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## Decentralization and the shadow economy: Oates meets Allingham-Sandmo

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Oates Meets Allingham-Sandmo

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# Decentralization and the Shadow Economy: Oates Meets Allingham-Sandmo

## Abstract

This paper studies the impact of decentralization on the shadow economy. We argue that decentralization may decrease the size of the shadow economy mainly through two transmission channels: (1) Decentralization enhancing public sector efficiency (efficiency effect), and (2) decentralization reducing the distance between bureaucrats and economic agents, which increases the probability of detection of shadow economic activities (deterrence effect). Using various measures of fiscal, political and government employment decentralization in a cross-section of countries, we find the deterrence effect to be of more importance. The deterrence effect is stronger, the lower the degree of institutional quality. Remarkably, we find no robust evidence of the efficiency effect.

JEL-Code: O170, H770, D780.

Keywords: decentralization, shadow economy.

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# 1 Introduction

Shadow economic activities are a widespread and growing phenomenon throughout the world, and almost all societies are engaged in trying to control these activities. This is due to eroding effects on the tax base and social security systems. A recent study by Schneider (2007) estimates the size of the shadow economy in 2005 ranging from 7.9% of official GDP in the United States to 66.4% in Georgia. On average, shadow economic activities amount to 15% of official GDP in OECD countries, while the average size in other parts of the world is around 35%. The large shadow economy in developing countries is associated with a number of serious problems, e. g. insufficient fiscal capacities, which may result in poor growth performance [Besley and Persson (2010)]. However, shadow economic activities are also significant and alarming in developed countries. The debt crisis in Greece has indubitably shown the negative outcomes of a large shadow economy (around 30% of official GDP in 2007) on tax bases and social security systems. Spain, Portugal, and Italy also face a critical budgetary situation. To handle such crises, governments have two options: cut expenditures or increase revenues. While the first option is difficult to implement, especially due to the risk of destabilizing the social coherence, the second option requires a solid tax base which is undermined by shadow economic activities. Under those circumstances, a large shadow economy may even threaten the economic and social stability.

Facing budgetary pressure, governments are likely to search for effective instruments controlling the shadow economy in order to increase the tax base and relax their budget constraint. Well known effective direct policy instruments to control these activities are law enforcement and punishment [see Schneider and Enste (2000)]. An alternative way to deplete the shadow economy is reforming the tax and social security systems, which could improve the dynamics of the official economy. A third established policy instrument is to reduce the regulatory burden in the official economy, which is one of the main causes for the migration into the shadow. Further instruments are to increase the competence and the trust in official institutions, to guarantee property rights, and to enhance the efficiency of public good provision.

One potential instrument to control the shadow economy that has been widely neglected in the literature is the degree of decentralization. Following Oates's the decentralization theorem, the transfer of powers to sub-national governments increases public sector efficiency [Oates (1972)]. Decentralized authorities are much better informed regarding local needs compared to their centralized counterparts and can provide the economically efficient quantity and quality of local public goods. The enhanced efficiency in decentralized systems increases the acceptance for state interventions as well as the tax morale [Torgler et al. (2010)] and may, thus, decrease the size of the

shadow economy (*efficiency effect*). Another argument in favor of decentralization is related to the observability of activities in the shadow economy. The closer the distance between bureaucrats and economic agents and/or the more face to face contacts are taking place, the higher the probability that working in the shadow economy will be discovered and the lower the expected gains from informality [Allingham and Sandmo (1972)]. Decentralization increases the surveillance effectiveness and should thus decrease the size of the shadow economy (*deterrence effect*). Both effects should impact the shadow economy in a similar direction, but the relative importance of the efficiency effect compared to the deterrence effect is *a priori* unclear.<sup>1</sup>

The three key questions the paper aims to answer are the following: Can we empirically identify a relationship between decentralization and the size of the shadow economy? If so, which transmission channel – the efficiency effect following Oates or the deterrence effect following Allingham and Sandmo – has the stronger explanatory power? How do instruments used to control the size of the shadow economy interact with each other?

For this purpose, we examine the impact of alternative measures of fiscal, political, and government employment decentralization on the size of the shadow economy using a cross-section of 73 countries. Moreover, we consider interaction effects between decentralization and measures of institutional quality, which turns out to be a very important determinant of the size of the shadow economy. We find that both fiscal and political decentralization have either only a weak or no significant impact on the shadow economy. Most importantly, the degree of government employment decentralization has a robust and highly significant negative effect. This result is in line with the theoretical prediction, that this form of decentralization increases the probability of detection of shadow economic activities. Thus, government employment decentralization is a useful instrument for governments to control these activities. Using an interaction term between decentralization and institutional quality shows that the marginal effect of decentralization decreases with the degree of institutional quality. This result suggests that government employment decentralization is a particularly useful policy instrument in less developed countries, which often have weak institutions.

The paper is organized as follows. Section 2 briefly reviews the related theoretical and empirical literature and discusses alternative transmission channels between decentralization and the shadow economy. Section 3 describes the data. Section 4 presents the empirical methodology, the estimation results, and robustness checks. Section 5 concludes.

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<sup>1</sup> Decentralization may also have opposite effects on the shadow economy e.g. through corruption as transmission channel [Dreher and Schneider (2010)]. They find a complementary relationship between corruption and the size of the shadow economy in low income countries. However, the direction of the relationship is not unambiguous, since Alexeev and Habodaszova (2007) find evidence of corruption and the shadow economy to be substitutes. The relationship between corruption and the shadow economy is beyond the scope of this paper. For recent empirical evidence see Dreher and Schneider (2010).

## 2 Related literature

### 2.1 Established determinants of the shadow economy

Although substantial literature exists on single aspects of the shadow economy and a comprehensive survey has been written by Schneider and Enste (2000), the subject is still controversially debated in the literature.<sup>2</sup> An appropriate and widely used definition of the shadow economy is the following: the shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for any of the following reasons:

- to avoid payment of income, value added or other taxes,
- to avoid payment of social security contributions,
- to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and
- to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.

The literature shows that the overall tax and social security contribution burdens are among the main causes for the existence of the shadow economy and that the bigger the difference between the total cost of labor in the official economy and the after-tax earnings (from work), the greater the incentive is to avoid this difference and to work instead in the shadow economy [Schneider and Enste (2000)]. Empirical evidence provide Kirchgaessner (1983, 1984) for Germany, Klovland (1984) for Norway and Sweden, and Lundager and Schneider (1986) for Denmark, Norway, and Sweden. Recent cross-country studies as e.g. Giles (1999), Schneider (2003, 2005), and Johnson et al. (1998)) confirm these findings.

In addition to the tax and social security contribution burden, the intensity of regulations is another important determinant of the shadow economy. Labor market regulations, such as minimum wages or dismissal protections, and labor market restrictions for foreigners, such as restrictions regarding the free movement of foreign workers, reduce the freedom (of choice) for individuals engaged in the official economy and lead to a substantial increase in labor costs in the official economy. Johnson et al. (1998) provide empirical evidence of the influence of (labor) regulations on the shadow economy. Friedman et al. (2000) reach a similar conclusion: more regulation is associated with a larger shadow economy.

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<sup>2</sup> Literature about the "shadow", "underground", "informal", "second", "cash" or "parallel" economy is increasing and various topics, such as how to measure it, its causes and effects on the official economy, and the usefulness of shadow economy estimates for economic policy are discussed by e. g. Frey and Pommerehne (1984), Johnson et al. (1997), Johnson et al. (1998), Gërxhani (2004) and Schneider (2005).

An increasing shadow economy can lead to reduced state revenues which in turn, reduces the quality and quantity of publicly provided goods and services. Ultimately, this can lead to an increase in the tax rates for firms and individuals in the official sector, quite often combined with deterioration in the quality of public goods with the consequence of even stronger incentives to participate in the shadow economy. Johnson et al. (1998) show that smaller shadow economies appear in countries with higher tax revenues if achieved by lower tax rates, fewer laws and regulations, and less corruption. Countries that are in such a good equilibrium of relatively low taxes and low regulatory burden usually have sizeable revenue mobilization and a (relatively) small shadow economy. By contrast, developing and transition countries are often in a bad equilibrium with a high tax and regulatory burden on firms, low revenue mobilization, and a (relatively) high share of activities in the shadow economy [Johnson et al. (1998)]. That is, the provision and quality of public goods is crucial for people's decision to work or not to work in the shadow economy.

