credit market, contradicting our *a priori* expectation. The coefficient is significant at the one percent level both in the OLS and the robust regression. Also at the one percent level, government effectiveness reduces the size of the informal sector. This is intuitive: the more effective the government, the greater the benefits of operating in the legal sector. Moreover, the risk of getting caught engaging in illegal activities is higher with more effective governments. Stronger minimum wage regulation also increases the shadow economy, with a coefficient significant at the one percent level in the OLS regression, and at the five percent level in the robust regression. The result is in line with our hypothesis 3: Stronger regulatory burden drives entrepreneurs underground.[8]

As the results of Table 1 show, corruption does not significantly affect the shadow economy. This is in contrast to the results of Johnson et al. (1998) reporting corruption to be among the major determinants of the unofficial sector. However, their regressions neglect the impact of institutional and governmental quality. Once institutional quality and government effectiveness is taken into account, neither GDP per capita nor corruption have a significant impact on the shadow economy. The results of Table 1 show that this is true for both income groups. This is in line with the results of Bjørnskov (2005) showing that the perceptions based index of corruption developed by Kaufmann et al. (2003) cannot be separated statistically from their other five indices of governance. Similarly, Andvig (2005), and Weber Abramo (2005) argue that perceptions based indices reflect the quality of a country's institutions rather than its actual degree of corruption.

Table 2 reports results for the full model explaining perceived corruption. As can be seen, price regulation leads to more corruption, while corruption is lower with better rule of law and greater democracy. While the fiscal burden significantly reduces corruption at the ten percent level of significance according to the OLS results, the coefficient is not significant in

[8] The correlation between credit market regulation and the rule of law is about 0.7, but the Variance Inflation Factors (VIFs) are consistently low, so there should be no problem identifying effects due to collinearity.

the robust regression. GDP per capita has no significant impact on corruption in the overall sample – and neither does the shadow economy. However, a bigger shadow economy reduces corruption in high income countries, with a coefficient significant at the one percent level. Corruption and the shadow economy are thus substitutes in high income countries. Quantitatively, a ten percentage points increase of the shadow economy (in percent of GDP) reduces the index of corruption by 0.7 points in high income countries. The standardised regression (beta) coefficient is 0.47.

We proceed with our instrumental variables approach. Table 3 shows that the results for the shadow economy are very similar to those presented above. Again, the index of corruption is not significant at the five percent level in any regression (while corruption reduces the shadow market at the ten percent level of significance in high income countries). The Sargan test accepts the overidentifying restrictions at the one percent level in all but the final regressions, where the restrictions are accepted at the ten percent level. Table 4 shows the correlation between the two sets of instruments and the residuals of the full model. The table shows that the correlation between the instruments and the residuals is reasonably low. The table also shows the comparably high correlation between most of the instruments and the endogenous variable (corruption).

Tables 5 and 6 replicate the analysis with corruption as the dependent variable. Again, the results are similar to those presented previously. However, the shadow economy no longer significantly affects corruption in high income countries.

Finally, we report results for the combined cross-section time-series analysis in Tables 7 (shadow economy) and 8 (corruption). They show that corruption increases the size of the shadow economy. When both income groups are included, this is true when the regression is estimated with fixed or random effects, and when corruption is instrumented with the time varying set of instruments.[9] An increase in the index of corruption by one point increases the shadow economy (in percent of GDP) by 1.3-3.5 percentage points (which amounts to standardised (beta) coefficients between 0.12-0.32). In high income countries, corruption also increases the size of the informal sector, while it has no significant impact in low income countries.

Finally, Table 8 shows that corruption is higher with a bigger informal sector also. In the fixed and random effects specifications, its coefficient is significant at the one percent level. The same is true in low income countries, where corruption again rises with the size of

[9] Note that we do not instrument them with variables that do not change over time.

the shadow market. In high income countries no significant impact exists. The same is true when the shadow economy is instrumented.

In summary, there is some evidence that corruption and the shadow economy are complements in countries with low income (hypothesis 1), while going underground is an alternative to corruption in high income countries (hypothesis 2).

4.3 Further Discussion

We test the robustness of our results employing two alternative indicators of perceived corruption. The first is the corruption perceptions index developed by Transparency International (TI), ranging from zero to ten. The second index is from the World Bank's 'governance matters' database (Kaufmann et al. 2003) with values between -1.85 and 2.58. We transform both indices so that higher values represent greater perceived corruption.

The results show that there is no significant relationship between corruption and the shadow economy when the TI index is used. There is one exception: In high income countries, corruption decreases with a greater shadow economy, with a coefficient significant at the five percent level. The result is presented in Table 9. Table 9 also shows that the result remains when the World Bank index of corruption is used instead. No other regression shows a significant relation between the World Bank index and the size of the shadow economy (not reported in the table).

Perceptions based indices are, however, not free of problems. One such problem refers to the correlation between perceived corruption and actual corruption. According to Mocan (2004) the two are completely unrelated once other relevant factors are controlled for. Similarly, Weber Abramo (2005) shows that perceived corruption is not related to bribery. Our results might thus arise from the poor quality of the perceptions based indices of corruption. We therefore employ an alternative index of actual corruption to test the stability of the results. The index has been developed in Dreher, Kotsogiannis and McCorriston (2005b) and is based on a structural model. The statistical method applied infers the magnitude of corruption from both the likely causes and likely effects of corruption. The index is available for about 100 countries for the year 2000 and ranges from 1 to 10, where higher values again represent more corruption.

