

SHADOW ECONOMIES AROUND THE WORLD: NOVEL INSIGHTS, ACCEPTED KNOWLEDGE, AND NEW ESTIMATES*

Andreas Buehn[†] and Friedrich Schneider[‡]

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Abstract This paper is a first attempt to study the impact of enforcement on the shadow economy. Using a MIMIC model, we find that a higher share of sub-national government employment and the aspiration of public employees to follow rules significantly deter shadow economic activities. Our results also confirm previous findings: Increased burdens of taxation and regulation as well as the state of the “official” economy are important determinants of the shadow economy. The estimated weighted average informality in 162 countries around the world, including developing, Eastern European, Central Asian, and high-income OECD countries, is 17.1% of “official” GDP.

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[†] Corresponding author. Andreas Buehn, Utrecht School of Economics, Utrecht University; Andrew Young School of Policy Studies, Georgia State University; Faculty of Business and Economics, Technische Universität Dresden. E-mail: A.Buehn@uu.nl

[‡] Friedrich Schneider, Johannes Kepler University of Linz, Department of Economics. E-mail: Friedrich.Schneider@jku.at

1 Introduction

Information about the extent of the shadow economy, who is engaged, the frequency of these activities, and their magnitude is crucial for making effective and efficient decisions regarding the allocations of a country's resources in this area. Unfortunately, it is very difficult to get accurate information about shadow economy activities on the goods and labor market, because all individuals engaged in these activities do not wish to be identified. Hence, doing research in this area can be considered as a scientific passion for knowing the unknown.

Although substantial literature exists on single aspects of the hidden or shadow economy and comprehensive surveys have been written by Schneider and Enste (2000) as well as Feld and Schneider (2010), the subject is still quite controversial as there are disagreements about the definition of shadow economic activities, the estimation procedures, and the use of their estimates in economic analysis and policy aspects.¹ Large shadow economies in developing countries are associated with a number of serious problems, e. g., insufficient fiscal capacities, which may result in poor growth performance [Besley and Persson (2010)]. Shadow economic activities are also significant and alarming in developed countries. The recent debt crisis in Greece has demonstrated the negative outcomes of a significant 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.

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. Reforming the tax and social security systems and reducing the regulatory burden are established and widely used policy instruments to improve the dynamics of the official economy. However, in most countries not registering or paying taxes is a punishable offense and governments therefore try to uncover those agents that are operating informally. Hence, a further effective direct policy instrument to deter the shadow economy might be enforcement as increasing the probability that working in the shadow economy will be discovered reduces the expected gains from informality [Allingham and Sandmo (1972)]. Surprisingly, the literature has not paid much attention to this policy instrument.

The goal of this paper is twofold. First and most importantly, we empirically study – alongside taxation and regulation – the important determinant of enforcement using different measures. To our knowledge, this has not been done in the literature and this paper is a first attempt to fill this gap. Second, we undertake the challenging task of

¹ Compare the different opinions of Tanzi (1999), Thomas (1999), Giles (1999a,b) and Pedersen (2003).

estimating the shadow economies for 162 countries all over the world and to provide some insights into the main causes as well as sizes and trends of the shadow economies between 1999 and 2006/2007 using a unique database. This is an improvement compared to previous work, because we successfully “created” a unique dataset and used the Multiple Indicators Multiple Causes (MIMIC) estimation method for all countries with the explicit goal to have a comparable shadow economy data set.²

The rest of the paper is organized as follows. Section 2 defines the shadow economy and provides the theoretical background. Section 3 briefly introduces the MIMIC approach and presents the empirical results. Section 4 concludes.

2 Theoretical considerations about the shadow economy

The shadow economy is still controversially debated in the literature, although substantial contributions have been made studying particular aspects of this phenomenon and a comprehensive survey had been written by Schneider and Enste (2000). While Smith (1994, p. 18) defines it as “...market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP”, others define the shadow economy as all currently unregistered economic activities that contribute to the officially calculated (or observed) Gross National Product.³ This paper defines the shadow economy as 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.

Informal agents (firms and workers) decide migrating into the shadow economy depending on the costs and benefits. According to the definition, they benefit from informality because avoiding taxes, social security contributions, and market regulations saves costs. However, not registering or paying taxes is a punishable offense and governments therefore try to uncover those agents that are tax evading or are operating illegally. The costs can thus be attributed to the punishment when being caught and the probability that the informal activity is detected [Becker (1968); Allingham and Sandmo (1972)]. In the

² A more comprehensive version of this article has been published in Schneider, Buehn, and Montenegro (2010a, 2011).

³ This definition is used for example by Feige (1989, 1994), Schneider (2005, 2007), Feld and Schneider (2010) as well as Frey and Pommerehne (1984). Do-it-yourself and illegal activities are not included. An examination of the shadow economy and the do-it-yourself activities for the case of Germany is presented in Buehn et al. (2009).

next section we will first address enforcement as determinant of the shadow economy and then discuss well-established determinants of the shadow economy such as taxes and regulation.

2.1 The role of enforcement

Allingham and Sandmo (1972) present a simple model of income tax evasion, the insights of which may be applied to the shadow economy [see e.g. Slemrod and Weber (2010)]. In this model, a risk-averse individual has true, taxable income Y subject to a flat income tax t . The individual hides the amount $H = Y - R$ if it reports less than the true income Y to authorities, i.e., $R < Y$. The authority will discover the informal activity with fixed probability p . If evasion is discovered, the individual pays the true tax liability plus a fine in relation either to the underreported income or the evaded tax liability. While the probability of detection p is fixed in Allingham-Sandmo (1972) it in fact positively depends on enforcement actions taken by the authority in order to increase the chance of detection. Using an endogenous growth model Sarte (2000) shows that increasing costs of informality decrease the number of informal firms operating in the shadow economy. Prado (2011) presents a general equilibrium model to study the interaction between government policy and the firms' choice to operate formally or informally. Calibrating the model to match data for 29 countries he shows that lower levels of enforcement – alongside other determinants of informality like higher taxation and regulation – are on average associated with a larger informal sector. This suggests that enforcement may be considered a very important determinant of the size of the shadow economy.⁴

An intuitive measure of enforcement would be a variable approximating the ability of government authorities to control economic agent's activities. A closer distance to economic agents and a higher frequency of face-to-face contacts between bureaucrats and economic agents (firms and workers) increase the probability of detection and deter shadow economic activities, all other things being equal. In order to test this deterrence argument, we use the share of sub-national government employment in total civilian government employment (SUBEMPL) as a measure because a direct measure for the probability of detection is not available. The data is provided by the International Labour Organization's (ILO) LABORSTA database. Due to lacking data, we are not able to consider the size of fines explicitly. However, given that the country specific punishment is set, an increase of the probability of detection increases deterrence.

In addition to the share of sub-national government employment, we use three further variables to investigate the relationship between enforcement and the shadow economy. The first variable is the share of sub-national government expenditures in total

⁴ Feld and Larsen (2011) using individual survey data find that the probability of detection has a significant negative effect on the probability of working in the shadow economy.

government expenditures (SUBEXP). The devolution of fiscal authority towards sub-national governments gives sub-national governments more discretionary (spending) power and enables them to allocate more resources to enforce shadow economic activities. Sub-national government expenditures are calculated from the IMF Government Finance Statistics. The second variable is taken from the QoG (Quality of Government) Institute at University of Goteborg. It provides a unique dataset on the structure and behavior of public administration based on a web survey. The QoG data includes key dimensions on the quality of government such as professionalization and impartiality and mostly covers advanced industrialized and post-communist economies. Question 8.d of the survey asks: *To what extent would you say that public sector employees strive to follow rules in the country you have chosen to submit your answer for.* To answer this question, respondents can choose a number between 1 (*Not at all*) and 7 (*To a very large extent*) from a discrete scale. We use the average of the answers provided by the representatives of a particular country as a further approximation of enforcement (*Rules*). The more people believe that public sector employees strive to follow rules, the higher the perceived probability of detection and the smaller shadow economic activities, all other things being equal. Finally, we use a dummy variable taking the value 1 if sub-national governments have extensive taking, spending, or regulatory authority, and zero otherwise (*Authority*). The variable is taken from a large (panel data) database on the Quality of Government, which is also maintained by the QoG Institute at University of Goteborg.

