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Corruption and the Shadow Economy at the Regional Level

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Abstract

The links between corruption and the shadow economy have mostly been studied empirically at the country level. This paper contributes to this literature by examining the relationship at the sub-national level. Using World Bank Enterprise Survey data, we find that sub-national units in which more firms report that corruption is an obstacle to their operations also tend to have more firms that report informal competitors as an obstacle and vice versa. We also ask whether within country variation matters and find that regions with a bigger problem in one of these dimensions than their national average also tend to have a relatively bigger problem in the other dimension. Sub-Saharan Africa is different in that neither of these findings are evident in that sub-sample.

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1 Introduction

This paper contributes to an interesting and important literature that has sought to establish the existence and nature of the relationship between corruption and the shadow economy. The weight of the existing evidence, which we discuss below, suggests that corruption and the shadow economy are complements in the sense that countries with a larger shadow economy tend to perform worse on various indices of perceived corruption. We take the analysis to the regional (or sub-national) level by using data from the World Bank's Enterprise Surveys (ES). We ask whether sub-national regions in which more firms say that corruption is a problem for their operations also have more firms claiming that informal sector competitors are a problem for their operations. Our findings that more corrupt regions tend to have a bigger problem with the shadow economy and vice versa is in line with the existing cross-country literature. We also find that within country variation matters in that regions which are more corrupt than their national average tend to have a bigger problem with the informal sector than the average region in that country and vice versa. Africa seems to be different though in that neither of these findings holds when we restrict our sample to sub-Saharan African countries.

Corruption and informal economic activities remain widespread in the world and have been shown to be rather costly illicit phenomena in a variety of ways. For example, the seminal works of Mauro (1995) and Wei (2000) show that corruption has negative implications for economic growth and foreign direct investment flows respectively. Gupta et al. (2002) find that corruption increases both inequality and poverty and Breen and Gillanders (2012) argue that corruption leads to more burdensome regulation of firms. Informal economic activity is costly in terms of lost revenue to the state. Recent estimates presented by Schneider et al. (2010) put the weighted average size of the informal economy as a percentage of GDP at nearly 38% in sub-Saharan Africa, 36% in the Europe and Central Asia region and 13% in the OECD (p 457). Schneider and Enste (2000) point out that a large shadow economy also distorts policymaking via the generation of biased statistics on employment, consumption and other such quantities of interest. Dreher et al. (2014) argue and demonstrate that correcting output information to include shadow output can matter for the formulation of policy when the objective is to improve income rather than official income.

Given the influence of these phenomena and the fact that both are illicit and widespread, it is unsurprising that the links between the two are of interest to both scholars and policymakers. Two intuitively appealing hypotheses have been advanced. Corruption and informal activity could be substitutes as the option of operating as an informal firm and thus avoiding bribe demands means that in order to prevent the firm from doing so, corruption must be curbed. Choi and Thum (2005) and Dreher et al. (2009) present models in which this is the case. Alternatively, corruption and informal activity could be complements. In these worlds,

corruption incentivises and enables firms to move to the shadows. Models of this flavour can be found in Johnson et al. (1997), Hindriks et al. (1999), and Hibbs and Piculescu (2005).

As mentioned above and elaborated on below, while there is empirical evidence in favour of both sets of theories, the weight of evidence seems to fall in favour of the complement theories. This evidence though has been mostly generated from cross country data with a necessarily small number of observations. Taking the analysis to the regional level offers a new perspective and means of testing these theories as well as being of interest in its own right. Within country variation in corruption has been shown to exist in the case of Italy by Golden and Picci (2005) and in the countries covered by the ES by Gillanders (2014). Torgler et al. (2010) and Buehn (2012) demonstrate that there is variation in the extent of the shadow economy across Swiss cantons and German districts respectively and Tafenau et al. (2010) similarly show that the depth of the shadow economy varies within European countries. The ES allows us to illustrate that this is true for a broad range of countries. Understanding how these two particular types of illicit activity associate with each other is important for regional policy, especially in this age of targeted development interventions. If we target the shadow economy in a region with, say, a incentivised registration scheme, are we likely to improve or worsen the region's corruption problem?

The next section of this paper further reviews the relevant empirical literature. Section 3 discusses the data and our approach. Section 4 presents our results and discusses their implications and Section 5 concludes.