When replicated with the index of actual corruption the regressions show that corruption does not significantly influence the size of the underground sector in any regression. We do therefore not present the results in a table. However, there is a significant impact of the shadow economy on corruption. The results of the OLS and robust regressions

are presented in Table 10; Table 11 presents the IV estimates.[10] As can be seen, corruption increases with the size of the underground sector, with coefficients significant at the ten percent level in the OLS and robust regressions. The disaggregated results show that the positive impact of the shadow economy on corruption is driven by low income countries. The results show that the magnitude of the coefficient is economically relevant. In low income countries, a one percentage point increase in the shadow economy (in percent of GDP) increases the index of corruption by 0.06 points (equivalent to a standardized beta coefficient of 0.36). The coefficient of the shadow economy is significant at the five percent level in low income countries, while it is insignificant in high income countries.

The results are similar when the shadow economy is instrumented with the two sets of instruments introduced above. When the determinants of the shadow economy identified by the general to specific approach are employed, corruption is again significantly higher with a larger shadow economy. This is true in the overall sample and in the low income sample (at the five percent level of significance). When the costs and flexibility of doing business are employed as instruments instead, the results are similar.

Table 12 summarizes our results. Overall, they show that an increase in perceived corruption over time also increases the shadow economy. This confirms the models of Johnson et al. (1997, 1998) and Hindriks et al. (1999). Across countries, however, greater perceived corruption does not lead to a greater shadow economy. To some extent this also supports the results of Méon and Sekkat (2004) showing the within-country variation to be important in their analysis of corruption on foreign direct investment and exports.

Regarding the impact of the shadow economy on perceived corruption, our results for the overall sample are similar to those for the other way round. In the cross-country regressions, all coefficients are completely insignificant. An increase in the shadow economy over time increases corruption according to the fixed and random effects estimator, but not when the endogeneity of the shadow is controlled for. Turning to the sub-samples, the results show that higher perceived corruption significantly reduces the shadow economy in high income countries, confirming the models of Choi and Thum (2004) and Dreher, Kotsogiannis and McCorriston (2005a). In low income countries, to the contrary, corruption tends to increase with a higher shadow economy, again confirming the models of Johnson et al. (1997, 1998) and Hindriks et al. (1999). This is true for the impact of perceived corruption in the within-groups specification and actual corruption in all specifications.

[10] Note that the index of actual corruption shows no variation over time, so we can not replicate the panel regressions.

In summary, the results of our empirical analysis suggest that corruption and the shadow economy tend to be substitutes in high income countries, but complements in low income countries. There is thus some support for our main hypotheses (1 and 2). The analysis also shows, however, that the results do to some extent depend on the method of estimation.

The next section concludes.

5. Conclusions

In this paper we have made a first attempt to deal with the dual relationship between corruption and the shadow economy. We hypothesized that the shadow economy and corruption are substitutes in high income countries. In low income countries, to the contrary, we expected the shadow economy and corruption to be complements. The empirical findings are more or less in line with these two hypotheses, although the results depend to some extent on how the regressions are specified and how corruption is measured. In summary there is evidence that going underground is an alternative to corruption in high income countries (this means a substitutive relationship) while corruption and the shadow economy are complements in countries with low and middle income. We also find a positive impact of regulation on the shadow economy, while our results regarding taxation are mixed. Our results show that heavier regulation leads to more corruption, while better rule of law and greater democracy imply less corruption.

What type of conclusions can we draw from these results? In general we must admit we have no clear and robust pattern that confirms our hypotheses among the range of indicators and specifications employed. Clearly, one of the most important problems in empirical studies on corruption and the shadow economy is the unavailability of high quality data both across countries and – more severely – over time. Our analysis confirms the importance of the choice of indicator on the results. If we use actual corruption figures as calculated by Dreher, Kotsogiannis and McCorriston (2005b) instead of indices of perceived corruption, e.g., our results show a strongly significant impact of the shadow economy on corruption in low income countries. However, these data are only available for one year. Testing our hypotheses with consistent panel data of actual corruption thus remains for future research.

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Table 1: Determinants of the Shadow Economy – Full Model

	OLS	RR	Income	
			Low	High
Corruption (ICRG)	1.88	1.32	3.57	-0.84
	(1.20)	(0.82)	(1.34)	(0.97)
Log GDP per capita	-2.42	-2.44	-2.41	-6.54
	(1.37)	(1.34)	(1.05)	(1.73*)
Credit Market Regulations (Fraser)	4.89	4.29	6.20	-0.27
	(2.74***)	(2.89***)	(3.13***)	(0.23)
Minimum Wage Regulation (Fraser)	-4.53	-3.71	-5.95	4.12
	(2.64***)	(2.29**)	(3.15***)	(1.26)
Government Effectiveness (World Bank)	-9.69	-9.80	-9.42	-7.81
	(3.17***)	(2.69***)	(2.51**)	(2.37**)
Adjusted R2	0.67		0.51	0.5
Observations	70	70	45	25
F-test (Prob>F)	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.31	0.29	0.19	0.11
Heteroscedasticity test (Prob>chi2)	0.03		0.98	0.44
RESET (Prob>F)	0.16		0.59	0.92

Notes: OLS and robust (RR) regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (ICRG), less regulation (Fraser), and better quality (World Bank).
Constant included but not reported.

Table 2: Determinants of Corruption – Full Model

	OLS	RR	Income	
			Low	High
Shadow Economy	0.003	0.003	0.008	-0.07
	(0.41)	(0.43)	(1.14)	(3.57***)
Log GDP per capita	0.07	0.01	0.029	1.13
	(0.62)	(0.08)	(0.24)	(3.98***)
Fiscal Burden (Heritage)	-0.27	-0.18	-0.08	-0.41
	(1.91*)	(1.45)	(0.51)	(0.80)
Regulation of Prices (Fraser)	-0.18	-0.19	-0.16	-0.14
	(3.67***)	(3.67***)	(2.91***)	(1.12)
Rule of Law (World Bank)	-0.66	-0.64	-0.44	-2.88
	(3.80***)	(3.71***)	(2.38**)	(5.18***)
Democracy	-0.06	-0.07	-0.04	-0.05
	(2.59**)	(2.62***)	(1.504)	(0.42)
Adjusted R2	0.62		0.35	0.69
Observations	98	98	71	27
F-test (Prob>F)	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.07	0.02	0.17	0.73
Heteroscedasticity test (Prob>chi2)	0.27		0.00	0.50
RESET (Prob>F)	0.05		0.06	0.69

Notes: OLS and robust (RR) regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (ICRG), higher burden (Heritage), less regulation (Fraser), better quality (World Bank), and more democracy.
Constant included but not reported.