Unfortunately, more direct measures of enforcement actions by authorities across countries are not available; even the chosen indirect measures are limited and often available only for developed and a handful transition countries. For that reason, we can test the impact of enforcement on the shadow economy only for a sub-sample of countries.⁵ Nevertheless, this is an important empirical contribution to the literature studying the impact of enforcement on informality.⁶

2.2 Established determinants

2.1.1 Tax and social security contribution

The bigger the difference between the total cost of labor in the official economy and the after-tax earnings (from work), the greater is the incentive to avoid this difference and

⁵ See also footnote 8.

⁶ We are not aware of any empirical analysis except Prado (2011) who uses simulated enforcement measures to study this relationship. The tax evasion literature however presents more direct empirical evidence on the impact of enforcement. For example, Beron, Tauchen, and Witte (1992) find that higher audit probabilities increase the reported adjusted gross income. Slemrod, Blumenthal, and Christian (2001) confirm this finding especially for low- and middle-income taxpayers analyzing the outcome of a randomized controlled field experiment conducted by the State of Minnesota Department of Revenue; see Slemrod (2007) for an excellent survey on the subject of tax evasion.

to work in the shadow economy. Since this difference depends broadly on the social security burden/payments and the overall tax burden, the latter are key features of the existence and the increase of the shadow economy. The relationship between taxes and the shadow economy is theoretically analyzed in Neck, Hofreither, and Schneider (1989). Assuming an additive-separable utility function and a two-stage decision setup of the consumer, they find that higher marginal (income) tax rates imply greater labor supply in the shadow economy. It has also been ascertained empirically that the overall tax and social security contribution burdens are among the main causes for the existence of the shadow economy.⁷

The concrete measurement of the tax and social security contribution burdens is not easy to define, because the tax and social security systems are vastly different among the countries. In order to have some general comparable proxies, we use the following causal variables: (1) Indirect taxes as a proportion of total overall taxation (positive sign expected); (2) Share of direct taxes: direct taxes as proportion of overall taxation (positive sign expected); (3) Size of government: general government final consumption expenditures (in percent of GDP, which includes all government current expenditures for purchases of goods and services; positive sign expected); (4) Fiscal freedom as subcomponent of the Heritage Foundation's economic freedom index measures the fiscal burden in an economy; i.e. top tax rates on individual and corporate income. The index ranges from 0 to 100, where 0 is least fiscal freedom and 100 maximum degree of fiscal freedom (negative sign expected).

2.1.2 Intensity of regulations

Increased intensity of regulations is another important factor that reduces the freedom (of choice) for individuals engaged in the official economy. One can think of labor market regulations such as minimum wages or dismissal protections, trade barriers such as import quotas, and labor market restrictions for foreigners such as restrictions regarding the free movement of foreign workers. Johnson et al. (1998b) find significant overall empirical evidence of the influence of (labor) regulations on the shadow economy; and the impact is clearly described and theoretically derived in other studies, e.g. for Germany [Deregulation Commission (1990/91)]. Regulations lead to a substantial increase in labor costs in the official economy. But since most of these costs can be shifted to the employees, these costs provide another incentive to work in the shadow economy, where they can be avoided. The empirical evidence supports the model of Johnson et al. (1997), which predicts, inter alia, that countries with more general regulation of their economies tend to have a higher share of the unofficial economy in total GDP.

⁷ See Schneider (1986, 2005, 2007); Johnson et al. (1998a,b); Tanzi (1999); Giles (1999a); Giles and Tedds (2002); Feld and Schneider (2010).

To measure the intensity of regulation or the impact of regulation on the decision of whether to work in the official or unofficial economy is a difficult task, and we try to model this by using the following causal variables: (1) Business freedom: it is a subcomponent of the Heritage Foundation's economic freedom index; it measures the time and efforts of business activity. It ranges from 0 to 100, where 0 is least business freedom and 100 maximum business freedom (negative sign expected); (2) Economic freedom: Heritage Foundation economic freedom index which ranges from 0 to 100, where 0 is least economic freedom and 100 maximum economic freedom (negative sign expected); (3) Regulatory quality: World Bank's regulatory quality index including measures of the incidents of market-unfriendly policies, such as price controls or inadequate bank supervision, as well as perceptions of the burdens imposed by excessive regulation in areas, such as foreign trade and business development. It scores between -2.5 and +2.5 with higher scores corresponding to better outcomes (negative sign expected).

2.1.3 Public sector services

An increase of the shadow economy can lead to reduced state revenues which in turn reduce 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 a deterioration in the quality of the public goods (such as the public infrastructure) and of the administration, with the consequence of even stronger incentives to participate in the shadow economy. The provision and especially the quality of the public sector services is thus also a crucial causal variable for people's decision to work or not work in the shadow economy. To capture this effect, we have the following variable: Government Effectiveness from the World Bank's Worldwide Governance Indicators. It captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of government's commitment to such policies. The scores of this index lie between -2.5 and +2.5 with higher scores corresponding to better outcomes (negative sign expected).

2.1.4 Official economy

As it has been shown in a number of studies [Enste and Schneider (2006); Feld and Schneider (2010)] the situation of the official economy also plays a crucial role of people's decision to work or not to work in the shadow economy. In a booming official economy, people have a lot of opportunities to earn a good salary and "extra money" in the official economy. This is not the case in an economy facing a recession and more people try to compensate their losses of income from the official economy through additional shadow economy activities. In order to capture this, we will use the following variables: (1) GDP per capita based on Purchasing Power Parity (PPP), measured in

constant 2005 US\$. PPP as gross domestic product converted to international dollars using PPP rates (negative sign expected); (2) Inflation rate: GDP deflator (annual rate in percent); inflation is measured by the annual growth rate of the GDP implicit deflator, it shows the rate of price changes in the economy as a whole (positive sign expected); (3) Openness: openness corresponds to trade (in percent of GDP). Trade is the sum of exports and imports of goods and services, measured as a share of gross domestic product (negative sign expected). We also use the unemployment rate defined as total unemployment in percent of total labor force as an additional measure for the situation of the official economy. We do however not formulate a hypothesis for the relationship to the shadow economy, as it is theoretically ambiguous. 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 unemployed workers turn to the shadow economy – where cheaper goods and services make it easier to counterbalance 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 a supply side effect when the unemployed search for and take up jobs in the shadow economy. While informality in this case clearly increases, the behavior of the unemployment rate depends on whether informal workers are considered unemployed in the official statistics or not.⁸ In the case informal workers are considered unemployed and part of the official unemployment statistics, the unemployment rate does not change. However, if informal workers are not considered unemployed unemployment decreases and one would observe a negative relationship between informality and unemployment. Because the relationship between unemployment and the shadow economy is less clear and – as explained above – theoretically ambiguous, we refrain from the formulation of an exact hypothesis.

2.3 Indicators for the shadow economy

By definition, the shadow economy cannot be directly measured. For that reason, we have to use indicators in which shadow economic activities are reflected and the challenge is to select those indicators that appear to be influenced. Here, we use the following three types of indicator variables to make the unobservable shadow economy visible: monetary indicators, labor market indicators, and variables indicating the impact on the official economy. These indicator variables mirror activities in the shadow economy particularly well, as explained below.

⁸ We thank one referee for pointing this out.

2.3.1 Monetary indicators

Given that people who engage in shadow economy transactions do not want to leave trace, they conduct these activities in cash as this protects the principal and the agent in their shadow economic activities. All other things being equal, more cash holdings can thus reflect more shadow economic activity. Hence, shadow economy activities are reflected in an additional use of cash (or currency). To take into account this, we use the following two indicators: (1) M0 / M1: M0 corresponds to the currency outside the banks; the usual definition for M1 is M0 plus deposits; (2) Currency / M2: It corresponds to the currency outside the banks as a proportion of M2.

2.3.2 Labour market indicators

Shadow economy activities are also reflected in labor market indicators and the labor force participation rate can serve as an indicator of the shadow economy as changes in the participation rate – all other things being equal – may reflect a flow of resources between the official and the shadow economy. We use the following two: (1) Labour force participation rate: Labour force participation rate is the proportion of the population that is economically active supplying labor for the production of goods and services during a specified period; (2) Growth rate of the total labor force: Total labor force comprises people aging 15 and older who meet the ILO's definition of the economically active population: all people who supply labor for the production of goods and services during a specified period.