## 2.2 The role of decentralization

Combining the arguments of the different strands of literature we identify three main linkages between decentralization and the shadow economy.

- efficiency effect
- tax morale effect
- deterrence effect

A first linkage is the *efficiency effect*. The main argument in favor of decentralization is based on the decentralization theorem: the transfer of powers to sub-national governments increases public sector efficiency, thus promoting economic development and growth [Oates (1993), Baskaran and Feld (2009)]. In decentralized economies, local authorities are better informed about local needs and can provide the economically-efficient quantity and quality of local public goods. Especially in an economy with heterogeneous regions, decentralized officials are in a better position to meet local demands [Oates (1972)]. Also, the competition between different jurisdictions and the mobility of individuals constrain the politicians and force them to provide policies which are close to the majority of voters' preferences [see Feld and Schneider (2010)]. The more efficient provision of public goods reduces the people's or firm's incentives to work in the shadow economy. This argument is valid in particular if the local public good increases the productivity of firms and if the public good is usable only in the official sector [see e.g. Alexeev and Habodaszova (2007)]. Hence, we expect that a higher degree of decentralization reduces the shadow economy, *ceteris paribus*.

Closely related to the efficiency argument is the *tax morale effect*. In decentralized governmental systems, people's preferences are better fulfilled compared to unitarian systems. The frequent interaction between economic agents (taxpayers) and local bureaucrats may induce trust and thus increases the tax morale [Dreher and Schneider (2010)]. If local authorities have not only expenditure competence but are also elected at the local level, they have a strong incentive to take the preferences of their electorate into account [see Frey and Eichenberger (1999)]. Furthermore, the proximity between people and local administrations enhance the transparency between tax prices and provided public goods. The higher transparency increases the tax moral and thus influences the decision to engage in shadow economic activities. Thus, a higher degree of decentralization reduces *ceteris paribus* the shadow economy via the tax morale effect. In this case, sub-national political autonomy should be the relevant kind of decentralization.

A last main linkage is the *deterrence effect*. The decision to migrate into the shadow economy depends on three factors. First, individuals benefit because costs can be saved by avoiding tax and social security contributions and market regulations. Second, the costs of shadow economic activities depend on the punishment when being caught and the productivity losses because public infrastructure such as law or contract enforcement through the legal system is only fully usable in the official sector. The third combining factor is the probability of detection [see Becker (1968) and Allingham and Sandmo (1972)]. Decentralization reduces the distance between bureaucrats and economic agents. The higher frequency of face to face contacts increases the probability of detection<sup>3</sup> and, therefore, lowers the expected net gains from activities in the shadow economy. Decentralization enhances the deterrence effect and should consequently decrease the size of the shadow economy, *ceteris paribus*.

### 2.3 Previous empirical studies

Although substantial literature on various aspects regarding the shadow economy exists, only very few studies address the influence of decentralization. Alexeev and Habodaszova (2007) analyze the effect of decentralization on the incentives of local governments to provide local public goods. Their model allows entrepreneurs to avoid the burden of taxation by escaping into the shadow economy. A higher share of locally raised tax revenues, however, increases the governments' incentives to provide public goods for official entrepreneurs, which cannot be fully used by entrepreneurs operating in the shadow economy. This in turn increases the incentive to stay in the official economy and decreases, *ceteris paribus*, the size of the shadow economy. Cross-sectional

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<sup>3</sup> Feld and Larsen (2010) using individual survey data and find that the probability of detection has a significant negative effect on the probability of working in the shadow economy.

estimations using a sample of 70 countries support the main hypothesis of the theoretical model. These results, however, are based solely on the share of sub-national government revenues in total government revenues. Other kinds of decentralization are not considered.

Torgler et al. (2010) take the tax compliance puzzle, i.e., an excessively high degree of observed tax compliance in relation to the level of deterrence, as motivation for an empirical investigation of the relationship between decentralization and tax morale/the shadow economy. The effect of decentralization on tax morale is analyzed using individual data from the International Social Survey Programme (ISSP) of Switzerland. In order to complement the micro approach, Torgler et al. (2010) also look at the relationship between decentralization and the shadow economy using Swiss data on the cantonal level. They find that a higher degree of decentralization – measured by the share of local expenditures in cantonal expenditures – leads to more cooperation of people with society rules, e.g. tax morale increases and the size of the shadow economy decreases with decentralization.

Teobaldelli (2011) analyzes public policies in terms of tax setting and public good provision in a model of a unitary country and compares the results with a federation consisting of a continuum of jurisdictions. She finds that the shadow economy is smaller in federal countries, since the free movement of labor induces fiscal policies that are closer to the social optimum. The results are tested based on a cross-section of up to 73 countries, in which decentralization is measured by the share of sub-national government expenditures in total government expenditures, a federal dummy variable and a measure of local autonomy. All considered decentralization measures turn out to decrease the size of the shadow economy. However, the paper does not control for current GDP levels which is an important determinant of the size of the shadow economy. Neglecting this issue might cause biased estimates and explain the differences to our analysis.

We improve the existing studies in several dimensions. First, we consider the particular federal design of countries which may have an influence on the relationship between decentralization and the size of the shadow economy. Using measures of fiscal, political, and government employment decentralization we are able to identify which transmission channel –the efficiency effect or the deterrence effect– has the stronger explanatory power. Second, a major problem is that existing results may suffer from an endogeneity bias, since the degree of decentralization may also depend on the size of the shadow economy. A decentralized government structure imposes higher administrative costs on the society, which is an important issue especially in developing countries [Tanzi (1996)]. A larger shadow economy erodes the tax bases, reduces government revenues, and, consequently, limits the scope to decentralize governmental authorities. Further-

more, also other important determinants of the size of the shadow economy may be endogenous such as e. g. the quality of institutions [see Friedman et al. (2000) for details]. To deal with the endogeneity problem we use a instrumental variable approach. In the two-stage estimations we instrument for both decentralization and institutional quality. Third, since the institutional quality and decentralization may be crucial determinants for the size of the shadow economy, an interaction of this variables should also be considered. This allows us to discern if decentralization and institutional quality are complementary or substitutive instruments to tackle the shadow economy.

### 3 The data

#### 3.1 Measuring the shadow economy

Estimations of the size of the shadow economies have been undertaken since the late 1980s starting with the works of Kaufmann and Kaliberda (1996), Johnson et al. (1997), and Lackó (2000). These initial studies use the physical input electricity method. Schneider (2007) uses a combination of the MIMIC (Multiple Indicators Multiple Causes) model and the currency demand approach. He estimates the size and trend of the shadow economies in 145 countries around the world over the period 1999 to 2005.<sup>4</sup> In developing countries, the shadow economy reached a remarkably large size of an average value of 36.7% of official GDP in 2005. In the Eastern European and Central Asian (mostly former transition) countries it was even larger with an average of 38.8% in 2005. Compared to the developing and transition countries, the size of the shadow economies in the high income OECD countries is much smaller. It was on average 14.8% of official GDP in 2005. Moreover, while the shadow economies in developing and transition countries increased in size over time, the shadow economies in the developed countries showed a downward trend. They decreased from 16.8% in 2000 to 14.8% of official GDP in 2005.

To our knowledge the study by Schneider (2007) is the most recent and comprehensive one on the shadow economies around the world. For this reason, we use Schneider's estimates to study the impact of decentralization on the shadow economy. The dependent variable used in the empirical analysis is the average over the observation period of the Schneider data set. The countries included in the sample are listed in table A.5 of the appendix.

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<sup>4</sup> The shadow economy is also estimated using surveys and discrepancy methods. For a detailed discussion on the strengths and weaknesses of the different estimation methodologies see Schneider and Enste (2000).

### 3.2 Decentralization measures

Several measurement concepts for decentralization are used in the literature [see, e.g., Treisman (2002) and Rodden (2004)]. Our theoretical discussion has shown that the particular federal design should matter for the nexus between decentralization and the shadow economy. In general, decentralization is viewed as the devolution of authority towards sub-national governments, with total government authority over society and economy perceived as fixed. Attempts to define and measure decentralization have mostly focused on fiscal authority rather than political authority. There is however reason to believe that the political dimension of decentralization is as important as the fiscal one. While fiscal decentralization does not necessarily improve efficiency, public goods and policies may be more efficiently provided or implemented if decisions are made at the local level. We thus consider not only fiscal decentralization but also political decentralization.