2   The Existing Literature

While the literature on the links between corruption and the shadow economy is rather small, it has attracted the attention of many leading researchers and they have uncovered some interesting, albeit occasionally conflicting, results. We noted above that there exist theoretical models which predict a complementary relationship (Johnson et al. (1997), Hindriks et al. (1999), and Hibbs and Piculescu (2005)) and those that suggest the relationship is substitutive (Choi and Thum (2005) and Dreher et al. (2009)).

Johnson et al. (1997) and Johnson et al. (1999) provide early empirical investigations into the relationship between corruption and the shadow economy and find that countries with greater levels of perceived corruption have larger shadow economies.[1] Friedman et al. (2000) similarly find that corruption and informal activity are complements in this way in a somewhat larger sample and motivate this finding with a micro level model of an entrepreneur's choice. Johnson et al. (2000) use firm level data and find that firms that pay bribes tend to

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[1]Schneider and Enste (2000) provides an interesting and useful discussion of early work on the causes and effects of the shadow economy.

hide output. This first wave of empirical work therefore seemed to confirm the early models of complementarity. Lassen (2007) and Torgler and Schneider (2009) also lend some more recent support to these models in that they both find that more corruption in a country, alongside other measures such as ethnic fractionalisation and poor institutional quality respectively, is associated with a larger shadow economy. Dreher et al. (2009) on the other hand present evidence in favour of their model in which the shadow economy affects corruption and the two are substitutes.

The majority of these empirical contributions are framed as studies of the effects of corruption on the shadow economy and for the most part do not tackle the issue of whether the shadow economy feeds or tempers corruption, Dreher et al. (2009) being a notable exception.[2] A recent strand of the literature has explicitly looked at both sides of the relationship simultaneously and attempted to resolve this mixed evidence. Dreher and Schneider (2010) attempt to resolve the conflicting evidence by speculating that a complementary relationship may obtain in low income countries while the two may be substitutes in high income settings.[3] Estimating equations for both corruption and the shadow economy they find no robust overall relationship, however they do find evidence of a complementary relationship in low income countries. Buehn and Schneider (2012) further acknowledge the probable interrelationship of corruption and the shadow economy by estimating a structural equation model. Given the requirements of their methodology they are limited to examining 51 countries over a five year period but they do find robust evidence of a complementary relationship within this sample. Goel and Saunoris (2014) provides an interesting new take on the question by employing spatial econometric methods. They present some evidence of complementarity within countries though it is not robust. They do however find evidence of own contagion in corruption and the shadow economy while their evidence on cross-contagion suggests that there is substitution between a country's own shadow economy and neighbouring corruption (and vice versa).

The weight of the available evidence therefore suggests that the shadow economy and corruption are complements though it seems that this may depend on the context to some degree and also that there may be interesting things going on with regards to spatial effects. It should be noted that almost all of this evidence comes from country level studies where the sample sizes are often somewhat small and constrained by the needs of the methodology chosen. Our approach, to which we will now turn, can be viewed in the light of this literature as an attempt to test the competing theories with larger sample sizes by making use of previously untapped variation in both variables of interest. In addition, by taking the analysis to the regional level we hope to offer a fresh viewpoint on the issue for policymakers.

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[2]Dreher et al. mention in Footnote 22 of their paper that they also estimated models in which corruption could influence the shadow economy and found no significant effect.

[3]Gërxhani (2004) similarly argues that the differences between developed and developing are important when studying the shadow economy.

3 Data

3.1 Measurements of Corruption and the Shadow Economy

The data used in this paper comes from the World Bank's Enterprise Surveys (ES) project. The ES collect data from firms in an increasing number of countries and are designed to be a representative sample.[4] From this firm level data we create regional indicators as is done in Gillanders (2014). To measure corruption and the shadow economy at the regional level we make use of two questions that ask firms how much of an obstacle corruption and informal competitors are to their operations. Firms can offer answers ranging from no obstacle to very severe obstacle. For both the corruption and the shadow economy questions, we create a firm level dummy variable that takes a value of one if the firm says that the issue is a major or very severe obstacle and zero otherwise. By averaging these firm level dummies by region we obtain regional indicators that we use in the analysis below. It should be noted that the sub-national units identified in the data are not necessarily real administrative divisions. Some countries and therefore some regions have been surveyed more than once. We have available to us a sample of 400 regional observations from across the world. The countries included in our sample are listed in Table A1 in the appendix.