2.3.3 State of the official economy

Also, shadow economy activities are reflected in the state of the official economy. For this reason, we include the following two indicators: (1) GDP per capita: GDP per capita is gross domestic product converted to international dollars using Purchasing Power Parity rates, divided by the population; (2) Growth rate of GDP per capita, as (1), but the annual growth rate of the GDP per capita.

3 The size of the shadow economy for 162 countries

3.1 Econometric methodology

Estimating the size and trend of the shadow economy is a difficult and challenging task. Methods – designed to estimate the size and trend of the shadow economy – such as the currency demand approach or the electricity approach consider just one indicator that “must” capture all effects of the shadow economy. However, it is obvious that shadow economy effects show up simultaneously in the production, labor, and money markets. The empirical method used in this paper is based on the statistical theory of unobserved

variables, which considers multiple causes and multiple indicators of the phenomenon to be measured, i.e., it explicitly considers the multiple causes as well as the multiple effects of the shadow economy.⁹ In particular, we use a Multiple Indicators Multiple Causes (MIMIC) model for the empirical analysis.

The main idea behind this model is to examine the relationship between an unobservable variable, i.e., the shadow economy, and a set of observable variables using covariance information. In particular, the MIMIC model compares a sample covariance matrix, i.e., the covariance matrix of the observable variables, with the parametric structure imposed on it by a hypothesized model.¹⁰ For this purpose, the unobservable variable is linked to the selected indicator variables in a factor analytical model, also called measurement model. The relationships between the unobservable variable and the observable explanatory (causal) variables or determinants are specified through a structural model. The MIMIC model has the following formal structure:

$$\eta = \gamma' \mathbf{x} + \zeta \quad (1)$$

$$\mathbf{y} = \lambda \eta + \varepsilon \quad (2)$$

The q -vector $\mathbf{x}' = (x_1, x_2, \dots, x_q)$ in the structural equation (1) is a vector of potential causes of the latent variable η such as measures of the tax and regulatory burdens. The coefficient vector $\gamma' = (\gamma_1, \gamma_2, \dots, \gamma_q)$ describes the relationships between the latent variable and its causes. Thus, the latent variable η is determined by a set of exogenous causes. Since these causes only partially explain the latent variable η , the error term ζ represents the unexplained component. The measurement equation (2) links the latent variable to its indicators. The p -vector $\mathbf{y}' = (y_1, y_2, \dots, y_p)$ is a vector of several indicator variables such as transaction measures and characteristics of the official economy, λ the corresponding coefficient vector, and ε a p -vector of white noise disturbances.

The MIMIC model is the simultaneous specification of a factor model and a structural model. In this sense, the MIMIC model tests the consistency of a "structural" theory through data and has two goals: (i) estimating the parameters (coefficients, variances, etc.) and (ii) assessing the fit of the model. Applying this to the shadow economy research, these two goals mean (i) measuring the relationships of a set of observed causes and indicators to the shadow economy (latent variable), and (ii) testing if the researcher's theory or the derived hypotheses, as a whole, fit the data.

⁹ The pioneers of this approach are Frey and Weck-Hannemann (1984) who applied this approach to cross-section data from the 24 OECD countries for various years.

¹⁰ For details see e.g. Bollen (1989).

3.2 Limitations estimating the shadow economy

We want to explicitly mention that when using the MIMIC method, there is no clear division between causal variables, which directly influence (drive) the shadow economy and indicator variables, in which shadow economy activities are reflected. In other words, one caveat of the MIMIC method is that, unfortunately, there is not a clear-cut division (or theoretically-oriented guiding rule) between indicator and causal variables. For example, when the economy is in a recession with high unemployment, people have a stronger incentive to work in the shadow economy; this may be seen as a causal variable, but GDP per capita and other measures are also used as indicator variables, in which shadow economy activities are reflected. Hence, we recognize that there is some arbitrariness whether to use a certain variable as causal or indicator. In this paper, we tried to be consistent, but we admit that we use GDP per capita, for instance, as a causal variable in some cases, and as an indicator variable in other cases. The reasoning here is that we use GDP per capita as a causal control variable in the specifications with a relatively heterogeneous sample, i.e., in the specifications considering the developing countries and the comprehensive sample of 151/120 countries. We use the growth rate of GDP per capita as indicator in these specifications and in the specification considering the transition countries (specification 2). Specifications 3 and 4 considering the high-income OECD countries use the GDP per capita as an indicator. Given that the OECD countries are relatively homogeneous, the GDP per capita is not necessarily required as a causal control variable in these specifications.

Macroeconomic studies estimating the shadow economy typically use traces of informal activities in the formal economy such as energy consumption, the currency in circulation, or measures of official GDP to make these activities visible. A "problem" that can occur is that statistical offices in some countries maybe use certain arbitrary procedures to impute shadow economy estimates in estimates of official GDP. However, neither is information about the particular imputation method available nor is data (or estimates) for the shadow economy published. Clearly, it is important to keep this measurement issue in mind when interpreting the results. If estimates of official GDP have been corrected for informality in some countries, we would attribute less informality, when the true size is larger. Nevertheless, the procedure outlined in this paper is very valuable for researchers and policy makers as it assesses the determinants and provides insights into the size and development of each country's shadow economy. This is especially true because we use a unique dataset and one consistent method, i.e., the MIMIC approach, for all countries with the explicit goal to derive shadow economy estimates as comparable as possible.

3.3 Econometric results

As mentioned in the introduction, one important contribution of the paper is to study the relationship between enforcement and the shadow economy. However, data limitations do neither allow us to consider these measures for a large number of the developing countries nor the whole sample. The ideal situation would be if a comprehensive data set including measures on enforcement was available for all countries over the entire period 1996 to 2007. Unfortunately, this is not the case. For that reason, we present four different specifications including measures of enforcement for a selected number of countries in Table 1.¹¹

The second contribution is using a coherent data set for a maximum number of countries to produce consistent data of the sizes and trends of the shadow economies in these countries. Doing this, we face – even without enforcement measures – the problem that there still be data limitations and due to this, Table 2 presents six different specifications. We believe it is interesting to see which variables turn out to be significant, especially if one uses subsamples of countries, where more and different causal variables are available. Consistent estimation for 120 and 151 countries is provided in specification 6 and 5 in Table 2, from which we can also calculate the size and trend of the shadow economies. The sources and definitions of the variables we have used in the estimations are elaborated in the appendix.

3.3.1 Findings considering enforcement measures

We have estimated four different specifications each including a different measure of enforcement. The first specification tests whether a higher share of sub-national government employment (SUBEMPL) impacts the shadow economy. The structural equation of this specification is given as:

$$\text{Shadow economy} = [\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7] \begin{bmatrix} \text{Size of government,} \\ \text{Share of direct taxation} \\ \text{Fiscal freedom} \\ \text{Business freedom} \\ \text{Unemployment rate} \\ \text{Government effectiveness} \\ \text{SUBEMPL} \end{bmatrix} + \zeta \quad (3)$$

and the measurement equation is:

¹¹ The sample includes the following countries: Australia, Bulgaria, Canada, Denmark, Estonia, Hungary, Lithuania, New Zealand, Norway, Poland, the Slovak Republic, Sweden, Switzerland, and the United States for the period 1996 to 2006.

$$\begin{bmatrix} \text{Currency} \\ \text{Labor force participation} \\ \text{GDP per capita} \end{bmatrix} = \begin{bmatrix} 1 \\ \lambda_2 \\ \lambda_3 \end{bmatrix} \text{Shadow economy} + \epsilon \quad (4)$$

Specifications two, three, and four include the share of sub-national government expenditures, a variable measuring people’s perceptions about the aspiration of public sector employees to follow rules in their country, and a dummy indicating whether governments have extensive taking, spending, or regulatory authority.

Two out of four regressions confirm our expectations that more enforcement significantly deters shadow economic activities. We find statistical evidence that a higher share of sub-national government employment reduces the occurrence of shadow economic activities, all other things being equal (column 1). This result confirms our theoretical predictions regarding enforcement: The closer the distance between economic agents and government 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 dummy variable indicating whether sub-national governments have extensive taking, spending, or regulatory authority (*Authority*) provides however only weak evidence to confirm this finding (Column 4). Column (2) of Table 1 considers a fiscal measure of enforcement, i.e., the share of sub-national government expenditures. Although the coefficient shows – as expected – a negative sign, it is not statistically significant at conventional levels. At a first glance, this result is contradictory to our theoretical considerations but may be driven by measurement inaccuracy. The disadvantage of the measure SUBEXP is that it does not reflect the political dimension of the underlying decision-making process. Even if money is spent at the local level it might be that central authorities decided about the allocation of expenditures at the local level. Unfortunately, the SUBEXP variable does not discriminate between financial flows and the underlying political decision making process. Column (1) however shows that the political dimension at the local level is an important dimension of enforcement. Finally, column (3) includes the variable *Rules*, which approximates enforcement using people’s believe about the aspiration of public sector employees to follow rules. The more people believe that public employees strive to follow and enforce rules, the higher the expected probability of detection and the smaller the shadow economy, all other things being equal. The estimation result of column (3) presents evidence in favor of this hypothesis as the estimated coefficient has the correct negative sign and is statistically significant.