The first issue can be approximated by using measures of fiscal decentralization, which can be calculated from the IMF Government Finance Statistics. Those measures include the degree of expenditure decentralization (*EXPDEC*) and the degree of revenue decentralization (*REVDEC*), which relate expenditures (revenues) of sub-national governments to total government expenditures (revenues). Both measures are commonly used in the empirical literature on decentralization. However, these measures are imperfect in so far as they do not reflect the political dimension of the underlying decision-making process.

To capture the dimension of political decentralization, we refer to decentralization measures provided by Daniel Treisman [see Treisman (2002) and Fan et al. (2009)]. The data set builds up on earlier work on the operationalization of federalism by Elazar (1995) and others. A first measure of political decentralization is a dummy variable for those countries, which have a federal constitution (*FEDERAL*).<sup>5</sup> Only 12 out of the 73 countries in our sample are classified as federal, so that the variance of this measure is not very high. Another decentralization measure reflects the number of vertical government tiers (*TIERS*). It ranges from 1 to 6 and can be used as a proxy for the distance of government officials to economic agents. In the context of government efficiency it is also important to have a measure of local autonomy. For this purpose, Treisman has created several dummy variables based on the constitutions of countries. A sub-national legislature is said to have ‘residual authority’ if the constitution assigns the exclusive right to legislate on issues that are not specifically assigned to one level of government. Another measure captures the ‘autonomy’ of a sub-national legislature

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<sup>5</sup> Several criteria have to be fulfilled to count as a federal country: Countries have at least two levels of government, which share parts of the executive and legislative authority; sub-national governments have a representation in the federal parliament (second chamber); there is a duty to obtain consent on constitutional amendments; a constitutional jurisdiction solves disputes between organs of state; institutions foster collaboration [see Watts (2008)].

regarding a given question, which is said to exist if the constitution reserves exclusive decision-making power on that question. We combine both indicators to a new dummy variable (*AUTRES*), which has the value one if sub-national governments has ‘residual authority’ or ‘autonomy’ or both. Treisman’s data also contains data on local elections, which is also important to test efficiency arguments. He defines two dummy variables reflecting whether elections take place at the lowest and second lowest government tier. We combine these two variables to a new dummy reflecting whether elections take place at the lowest and/or second lowest tier of government (*BOSEC*).

In addition to the measures of fiscal and political decentralization, we use the share of sub-national government employment in total civilian government employment as a further decentralization indicator (*SUBEMPL*), which cannot be assigned to one of the two categories. We refer to this kind of decentralization as government employment decentralization. The data is provided by the International Labour Organization’s (ILO) LABORSTA database. This decentralization measure allows to test the deterrence argument that decentralization increases the frequency of interactions between people/firms and bureaucrats, thereby increasing the probability of detection of activities in the shadow economy. Due to lacking data, we are not able to consider the size of fines explicitly. However, given that the threat of country specific punishment is set, an increase of the probability of detection increases the deterrence.

### 3.3 Other explanatory variables

In line with the previous empirical literature, we use a number of control variables. All regressions include the log of per capita GDP (*GDPpc*) to take the level of economic development into account.<sup>6</sup> One of the main determinants of the shadow economy is the tax burden. The expected correlation between the tax burden and the shadow economy is positive. As measure for the tax burden we use the total government tax revenues in percentage of GDP (*Tax burden*). For robustness test we also use the Heritage Foundation’s measure of fiscal burden. The third control variable is the unemployment rate (*Unemployment*). In economies with low unemployment rates, individuals have more opportunities to earn a good salary and “extra money” in the official economy. This is not the case in an economy facing a high unemployment rate and people will try to compensate their losses of income through shadow economic activities. Whether unemployment exhibits a positive or negative relationship to the shadow economy depends, however, on the income and the substitution effect. Income losses due to unemployment reduce demand in both the shadow and official economies. A substitution of official demand for goods and services for unofficial demand takes place as

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<sup>6</sup> See Table A.1 in the appendix for details. Table A.2 provides summary statistics of all variables.

unemployed workers turn to the shadow economy – where cheaper goods and services make it easier to countervail utility losses. This behavior may stimulate additional demand in the shadow economy. If the income effect exceeds the substitution effect, a negative relationship develops. Likewise, if the substitution effect exceeds the income effect, the relationship is positive. Moreover, the ambiguous effect of unemployment on the shadow economy may not only be due to the countervailing forces of the income and substitution effect but a consequence of supply side effect when the unemployed search for jobs in the shadow economy. To capture regional differences we add dummies for Latin America and Caribbean (*LAC*), for Middle East and North Africa (*MENA*), and countries that are located in Europe and Central Asia (*ECA*). Furthermore, we use a measure for institutional quality (*IQ*). Higher institutional quality increases the benefits of people and firms operating in the official sector, leading to a reduction of the shadow economy. Our measure of institutional quality is the mean value of the three governance indicators: ‘government effectiveness’, ‘control of corruption’, and ‘rule of law’ provided by Kaufman et al. (2009). We will comment on some additional variables when we discuss the results of specific regressions and the robustness checks.

## 4 Empirical analysis

Our empirical work attempts to answer three key questions: Can we empirically identify a relationship between decentralization and the size of the shadow economy? If so, which transmission channel –the efficiency effect or the deterrence effect– has the stronger explanatory power? How do instruments used to control the size of the shadow economy interact with each other?

### 4.1 Econometric specification

Our estimation strategy is the following: As a first step, we estimate the impact of the control variables on the shadow economy in a cross-country data set without considering decentralization. In the second step, we add alternative decentralization measures. This estimation approach enables us to compare our results with previous research on the basis of a cross-section data set covering up to 73 countries depending on the availability of the decentralization measures and controls. The sample countries are summarized in Table A.5. Of course, using a panel instead of a cross-section data set would be preferable as this would allow us to control for unobserved heterogeneity between countries. Unfortunately, Schneider’s estimates of the shadow economy cover only a short time period (1999 to 2005) in which the decentralization measures show not enough variance – if any – to estimate a fixed effects model. The cross-section

estimation equation has the form

$$SE_i = \alpha + \sum_{j=1}^k \beta_k \cdot CONTROLS_{k,i} + \gamma \cdot IQ_i + \delta \cdot DEC_i + \epsilon_i, \quad (1)$$

where the dependent variable  $SE_i$  reflects the size of the shadow economy in percent of official GDP in country  $i$ ,  $CONTROLS_i$  is a vector of  $k$  controls including the log of per capita GDP, the tax burden, the unemployment rate, and the regional dummies.  $IQ_i$  is our measure of institutional quality. The variable  $DEC_i$  represents one of the different decentralization measures.

Estimation of equation (1) will show that institutional quality ( $IQ$ ) is the most important policy instrument for reducing the shadow economy. To investigate how institutional quality and decentralization interact with each other, we estimate the following interaction model:

$$SE_i = \alpha + \sum_{j=1}^k \beta_k \cdot CONTROLS_{k,i} + \gamma \cdot IQ_i + \delta \cdot DEC_i + \zeta \cdot (IQ_i \times DEC_i) + \epsilon_i. \quad (2)$$

In addition to the variables in equation (1), the estimation now includes the interaction term between institutional quality and the decentralization measure ( $IQ_i \times DEC_i$ ). It is important to note that we have to interpret the coefficients of our main variables of interest with caution, since we are dealing with an interaction term of two continuous variables. Without interaction of variables, each coefficient reflects the marginal impact of the corresponding independent variable on the dependent variable. With interaction of variables, the coefficient  $\gamma$  ( $\delta$ ) only captures the effect of institutional quality (decentralization) on the shadow economy when decentralization (institutional quality) is zero. The marginal impact of decentralization on the size of the shadow economy now depends on the sign and magnitude of the coefficient of the respective decentralization measure ( $\delta$ ), the coefficient of the interaction term ( $\zeta$ ) and the level of institutional quality ( $IQ_i$ ). For a detailed explanation, see section 4.2. We apply the OLS estimation technique and, additionally, TSLS to handle problems arising from a possible endogeneity bias.