The resulting corruption measure may at first glance be seen as a product of necessity in that we need a measure at the regional level and the more commonly used corruption indices mostly exist only at the national level. However these commonly used indices have been the subject of increasing criticism with leading scholars pointing out that measures such as the Corruption Perceptions Index are subject to perceptions biases (Svensson (2003); Reinikka and Svensson (2006); Treisman (2007); Fan et al. (2009)) and they may lag reality (Knack (2007); Kenny (2009)). It has been argued that well designed surveys, of which the ES are an exemplar, can yield more convincing evidence on the nature and extent of corruption (Svensson (2005); Reinikka and Svensson (2006)) and it has been demonstrated that the difference between perceptions and the reality of experienced corruption can be large (Treisman (2007); Razafindrakoto and Roubaud (2010); Donchev and Ujhelyi (2014); Gillanders and Parviainen (2014)). Gillanders (2014) uses this index to study the relationship between corruption and infrastructure at the regional level and shows that there is substantial within and cross-country variation.

Several methods of estimating the extent of the shadow economy have been employed in the literature. The most commonly used and accepted is perhaps the multiple-indicators multiple-causes (MIMIC) procedure used by Schneider and coauthors in several papers. Details of the method can be found in Schneider et al. (2010). Elgin and Öztunali (2012) criticise this approach and present estimates obtained from a calibrated dynamic general

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[4]See www.enterprisesurveys.org/methodology for the full methodology.

equilibrium model. Another set of estimates are provided by Alm and Embaye (2013) whose approach makes use of dynamic panel data methods. However, Torgler et al. (2010) acknowledge the limitations and likely errors in MIMIC estimates and that measurement error is likely to be unavoidable in any attempt to measure a phenomenon that by its very name evokes darkness. Further, the results of Goel and Saunoris (2014) are insensitive to which of these three estimates of the shadow economy they use. There have been many more attempts to estimate the size of the shadow economies and the appendix to Schneider (2005) provides an excellent overview. Measurement is further complicated by definitional problems (Schneider and Enste (2000); Gërxhani (2004)).

The measure we use here is clearly more straightforward than the ones mentioned above and differs from them in a key sense. While methods such as the MIMIC approach provide information about the extent of the shadow economy, the ES based measure we use provides information about the extent to which firms see the shadow economy as a problem. This is not a trivial distinction.[5] Again it may initially seem that we are obliged to use this measure out of necessity but both pieces of information should be of interest to policymakers. A larger shadow economy may indicate that a lot of potential tax revenue is failing to be captured by the state while a more burdensome shadow economy in the eyes of the official sector is of clear importance for policymaking.[6]

Figure 1 shows that there is large cross and within country variation in this index of the shadow economy. The dots give the country average while the upper and lower bars show the maximum and minimum values reported by the regions in that country. Table 1 presents means and summary statistics (at the sub-national level) for the variables used in this paper. 33% of firms in the average region in Sub-Saharan Africa feel that the shadow economy is an obstacle and, similar to the pattern in Schneider et al. (2010), this fraction is only slightly lower in the Europe and Central Asia sample. The story is much the same with regards to corruption. In the Latin America and Caribbean sample, both of these numbers are substanitally higher and this is the case for the other variables we use that ask about obstacles. This may be in part an artifact of cultural propensities to complain more or less about certain things and so it will be important to control for country fixed effects in our analysis. That said, Schneider et al. (2010) also identify this region as having the highest (unweighted) mean informality.

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[5]The correlation between the Schneider et al. (2010) shadow economy measure and the ES variable at the macro level is only 0.17 though as we only have a small overlap of 34 observations this is perhaps not overly informative.

[6]The surveys also ask firms if they compete against informal or unregistered firms. Given that in principle one very small informal firm in a sector in a region could cause all the formal firms in that same region and sector to answer yes to this question, we prefer the "obstacle" question as a measure of the extent of the shadow economy (or at least the extent of the problems it causes). If we do use this measure, we fail to find any significant association with corruption though if we omit the country dummies we do find a substitutive relationship such as that found in Dreher et al. (2009).