Table 3: Determinants of the Shadow Economy, Full Model, Instrumental Variables

	(1)			(2)		
	All	Low	High	All	Low	High
Corruption (ICRG)	3.72	3.12	5.41	-4.04	5.14	-1.85
	(1.17)	(0.86)	(1.40)	(1.33)	(0.78)	(1.91*)
Log GDP per capita	-1.98	-2.52	-8.49	-3.17	-1.95	-6.24
	(1.10)	(1.11)	(2.17**)	(1.62)	(0.78)	(1.50)
Credit Market Regulations (Fraser)	5.82	6.05	5.96	2.38	6.87	-1.12
	(3.00***)	(2.92***)	(1.49)	(1.03)	(2.31**)	(0.95)
Minimum Wage Regulation (Fraser)	-4.49	-5.94	6.25	-4.18	-5.89	3.85
	(2.55**)	(3.18***)	(1.90*)	(2.32**)	(2.83***)	(1.10)
Government Effectiveness (World Bank)	-9.08	-9.60	-9.10	-12.64	-8.81	-8.08
	(2.59**)	(2.35**)	(2.07**)	(3.44***)	(2.01**)	(2.42**)
Adjusted R2	0.66	0.51	-0.11	0.60	0.47	0.43
Observations	69	45	24	67	43	24
Sargan Test (Prob. > F)	0.77	0.82	0.89	0.73	0.14	0.03

Notes:
(1) Corruption instrumented with Fiscal Burden (Heritage), Regulation of Prices (Fraser), Rule of Law (World Bank), Democracy.
(2) Corruption instrumented with Ethnic Fractionalization, Religious Fractionalization, Latitude, French Legacy, Socialist Legacy, German Legacy, Scandinavian Legacy.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level
Higher values represent more corruption (ICRG), less regulation (Fraser), and better quality (World Bank).
Constant included but not reported.

Table 4: Instruments for Corruption – Correlation between Instruments and Residuals/ Endogenous Explanatory Variable

	Residuals of Full Model	Corruption (ICRG)
Corruption (ICRG)	-0.03	
Log GDP per capita	0.04	-0.61
Fiscal Burden (Heritage)	-0.08	-0.11
Regulation of Prices (Fraser)	0.11	-0.46
Rule of Law (World Bank)	0.06	-0.72
Democracy	0.14	-0.50
Ethnic fractionalization	-0.08	0.34
Religious fractionalization	0.07	-0.02
Latitude	0.14	-0.52
French legal origin	0.06	0.17
Socialist legal origin	0.05	0.06
German legal origin	-0.02	-0.20
Scandinavian legal origin	-0.02	-0.40

Table 5: Determinants of Corruption, Full Model, Instrumental Variables

	(1)			(2)		
	All	Low	High	All	Low	High
Shadow Economy	-0.03	-0.01	-0.09	-0.02	-0.02	-0.11
	(1.28)	(0.42)	(1.57)	(0.66)	(0.46)	(1.45)
Log GDP per capita	-0.04	-0.17	1.11	-0.03	-0.08	1.06
	(0.25)	(1.30)	(2.58**)	(0.24)	(0.60)	(2.93***)
Fiscal Burden (Heritage)	0.004	0.11	-0.53	-0.40	-0.20	-0.50
	(0.02)	(0.67)	(0.84)	(2.17**)	(1.14)	(0.91)
Regulation of Prices (Fraser)	-0.20	-0.21	-0.12	-0.16	-0.11	-0.13
	(3.04***)	(3.37***)	(0.90)	(2.09**)	(1.09)	(1.01)
Rule of Law (World Bank)	-0.94	-0.57	-3.23	-0.84	-0.58	-3.30
	(2.96***)	(2.10**)	(4.17***)	(2.30**)	(1.83*)	(3.50***)
Democracy	-0.08	-0.07	-0.06	-0.04	-0.03	-0.03
	(2.44**)	(1.88*)	(0.82)	(1.50)	(0.96)	(0.28)
Adjusted R2	0.69	0.39	0.56	0.57	0.22	0.67
Observations	69	45	24	94	68	26
Sargan Test (Prob. > F)	0.14	0.33	0.06	0.09	0.06	0.45

Notes:
(1) Shadow Economy instrumented with Credit Market Regulations (Fraser), Minimum Wage Regulation (Fraser), Government Effectiveness (World Bank).
(2) Shadow Economy instrumented with Starting a Business (Duration), Starting a Business (Costs), Flexibility to Hire, Flexibility to Fire.
* denotes significant at 10% level; ** significant at 5% level; ******* significant at 1% level
Higher values represent more corruption (ICRG), higher burden (Heritage), less regulation (Fraser), better quality (World Bank), and more democracy.
Constant included but not reported.