## 4.2 Estimation results

In this section, we analyze the relationship between decentralization and the size of the shadow economy. Our discussion of the alternative theoretical links in section 2 suggests that all types of decentralization, i.e., fiscal, political, and employment decentralization, may play a role in the nexus between shadow economy and decentralization. To investigate this interesting question we estimate equation (1) considering

different decentralization measures. Furthermore, we analyze possible interaction effects between institutional quality ( $IQ$ ) and the different decentralization measures by estimating equation (2). We close this section with a number of robustness checks.

### *Checking the data set*

We first analyze our data graphically. Figure 1 shows two scatter plots with the share of sub-national government expenditures in total government expenditures ( $EXPDEC$ ) and with the sub-national employment share as decentralization measures ( $SUBEMPL$ ) on the abscissa, respectively, and the size of the shadow economy on the ordinate. The figures also include a trendline suggesting that the impact of decentralization and the shadow economy is negative: the higher the degree of decentralization, the smaller the size of the shadow economy. However, it is important to note that the average deviation of the observations from the trend is much smaller, when the sub-national employment share is considered as a decentralization measure. This implies that different measures of decentralization have different explanatory power in relation to the size of the shadow economy. Inspection of the raw data suggests that there are no important outliers.

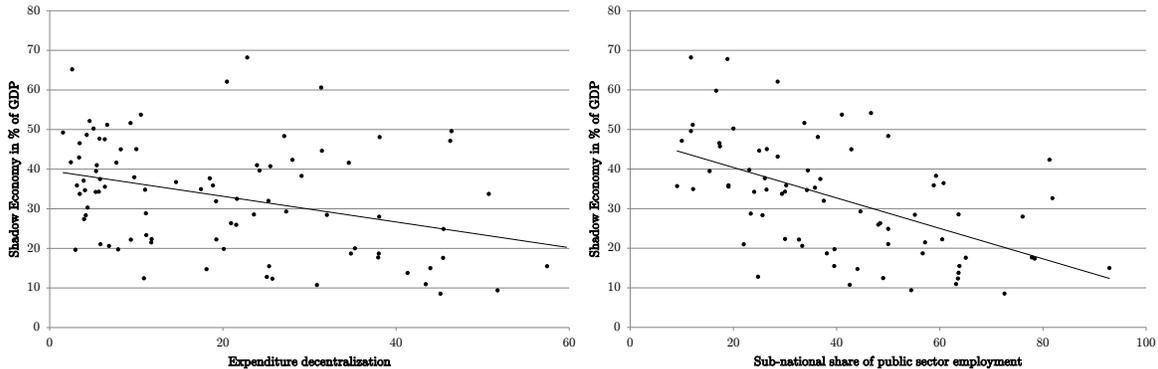


Figure 1: Decentralization and shadow economy

The inspection of scatter plots is of course only the first step. In the next step we estimate variants of equation (1) to test our hypothesis econometrically. Table 1 presents our main results.

In column (1) we show the results for the baseline-regression without considering decentralization, instead we focus only on the other control variables. In line with the previous literature, we find a significant positive correlation between the *Tax burden* and the shadow economy. The *unemployment* rate and the *IQ*-variable are significantly negatively correlated to the shadow economy. Unexpectedly we are not able to identify a significant relationship between *GDPpc* and the shadow economy. The Middle East and North Africa as well as the Europe and Central Asia dummies show a

Table 1: Estimation results: decentralization and the shadow economy (OLS)

	Dependent variable: shadow economic activities as percent of GDP							
	basis reg. (1)	— fiscal dec. — (2) (3)		— political dec. — (4) (5) (6)			empl. dec. (7) (8)	
<i>GDPpc</i>	-0.010 (-0.01)	-1.473 (-0.62)	-1.377 (-0.61)	0.132 (0.07)	-1.809 (-1.09)	-0.021 (-0.01)	0.641 (0.29)	-1.404 (-0.60)
<i>Tax burden</i>	0.340* (1.79)	0.642** (2.51)	0.641** (2.44)	0.298 (1.37)	0.305 (1.61)	0.325 (1.54)	0.103 (0.52)	-0.056 (-0.21)
<i>Unemployment</i>	-0.341* (-1.81)	-0.400* (-1.97)	-0.390* (-1.93)	-0.327* (-1.75)	-0.299* (-1.81)	-0.382* (-1.75)	-0.362* (-1.76)	-0.155 (-0.75)
<i>LAC-Dummy</i>	7.583** (2.01)	9.611** (2.60)	9.522** (2.57)	7.61** (2.04)	6.30* (1.69)	7.493 (1.33)	5.883 (1.39)	4.604 (0.90)
<i>MENA-Dummy</i>	-6.066 (-1.00)	-4.001 (-0.76)	-4.343 (-0.83)	-6.322 (-1.03)	-7.278 (-1.21)	-5.603 (-0.91)	-1.165 (-0.25)	-3.662 (-0.87)
<i>ECA-Dummy</i>	-2.374 (-0.93)	-0.728 (-0.32)	-0.795 (-0.34)	-2.449 (-0.91)	-2.813 (-1.09)	-2.040 (-0.73)	-3.722 (-1.49)	-2.363 (-0.67)
<i>IQ</i>	-12.12*** (-6.65)	-11.82*** (-6.75)	-11.70*** (-6.51)	-11.90*** (-6.39)	-11.29*** (-6.66)	-11.88*** (-5.98)	-12.64*** (-6.69)	-9.344*** (-4.03)
<i>EXPDEC</i>		0.063 (0.52)						
<i>REVDEC</i>			0.054 (0.39)					
<i>FEDERAL</i>				-1.926 (-0.78)				
<i>TIERS</i>					-2.058* (-1.75)			
<i>AUTRES</i>						-2.100 (-0.72)		
<i>BOSEC</i>							-0.544 (-0.14)	
<i>SUBEMPL</i>								-0.188** (-2.03)
Obs.	73	63	63	73	72	65	62	51
adj.-R <sup>2</sup>	0.65	0.67	0.67	0.65	0.68	0.61	0.70	0.69

All *t*-statistics reported below the coefficient estimates are based on robust standard errors [see White (1980)]. Significance levels are reported as follows: \* for a 10%-significance-level, \*\* for 5% and \*\*\* for more than 1%.

negative, while the Latin America and Caribbean dummy shows a significant positive sign. Our baseline-regression results are in line with the previous empirical literature on the shadow economy.

### ***Fiscal decentralization***

Columns (2) and (3) of table 1 report specifications considering the fiscal decentralization measures *EXPDEC* and *REVDEC*. Following the theoretical considerations of section 2.2, we expect a negative sign for both coefficients. Higher decentralization should correlate with a lower shadow economy. Surprisingly, we are not able to find any significant results. The coefficients show a positive sign with relatively small *t*-statistics. Note that the control variables show similar coefficients as in the baseline-regression. Importantly, the *IQ*-variable has a strong negative effect on the size of the shadow economy.

The results suggest that fiscal decentralization is not an appropriate policy instrument to reduce the shadow economy. At a first glance, this result is contradictory to our

theoretical considerations but may be driven by the measurement inaccuracy of the fiscal decentralization measures. The disadvantage of these measures is that they do not reflect the political dimension of the underlying decision-making process. Even if money is spent at the local level, it might be that the decision for the expenditures was made by central authorities. Following the efficiency and tax morale argument (see section 2.2), fiscal decentralization does not necessarily lead to a more efficient provision of local public goods and policies compared to a centralized government under those circumstances. Unfortunately, the fiscal decentralization measures do not discriminate between financial flows and the political decision making process. To mitigate this shortcoming we consider measures for political decentralization taking local autonomy into account.

### ***Political decentralization***

As discussed above, the degree of fiscal decentralization is unable to reflect the political dimension of the devolution of powers. For this purpose, we use the previously introduced measures of political decentralization. The results are presented in columns (4) to (7) in table 1. All measures of political decentralization show negative coefficients, although only the coefficient of the number of vertical government tiers is significant at conventional confidence levels. The results for the control variables are similar to the baseline-regression. Again, the *IQ*-variable has a strong negative effect on the size of the shadow economy.