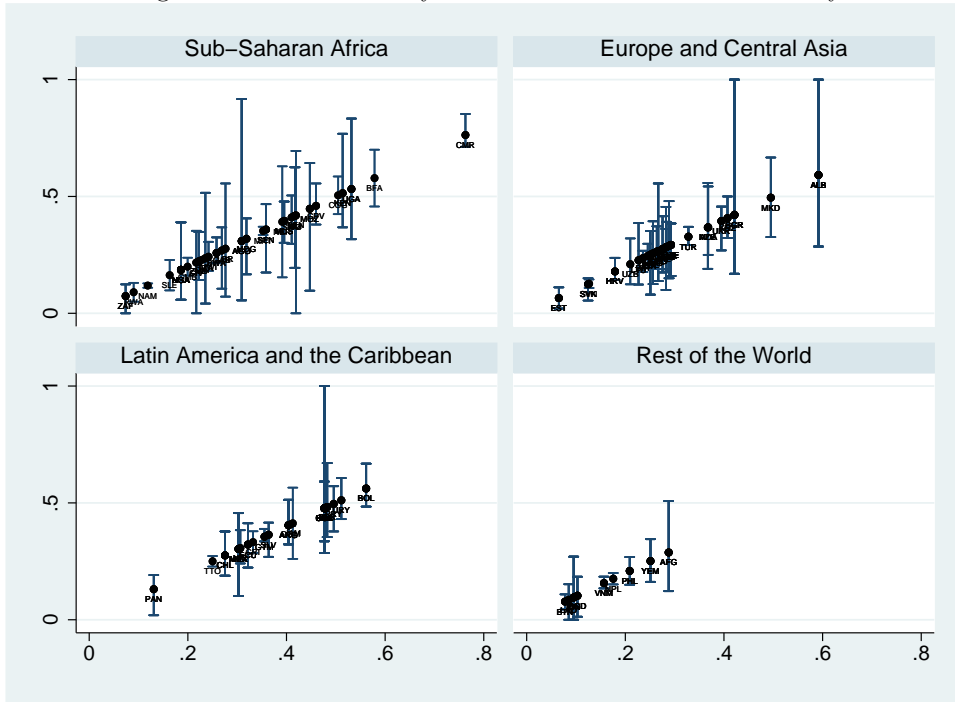Figure 1: Within Country Variation in the Shadow Economy

Table 1: Summary Statistics

	Full Sample	Sub-Saharan Africa	Europe and Central Asia	Latin America and Caribbean	Rest of the World
Shadow	0.318	0.331	0.305	0.390	0.161
	(0.176)	(0.205)	(0.161)	(0.140)	(0.103)
Corruption	0.374	0.330	0.321	0.500	0.338
	(0.215)	(0.231)	(0.162)	(0.183)	(0.259)
Log of Average Total Cost of Labour	12.581	11.457	13.022	13.530	11.799
	(1.585)	(1.583)	(1.301)	(1.110)	(1.304)
Average % of Sales That Are National	90.658	94.858	87.466	91.463	88.135
	(8.076)	(5.373)	(8.584)	(5.731)	(11.183)
Bureaucratic Burden	0.688	0.635	0.636	0.907	0.464
	(0.449)	(0.478)	(0.283)	(0.544)	(0.334)
Inadequately Educated Workforce	0.275	0.185	0.312	0.380	0.144
	(0.189)	(0.171)	(0.155)	(0.198)	(0.118)

Means with standard deviations in parentheses

3.2 Specification and Controls

Following closely the specification of Dreher and Schneider (2010), we estimate models of the following form:

$$Y_{ij} = \alpha + \beta_1 X_{ij} + \beta_2 Z'_{ij} + u_j + \epsilon_{ij} \tag{1}$$

where Y_{ij} is our measure of corruption (the shadow economy) in region i in country j while X_{ij} measures the shadow economy (corruption). Z'_{ij} includes controls which we will discuss in a moment, u_j are country dummies, and ϵ_{ij} is an error term. It is well known and rather obvious that endogeneity is a problem in estimating the relationship between the shadow economy and corruption. As discussed above, solid theories exist for a relationship running in both directions. Macro level studies have availed of instrumental variables capturing deep historical and geographical characteristics of the society (Dreher and Schneider (2010)) and structural equation models (Buehn and Schneider (2012)). Since we are dealing with data based on surveys of individual firms in sometimes loosely defined sub-national units, we estimate Equation (1) with OLS and are formally limited to talking in terms of associations and not causal relationships. Still, we feel that by studying these relationships at this level we can learn something new and interesting about them, especially when we turn to consider deviations from the national average. The inclusion of country fixed effects may lessen concerns about corruption and the shadow economy being commonly caused by macro level phenomenon.