In all four estimated specifications we can confirm already accepted knowledge regarding the determinants of the shadow economy. We find that the variables capturing the burden of taxation (in a wide sense), i.e., the size of government and fiscal freedom, have the expected signs and are statistically significant. The same holds for the unemployment rate. The variable business freedom measuring the regulatory burden also

has the expected negative sign and is statistically significant. Turning to the indicator variables we find that the labor force participation rate and GDP per capita are statistically significant showing the expected signs.¹²

[Insert Table 1 about here]

Summarizing these results, we can say that they provide evidence that more enforcement significantly deters shadow economic activities and confirm our expectations. The estimated coefficients of the other covariates in the structural equation are quite stable from one specification to the next and confirm already accepted knowledge about the shadow economy's determinants. Although we would like to establish the findings regarding enforcement making use of a larger set of countries, data availability is the limiting factor. This is also the reason why we are not able to include enforcement measures in the empirical analyses for broader sets of countries, which are presented in the next section.

3.3.2 Findings considering established determinants only

For the total sample two estimations are shown, one for the 151 countries over 1996 to 2007 and, with more causal variables, one sample for 120 countries over 1996 to 2006. The structural and measurement equations in the empirical models are similar to equations (3) and (4), although different covariates may be used in the particular equation depending on data availability and economic reasoning. In addition to the total sample estimations, econometric estimations using the MIMIC approach are presented for 88 developing countries, 21 Eastern European and Central Asian (mostly former transition) countries; and 25 high income OECD-countries. For the high income OECD countries two estimations are shown, one over the period 1996 to 2006 and one over the period 1996 to 2007. For the 88 developing countries and the 21 Eastern European and Central Asian countries, the estimations were done over the period 1994 to 2006 and for the 25 OECD countries over the period 1996 to 2007. For the total sample of 151(120) countries we use data for the period from 1996 up to 2007(2006).

For the developing countries we use as cause variables the following six: share of direct taxation (direct taxes in percent of overall taxation), size of government (general government final consumption expenditure, in percent of GDP) as proxy for indirect taxation and a variable, fiscal freedom (an index consisting of the top tax rate on individual income, the top tax rate on corporate income, and total tax revenues as percent of GDP) as three tax burden variables in a wide sense; regulatory intensity for state regulation, and the business freedom index (which is composed of the following components: time to open a business, financial costs to start a business, minimum capital

¹² Note that the coefficient of the variable currency is fixed to the value of 1 in order to identify the model as explained in section 3.1.

stock to start a business, and costs for obtaining a license), the state of economy with the two variables: the unemployment rate and GDP per capita. As indicator variables we use growth rate of GDP per capita, the labor force participation rate (people over 15 economically active in % of total population), and as currency we use M0 divided by M1. For the Eastern European and Central Asian (mostly former transition) countries, we use as cause variables the size of government, the fiscal freedom index, for state regulation the business freedom index, and for the state of the economy the unemployment rate, inflation rate and openness (sum of export and imports of goods and services, in percent of GDP). As indicators, we use the growth rate of GDP per capita, the growth rate of total labor force, and the ratio M0 over M1. For the 25 OECD countries, we use the total tax burden (total tax revenues in percent of GDP), the fiscal and business freedom indices, a regulatory quality index, and the unemployment rate. As indicator variables, we use GDP per capita, the labor force participation rate and a measure for currency (M0 over M2). For the total sample of 151 countries we use as cause variables the size of the government, the unemployment rate, government effectiveness, and the GDP per capita. As indicators we use currency (M0 over M1), the growth rate of GDP per capita, and the labor force participation rate. For the 120 countries, we have additional causal variables. Here we include the size of the government, the fiscal freedom index, the share of direct taxation, the business freedom index, the unemployment rate, government effectiveness, and the GDP per capita. As indicator variables we use currency (M0 over M1), the growth rate of GDP per capita, and the growth rate of total labor force.

The estimations results for the 88 developing countries over the same period are shown in specification 1. All estimated coefficients of the cause variables have the theoretically expected signs. Except for the unemployment rate, all other cause variables are statistically significant, at least at the 90-percent confidence level. The share of direct taxation and the size of government are highly statistically significant, as well as the fiscal freedom and the business freedom variable. Also, the GDP per capita is highly statistically significant with the expected negative sign. If we turn to the indicator variables, the labor force participation rate and the growth rate of GDP per capita in the measurement equation are highly statistically significant. The test statistics are also quite satisfactory.

In specification 2, the MIMIC estimation result for the 21 Eastern European and Central Asian (mostly former transition) countries over the period 1994 to 2006 is shown. The size of government and the fiscal freedom variable (both capturing the overall state burden), they are highly statistically significant causes and have the expected signs. Turning to regulation, the economic freedom variable has the expected negative significant sign. As these countries experienced periods of high inflation, we include the inflation rate, which has the expected positive, highly significant sign. The variable openness, modeling in a certain way the transition process, is also statistically significant. Considering the

indicator variables, the growth rate of the total labor force is statistically significant, as well as the growth rate of GDP per capita. Also, here the test statistics are quite satisfactory.

In specifications 3 and 4, the estimation results for the 25 high-income OECD countries are shown over the period 1996 to 2006 and 1996 to 2007.¹³ In specification 3, the two variables capturing government burden (total tax burden and fiscal freedom) are highly statistically significant and have the expected sign. The unemployment rate has a positive sign and is at 90 percent confidence level statistically significant. The two variables capturing the regulatory burden, i.e., business freedom and regulatory quality, have the expected signs and are highly statistically significant. Turning to the indicator variables, the labor force participation rate and currency (ratio of M0 over M2) are both highly statistically significant. Also, the test statistics for this equation are quite satisfactory. Specification 4 excludes fiscal and business freedom, which allows us to estimate the model up to the year 2007. All causal variables are highly statistically significant and have the same signs as in specification 3. The same is true for the indicators.

Specifications 5 and 6 present two estimations of 151 and 120 countries. In specification 5 we present the results of 151 countries estimated over the period 1996 to 2007. Turning first to the causal variables, we see that the size of government has the expected positive sign and is highly statistically significant. The same holds for the two variables that describe the state of the economy, the unemployment variable, statistically significant with a positive sign, and GDP per capita, which is highly statistically significant with the expected negative sign. Turning to the indicator variables, the growth rate of GDP per capita and the labor force participation rate have the expected signs and are highly statistically significant. If we reduce this sample to 120 countries, we can include more causal variables and the results are presented in specification 6. Here, we see that as we have three variables capturing the burden of taxation (in a wide sense): the size of government, fiscal freedom and share of direct taxation. All three have the expected signs and are statistically significant. As regulatory variables we have business freedom and government effectiveness, which, again, have the expected negative signs and are statistically significant. For the state of the economy, we have the unemployment rate, which is not statistically significant, and GDP per capita, statistically significant with the expected negative sign. For the indicators, we have currency (M0 over M1), the labor force participation rate and GDP per capita, being statistically significant and showing the expected sign.

[Insert Table 2 about here]

¹³ A number of variables are not available for 2007; hence we have two different sets of cause variables.