Table 6: Instruments for the Shadow Economy – Correlation between Instruments and Residuals/ Endogenous Explanatory Variable

	Residuals of Full Model	Shadow Economy
Shadow Economy	-0.05	
Log GDP per capita	0.15	-0.71
Credit Market Regulations (Fraser)	0.37	-0.37
Minimum Wage Regulation (Fraser)	0.04	-0.49
Government Effectiveness (World Bank)	0.13	-0.76
Starting a Business (Duration)	0.22	0.33
Starting a Business (Costs)	0.16	0.53
Flexibility to Hire	0.19	0.18
Flexibility to Fire	0.12	0.37

Table 7: Determinants of the Shadow Economy, Full Model, Panel

	All	All	Income		All
			Low	High	
Corruption (ICRG)	1.34	1.59	1.36	0.69	3.46
	(2.63**)	(4.81***)	(1.42)	(1.98**)	(3.48***)
Log GDP per capita	-0.81	-5.48	-5.33	-2.95	-14.60
	(0.15)	(4.20***)	(0.86)	(0.42)	(1.88*)
Credit Market Regulations (Fraser)	0.06	0.48	0.11	0.33	-0.04
	(0.14)	(1.25)	(0.25)	(1.42)	(0.09)
Minimum Wage Regulation (Fraser)	-0.89	-1.04	-1.37	-0.33	-0.73
	(3.97***)	(5.54***)	(4.50***)	(1.76*)	(3.00***)
Government Effectiveness (World Bank)	-0.11	-1.47	-1.74	6.30	4.89
	(0.05)	(1.00)	(0.54)	(1.72*)	(1.53)
Method	FE	RE	FE	FE	IV
R2 (overall)	0.99	0.56	0.23	0.99	0.45
Observations	118	118	69	49	116
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.00	0.03	0.02	0.02	0.00
Sargan Test (Prob. > F)					0.10

Notes:
The low income group has not enough observations.
FE: fixed country effects included.
RE: random effects model.
IV: Corruption instrumented with Fiscal Burden (Heritage), Regulation of Prices (Fraser), Rule of Law (World Bank), Democracy.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level
Higher values represent more corruption (ICRG), less regulation (Fraser), and better quality (World Bank).

Table 8: Determinants of Corruption, Full Model, Panel

	All	All	Income		All
			Low	High	
Shadow Economy	0.09	0.02	0.10	0.09	0.01
	(2.88***)	(2.64***)	(2.77***)	(0.76)	(0.12)
Log GDP per capita	2.10	0.15	1.54	2.99	3.88
	(2.39**)	(1.49)	(1.16)	(2.15**)	(2.85***)
Fiscal Burden (Heritage)	-0.33	-0.44	-0.27	-0.33	-0.69
	(1.51)	(4.00***)	(1.12)	(0.59)	(2.42**)
Regulation of Prices (Fraser)	-0.06	-0.06	-0.07	0.03	-0.09
	(1.04)	(1.44)	(0.99)	(0.17)	(1.00)
Rule of Law (World Bank)	-0.64	-0.75	-0.48	-0.53	-2.61
	(1.03)	(4.18***)	(0.67)	(0.31)	(2.39**)
Democracy	0.08	-0.05	0.08	0.76	0.03
	(2.21**)	(2.54***)	(2.33**)	(1.07)	(0.27)
Method	FE	RE	FE	FE	IV
R2 (overall)	0.91	0.58	0.54	0.91	0.21
Observations	183	183	131	52	116
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.00	0.77	0.09	0.00	0.00
Sargan Test (Prob. > F)					0.03

Notes:
FE: fixed country effects included.
RE: random effects model.
IV: Corruption instrumented with Fiscal Burden (Heritage), Regulation of Prices (Fraser), Rule of Law (World Bank), Democracy.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level
Higher values represent more corruption (ICRG), higher burden (Heritage), less regulation (Fraser), better quality (World Bank), and more democracy.

Table 9: Determinants of Corruption in high income countries (TI and World Bank) – Full Model

	TI	World Bank
Shadow Economy	-0.06	-0.01
	(2.35**)	(2.76**)
Log GDP per capita	0.19	-0.29
	(0.49)	(2.80**)
Fiscal Burden (Heritage)	-0.29	-0.14
	(0.52)	(1.62)
Regulation of Prices (Fraser)	-0.30	-0.06
	(2.55**)	(1.91*)
Rule of Law (World Bank)	-3.38	-1.41
	(3.93*)	(8.44***)
Democracy	-0.08	0.03
	(1.69)	(1.18)
Adjusted R2	0.80	0.90
Observations	24	27
F-test (Prob>F)	0.00	0.00
Normality test (Prob>chi2)	0.00	0.07
Heteroscedasticity test (Prob>chi2)	0.14	0.47
RESET (Prob>F)	0.30	0.83

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (Transparency International (TI) and World Bank), higher burden (Heritage), less regulation (Fraser), better quality (World Bank), and more democracy.
Constant included but not reported.

Table 10: Determinants of Corruption (DKM) – Full Model

	OLS	RR	Income	
			Low	High
Shadow Economy	0.04	0.04	0.06	-0.10
	(1.77*)	(1.69*)	(2.49**)	(1.50)
Log GDP per capita	-0.17	-0.31	-0.16	-0.58
	(0.53)	(0.95)	(0.44)	(0.39)
Fiscal Burden (Heritage)	0.10	0.11	0.35	-1.72
	(0.33)	(0.24)	(0.73)	(1.51)
Regulation of Prices (Fraser)	-0.19	-0.20	-0.26	-0.18
	(1.46)	(1.18)	(1.70*)	(0.45)
Rule of Law (World Bank)	0.88	1.13	0.76	-0.46
	(1.50)	(1.98**)	(1.24)	(0.22)
Democracy	-0.07	-0.06	-0.03	0.28
	(0.97)	(0.67)	(0.30)	(0.86)
Adjusted R2	0.01		0.16	0.69
Observations	90	90	65	25
F-test (Prob>F)	0.33	0.37	0.05	0.61
Normality test (Prob>chi2)	0.03	0.03	0.06	0.01
Heteroscedasticity test (Prob>chi2)	0.87		0.57	0.22
RESET (Prob>F)	0.23		0.46	0.14

Notes: OLS and robust (RR) regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (Dreher, Kotsogiannis, McCorriston 2005b), higher burden (Heritage), less regulation (Fraser), better quality (World Bank), and more democracy.
Constant included but not reported.