We include controls that are analogous to some of those commonly included in the cross-country literature. We follow Gillanders (2014) and treat the average total cost of labour as a rough proxy for the level of income in the region and also control for the export orientation of the region with a variable capturing the average percentage of sales that are national. The level of prosperity in a region and its tendency to trade across international borders could have implications for both of our outcomes of interest. The literature has identified various aspects of regulation as important for both corruption and the shadow economy (Johnson et al. (1997); Buehn and Schneider (2012); Liu and Feng (2015)). We construct an index of bureaucratic burden from questions that ask how much of an obstacle tax administration, labour regulations, licensing and permits, and customs and trade regulations are to a firm's operations. We first generate regional indicators separately in the same manner as for corruption and the shadow economy and then add the 4 together to obtain a measure that can takes values between 0 and 4. Finally, we include the proportion of firms in a region that state that an inadequately educated workforce is a major or very severe obstacle to their operations as a crude measure of regional human capital.

Table 2: Corruption and the Shadow Economy at the Regional Level

	(1) Corruption	(2) Corruption	(3) Shadow	(4) Shadow
Shadow	0.340***	0.178**		
	(0.0912)	(0.0782)		
Corruption			0.288***	0.147**
			(0.0795)	(0.0718)
Log of Average Total Cost of Labour		-0.0221**		-0.000989
		(0.00974)		(0.00777)
Average % of Sales That Are National		0.000861		0.00116
		(0.00117)		(0.000888)
Bureaucratic Burden		0.149***		0.165***
		(0.0401)		(0.0431)
Inadequately Educated Workforce		0.283***		0.0480
		(0.0796)		(0.0776)
Constant	0.437***	0.513**	0.134*	-0.00809
	(0.124)	(0.210)	(0.0741)	(0.152)
Country Fixed Effects	Yes	Yes	Yes	Yes
N	400	398	400	398
R^2	0.704	0.762	0.628	0.695

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

4 Results

4.1 Complements or Substitutes?

Table 2 presents the results of estimating Equation 1 on the sample of 400 sub-national observations. Columns 1 and 3 show that there is a significant positive relationship between corruption and the shadow economy at the regional level. Regions in which more firms report that corruption is an obstacle to their operations also tend to be regions in which more firms feel that the shadow economy is getting in their way. The magnitude of the association is economically meaningful. A one standard deviation increase in the shadow economy variable is associated with an increase in the corruption variable of 0.28 of a standard deviation while a one standard deviation increase in corruption is associated with an increase of 0.35 of a standard deviation in the shadow economy variable. These magnitudes are substantially smaller when we include the additional controls in columns 2 and 4 but the results still suggest that corruption and the shadow economy are complements at the regional level. While we freely acknowledge that these results are subject to the usual concerns regarding

endogeneity this is a potentially important and useful finding as it gives policy-makers some reason to expect that reducing the size of the shadow economy in a region will also yield benefits in terms of abating corruption. Likewise, curbing corruption would seem to be associated with a diminution of the shadow economy - an additional factor to be considered in the cost-benefit analysis of anti-corruption measures. We will discuss how future work could take these simple OLS results as a starting point for more conclusive, and expensive, research in the concluding section.

The results for some of the control variables are interesting and worth noting in brief. Our proxy for regional income is associated with corruption but not the shadow economy. The international focus of a region seems to play no role in either regard. Something that matters a great deal is the level of bureaucratic burden. Regions with more burdensome regulation, according to our index, tend to have a larger shadow economy and a greater problem with corruption.[7] This is in line with much of the previous literature that we discussed above and again offers a fresh perspective on the issue. Finally, regions with an inadequately educated workforce in the eyes of firms tend to have a larger corruption problem but the level of human capital, thus defined, does not matter for the shadow economy.

While corruption and the shadow economy may be complements at the sub-national level on average, it does not follow that this need be the case everywhere. Gërxhani (2004) argues that the differences between different types of country should be borne in mind and Dreher and Schneider (2010) find that while there is a complementary relationship in low income countries this does not seem to be the case in high income countries. In addition, there are important social and cultural characteristics that we are not explicitly controlling for, though we do have country fixed effects. Lassen (2007), for example, argues that trust and ethnic fractionalisation matter for the size of the shadow economy. Dreher et al. (2009) argue for the importance of institutional quality for both phenomena of interest. Goel and Saunoris (2014) show that the neighbourhood a country finds itself in matters. Thus, context can matter and with this in mind and in order to refine our policy advice, we split our sample into groups defined by broad global region.