Of course, these results are not very strong in terms of statistical significance but nevertheless suggest a negative relationship between political decentralization and the size of the shadow economy. Although our approach does not directly capture the efficiency enhancing effect of local autonomy on local policies and public good provision, the negative impact of measures of political decentralization on the size of the shadow economy indicate the validity of the efficiency and tax moral effects. It seems that economic agents in decentralized countries are more satisfied with the quantity and quality of the provided public goods and thus rather willing to stay in the official sector. Our cautious interpretation is: political decentralization is a useful policy instrument to control the shadow economy.

### ***Government employment decentralization***

As a last decentralization measure we use the share of sub-national government employment in total civilian government employment (*SUBEMPL*). Using this decentralization measure we test the deterrence effect. The estimation results are shown in column (8) of table 1. We find a highly significant negative effect of the share of sub-national government employment in total civilian government employment on the size of the shadow economy: A higher share of employment at the sub-national le-

vels downsizes the shadow economy. As in the other estimations, the  $IQ$ -variable has a strong negative effect on the size of the shadow economy. The result is also supported by the estimations using the number of vertical government tiers ( $TIERS$ ) as decentralization measure, where the sign of the coefficient was negative as well and statistically significant. On average, a higher number of government tiers implies more government employees working at sub-national levels of government, thus increasing the surveillance of economic agents.

This result confirms our theoretical predictions regarding the deterrence effect. The closer the distance between economic agents and governmental authorities and the more face to face contacts take place, the higher is the probability of detection and the less attractive are shadow economic activities. The overall deterrence effect might be driven by two sub-effects. First, the closer distance can lead to better information of policymakers regarding local needs and thus to a more efficient provision of public goods. Second, the proximity of governmental authorities to economic agents increases the probability of detection and consequently the expected costs of shadow economic activities making them less attractive. Since the results for measures of fiscal and political decentralization are not overwhelmingly strong, we tend to lean towards the second interpretation. However, both sub-effects cannot be separated econometrically. Our conclusion is that government employment decentralization increases the probability of detection and that it is, therefore, an appropriate instrument to control the shadow economy.

We perform a number of robustness checks in order to verify the deterrence effect (see table 2). In line with the previous empirical literature, we include money supply per capita, the degree of urbanization, the population density, the highest marginal corporate tax rate as well as the highest marginal income tax rate.<sup>7</sup> The identified relationship between government employment decentralization, institutional quality, and the shadow economy remains strong and robust, which confirms our previous results.

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<sup>7</sup> Using the fiscal freedom index of the Heritage Foundation as an alternative measure of the tax burden does not change the results. The estimated coefficient of the fiscal freedom index is not statistically significant.

Table 2: Robustness test: alternative control variables

	Dependent variable: shadow economic activities as percent of GDP							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>SUBEMPL</i>	-0.385*** (-5.58)	-0.188*** (-3.11)	-0.186*** (-3.02)	-0.222*** (-3.38)	-0.187*** (-3.16)	-0.181*** (-3.12)	-0.220*** (-2.91)	-0.154*** (-2.74)
<i>IQ</i>		-8.756*** (-9.47)	-8.192*** (-4.29)	-8.227*** (-7.91)	-9.055*** (-7.32)	-8.633*** (-9.54)	-9.409*** (-7.94)	-8.891*** (-9.61)
<i>GDPpc</i>			-0.659 (-0.33)					
<i>Money pc</i>				0.056*** (10.48)				
<i>Urban</i>					0.025 (0.33)			
<i>Pop. density</i>						-0.009 (-1.35)		
<i>Corp. tax</i>							0.042 (0.32)	
<i>Inc. tax</i>								-0.303*** (-2.78)
Obs.	73	73	73	63	73	73	63	64
adj.-R <sup>2</sup>	0.28	0.59	0.59	0.55	0.59	0.59	0.63	0.69

All *t*-statistics reported below the coefficient estimates are based on robust standard errors [see White (1980)]. Significance levels are reported as follows: \* for a 10%-significance-level, \*\* for 5% and \*\*\* for more than 1%. The number of observations depends on the covariates included in the particular specification.

### *Interaction effects*

Confirming previous findings [e.g. Friedman et al. (2000)] our analysis discovers institutional quality as the most important determinant of the size of the shadow economy. Countries with a bad institutional framework in terms of government effectiveness, control of corruption, and rule of law face a higher share of shadow economic activities in official GDP. However, the detection of shadow economic activities also plays an important role, as the coefficient of the decentralization measure *SUBEMPL* shows. To derive clear policy recommendations from our analysis concerning the impact of decentralization, it is interesting to know how these two determinants interact with each other. In particular, the question is whether both determinants are complements or substitutes concerning their effects on the size of the shadow economy. From a theoretical point of view, one might argue that they are substitutes, since an intensive surveillance may make high quality institutions redundant, and vice versa. However, both instruments may also complement each other since high quality institutions are necessary to bring detected people to court so that the surveillance effectiveness increases with institutional quality.

To study these effects we estimate equation (2), in which our decentralization measure (*SUBEMPL*) is interacted with *IQ*. We receive the following results concerning the coefficients of interest:  $\gamma$ , the coefficient of the institutional quality variable, is -14.033

( $t$ -statistic: -3.56),  $\delta$ , the coefficient of *SUBEMPL*, is -0.483 ( $t$ -statistic: -2.47), and  $\zeta$ , the coefficient of the interaction term, is 0.1067 ( $t$ -statistic: 1.62). However, we are not particularly interested in the individual statistical significance of either of these terms. Instead, we want to know their joint significance or, more precisely, the marginal effect of decentralization on the size of the shadow economy.<sup>8</sup> The marginal effect can be calculated by derivation of equation (2) with respect to the decentralization variable:

$$\frac{\partial SE}{\partial DEC} = \delta + \zeta \cdot IQ. \quad (3)$$

The interaction model asserts that the effect of a change in decentralization on the shadow economy depends on the value of the conditioning variable institutional quality. While it is possible to calculate the marginal effect using equation (2) and the results mentioned above, it is not possible to do likewise for the standard errors. The standard error of interest is:

$$\hat{\sigma}_{\frac{\partial SE}{\partial DEC}} = \sqrt{var(\delta) + IQ^2 \cdot var(\zeta) + 2 \cdot IQ \cdot cov(\delta\zeta)}. \quad (4)$$

These standard errors are now used to calculate the confidence bands around the marginal effects. To see more precisely how the marginal effect of decentralization on the shadow economy varies with institutional quality, this marginal effect is plotted in figure 2. The figure also includes confidence bands for the 1 and 10 percent significance levels.

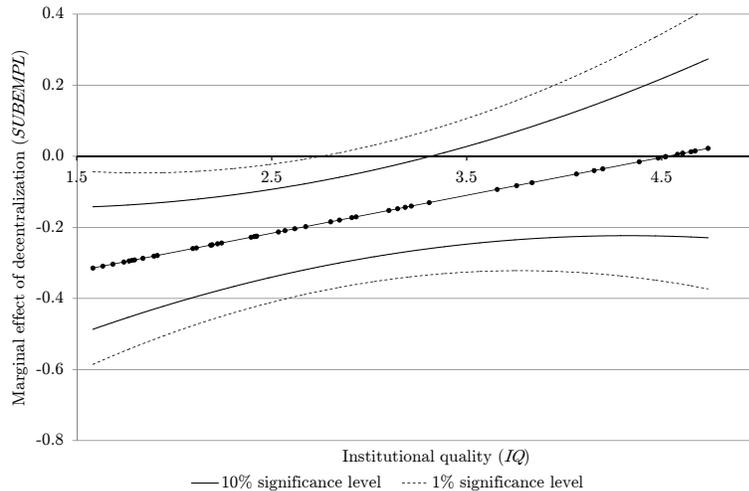


Figure 2: Marginal effect of *SUBEMPL* on the size of *SE* depending on the level of *IQ*

The cutoff value of institutional quality, i.e., the value for which  $\partial SE/\partial DEC = 0$ , is 4.5 in the fully specified regression. Our results imply that for about 75% of countries

<sup>8</sup> For an excellent overview on does and don'ts in interaction models see Brambor et al. (2006).

in our sample, increased decentralization is significantly associated with a lower shadow economy. For the remaining countries, decentralization has no significant effect. The effect is stronger the lower the institutional quality measure is. The marginal effect is statistically significant with 90% confidence up to an institutional quality index value of roughly 3.3. Our results imply that decentralization is more effective in controlling the size of the shadow economy in countries with weak institutions. The analysis of interaction effects shows, that decentralization and institutional quality are substitutes.