Summarizing these results, we can say that for all groups of countries, the theoretical considerations of the causes of the shadow economy in section 2 behave according to our expectations. However, the estimated coefficients in Table 2 are quite different in magnitude from one specification to the next. Because it is rather difficult to come up with an explanation for the exact differences in the magnitude of the coefficients, we only present a general interpretation for this observation. With respect to the indices measuring regulation in one way or the other, i.e., the fiscal freedom and business/economic freedom indices, our results suggest that regulation is a much more important determinant in developed and transition countries than in developing ones. It seems that – for the reason that the burden of regulation is on average higher in developed and transition countries as more rules, regulations, and administrative procedures are in place – the importance of regulation being a determinant of the shadow economy increases with the level of development. On the contrary, in developing countries in which regulation is often less burdensome, the coefficients of the fiscal and business freedom indices are much smaller and hence regulation is a less important determinant of the shadow economy. Regarding the unemployment rate it seems that higher unemployment rates due to on average more regulated and hence less flexible labor markets significantly contribute to the size and trend of the shadow economies in OECD countries. Comparing specifications 2 and 4, the unemployment rate seems to be a more important determinant in OECD than in transition countries. In developing countries however, unemployment is not a significant determinant of the shadow economy. This finding may not be surprising as the formal economy in those countries hardly provides sufficient income for families and individuals. Working in the informal sector, or the shadow economy, however is a way of making a living outside the formal economy – either as an alternative to or as a means of supplementing income earned in the formal economy [ILO (1972); Bromley and Gerry (1979), pp. 4-6]. That is, providing subsistence to families is an important reason for the existence of the shadow economy in developing countries. It may thus not be necessarily attributed to official measures of the unemployment rate.

The estimation results further show a slightly different impact of “policy” causal variables compared to non-policy “economic” causal variables across the different groups of countries. In general economic variables, i.e., the level of development and the state of the economy measured by the GDP per capital and the unemployment rate are very important determinants of the shadow economy. The estimated coefficients indicate that an improvement of economic conditions would reduce the size of the shadow economy. Of course, for the unemployment rate this is only true for transition and highly developed OECD countries. Comparing the impact of the policy variables such as the different measures of the tax burden and regulation on the shadow economy across the estimated specifications also reveals interesting results. A reduction of the regulatory burden and

improvement of business/economic freedom in transition and OECD countries leads to a much higher reduction of the shadow economy than it would in developing countries; which is clearly indicated by the (much) larger coefficients of these variables. Fiscal freedom, however, is similarly important across all groups of countries.

3.4 The shadow economies in 162 countries from 1999 to 2006/2007

We use the estimation results shown in Table 2 to calculate the sizes and trends of the shadow economies in 162 countries as they are derived from the most comprehensive dataset available.¹⁴ The estimated MIMIC coefficients allow us to determine only relatively estimated sizes of the shadow economies in the first place, describing their pattern over time. In order to calculate the sizes and trends of the shadow economies, we must convert the MIMIC index into "real world" figures measured in percentage of official GDP. This final step requires an additional procedure so called benchmarking or calibration procedure. Unfortunately, no consensus exists in the literature which benchmarking procedure to use. We use the methodology promoted by Dell'Anno (2007) and Dell'Anno and Solomon (2008). In the first step, the MIMIC model index of the shadow economies is calculated using the structural equation (1), i.e., by multiplying the coefficients of the significant causal variables with the respective time series. For the numerical example of specification 1 in Table 2 the structural equation is given as

$$\tilde{\eta}_t = 0.15 \cdot x_{1t} + 0.06 \cdot x_{2t} - 0.03 \cdot x_{3t} - 0.05 \cdot x_{4t} - 0.26 \cdot x_{5t} \quad (5)$$

Secondly, this index is converted into absolute values of the shadow economies taking base values in a particular base year. The exogenous base values necessary for this final step of the calibration procedure are from the year 2000 and taken from Schneider (2007) who estimated the shadow economies in 145 countries around the world using the MIMIC and the currency demand approach.¹⁶ Using the exogenous shadow economy estimates of Schneider (2007) derived from a currency demand approach, the size of the shadow

¹⁴ Schneider, Buehn, and Montenegro (2010b) present first, preliminary estimates for the shadow economies around the world.

¹⁵ x_{1t} is size of government, x_{2t} is the share of direct taxation, x_{3t} and x_{4t} are the fiscal and business freedom indices, and x_{5t} represents GDP per capita.

¹⁶ The currency demand approach may be attributed to Tanzi (1983) who estimated a currency demand function for the United States for the period 1929 to 1980 in order to calculate the shadow economy. Assuming that economic agents in the shadow economy use cash to leave no observable traces for authorities, an increase in the size of the shadow economy will increase the demand for currency. To isolate the resulting excess demand for currency an equation for currency demand is estimated including covariates such as the development of income, payment habits, interest rates, and so forth. Figures for the size and trend of the shadow economy can then be calculated by comparing the difference between the development of currency when the direct and indirect tax burdens (and government regulations) are held at their lowest values, and the development of currency with the actual burden of taxation and government regulations. See Schneider and Enste (2000) for a more detailed description.

economy $\hat{\eta}_t$ at time t can be calculated as:

$$\hat{\eta}_t = \frac{\tilde{\eta}_t}{\tilde{\eta}_{2000}} \eta_{2000}^* \quad (6)$$

where $\tilde{\eta}_t$ denotes the value of the MIMIC index at t according to equation (1), $\tilde{\eta}_{2000}$ is the value of this index in the base year 2000, and η_{2000}^* is the exogenous currency-demand-approach-estimate (base value) of the shadow economies in 2000. Applying this benchmarking procedure, the final estimates of the shadow economies can be calculated.¹⁷

Of course, when showing the size of the shadow economies for countries which are quite different in location and development stage, one should be aware that such country comparisons gives only a rough picture of the ranking of the size of the shadow economy in these countries and over time, because the MIMIC and the currency demand methods have shortcomings [see e.g. Breusch (2005); Ahumada et al. (2007)]. Table 3 presents the evolution of the shadow economy in 162 countries between 1999 and 2007. In order to make the results more accessible for the reader, Table 3 highlights three important sub-groups of countries, i.e., transition countries of Eastern Europe and the former Soviet Union, high-income OECD countries, as well as emerging and developing countries.¹⁸ The results within each group are presented in alphabetical order.

[Insert Table 3 about here]

The un-weighted average of the shadow economies in 25 high-income OECD countries was 17.7% in 1999, and decreased to 16.6% in 2007. Some high-income OECD countries, like Portugal, have ups and downs, while others (like Belgium and Australia) show a steady decrease. The countries with the smallest shadow economies include Switzerland, the United States, and Luxembourg with an average size over the period 1999 to 2007 of 8.5, 8.6, and 9.7 percent, respectively. The largest shadow economies among these 25 high-income OECD countries include Mexico with 30.0, Greece with 27.5, and Italy with 27.0 percent. The un-weighted average shadow economy of the 25 Eastern European and Central Asian (mostly former transition) countries was 38.7% in 1999 and decreased to 34.2% in 2007. The three countries with the smallest shadow economies are the Slovak and Czech Republics, and Hungary with an average size over the period 1999 to 2007 of 18.1, 18.4, and 24.4 percent. Romania, Bosnia & Herzegovina, and Albania are in the middle with 32.6, 33.6, and 34.3 percent. The highest shadow economies include the Ukraine, Azerbaijan, and Georgia with 49.7, 58.0, and 65.8 percent, respectively.

Large shadow economies in some developing countries are only to some extent an issue of tax burden and regulation, given the simple fact that the limited local economy means that citizens are often unable to earn a living wage in a legitimate manner. Working

¹⁷ The base values originate from the year 2000 except for some developing countries, for which we sometimes used base values from the year 2005 because of data availability.

¹⁸ Classification of emerging and developing countries follows the IMF (2010).

in the shadow economy is often the only way of achieving a minimal standard of living in developing countries (excluding the direct taxation variable in the MIMIC estimation). If we consider the trend of the un-weighted average of the emerging and developing countries over time, in the year 1999 the size was 37.5% and modestly decreased to 35.4% in the year 2007. The three countries with the smallest shadow economies are China, Qatar, and Vietnam with an average country size of 12.7, 14.1, and 15.1 percent respectively.¹⁹ The middle of the distribution includes Brazil, Guinea, and Burundi with an average size of 39.0, 39.0, and 39.5 percent of GDP. The highest shadow economies include Zimbabwe, Panama, and Bolivia with a size of 61.8, 63.5, and 66.1 percent of GDP. Overall, the lowest level of informality for any country in the world is 8.5% of GDP (Switzerland), and the highest is 66.1 (Bolivia).