Table 3 presents the results. Even splitting our sample into four groups, the composition of which can be seen in Table A1 in the appendix, we still have a reasonable number of observations in three of them (the rest of the world category being a small and rather heterogeneous group). While our conclusions from Table 2 above are still applicable for both the Europe and Central Asia, and Latin America and Caribbean samples, in the case

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[7]If we allow each element of the bureaucratic burden index to enter separately, our conclusions regarding the relationship between corruption and the shadow economy are unchanged. Interestingly, and somewhat surprisingly, the only significant element of the index in terms of explaining the shadow economy is tax administration (which lends support to Liu and Feng (2015)) while for corruption only licensing and permits matters. In both cases more burdensome regulation is detrimental.

Table 3: Sample Splits

	(1) AFR Corruption	(2) ECA Corruption	(3) LAC Corruption	(4) ROW Corruption	(5) AFR Shadow	(6) ECA Shadow	(7) LAC Shadow	(8) ROW Shadow
Shadow	0.0231	0.228**	0.518***	-0.0322				
	(0.122)	(0.0975)	(0.121)	(0.447)				
Corruption					0.0205	0.301**	0.361***	-0.0121
					(0.110)	(0.138)	(0.0942)	(0.165)
Log of Average Total Cost of Labour	-0.0232	-0.00703	-0.0288*	0.00983	-0.00538	0.00113	0.00324	-0.00294
	(0.0179)	(0.0137)	(0.0155)	(0.0383)	(0.0202)	(0.0140)	(0.0107)	(0.0175)
Average % of Sales That Are National	0.00497	0.00361**	-0.00171	-0.000693	0.00556*	0.00217	0.000310	-0.00119
	(0.00434)	(0.00170)	(0.00201)	(0.00243)	(0.00317)	(0.00156)	(0.00148)	(0.00126)
Bureaucratic Burden	0.0403	0.257***	0.200***	0.327***	0.246***	0.119**	0.00258	0.103
	(0.0676)	(0.0493)	(0.0577)	(0.0952)	(0.0629)	(0.0519)	(0.0781)	(0.0907)
Inadequately Educated Workforce	0.617***	0.292***	0.142	-0.214	0.124	-0.00941	0.0383	0.0210
	(0.198)	(0.0867)	(0.141)	(0.326)	(0.208)	(0.106)	(0.143)	(0.191)
Constant	-0.176	-0.225	0.504*	0.305	-0.323	-0.123	0.0795	0.367
	(0.488)	(0.251)	(0.276)	(0.655)	(0.394)	(0.217)	(0.207)	(0.289)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	110	133	107	48	110	133	107	48
R^2	0.722	0.758	0.783	0.838	0.687	0.637	0.706	0.616

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

AFR = Sub-Saharan Africa, ECA = Europe and Central Asia, LAC = Latin America and Caribbean, ROW = Rest of the World.

of sub-Saharan Africa we fail to find any significant association between corruption and the shadow economy. Not only are the relevant coefficients insignificant they are much smaller in magnitude.

One plausible explanation for this is that the measures that we are using might not be appropriate for measuring corruption and the shadow economy in sub-Saharan Africa. Asking about "obstacles" might not make sense in a context in which, according to the popular narrative and measurements, corruption and informal activity are all pervasive. The fact that according to Table 1 many firms in sub-Saharan Africa do see these factors as obstacles gives us some reassurance that inappropriate measurement is not the problem. Indeed as we noted above the means in the African sample are much the same as those in the Europe and Central Asia sample and this is in line with the pattern in the Schneider et al. (2010) data. Still, the possibility remains that due to acclimatisation to a hugely and persistently corrupt environment, for example, the true number of firms who are objectively hampered by corruption in Africa is much higher than we observe in the ES data. It could also be the case that the mechanisms proposed in the theories break down at the sub-national level in the case of sub-Saharan Africa. This could be due to the nature of corruption differing in this part of the world or to a different relationship between a country's regions and the centre when it comes to corruption and the shadow economy. A final consideration is the fact that the significance of some of the other covariates also changes across samples. This supports the idea that the importance of certain factors for corruption and the shadow economy varies around the world.

4.2   Within Country Variation

We conclude our analysis by asking if regions with a bigger corruption problem relative to the average for their country have a bigger relative shadow economy problem. Figure 1 shows that there is substantial within-country variation in the shadow economy in all global regions for which we have data and we noted above that Torgler et al. (2010), Tafenau et al. (2010), and Buehn (2012) have shown that there is such variation in various European countries. Gillanders (2014) shows that the ES corruption measure used here likewise exhibits within-country variation. Therefore, it is a natural next step to see how our outcomes of interest covary within countries. Evaluating the problems with reference to national averages may further reduce concerns about the sundry potential measurement biases mentioned above. This analysis can also arguably provide stronger evidence that variation at the regional level in one regard is closely tied to variation in the other regard by, in a sense, making other regions the reference group that share (reasonably broad) cultural, historical and institutional characteristics. However, it should be pointed out that we still fall short of hard causal evidence about the direction of influence.