### ***Addressing endogeneity issues***

In order to address a possible endogeneity bias in our main results we run a number of instrumental variable (IV) regressions. A first source of endogeneity is the possible simultaneity between institutional quality (*IQ*) and the shadow economy. On the one hand, a large shadow economy erodes the tax bases, reduces government revenues, and thus undermines institutional quality. On the other hand, low institutional quality increases the incentives of economic agents to migrate into the shadow. Obviously, there is a strong relationship between institutional quality and the size of the shadow economy and the direction of the causality is at least ambiguous. To handle this issue we instrument the institutional quality variable. Following La Porta et al. (1999) and Friedman et al. (2000) we use the legal origin of a particular country, the population's religious denomination, and the degree of ethnolinguistic fractionalization as instruments in the first stage regressions.

The IV regression results in table A.3 in the appendix confirm our previous results. Again, we find no significant effect of fiscal decentralization on the shadow economy, a weak negative effect of political decentralization (*TIERS*), and a significant effect of the sub-national employment share (*SUBEMPL*). The magnitude of the coefficients is similar to the OLS regressions. Instrumental variables are important to obtain consistent estimates, however, weak instruments can produce meaningless results. The first-stage regression can test for significance of instruments using the *F*-statistic which should be larger than 10 [see Stock and Watson (2003) or Baltagi (2008)]. As the first-stage *F*-statistics in table A.3 take values between 13.5 and 23.9 (also the partial  $R^2$  of excluded instruments is quite large), our IV-regressions do not suffer from weak instruments. Moreover, having more than one instrument, one should test whether the additional instruments are valid. The *p*-values of the *J*-statistics in table A.3 show that our estimates are overidentified and that the error term is uncorrelated with the instruments. Using instruments, we can confirm our result that government employment decentralization is an appropriate instrument to control the shadow economy.

A second source of possible endogeneity is the nexus between decentralization and the shadow economy. In section 2.2 we have already argued that a higher degree of decen-

tralization can reduce the size of the shadow economy via three different transmission channels. However, the causality may also run in the opposite direction. Since administrative costs are higher in decentralized countries [Tanzi (1996)], a larger shadow economy erodes the tax bases, reduces government revenues, and, consequently, limits the scope to decentralize governmental authorities. Thus, the shadow economy may impede decentralization. To control for reverse causation, we use the logarithm of each country’s area in square kilometers as instrument for decentralization following e.g. Wasylenko (1987), Arikkan (2004), and La Porta et al. (1999). A suitable instrument should affect the countries’ degree of decentralization but not the size of the shadow economy. The area of a country should not have any effect on the size of the shadow economy per se and is, for this reason, often used as an instrumental variable for decentralization in the literature.

Table A.4 in the appendix confirms our previous results regarding the impact of employment decentralization on the size of the shadow economy. Again, we find a significant negative effect of the sub-national employment share (*SUBEMPL*). The impact of political decentralization with regard to the number of vertical government tiers (*TIERS*) and the shadow economy is, however, no longer significant. Using the logarithm of a country’s area as an instrument for decentralization also confirms the result that public employment decentralization is an appropriate policy instrument to use to reduce the size of the shadow economy.

## 5 Summary and Conclusions

Shadow economic activities are a widespread phenomenon throughout the world, and almost all societies try to control these activities. This may be due to the illegal nature of parts of these activities, or due to the eroding effects on the tax and social security base. Well known effective direct policy instruments to control these activities are law enforcement and punishment or reforming the tax and social security systems. An alternative way to deplete the shadow economy is to reduce the regulatory burden in the official economy, which is one of the main causes for the migration into the shadow. Further instruments are inter alia increasing the competence and the trust in official institutions, guaranteeing property rights, and enhancing the efficiency of public good provision. One potential determinant of the shadow economy that has been widely neglected in the literature is the degree of fiscal, political and employment decentralization. The theoretical considerations have shown that the impact of decentralization on the shadow economy is ambiguous. Decentralization may decrease activities in the shadow economy through increased efficiency of public good provision or increase shadow economic activities through the effect of weak institutions. Decentralization, in

particular government employment decentralization, may also increase the deterrence by strengthening the surveillance effectiveness and should thus decrease the size of the shadow economy. This paper has analyzed the relationship between these different kinds of decentralization and the shadow economy.

Four empirical results should be stressed. First, measures of fiscal decentralization are not significantly related to the shadow economy. This contradicts the results of parts of the previous empirical literature. Our results suggest that fiscal decentralization is not an appropriate policy instrument to reduce the shadow economy. This finding may be driven by the measurement inaccuracy of the standard fiscal decentralization measures. The disadvantage of these measures is that they do not reflect the political dimension of the underlying decision-making process. Therefore, we have also considered measures of political decentralization.

The second important result is, that all measures of political decentralization show negative coefficients, although only the coefficient of the number of vertical government tiers is significant at conventional confidence levels. It seems that economic agents in political decentralized countries are more satisfied with the quantity and quality of the provided public goods and thus rather willing to stay in the official sector. Our cautious interpretation is: political decentralization is an useful policy instrument to control the size of the shadow economy.

A third result is that the share of sub-national government employment in total civilian government employment has a significant and highly robust negative effect on the shadow economy. This result confirms our theoretical predictions regarding what we call the *deterrence effect* of decentralization. The closer the distance between economic agents and governmental authorities, the less attractive shadow economic activities are. Government employment decentralization increases the probability of detection and is therefore an appropriate instrument to control the shadow economy. Altogether, we conclude from our analysis that the *deterrence effect* (higher probability of detection) is more important when compared to the *efficiency effect* (better provision of public goods and policies) of decentralization in terms of statistical significance.

Fourth, government employment decentralization is more effective in controlling the size of the shadow economy in countries with a weak institutional quality. Institutional quality has turned out to be the most important determinant of shadow economic activities. To check how both instruments – government employment decentralization and institutional quality – work together, we have analyzed interaction effects. It turns out that government employment decentralization is a useful instrument to control shadow economic activities in countries with a weak institutional framework (substitutes), while the deterrence effect is not significant in countries with good institutions. This

result implies that government employment decentralization may be helpful to increase the fiscal capacity, particularly in developing countries.

All in all, we find decentralization to be an important determinant of the size of the shadow economy. The different aspects of decentralization and their interplay with other institutional factors must be considered in policy analysis and policy recommendations.

## References

- Alexeev, M. and L. Habodaszova (2007). Decentralization, Corruption, and the Unofficial Economy. CAEPR Working Paper Series 2007-008, Center for Research Applied Economics and Policy Research (CAEPR).
- Allingham, M. G. and A. Sandmo (1972). Income Tax Evasion: A Theoretical Analysis. *Journal of Public Economics*, 1(3-4), pp. 323–338.
- Arikan, G. G. (2004). Fiscal Decentralization: A Remedy for Corruption? *International Tax and Public Finance*, 11, pp. 175–195.
- Baltagi, B. H. (2008). *Econometrics*. Heidelberg: Springer.
- Baskaran, T. and L. Feld (2009). Fiscal Decentralization and Economic Growth in OECD Countries: Is There a Relationship? CESifo Working Paper 2721.
- Becker, G. (1968). Crime and Punishment: An Economic Approach. *Journal of Political Economy*, 76, pp. 169–217.
- Besley, T. and T. Persson (2010). State Capacity, Conflict, and Development. *Econometrica*, 78(1), pp. 1–34.
- Brambor, T., W. R. Clark, and M. Golder (2006). Understanding Interaction Models: Improving Empirical Analyses. *Political Analysis*, 14, pp. 63–82.
- Dreher, A. and F. Schneider (2010). Corruption and the Shadow Economy: An Empirical Analysis. *Public Choice*, 144(1-2), pp. 215–238.
- Elazar, D. J. (1995). *Federalism: An Overview*. Pretoria: HSRC Publishers.
- Fan, C. S., C. Lin, and D. Treisman (2009). Political Decentralization and Corruption: Evidence from Around the World. *Journal of Public Economics*, 93(1-2), pp. 14–34.
- Feld, L. and C. Larsen (2010). *Undeclared Work in Germany 2001-2007 - Impact of Deterrence, Tax Policy, and Social Norms: An Analysis Based on Survey Data*. Berlin: Springer.
- Feld, L. and F. Schneider (2010). Survey on the Shadow Economy and Undeclared Earnings in OECD Countries. *German Economic Review*, 11(2), pp. 109–149.
- Frey, B. S. and R. Eichenberger (1999). *The New Democratic Federalism for Europe*. Cheltenham UK: Edward Elgar.