Table 11: Determinants of Corruption (DKM), Full Model, Instrumental Variables

		(1)			(2)	
	All	Low	High	All	Low	High
Shadow Economy	0.14	0.10	-0.32	0.12	0.12	0.04
	(2.59**)	(2.65**)	(1.22)	(2.45**)	(2.50**)	(0.19)
Log GDP per capita	0.41	0.26	-0.94	0.13	0.12	-0.16
	(0.76)	(0.41)	(0.46)	(0.35)	(0.27)	(0.11)
Fiscal Burden (Heritage)	0.09	0.82	-3.51	0.11	0.39	-1.47
	(0.18)	(1.18)	(2.20**)	(0.34)	(0.71)	(1.31)
Regulation of Prices (Fraser)	-0.44	-0.41	-0.16	-0.41	-0.45	-0.20
	(2.10**)	(2.00**)	(0.41)	(2.45**)	(2.29**)	(0.42)
Rule of Law (World Bank)	1.58	0.67	-4.04	1.66	1.29	0.82
	(1.80*)	(0.83)	(1.23)	(2.61**)	(1.94*)	(0.28)
Democracy	-0.08	0.04	0.18	-0.12	-0.07	0.20
	(0.79)	(0.34)	(0.98)	(1.50)	(0.76)	(0.60)
Adjusted R2	0.30	0.23	-0.18	-0.04	0.25	-0.23
Observations	66	43	23	86	62	24
Sargan Test (Prob. > F)	0.89	0.17	0.01	0.83	0.87	0.21

Notes:
(1) Shadow Economy instrumented with Credit Market Regulations (Fraser), Minimum Wage Regulation (Fraser), Government Effectiveness (World Bank).
(2) Shadow Economy instrumented with Starting a Business (Duration), Starting a Business (Costs), Flexibility to Hire, Flexibility to Fire.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level
Higher values represent more corruption (Dreher, Kotsogiannis, McCorriston 2005b), higher burden (Heritage), less regulation (Fraser), better quality (World Bank), and more democracy.
Constant included but not reported.

Table 12: Summary

Dependent Variable:	Shadow Economy			Corruption		
Independent Variable:	Corruption			Shadow Economy		
	All	Low	High	All	Low	High
ICRG index of corruption						
OLS	1.88	3.57	-0.84	0.00	0.01	-0.07
	(1.20)	(1.34)	(0.97)	(0.41)	(1.14)	(3.57***)
Robust regression	1.32			0.00		
	(0.82)			(0.43)		
IV, set 1	3.72	3.12	5.41	-0.03	-0.01	-0.09
	(1.17)	(0.86)	(1.40)	(1.28)	(0.42)	(1.57)
IV, set 2	-4.04	5.14	-1.85	-0.02	-0.02	-0.11
	(1.33)	(0.78)	(1.91*)	(0.66)	(0.46)	(1.45)
Panel, fixed effects	1.34	1.36	0.69	0.09	0.10	0.09
	(2.63**)	(1.42)	(1.98**)	(2.88***)	(2.77***)	(0.76)
Panel, random effects	1.59			0.02		
	(4.81***)			(2.64***)		
Panel IV	3.46			0.01		
	(3.48***)			(0.12)		
TI index of corruption						
OLS						-0.06
						(2.35**)
World Bank Index of corruption						
OLS						-0.01
						(2.76**)
DKM index of corruption						
OLS				0.04	0.06	-0.10
				(1.77*)	(2.49**)	(1.50)
Robust regression				0.04		
				(1.69*)		
IV, set 1				0.14	0.10	-0.32
				(2.59**)	(2.65**)	(1.22)
IV, set 2				0.12	0.12	0.04
				(2.45**)	(2.50**)	(0.19)

Notes:
Instruments for the shadow economy are: (1) Credit Market Regulations (Fraser), Minimum Wage Regulation (Fraser), Government Effectiveness (World Bank); (2) Starting a Business (Duration), Starting a Business (Costs), Flexibility to Hire, Flexibility to Fire.
Instruments for corruption are: (1) Fiscal Burden (Heritage), Regulation of Prices (Fraser), Rule of Law (World Bank), Democracy; (2) Ethnic Fractionalization, Religious Fractionalization, Latitude, French Legacy, Socialist Legacy, German Legacy, Scandinavian Legacy.

* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level

Appendix A

Table A-1: Determinants of the Shadow Economy – Tax Burden

	(1)	(2)	(3)	(4)	(5)	(6)
Corruption (ICRG)	1.45	1.71	1.91	2.18	3.04	3.26
	(1.41)	(1.54)	(1.90*)	(2.40**)	(1.62)	(1.98*)
Log GDP per capita	-5.28	-5.61	-5.41	-5.28	-3.82	-3.68
	(7.61***)	(7.62***)	(5.62***)	(5.70***)	(2.16**)	(2.31**)
Fiscal Burden (Heritage)	-2.47					
	(1.89*)					
Top marginal income tax rate (Fraser)		-0.05				
		(0.20)				
Taxes on international trade (Fraser)			0.26			
			(0.29)			
Trade Barriers (Heritage)				-1.22		
				(0.87)		
Taxes (percent of GDP)					-0.10	
					(0.56)	
Revenue (percent of GDP)						-0.20
						(1.15)
Adjusted R2	0.44	0.46	0.47	0.45	0.25	0.29
Observations	118	95	103	118	57	59
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.00	0.00	0.00	0.00	0.01	0.03
Heteroscedasticity test (Prob>chi2)	0.03	0.01	0.03	0.03	0.02	0.04
RESET (Prob>F)	0.13	0.03	0.06	0.01	0.01	0.07

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (ICRG), higher burden (Heritage) and smaller burden (Fraser).
Constant included but not reported.