Table 4: Within Country Variation

	(1) Corruption Difference	(2) Corruption Difference	(3) Shadow Difference	(4) Shadow Difference
Shadow Difference	0.265***	0.152*		
	(0.0949)	(0.0798)		
Corruption Difference			0.251***	0.137*
			(0.0890)	(0.0775)
Log of average Total Cost of Labour		-0.0170*		-0.000449
		(0.00961)		(0.00758)
Average % of Sales That Are National		0.00131		0.00133
		(0.00118)		(0.000877)
Bureaucratic Burden		0.105**		0.144***
		(0.0518)		(0.0373)
Inadequately Educated Workforce		0.269***		0.0633
		(0.0725)		(0.0787)
Constant	-0.0000	-0.0398	0.0000	-0.227
	(0.118)	(0.217)	(0.0644)	(0.143)
Country Fixed Effects	Yes	Yes	Yes	Yes
N	400	398	400	398
R^2	0.066	0.203	0.066	0.208

Robust standard errors in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The term "difference" refers to the sub-national unit's variation from it's national average.

Table 4 presents the results of an exercise in which the regional shadow economy and corruption variables are expressed in terms of deviations from the national average (calculated yearly as appropriate). Similarly to our results above, regions that do worse relative to their national average in one regard tend to do relatively worse in the other dimension too. However, once we include our controls the relationship of interest is only significant at the 10% level. Table 5 shows that when we split our sample into the same groups as we used above, we do find strong evidence of a relationship in the Europe and Central Asia, and Latin America and Caribbean groups. Once again there is no statistically or economically significant association between our phenomena of interest in the sub-Saharan African group.

Our results tell a consistent story. In many parts of the world, regions which have a larger problem with corruption (the shadow economy) either in absolute terms or relative to their national average also have a larger problem with the shadow economy (corruption) in these terms. However, this is not the case in sub-Saharan Africa. In the next section we briefly discuss the potential importance of our findings and how they could, and we hope will, be

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used as a motivation and starting point for future work.

5 Conclusions

This paper contributes to a literature that has, for the most part, found that corruption and the shadow economy are complements at the country level. Our analysis at the level of sub-national units using Enterprise Surveys data likewise finds that the two illicit phenomena are strongly and significantly positively correlated. Regions with more of a problem in terms of one tend to have more of a problem in terms of the other. Expressing our measures of the problems in terms of deviations from national averages showed a similar pattern. Relatively more corrupt regions tend to be relatively more burdened by the shadow economy. Motivated by interesting findings in the literature, we split the sample into groups defined by broad global region and found that while our results hold in the Europe and Central Asia, and Latin America and Caribbean groups, these relationships are not evident in sub-Saharan Africa.

While our OLS results limit us to speaking of associations rather than causality, they fit well with the literature at the macro level. At the macro level, researchers have had available to them certain instrumental variable and structural modeling strategies that, to us, seem infeasible with the survey data we employ in this regional analysis. These findings should be of interest to policymakers and to other actors interested in the design and evaluation of targeted regional development interventions. According to these results, encouraging and incentivising firms to move from the shadows may yield additional benefits in terms of reduced corruption. Similarly, reducing corruption in a region may give rise to an increase in the number of firms caught in the tax net.

If this is the case then the benefits of such interventions could be greater than they are commonly thought and found to be. A well designed field experiment or set of experiments could, we believe, evaluate if such additional complementary benefits exist. We hope that the current paper will serve as a motivation and justification for such an exercise though we also believe that, in the context of a literature that has thus far relied on often small samples of cross-country data, our analysis is of intrinsic value and interest.