Table 3 presents at its bottom line the simple un-weighted yearly average which is not the average informality for the World but the average World's informality when one weights every country equally. In order to measure how much of the GDP in the world is really informal, we weighted by total country GDP. In particular, for every country/year we weighted the rate of informality by the total GDP. This gives us the GDP in current Billion US dollars that is informal for each country/year. Then we added up this amount and divided it by the total GDP of the sample. The same had also been done for the sub-samples of the eight world regions the World Bank distinguishes. According to these calculations, Table 4 shows much lower rates of informal GDP for the world as a whole, with an average of 17.1%. The results with respect to the countries' development stage are very impressive too: the averages of the weighted yearly informality estimates demonstrate that Sub-Saharan Africa has the largest shadow economies (with an average of 37.6%) followed by Europe and Central Asia (with an average of 36.4%). At the bottom of the distribution we find the OECD countries with an average of 13.4%, which is consistent with the fact that richer economies have lower informality rates.

[Insert Table 4 about here]

We also present the shadow economy measures country by country in a world map view using the country's simple average over the years. Countries shown with darker colors in Figure 1 indicate countries with higher level of informality. Among them are for example Azerbaijan, Bolivia, Peru, Panama, Tanzania, and Zimbabwe. Countries shown with lighter color indicate countries with lower levels of informality. Among them are for example Austria, Japan, Luxembourg, Switzerland, the United States, and the United Kingdom.

[Figure 1 here]

Finally, we would like to address the reliability of our estimates. The size of the

¹⁹ It should be mentioned that Mainland China and Vietnam are still communist countries with partly market economies, so that the figures of these two countries may be biased.

shadow economy has been estimated for different countries and time periods using various methods such as the physical (electricity) input method, the transaction approach, the currency demand approach, or the MIMIC approach.²⁰ Of course, different estimation procedures produce different results. The literature agrees on figures produced by the transaction and the discrepancy approaches being unrealistically large. The figures obtained using the currency demand and MIMIC approaches are much lower and the estimates obtained from the survey approach are even more so because when using survey methods, structured, face-to-face interviews are done asking sensitive questions about respondents' activities in the shadow economy. For that reason, the survey method is often considered providing a lower bound for the size of the shadow economy. The survey method has been used e.g. in Germany, the Scandinavian countries, Great Britain, and the Netherlands. While the questionnaires in these studies are broadly comparable in design, recent attempts by the European Union (EU) to provide survey results for all EU member states report difficulties regarding comparability [Renooy et al. (2004); European Commission (2007)]; the wording of the questionnaires becomes more and more cumbersome depending on the culture of different countries with respect to the shadow economy.

The MIMIC approach assumes that the shadow economy is an unobservable phenomenon (latent variable) that can be estimated using measurable causes of informality such as the tax burden and the intensity of regulation, and indicators reflecting these activities, for example, currency in circulation or official GDP. Although it yields reasonable estimates bounded by those produced by the survey method and the currency demand approach, a disadvantage of the MIMIC procedure is the fact that it produces only relative estimates of the size and the development of the shadow economy. Thus, exogenous estimates – mostly calculated using the currency demand approach – are needed to calibrate the relative into absolute estimates of the size of the shadow economy. Although both – most widely used methods – have their drawbacks and biases in the estimates of the shadow economy may exist, no better data are currently available.

4 Summary and conclusions

There are many obstacles to overcome when measuring the size of the shadow economy and analyzing its consequences on the official economy. But, as this paper shows, some progress can be made. We provide estimates for the sizes of the shadow economies in 162 countries over the period 1999 to 2006/2007 using the MIMIC procedure for the econometric analysis and a benchmarking procedure to calibrate the estimated

²⁰ The paper does not discuss the different methodologies nor their advantages or disadvantages in detail. For an excellent survey concerning this matter we refer to Schneider and Enste (2000).

MIMIC into absolute shadow economy values. One may argue that the estimated models do not capture the shadow economy as the measurement model regresses the indicators on a – per se undefined – latent variable and the meaning of the latent variable depends on how well the indicators correspond to the operational definition. Of course, indicators are often only imperfectly linked to the latent variable (Bollen 1989), but it is obvious from equation (2) that a change in the latent variable affects its indicators. This can be clarified further taking the structural model of equation (1) into account: The (microeconomic) incentives determine the economic agent's migration into the shadow and the latent macroeconomic amount of the shadow economy should react. Thus, a change in the microeconomic incentive structure transmits uniformly to the macroeconomic aggregate of the shadow economy. From an econometric point of view, there are two ways to test for the validity of a structural model [Bollen (1989)]. First, it is necessary to examine the fit of the model. Secondly, variables related to the latent variable in the theoretical literature should have the expected impact. We have dealt with these two validity tests above: all causal and indicator variables – their selection has been guided by previous theoretical as well as empirical findings – show the theoretically expected correlation to the shadow economy and the various estimated specifications show satisfactory goodness-of-fit statistics. We thus accept the validity of the empirical models and the new insights gained from our analysis of the sizes and trends of the shadow economies of 162 countries lead to four conclusions:

The first conclusion is that enforcement is an important determinant of the shadow economy. All four enforcement measures are negatively correlated to the shadow economy and two of them are significant at conventional confidence levels. Our results thus confirm findings of the theoretical literature: More enforcement can effectively deter shadow economic activities. Although this result has been derived from a small sub-sample of countries, the cautious conclusion is that enforcement is a useful policy instrument to control the size of the shadow economy. Of course, our analysis is only a first step but offers a promising avenue for future research. **The second conclusion** is that for all countries investigated the shadow economy has reached a size of an weighted average value of 17.1% of official GDP over 162 countries over 1999 to 2007. However, equally important is the clear negative trend of the sizes of the shadow economies over time. The average size of the shadow economies of all 162 countries (developing, Eastern European and Central Asian and high income OECD countries) decreased from 34.0% of official GDP in 1999 to 31.2% of official GDP in 2007. Of course, these results need to be interpreted with caution as measurement inaccuracies in the observable variables may lead to biased shadow economy estimates. **The third conclusion** is that shadow economies are a complex phenomenon present to an important extent in developing, transition as well as highly developed economies. People engage in shadow economic

activities for a variety of reasons. Among the most important are government actions, most notably, taxation and regulation. **The fourth conclusion** is that there are regional disparities in the level of informality, but obviously also regional clusters. At the top level of informality we find Sub-Saharan Africa, while OECD countries show the lowest level.

Considering these four conclusions, it is apparent that one of the big challenges for every government is to undertake efficient incentive orientated policy measures in order to make working in the shadow economy less attractive and, hence, to make working in the official economy more attractive. Successful implementation of such policies may lead to a stabilization, or even reduction, of the size of the shadow economies. Of course, even after 20 years of intensive research the size, causes, and consequences of the shadow economy are still controversially debated in the literature and further research is necessary to improve our understanding about the shadow economy.

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Table 1 Estimation results addressing enforcement

Independent variables	Enforcement-specification 1	Enforcement-specification 2	Enforcement-specification 3	Enforcement-specification 4
Causal variables				
Size of government	0.28*** (4.52)	0.30*** (4.68)	0.31*** (4.79)	0.30*** (4.60)
Share of direct taxation	0.05 (1.50)	0.05 (1.45)	0.05 (1.70)*	0.04 (1.29)
Fiscal freedom	-0.09*** (2.77)	-0.09*** (2.62)	-0.09*** (2.63)	-0.08*** (2.55)
Business freedom	-0.24*** (5.38)	-0.25*** (5.53)	-0.25*** (5.55)	-0.25*** (5.39)
Unemployment rate	0.08** (2.23)	0.08** (2.23)	0.09*** (2.42)	0.08** (2.22)
Government effectiveness	-0.02 (0.79)	-0.02 (0.85)	-0.02 (0.71)	-0.02 (0.85)
SUBEMPL	-0.38** (1.99)			
SUBEXP		-0.21 (1.27)		
Rules			-0.11** (2.17)	
Autonomy				-0.05 (0.66)
Indicator variables				
GDP per capita	-1.40*** (6.35)	-1.35*** (6.53)	-1.34*** (6.59)	-1.39*** (6.36)
Labor force participation rate	-0.26* (1.68)	-0.25* (1.68)	-0.26* (1.71)	-0.25 (1.63)
Currency	1	1	1	1
Statistical tests				
RMSEA (p-value)	0.00 (1.00)	0.00 (1.00)	0.00 (1.00)	0.00 (0.98)
Chi-square (p-value)	21.06 (0.97)	21.99 (0.96)	21.00 (0.97)	27.10 (0.83)
AGFI	0.95	0.95	0.95	0.94
Degrees of freedom	35	35	35	35
Number of observations	141	141	141	141

Note: SUBEMPL = share of sub-national government employment; SUBEXP = share of sub-national government expenditures; Rules = people's perceptions about public employees' aspirations to follow rules; Authority dummy = 1 if sub-national governments have extensive taking, spending, or regulatory authority, zero otherwise. Absolute z-statistics in parentheses. ***, **, * denote significance at the 1, 5, and 10% significance level. All variables are used as their standardized deviations from mean. According to the MIMIC models identification rule (see also section 3.1), one indicator has to be fixed to an a priori value. We have consistently chosen the currency variable. The degrees of freedom are determined by $0.5(p+q)(p+q+1)-t$; with p = number of indicators; q = number of causes; t = the number for free parameters.