Table A-2: Determinants of the Shadow Economy – Measures of Regulation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Corruption (ICRG)	2.22	1.13	2.24	0.76	1.05	2.41	2.01
	(2.15**)	(0.80)	(2.12**)	(0.54)	(0.75)	(2.43**)	(2.14**)
Log GDP per capita	-6.19	-6.16	-5.68	-6.22	-5.85	-5.34	-4.86
	(8.33***)	(4.49)	(6.25***)	(4.71***)	(3.42***)	(8.04***)	(6.86***)
Credit Market Regulations (Fraser)	1.48						
	(2.16**)						
Minimum Wage Regulation (Fraser)		-5.78					
		(3.22***)					
Regulation of Prices (Fraser)			0.63				
			(0.89)				
Administrative Procedures (Fraser)				-5.65			
				(2.58**)			
Time with government bureaucracy (Fraser)					-1.97		
					(1.30)		
Wage and Price Regulation (Heritage)						-3.39	
						(1.78*)	
Regulation (Heritage)							-0.24
							(0.16)
Adjusted R2	0.49	0.56	0.48	0.56	0.51	0.45	0.43
Observations	103	70	102	70	70	117	117
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.04	0.05	0.01	0.06	0.10	0.02	0.01
Heteroscedasticity test (Prob>chi2)	0.02	0.00	0.06	0.00	0.00	0.11	0.02
RESET (Prob>F)	0.13	0.42	0.18	0.12	0.27	0.03	0.03

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (ICRG), more regulation (Heritage), and less regulation (Fraser).
Constant included but not reported.

Table A-3: Determinants of the Shadow Economy – Institutional Quality

	(1)	(2)	(3)	(4)	(5)
Corruption (ICRG)	-0.17	0.07	-0.06	1.17	1.04
	(0.17)	(0.07)	(0.03)	(1.04)	(1.03)
Log GDP per capita	-0.82	-1.82	-5.25	-3.55	-3.96
	(0.84)	(1.85*)	(5.00***)	(4.07***)	(4.93)
Rule of Law (World Bank)	-8.81				
	(5.01***)				
Government Effectiveness (World Bank)		-7.16			
		(4.09***)			
Judicial independence (Fraser)			-2.16		
			(2.23**)		
Impartial courts (Fraser)				-2.22	
				(2.37**)	
Integrety of Legal System (Fraser)					-1.64
					(2.67***)
Adjusted R2	0.52	0.49	0.58	0.50	0.5
Observations	118	118	57	103	103
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.01	0.01	0.04	0.02	0.01
Heteroscedasticity test (Prob>chi2)	0.01	0.08	0.00	0.01	0.02
RESET (Prob>F)	0.62	0.58	0.65	0.44	0.12

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; ***** significant at 1% level.
Higher values represent more corruption (ICRG) and better quality (World Bank, Fraser).
Constant included but not reported.

Table A-4: Determinants of Corruption – Tax Burden

	(1)	(2)	(3)	(4)	(5)	(6)
Shadow Economy	0.01	0.01	0.02	0.02	0.01	0.02
	(1.35)	(1.43)	(1.77*)	(2.32**)	(1.65)	(1.98**)
Log GDP per capita	-0.42	-0.39	-0.31	-0.23	-0.44	-0.40
	(5.66***)	(4.02***)	(2.99***)	(2.79***)	(4.03***)	(3.43***)
Fiscal Burden (Heritage)	-0.34					
	(2.32**)					
Top marginal income tax rate (Fraser)		0.03				
		(0.95)				
Taxes on international trade (Fraser)			-0.06			
			(0.80)			
Trade Barriers (Heritage)				0.24		
				(2.85***)		
Taxes (percent of GDP)					-0.05	
					(0.42)	
Revenue (percent of GDP)						0.02
						(1.23)
Adjusted R2	0.41	0.39	0.38	0.25	0.38	0.32
Observations	118	95	103	118	57	59
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.35	0.19	0.33	0.15	0.18	0.24
Heteroscedasticity test (Prob>chi2)	0.15	0.47	0.71	0.53	0.68	0.33
RESET (Prob>F)	0.05	0.02	0.01	0.00	0.02	0.00

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level.
Higher values represent more corruption (ICRG), higher burden (Heritage) and smaller burden (Fraser).
Constant included but not reported.

Table A-5: Determinants of Corruption – Measures of Regulation

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Shadow Economy	-0.02	0.01	0.02	0.01	0.02	0.02	0.01
	(2.40**)	(0.81)	(2.00**)	(1.44)	(1.76*)	(2.25**)	(1.97**)
Log GDP per capita	-0.20	-0.62	-0.24	-0.42	-0.34	-0.28	-0.23
	(2.09**)	(5.71***)	(2.57**)	(4.10***)	(3.34***)	(3.36***)	(2.43**)
Credit Market Regulations (Fraser)	-0.21						
	(2.51**)						
Minimum Wage Regulation (Fraser)		-0.01					
		(0.07)					
Regulation of Prices (Fraser)			-0.20				
			(3.22***)				
Administrative Procedures (Fraser)				-0.07			
				(0.60)			
Time with government bureaucracy (Fraser)					0.26		
					(0.26)		
Wage and Price Regulation (Heritage)						0.30	
						(2.22**)	
Regulation (Heritage)							0.35
							(2.56**)
Adjusted R2	0.41	0.38	0.25	0.50	0.32	0.40	0.32
Observations	103	70	103	88	88	118	118
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.88	0.16	0.75	0.60	0.39	0.39	0.51
Heteroscedasticity test (Prob>chi2)	0.29	0.17	0.17	0.42	0.32	0.50	0.04
RESET (Prob>F)	0.00	0.67	0.00	0.05	0.08	0.00	0.01

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; ***** significant at 1% level.
Higher values represent more corruption (ICRG), more regulation (Heritage) and less regulation (Fraser).
Constant included but not reported.