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Table 5: Within Country Variation: Sample Splits

	(1) AFR Corruption Difference	(2) ECA Corruption Difference	(3) LAC Corruption Difference	(4) ROW Corruption Difference	(5) AFR Shadow Difference	(6) ECA Shadow Difference	(7) LAC Shadow Difference	(8) ROW Shadow Difference
Shadow Difference	0.00881	0.231**	0.382**	-0.0322				
	(0.117)	(0.100)	(0.150)	(0.447)				
Corruption Difference					0.0112	0.303**	0.313***	-0.0121
					(0.149)	(0.143)	(0.109)	(0.165)
Log of Average Total Cost of Labour	-0.0338*	-0.00690	-0.000704	0.00983	-0.0115	0.000966	0.00536	-0.00294
	(0.0173)	(0.0137)	(0.0111)	(0.0383)	(0.0215)	(0.0142)	(0.00949)	(0.0175)
Average % of Sales That Are National	0.00530	0.00384**	-0.000506	-0.000693	0.00568	0.00181	0.00120	-0.00119
	(0.00349)	(0.00167)	(0.00152)	(0.00243)	(0.00352)	(0.00162)	(0.00130)	(0.00126)
Bureaucratic Burden	-0.0168	0.258***	0.131**	0.327***	0.213***	0.116**	0.00213	0.103
	(0.0649)	(0.0495)	(0.0579)	(0.0952)	(0.0653)	(0.0525)	(0.0718)	(0.0907)
Inadequately Educated Workforce	0.523***	0.278***	0.145	-0.214	0.0740	0.0105	0.0898	0.0210
	(0.134)	(0.0851)	(0.125)	(0.326)	(0.216)	(0.106)	(0.142)	(0.191)
Constant	-0.261	-0.310	-0.331*	-0.239	-0.453	-0.192	-0.295	0.0726
	(0.440)	(0.253)	(0.188)	(0.615)	(0.421)	(0.221)	(0.194)	(0.318)
Country Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	110	133	107	48	110	133	107	48
R^2	0.184	0.532	0.303	0.373	0.257	0.285	0.219	0.178

Robust standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

AFR = Sub-Saharan Africa, ECA = Europe and Central Asia, LAC = Latin America and Caribbean, ROW = Rest of the World.

The term "difference" refers to the sub-national unit's variation from it's national average.

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Table A1: List of Countries Included in the Analysis

Sub-Saharan Africa	Europe and Central Asia	Latin America and Caribbean	Rest of the World
Angola (2)	Albania (1)	Argentina (2)	Afghanistan (1)
Benin (1)	Armenia (1)	Bahamas (1)	Bangladesh (1)
Botswana (2)	Azerbaijan (1)	Bolivia (2)	Bhutan (1)
Burkina Faso (1)	Belarus (1)	Brazil (1)	Fiji (1)
Burundi (1)	Bosnia and Herzegovina (1)	Chile (2)	Indonesia (1)
Cameroon (1)	Bulgaria (2)	Colombia (2)	Lao PDR (1)
Cape Verde (1)	Croatia (1)	Costa Rica (1)	Micronesia (1)
Chad (1)	Czech Republic (1)	Dominican Republic (1)	Nepal (1)
Congo (1)	Estonia (1)	Ecuador (2)	Philippines (1)
Eritrea (1)	FYR Macedonia (1)	El Salvador (2)	Samoa (1)
Gabon(1)	Georgia (1)	Grenada (1)	Tonga (1)
Gambia (1)	Hungary (1)	Guatemala (2)	Vanuatu (1)
Guinea (1)	Kazakhstan (1)	Guyana (1)	Vietnam (1)
Guinea Bissau (1)	Kyrgyz Republic (1)	Jamaica (1)	Yemen (1)
Ivory Coast (1)	Latvia (1)	Mexico (2)	
Kenya (1)	Lithuania (1)	Nicaragua (2)	
Lesotho (1)	Moldova (1)	Panama (2)	
Liberia (1)	Mongolia (1)	Paraguay (2)	
Madagascar (1)	Poland (1)	Peru (2)	
Malawi (1)	Russia (1)	St. Kitts and Nevis (1)	
Mali (2)	Slovak Republic (1)	St. Vincent and the Grenadines (1)	
Mauritania (1)	Slovenia (1)	Trinidad and Tobago (1)	
Mauritius (1)	Tajikistan (1)	Uruguay (2)	
Mozambique (1)	Turkey (1)		
Namibia (1)	Ukraine (1)		
Niger (1)	Uzbekistan (1)		
Nigeria (1)			
Rwanda (1)			
Senegal (1)			
Sierra Leone (1)			
South Africa (1)			
Swaziland (1)			
Tanzania (1)			
Togo (1)			
Uganda (1)			
Zambia (1)			

Number of years for which we have surveys in parentheses

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