- Frey, B. S. and W. Pommerehne (1984). The Hidden Economy: State and Prospect for Measurement. *Review of Income and Wealth*, 30(1), pp. 1–23.
- Friedman, E., S. Johnson, D. Kaufmann, and P. Zoido-Labton (2000). Dodging the Grabbing hand: The Determinants of Unofficial Activity in 69 Countries. *Journal of Public Economics*, 76(4), pp. 459–493.
- Giles, D. E. A. (1999). Modelling the Hidden Economy in the Tax-Gap in New Zealand. *Empirical Economics*, 24(4), pp. 621–640.
- Gërzhani, K. (2004). The Informal Sector in Developed and Less-Developed Countries: A Literature Survey. *Public Choice*, 120(3), pp. 267–300.
- Johnson, S., D. Kaufmann, and A. Shleifer (1997). The Unofficial Economy in Transition. *Brookings Papers on Economic Activity*, 2, pp. 159–221.
- Johnson, S., D. Kaufmann, and P. Zoido-Lobaton (1998). Regulatory Discretion and the Unofficial Economy. *American Economic Review*, 288(2), pp. 387–392.
- Kaufman, D., A. Kraay, and M. Mastruzzi (2009). Governance Matters VIII: Aggregate and Individual Governance Indicators, 1996-2008. World bank policy research working paper no. 4978.
- Kaufmann, D. and A. Kaliberda (1996). Integrating the Unofficial Economy into the Dynamics of Post Socialist Economies: A framework of Analyses and Evidence. In B. Kaminski (editor), *Economic Transition in Russia and the New States of Eurasia*, pp. 81–120.
- Kirchgaessner, G. (1983). Size and Development of West-German Shadow Economy 1955-1980. *Zeitschrift für die gesamte Staatswissenschaft*, 139(2), pp. 197–214.
- Kirchgaessner, G. (1984). Verfahren zur Erfassung des in der Schattenwirtschaft erarbeiteten Sozialprodukts. *Allgemeines Statistisches Archiv*, 68(4), pp. 378–405.
- Klovland, J. (1984). Tax Evasion and the Demand for Currency in Norway and Sweden: Is there a Hidden Relationship? *Scandinavian Journal of Economics*, 86(4), pp. 423–439.
- La Porta, R., F. L. de Silanes, A. Shleifer, and R. Vishny (1999). The Quality of Government. *Journal of Law, Economics and Organization*, 15(1), pp. 222–279.
- Lackó, M. (2000). Hidden Economy - an Unknown Quantity: Comparative Analysis of Hidden Economics in Transition Countries 1989-95. *Economics of Transition*, 8(1), pp. 117–149.
- Lundager, J. and F. Schneider (1986). The Development of the Shadow Economics for Denmark, Norway and Sweden: A Comparison. *Europäische Zeitschrift für Politische Ökonomie*, 3(2), pp. 351–394.
- Oates, W. (1993). Fiscal decentralization and Economic Development. *National Tax Journal*, 46(2), pp. 237–243.
- Oates, W. E. (1972). *Fiscal Federalism*. New York: Harcourt Brace Jovanovich.

- Rodden, J. (2004). Comparative Federalism and Decentralization: On Meaning and Measurement. *Comparative Politics*, 36(4), pp. 481–500.
- Schiavo-Campo, S., G. de Tommaso, and A. Mukherjee (1997). An International Statistical Survey of Government Employment and Wages. World bank policy research working paper no. 1806.
- Schneider, F. (2003). The Shadow Economy. In C. K. Rowley and F. Schneider (editors), *Encyclopedia of Public Choice*. Kluwer Academic Publishers.
- Schneider, F. (2005). Shadow Economies Around the World: What do we Really Know? *European Journal of Political Economy*, 21(3), pp. 598–642.
- Schneider, F. (2007). Shadow Economies and Corruption All Over the World: New Estimates for 145 Countries. *Economics - The Open-Access, Open-Assessment E-Journal*, 1(9), pp. 1–66.
- Schneider, F. and D. H. Enste (2000). Shadow Economies: Size, Causes, and Consequences. *Journal of Economic Literature*, 38(1), pp. 77–114.
- Stock, J. and M. Watson (2003). *Introduction to Econometrics*. München: Addison Wesley.
- Tanzi, V. (1996). Fiscal Federalism and Decentralization: A Review of some Efficiency and Macroeconomic Aspects. In *Proceedings of the Annual World Bank Conference on Development Economics 1995*, pp. 295–316. Washington D.C.: The World Bank.
- Teobaldelli, D. (2011). Federalism and the Shadow Economy. *Public Choice*, 146(3-4), pp. 269–289.
- Torgler, B., F. Schneider, and C. Schaltegger (2010). Local autonomy, tax morale, and the shadow economy. *Public Choice*, 144(1), pp. 293–321.
- Treisman, D. (2002). Defining and Measuring Decentralization: A Global Perspective. Working paper university of california.
- Wasylenko, M. (1987). Fiscal Decentralization and Economic Development. *Public Budgeting and Finance*, 4, pp. 57–71.
- Watts, R. L. (2008). *Comparing Federal Systems*. Montréal: McGill-Queen’s Univ. Press.
- White, H. (1980). A Heteroskedasticity-Consistent Covariance Matrix and a Direct Test of Heteroskedasticity. *Econometrica*, 48, pp. 817–838.
- Worldbank (2009). World Development Indicators 2009. Technical report.

Table A.1: Data sources &amp; definitions

Variable	Definition	Source
<i>SE</i>	Size of the shadow economy (legal and illegal) in % of GDP	Schneider (2007)
<i>GDPpc</i>	real GDP per capita in 2000 \$ prices (Laspeyres)	Worldbank (2009)
<i>Tax burden</i>	Total government tax revenues in % of GDP	IMF Government Finance Statistics
<i>Unemployment</i>	Unemployment rate	Worldbank (2009)
<i>IQ</i>	Mean of three governance indicators (1996): ‘government effectiveness’, ‘control of corruption’, and ‘rule of law’	Kaufman et al. (2009)
<i>Money pc</i>	Total cash per capita	Worldbank (2009)
<i>Urban</i>	Share of urban living population in total population	Worldbank (2009)
<i>Pop. density</i>	Population per area in square kilometers	Worldbank (2009)
<i>Corp. tax</i>	Highest marginal corporate tax rate	Worldbank (2009)
<i>Inc. tax</i>	Highest marginal income tax rate	Worldbank (2009)
<i>EXPDEC</i>	The degree of expenditure decentralization relates the sum of sub-national (state & local) government expenditures to total government expenditures (1970-2000)	IMF Government Finance Statistics.
<i>REVDEC</i>	The degree of revenue decentralization relates the sum of sub-national (state & local) government revenues to total government revenues (1970-2000)	IMF Government Finance Statistics
<i>FEDERAL</i>	Dummy for countries with a federal constitution	Treisman (2002) and Elazar (1995)
<i>TIERS</i>	Number of vertical government tiers	Treisman (2002) and Fan et al. (2009)
<i>AUTRES</i>	Local jurisdictions have a certain amount of ‘autonomy’ regarding a given question, if the constitution reserves exclusive decision-making power on that question	Treisman (2002) and Fan et al. (2009)
<i>BOSEC</i>	Dummy variable, which is one if a country has elections at the lowest and/or second lowest tier of government	Treisman (2002) and Fan et al. (2009)
<i>SUBEMPL</i>	Share of sub-national government employment in total civilian government employment (xxxx-yyyy)	Schiavo-Campo et al. (1997)