Table A-6: Determinants of Corruption – Institutional Quality

	(1)	(2)	(3)	(4)	(5)
Shadow Economy	-0.003	-0.002	0.01	0.01	0.01
	(0.46)	(0.21)	(0.46)	(0.69)	(0.89)
Log GDP per capita	0.003	-0.02	-0.35	-0.26	-0.27
	(0.04)	(0.17)	(4.21***)	(2.96***)	(2.97***)
Rule of Law (World Bank)	-0.86				
	(5.54***)				
Government Effectiveness (World Bank)		-0.82			
		(5.09***)			
Judicial independence (Fraser)			-0.17		
			(3.82***)		
Impartial courts (Fraser)				-0.19	
				(3.12***)	
Integrety of Legal System (Fraser)					-0.14
					(3.18***)
Adjusted R2	0.50	0.49	0.55	0.42	0.41
Observations	118	118	88	103	103
F-test (Prob>F)	0.00	0.00	0.00	0.00	0.00
Normality test (Prob>chi2)	0.48	0.20	0.77	0.46	0.91
Heteroscedasticity test (Prob>chi2)	0.71	0.41	0.78	0.61	0.95
RESET (Prob>F)	0.00	0.00	0.03	0.01	0.00

Notes: OLS regressions; robust absolute t-statistics in parentheses.
* denotes significant at 10% level; ** significant at 5% level; ***** significant at 1% level.
Higher values represent more corruption (ICRG) and better quality (World Bank, Fraser).
Constant included but not reported.

Appendix B: Sources and Definitions

Variable	Description	Source
Shadow Economy	Size of the shadow economy in percent of GDP calculated with dymimic and currency demand estimation techniques.	Schneider (2005a)
Corruption (ICRG)	Measures corruption in the political system as a threat to foreign investment based on the analysis of a worldwide network of experts. Rescaled so that 0 represents no corruption and 6 highest corruption.	International Country Risk Guide (ICRG)
Corruption (TI)	Corruption Perception Index. Rescaled so that 0 represents no corruption and 10 highest corruption.	Transparency International
Corruption (World Bank)	Control of Corruption Index.	Kaufman et al. (2003)
Corruption (DKM)	Index infered from a structural model using both the likely causes and likely effects of corruption. The index ranges from 1 to 10, where higher values represent more corruption.	Dreher, Kotsogiannis and McCorriston (2005b)
GDP per capita	GDP per capita is gross domestic product divided by midyear population. Data are in constant U.S. dollars.	World Bank (2003)
Fiscal burden (Heritage)	The index of the fiscal burden refers to average and marginal corporate and income taxation where a score of 1 signifies an economic environment most conducive to economic freedom, while a score of 5 signifies least economic freedom.	Heritage (2005)
Top marginal income tax rate (Fraser)	Show higher scores for countries with lower tax rates, on a scale of 1-10.	Gwartney and Lawson (2004)
Taxes on international trade (Fraser)	Show higher scores for countries with lower tax rates, on a scale of 1-10.	Gwartney and Lawson (2004)
Trade barriers (Heritage)	Captures international trade taxation and regulation. A higher score implies a higher burden of taxation, i.e. higher average and marginal tax rates and, respectively, higher taxes on trade.	Heritage (2005)
Taxes (percent of GDP)	Tax revenue in percent of GDP.	World Bank (2003)
Revenue (percent of GDP)	Current revenue (excluding grants) in percent of GDP.	World Bank (2003)
Credit Market Regulation (Fraser)	Show higher scores for countries with less regulation, on a scale of 1-10.	Gwartney and Lawson (2004)
Minimum Wage Regulation (Fraser)	Show higher scores for countries with less regulation, on a scale of 1-10.	Gwartney and Lawson (2004)
Credit Market Regulation (Fraser)	Show higher scores for countries with less regulation, on a scale of 1-10.	Gwartney and Lawson (2004)
Regulation of prices (Fraser)	Show higher scores for countries with less regulation, on a scale of 1-10.	Gwartney and Lawson (2004)
Administrative procedures (Fraser)	Show higher scores for countries with fewer procedures, on a scale of 1-10.	Gwartney and Lawson (2004)
Time with government bureaucracy (Fraser)	Show higher scores for countries with less bureaucracy, on a scale of 1-10.	Gwartney and Lawson (2004)
Wage and price regulation (Heritage)	Index of wage and price regulation where a score of 1 signifies an economic environment most conducive to economic freedom, while a score of 5 signifies least economic freedom.	Heritage (2005)
Regulation (Heritage)	Index of regulation where a score of 1 signifies an economic environment most conducive to economic freedom, while a score of 5 signifies least economic	Heritage (2005)
Rule of law (World Bank)	Ranges from -2.58 to 2.48, with higher scores showing “better” environments.	Kaufmann et al. (2003)

Appendix B (continued)