Table 2 Estimation results related to the calculation of the shadow economies

Independent variables	Specification 1	Specification 2	Specification 3	Specification 4	Specification 5	Specification 6
	88 developing countries (1994 - 2006)	21 transition countries (1994 - 2006)	25 high income OECD countries (1996 - 2006)	25 high income OECD countries (1996 - 2007)	151 countries (1996 - 2007)	120 countries (1996 - 2006)
Causal variables						
Size of government	0.15 (5.57)***	0.18 (3.49)***			0.05 (2.64)***	0.10 (3.77)***
Share of direct taxation	0.06 (2.57)**					0.05 (2.39)**
Total tax burden			0.05 (2.05)**	0.06 (1.78)*		
Fiscal freedom	-0.03 (1.69)*	-0.08 (1.68)*	-0.07 (2.84)***			-0.04 (2.08)**
Business freedom	-0.05 (2.33)**		-0.23 (5.93)***			-0.04 (1.84)*
Economic freedom		-0.09 (1.91)*				
Unemployment rate	-0.00 (0.06)	0.08 (1.84)*	0.05 (1.89)*	0.11 (3.16)***	0.04 (2.08)**	0.02 (0.89)
GDP per capita	-0.26 (6.87)***				-0.38 (15.89)***	-0.33 (9.15)***
Regulatory quality			-0.21 (5.45)***	-0.31 (6.50)***		
Government effectiveness					-0.05 (2.64)***	-0.04 (2.11)**
Openness		-0.15 (2.47)**				
Inflation rate		0.22 (2.83)***				
Indicator variables						
Growth rate of GDP per capita	-1.39 (6.70)***	-0.76 (4.41)***			-0.79 (10.93)***	-0.99 (8.42)***
GDP per capita			-1.52 (6.71)***	-1.25 (8.36)***		
Labor force participation rate	0.02 (0.14)		-1.11 (5.45)***	-1.03 (7.70)***	-0.19 (3.15)***	
Growth rate of labor force		-0.83 (3.90)***				-0.16 (1.76)*
Currency	1	1	1	1	1	1
Statistical tests						
RMSEA (<i>p</i> -value)	0.03 (0.99)	0.00 (1.00)	0.00 (0.88)	0.00 (0.99)	0.03 (1.00)	0.02 (1.00)
Chi-square (<i>p</i> -value)	44.43 (0.02)	17.75 (0.91)	17.74 (0.60)	3.55 (0.94)	29.95 (0.00)	51.82 (0.03)
AGFI	0.98	0.97	0.95	0.99	0.99	0.98
Degrees of freedom	27	27	20	9	13	35
Number of observations	741	213	145	243	1563	942

Note: Absolute z-statistics in parentheses. ***, **, * denote significance at the 1, 5, and 10% significance level. All variables are used as their standardized deviations from mean. According to the MIMIC models identification rule (see also section 3.1), one indicator has to be fixed to an a priori value. We have consistently chosen the currency variable. The degrees of freedom are determined by $0.5(p+q)(p+q+1)-t$; with p = number of indicators; q = number of causes; t = the number for free parameters.

Table 3 Ranking of 162 countries (categorized and in alphabetical order)

No.	Country	Years									Country Av.
		1999	2000	2001	2002	2003	2004	2005	2006	2007	
High-income OECD countries											
1	Australia	14.4	14.3	14.3	14.1	13.9	13.7	13.7	13.7	13.5	14.0
2	Austria	10.0	9.8	9.7	9.8	9.8	9.8	9.8	9.6	9.5	9.8
3	Belgium	22.7	22.2	22.1	22.0	22.0	21.8	21.8	21.4	21.3	21.9
4	Canada	16.3	16.0	15.9	15.8	15.7	15.6	15.5	15.3	15.3	15.7
5	Denmark	18.4	18.0	18.0	18.0	18.0	17.8	17.6	17.0	16.9	17.7
6	Finland	18.4	18.1	17.9	17.8	17.7	17.6	17.4	17.1	17.0	17.7
7	France	15.7	15.2	15.0	15.1	15.0	14.9	14.8	14.8	14.7	15.0
8	Germany	16.4	16.0	15.9	16.1	16.3	16.1	16.0	15.6	15.3	16.0
9	Greece	28.5	28.7	28.2	28.0	27.4	27.1	26.9	26.4	26.5	27.5
10	Iceland	16.0	15.9	15.8	16.0	15.9	15.5	15.1	15.0	15.0	15.6
11	Ireland	16.1	15.9	15.9	15.9	16.0	15.8	15.6	15.5	15.4	15.8
12	Italy	27.8	27.1	26.7	26.8	27.0	27.0	27.1	26.9	26.8	27.0
13	Japan	11.4	11.2	11.2	11.3	11.2	10.9	10.7	10.4	10.3	11.0
14	Korea. Rep.	28.3	27.5	27.3	26.9	26.8	26.5	26.3	25.9	25.6	26.8
15	Luxembourg	10.0	9.8	9.8	9.8	9.8	9.8	9.7	9.6	9.4	9.7
16	Mexico	30.8	30.1	30.3	30.4	30.5	30.1	29.9	29.2	28.8	30.0
17	Netherlands	13.3	13.1	13.1	13.2	13.3	13.2	13.2	13.2	13.0	13.2
18	New Zealand	13.0	12.8	12.6	12.4	12.2	12.0	12.1	12.1	12.0	12.4
19	Norway	19.2	19.1	19.0	19.0	19.0	18.5	18.5	18.2	18.0	18.7
20	Portugal	23.0	22.7	22.6	22.7	23.0	23.1	23.3	23.2	23.0	23.0
21	Spain	23.0	22.7	22.4	22.4	22.4	22.5	22.4	22.4	22.2	22.5
22	Sweden	19.6	19.2	19.1	19.0	18.7	18.5	18.6	18.2	17.9	18.8
23	Switzerland	8.8	8.6	8.6	8.6	8.8	8.6	8.5	8.3	8.1	8.5
24	United Kingdom	12.8	12.7	12.6	12.6	12.5	12.4	12.4	12.3	12.2	12.5
25	United States	8.8	8.7	8.8	8.8	8.7	8.6	8.5	8.4	8.4	8.6
	Average	17.7	17.4	17.3	17.3	17.3	17.1	17.0	16.8	16.6	
Transition countries											
26	Albania	35.7	35.3	34.9	34.7	34.4	33.9	33.7	33.3	32.9	34.3
27	Armenia	46.6	46.3	45.4	44.5	43.9	43.6	42.7	42.1	41.1	44.0
28	Azerbaijan	61.0	60.6	60.3	60.0	59.1	58.6	56.7	54.0	52.0	58.0
29	Belarus	48.3	48.1	47.9	47.6	47.0	46.1	45.2	44.2	43.3	46.4
30	Bosnia Herzeg.	34.3	34.1	34.0	33.9	33.5	33.6	33.2	32.9	32.8	33.6
31	Bulgaria	37.3	36.9	36.6	36.1	35.6	34.9	34.1	33.5	32.7	35.3
32	Croatia	33.8	33.4	33.2	32.6	32.1	31.7	31.3	30.8	30.4	32.1
33	Czech Republic	19.3	19.1	18.9	18.8	18.7	18.4	17.8	17.3	17.0	18.4
34	Estonia	-	32.7	32.4	32.0	31.4	31.1	30.5	29.8	29.5	31.2
35	Georgia	68.3	67.3	67.2	67.2	65.9	65.5	65.1	63.6	62.1	65.8
36	Hungary	25.4	25.1	24.8	24.5	24.4	24.1	24.0	23.7	23.7	24.4
37	Kazakhstan	43.8	43.2	42.5	42.0	41.1	40.6	39.8	38.9	38.4	41.1
38	Kyrgyz Republic	41.4	41.2	40.8	41.4	40.5	39.8	40.1	39.8	38.8	40.4
39	Latvia	30.8	30.5	30.1	29.8	29.4	29.0	28.4	27.7	27.2	29.2
40	Lithuania	33.8	33.7	33.3	32.8	32.0	31.7	31.0	30.4	29.7	32.0
41	Macedonia. FYR	39.0	38.2	39.1	38.9	38.4	37.4	36.9	36.0	34.9	37.6
42	Moldova	45.6	45.1	44.1	44.5	44.6	44.0	43.4	44.3	-	44.5
43	Poland	27.7	27.6	27.7	27.7	27.5	27.3	26.9	26.4	26.0	27.2
44	Romania	34.3	34.4	33.7	33.5	32.8	32.0	31.7	30.7	30.2	32.6
45	Russia	47.0	46.1	45.3	44.5	43.6	43.0	42.4	41.7	40.6	43.8
46	Slovak Republic	18.9	18.9	18.8	18.6	18.3	18.1	17.6	17.2	16.8	18.1
47	Slovenia	27.3	27.1	26.7	26.6	26.4	26.2	25.8	25.3	24.7	26.2
48	Tajikistan	43.5	43.2	42.9	42.7	42.1	41.7	41.5	41.2	41.0	42.2
49	Turkey	32.7	32.1	32.8	32.4	31.8	31.0	30.0	29.5	29.1	31.3
50	Ukraine	52.7	52.2	51.4	50.8	49.7	48.8	47.8	47.3	46.8	49.7
	Average	38.7	38.1	37.8	37.5	37.0	36.5	35.9	35.3	34.2	