Table A.2: Summary statistics

	Mean	Maximum	Minimum	Std. dev.	Observations
<i>SE</i>	31.97	68.20	8.55	14.25	73
<i>GDPpc</i>	11238	33865	750	9074	73
<i>Tax burden</i>	16.50	29.65	0.96	6.15	73
<i>Unemployment</i>	9.21	30.86	0.68	5.43	73
<i>IQ</i>	2.85	4.74	1.29	1.01	73
<i>Money pc</i>	1770	21425	20	4072	62
<i>Urban</i>	64.72	100.00	15.10	18.80	73
<i>Pop. density</i>	206	6279	2	737	73
<i>Corp. tax</i>	28.49	45.00	0.00	8.02	62
<i>Inc. tax</i>	34.64	59.00	0.00	11.64	61
<i>EXPDEC</i>	19.82	57.43	2.97	13.99	63
<i>REVDEC</i>	15.24	52.18	1.18	12.37	63
<i>FEDERAL</i>	0.19	1.00	0.00	0.40	73
<i>TIERS</i>	3.59	6.00	1.00	0.80	72
<i>AUTRES</i>	0.11	1.00	0.00	0.31	65
<i>BOSEC</i>	0.85	1.00	0.00	0.36	62
<i>SUBEMPL</i>	44.71	92.86	11.76	18.77	51

Table A.3: Estimation results: decentralization and the shadow economy (TOLS 1)

	Dependent variable: shadow economic activities as percent of GDP							
	base.-reg.	— fiscal dec. —		political dec.			empl. dec.	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<i>GDPpc</i>	-0.438 (-0.13)	-3.311 (-0.86)	-3.281 (-0.83)	-0.677 (-0.21)	-0.498 (-0.13)	-1.267 (-0.42)	1.506 (0.40)	-2.272 (-0.62)
<i>Tax burden</i>	0.314 (1.12)	0.478 (0.98)	0.473 (0.90)	0.243 (0.73)	0.376 (1.49)	0.246 (0.86)	0.136 (0.63)	-0.096 (-0.32)
<i>Unemployment</i>	-0.313 (-1.20)	-0.284 (-0.99)	-0.276 (-0.99)	-0.271 (-0.98)	-0.387 (-1.49)	-0.286 (-0.99)	-0.416 (-1.53)	-0.107 (-0.36)
<i>LAC-Dummy</i>	7.657** (1.98)	9.955** (2.51)	9.906** (2.48)	7.762** (2.04)	6.115 (1.61)	7.594 (1.31)	5.904 (1.40)	4.507 (0.89)
<i>MENA-Dummy</i>	-6.029 (-1.00)	-3.954 (-0.75)	-4.141 (-0.78)	-6.286 (-1.02)	-7.324 (-1.20)	-5.514 (-0.90)	-0.855 (-0.18)	-4.025 (-0.94)
<i>ECA-Dummy</i>	-2.177 (-0.70)	0.374 (0.10)	0.354 (0.09)	-2.078 (-0.66)	-3.366 (-1.09)	-1.479 (-0.44)	-4.026 (-1.39)	-2.053 (-0.52)
<i>IQ</i>	-11.51** (-2.46)	-8.722 (-1.22)	-8.616 (-1.19)	-10.69** (-2.19)	-13.10*** (-2.66)	-10.02** (-2.21)	-13.689*** (-3.30)	-8.259* (-1.72)
<i>EXPDEC</i>		0.032 (0.20)						
<i>REVDEC</i>			0.026 (0.14)					
<i>FEDERAL</i>				-2.187 (-0.80)				
<i>TIERS</i>					-2.088* (-1.76)			
<i>AUTRES</i>						-2.524 (-0.87)		
<i>BOSEC</i>							-0.458 (-0.12)	
<i>SUBEMPL</i>								-0.199* (-1.88)
Obs.	73	63	63	73	72	65	62	51
Adj.-R <sup>2</sup>	0.65	0.66	0.66	0.65	0.67	0.61	0.70	0.69
first stage F-stat.	23.18	18.74	18.33	21.14	22.66	19.30	23.94	13.56
part. R <sup>2</sup> excl. instr.	0.12	0.10	0.10	0.11	0.15	0.13	0.22	0.22
Prob(J-statistic)	0.57	0.34	0.34	0.56	0.66	0.45	0.39	0.48

The instrumented variable is *GOV*. Exogenous variables used as instruments: *legal origin, religion, ethnic fractionalization*. All *t*-statistics reported below the coefficient estimates are based on robust standard errors [see White (1980)]. Significance levels are reported as follows: \* for a 10%-significance-level, \*\* for 5% and \*\*\* for more than 1%.

Table A.4: Estimation results: decentralization and the shadow economy (TSLS 2)

	Dependent variable: shadow economic activities as percent of GDP					
	— fiscal dec. —		— political dec. —			empl. dec.
	(1)	(2)	(3)	(4)	(5)	(6)
<i>GDPpc</i>	-0.653 (-0.30)	-0.801 (-0.38)	0.602 (0.29)	-1.918 (-1.12)	0.856 (0.10)	-2.106 (-0.87)
<i>Tax burden</i>	0.430 (1.46)	0.397 (1.20)	0.160 (0.57)	0.297 (1.45)	0.127 (0.12)	-0.301 (-0.85)
<i>Unemployment</i>	-0.346 (-1.59)	-0.369* (-1.82)	-0.281 (-1.30)	-0.306* (-1.96)	-0.336 (-0.34)	0.005 (0.02)
<i>LAC-Dummy</i>	8.357* (1.92)	8.409* (1.97)	7.716** (2.11)	6.138 (1.51)	6.669 (0.20)	3.408 (0.62)
<i>MENA-Dummy</i>	-6.945 (-1.09)	-6.428 (-1.05)	-7.171 (-1.08)	-7.371 (-1.21)	-1.451 (-0.11)	-5.565 (-1.38)
<i>ECA-Dummy</i>	-0.951 (-0.33)	-0.791 (-0.28)	-2.699 (-0.82)	-2.879 (-1.05)	-3.215 (-0.15)	-2.401 (-0.60)
<i>IQ</i>	-10.54*** (-4.40)	-10.67*** (-4.59)	-11.17*** (-4.94)	-11.31*** (-6.57)	-12.55*** (-2.85)	-6.612* (-1.72)
<i>EXPDEC</i>	-0.151 (-0.71)					
<i>REVDEC</i>		-0.161 (-0.71)				
<i>FEDERAL</i>			-8.298 (-0.93)			
<i>TIERS</i>				-2.446 (-0.87)		
<i>BOSEC</i>					-2.926 (-0.03)	
<i>SUBEMPL</i>						-0.386* (-1.77)
Obs.	63	63	73	72	62	51
adj.-R <sup>2</sup>	0.64	0.64	0.63	0.68	0.70	0.63
first stage F-statistic	14.60	6.48	3.89	5.20	1.81	4.99
partial R <sup>2</sup> of excl. instr.	0.27	0.27	0.16	0.28	0.01	0.11

The instrumented variable is in each case the decentralization measure. Exogenous variables used as instruments: the log of *area* in square kilometers. All *t*-statistics reported below the coefficient estimates are based on robust standard errors [see White (1980)]. Significance levels are reported as follows: \* for a 10%-significance-level, \*\* for 5% and \*\*\* for more than 1%.

Table A.5: Countries considered

Algeria, Argentina, Australia, Austria, Belgium, Benin, Bulgaria, Bangladesh, Bolivia, Canada, Chile, China, Colombia, Costa Rica, Croatia, Czech Republic, Denmark, Dominican Republic, Egypt, El Salvador, Estonia, Finland, France, Georgia, Greece, Guatemala, Honduras, Hungary, Indonesia, Iran, Ireland, Israel, Italy, Jamaica, Jordan, Kazakhstan, Korea (South), Kuwait, Latvia, Lebanon, Lithuania, Madagascar, Mali, Malaysia, Moldova, Mongolia, Morocco, Netherlands, New Zealand, Nicaragua, Norway, Pakistan, Peru, Philippines, Poland, Portugal, Romania, Russia, Sierra Leone, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sri Lanka, Switzerland, Tunisia, Uganda, Ukraine, United Kingdom, Uruguay, United States of America, Venezuela.
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