Variable	Description	Source
Government effectiveness (World Bank)	Ranges -2.31 to 2.22, with higher scores showing "better" environments.	Kaufmann et al. (2003)
Judicial independence (Fraser)	Show higher scores for countries with greater judicial independence, on a scale of 1-10.	Gwartney and Lawson (2004)
Impartial courts (Fraser)	Show higher scores for countries with greater impartiality, on a scale of 1-10.	Gwartney and Lawson (2004)
Integrity of legal system (Fraser)	Show higher scores for countries with higher integrity, on a scale of 1-10.	Gwartney and Lawson (2004)
Ethnolinguistic fractionalization	Fractionalization$_j$=, $1-\sum_{i=1}^{n} s_{ij}^2$ with s_{ij} being the share of group i in country j.	Alesina et al. (2003)
Latitude	Absolute value of latitude.	Easterly and Sewadeh (2001)
Legal origin	Dummies representing French, German, Socialist, and Scandinavian legal origin.	La Porta et al. (1999)
Costs to start business	Measures the costs of the start-up of commercial or industrial firms with up to 50 employees and start-up capital of 10 times the economy's per-capita Gross National Income. All procedures required to register a firm are counted, including screening procedures by overseeing government entities, tax- and labour-related registration procedures, health and safety procedures, and environment-related procedures. The costs of these procedures are calculated as percentage of income per capita.	Djankov et al. (2002)
Duration to start business	Measures the duration of the start-up of commercial or industrial firms with up to 50 employees and start-up capital of 10 times the economy's per-capita Gross National Income. All procedures required to register a firm are counted, including screening procedures by overseeing government entities, tax- and labour-related registration procedures, health and safety procedures, and environment-related procedures. Time is recorded in calendar days.	Djankov et al. (2002)
Hiring flexibility index	The hiring cost indicator measures all social security payments (including retirement fund; sickness, maternity and health insurance; workplace injury; family allowance; and other obligatory contributions) and payroll taxes associated with hiring an employee. The cost is expressed as a percentage of the worker's salary.	Botero et al. (2004)
Firing flexibility index	The firing cost indicator measures the cost of advance notice requirements, severance payments and penalties due when dismissing a redundant worker, expressed in weekly wages.	Botero et al. (2004)
Religious fractionalization	Fractionalization$_j$=, $1-\sum_{i=1}^{n} s_{ij}^2$ with s_{ij} being the share of group i in country j.	Alesina et al. (2003)

Appendix C: Descriptive Statistics

Variable	Mean	Minimum	Maximum	Standard Deviation
Shadow Economy	31.78	6.90	68.20	12.72
Corruption (ICRG)	3.26	0.00	6.00	1.32
Corruption (TI)	5.20	0.00	9.95	2.61
Corruption (World Bank)	0.00	-1.85	2.58	0.98
Corruption (DKM)	0.08	-0.91	0.35	0.29
GDP per capita	7.50	3.98	10.72	1.55
Fiscal burden (Heritage)	3.82	1.30	5.00	0.75
Top marginal income tax rate (Fraser)	4.95	0.00	10.00	3.01
Taxes on international trade (Fraser)	6.44	0.00	10.00	2.34
Trade barriers (Heritage)	3.55	1.00	5.00	1.22
Taxes (percent of GDP)	20.20	0.37	47.28	9.69
Revenue (percent of GDP)	24.63	0.04	58.76	10.48
Credit Market Regulation (Fraser)	6.27	0.00	10.00	2.46
Minimum Wage Regulation (Fraser)	4.65	1.80	8.30	1.35
Credit Market Regulation (Fraser)	5.76	0.35	9.80	2.35
Regulation of prices (Fraser)	4.30	0.00	10.00	2.65
Administrative procedures (Fraser)	4.10	1.30	7.33	1.11
Time with government bureaucracy (Fraser)	6.10	2.20	9.70	1.32
Wage and price regulation (Heritage)	2.86	1.00	5.00	0.87
Regulation (Heritage)	3.37	1.00	5.00	0.93
Rule of law (World Bank)	0.00	-2.04	2.36	0.98
Government effectiveness (World Bank)	-0.02	-2.28	2.59	0.95
Judicial independence (Fraser)	5.76	0.35	9.80	2.34
Impartial courts (Fraser)	5.49	0.00	9.50	1.85
Integrity of legal system (Fraser)	6.52	0.00	10.00	2.59
Ethnolinguistic fractionalization	0.44	0.00	0.93	0.26
Latitude	17.89	-36.89	64.22	23.77
Legal origin British	0.35	0.00	1.00	0.48
Legal origin French	0.44	0.00	1.00	0.50
Legal origin Socialist	0.16	0.00	1.00	0.37
Legal origin German	0.03	0.00	1.00	0.16
Legal origin Scandinavian	0.03	0.00	1.00	0.16
Costs to start business	79.90	0.00	861.30	134.67
Duration to start business	54.60	2.00	203.00	40.15
Hiring flexibility index	49.30	17.00	81.00	17.09
Firing flexibility index	37.95	1.00	74.00	17.57
Religious fractionalization	0.44	0.00	0.86	0.23

Appendix D: Countries included in the Analysis

Albania	Guatemala	Pakistan
Algeria	Guinea	Panama
Angola	Haiti	Papua New Guinea
Argentina	Honduras	Paraguay
Armenia	Hong Kong, China	Peru
Australia	Hungary	Philippines
Austria	India	Poland
Azerbaijan	Indonesia	Portugal
Bangladesh	Iran, Islamic Rep.	Romania
Belarus	Iraq	Russian Federation
Belgium	Ireland	Saudi Arabia
Bolivia	Israel	Senegal
Botswana	Italy	Sierra Leone
Brazil	Jamaica	Singapore
Bulgaria	Japan	Slovak Republic
BurkinaFaso	Jordan	Slovenia
Cameroon	Kazakhstan	South Africa
Canada	Kenya	Spain
Chile	Korea, Rep.	SriLanka
China	Kuwait	Sweden
Colombia	Latvia	Switzerland
Congo, Dem. Rep.	Lebanon	Syrian Arab Republic
Congo, Rep.	Lithuania	Taiwan, China
Costa Rica	Madagascar	Tanzania
Cote d' Ivoire	Malawi	Thailand
Croatia	Malaysia	Togo
Cyprus	Mali	Tunisia
Czech Republic	Mexico	Turkey
Denmark	Moldova	Uganda
Dominican Republic	Mongolia	Ukraine
Ecuador	Morocco	United Arab Emirates
Egypt, Arab Rep.	Mozambique	United Kingdom
El Salvador	Namibia	United States
Estonia	Netherlands	Uruguay
Ethiopia	New Zealand	Venezuela, RB
Finland	Nicaragua	Vietnam
France	Niger	Yemen,Rep.
Gabon	Nigeria	Yugoslavia, Fed. Rep.
Germany	Norway	Zambia
Ghana	Oman	Zimbabwe
Greece		

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