Emerging and developing economies											
51	Algeria	34.2	34.1	33.8	33.3	32.5	31.7	31.1	31.0	31.2	32.5
52	Angola	48.8	48.8	48.4	47.4	47.3	47.1	45.0	44.0	42.1	46.5
53	Argentina	25.2	25.4	26.1	27.6	26.4	25.5	24.7	23.8	23.0	25.3
54	Bahamas. The	26.3	26.2	26.4	26.5	27.0	27.4	26.7	26.2	26.2	26.5
55	Bahrain	18.6	18.4	18.2	18.0	17.8	17.4	17.1	-	-	17.9
56	Bangladesh	36.0	35.6	35.5	35.7	35.6	35.5	35.1	34.5	34.1	35.3
57	Belize	45.2	43.8	43.3	43.4	42.3	42.0	42.1	41.7	42.0	42.9
58	Benin	51.2	50.2	49.8	49.6	49.3	49.5	49.8	49.6	49.1	49.8
59	Bhutan	29.6	29.4	29.2	29.1	28.7	28.7	28.3	28.2	27.7	28.8
60	Bolivia	67.0	67.1	67.6	67.7	67.7	66.9	64.3	62.8	63.5	66.1
61	Botswana	33.9	33.4	33.2	33.3	33.0	32.8	32.7	32.3	31.9	32.9
62	Brazil	40.8	39.8	39.9	39.9	39.6	38.6	38.4	37.8	36.6	39.0
63	Burkina Faso	41.3	41.4	41.3	41.4	40.3	40.1	39.7	39.7	39.6	40.5
64	Burundi	39.1	39.5	39.6	39.4	39.6	39.6	39.7	39.6	39.6	39.5
65	Cameroon	33.3	32.8	32.4	32.1	31.7	31.6	31.6	31.4	31.4	32.0
66	Cape Verde	36.5	36.1	35.9	35.9	35.7	35.8	35.4	34.1	33.4	35.4
67	Central African Rep.	42.8	42.6	43.1	44.0	46.9	47.3	46.9	45.9	45.1	45.0
68	Chad	45.8	46.2	45.5	45.1	44.2	41.5	41.1	41.7	42.2	43.7
69	Chile	19.9	19.8	19.6	19.6	19.4	19.1	18.9	18.7	18.5	19.3
70	China	13.2	13.1	13.0	12.9	12.8	12.6	12.5	12.2	11.9	12.7
71	Colombia	39.4	39.1	38.9	38.9	37.9	37.1	36.1	35.1	33.5	37.3
72	Comoros	39.3	39.6	39.0	37.7	37.6	39.0	38.0	38.4	39.4	38.7
73	Congo. Dem. Rep.	47.2	48.0	48.2	48.1	47.1	46.9	46.8	46.8	46.7	47.3
74	Congo. Rep.	49.5	48.2	47.2	46.8	46.8	46.2	44.7	43.3	44.6	46.4
75	Costa Rica	26.1	26.2	26.4	26.4	26.1	25.9	25.6	25.0	24.0	25.7
76	Côte d'Ivoire	41.4	43.2	44.3	45.5	46.0	46.1	46.3	46.8	47.0	45.2
77	Dominican Rep.	32.4	32.1	32.4	32.1	32.1	32.4	31.7	31.0	30.5	31.9
78	Ecuador	34.2	34.4	33.7	33.3	32.8	31.6	30.8	30.4	30.4	32.4
79	Egypt	35.5	35.1	35.2	35.7	35.4	35.0	34.8	34.1	33.1	34.9
80	El Salvador	46.5	46.3	46.2	45.6	45.2	44.9	44.5	43.8	43.0	45.1
81	Equatorial Guinea	32.7	32.8	32.0	31.5	31.2	30.8	30.5	30.6	30.1	31.4
82	Eritrea	38.1	40.3	39.4	39.4	40.3	40.6	40.5	41.2	41.4	40.1
83	Ethiopia	40.6	40.3	39.5	39.6	40.1	38.6	37.7	36.3	35.1	38.6
84	Fiji	32.9	33.6	33.3	32.6	32.5	31.9	31.4	31.0	32.6	32.4
85	Gabon	46.2	48.0	47.4	47.6	47.5	48.0	47.7	48.0	47.3	47.5
86	Gambia. The	46.1	45.1	44.7	47.1	45.4	43.8	43.6	42.4	40.9	44.3
87	Ghana	42.0	41.9	41.8	41.6	41.3	40.9	39.5	38.6	38.3	40.7
88	Guatemala	51.6	51.5	51.6	51.2	50.7	50.5	50.2	49.0	47.9	50.5
89	Guinea	39.7	39.6	39.3	38.7	38.8	38.5	38.4	38.9	39.2	39.0
90	Guinea-Bissau	40.4	39.6	39.6	40.7	41.5	41.9	41.7	41.5	41.6	40.9
91	Guyana	33.4	33.6	33.3	33.7	33.9	33.4	34.3	33.8	34.0	33.7
92	Haiti	54.8	55.4	56.1	56.5	56.4	57.4	57.1	57.0	57.1	56.4
93	Honduras	50.3	49.6	49.7	49.6	48.9	48.3	47.3	46.1	45.1	48.3
94	India	23.2	23.1	22.8	22.6	22.3	22.0	21.7	21.2	20.7	22.2
95	Indonesia	19.7	19.4	19.4	19.3	19.1	18.8	18.6	18.3	17.9	18.9
96	Iran	19.1	18.9	19.0	18.7	18.2	17.9	18.1	17.7	17.3	18.3
97	Jamaica	36.4	36.4	36.2	36.2	34.4	33.9	34.0	32.9	32.5	34.8
98	Jordan	19.4	19.4	19.2	18.9	18.7	18.3	18.0	17.5	17.2	18.5
99	Kenya	33.7	34.3	34.0	34.8	34.6	33.7	32.7	31.1	29.5	33.2
100	Kuwait	20.1	20.1	20.2	20.3	19.3	18.8	18.1	17.9	-	19.4
101	Laos	30.9	30.6	30.2	30.0	29.8	29.4	28.9	28.4	28.0	29.6
102	Lebanon	34.1	34.1	33.7	33.5	33.2	32.4	32.4	32.8	32.0	33.1
103	Lesotho	31.7	31.3	31.1	31.0	30.7	30.1	30.2	29.3	28.8	30.5
104	Liberia	44.2	43.2	43.2	43.1	45.0	45.4	44.9	44.5	44.2	44.2
105	Libyan	34.7	35.1	34.5	33.8	34.9	33.9	33.1	32.0	30.9	33.7
106	Madagascar	40.1	39.6	38.7	44.8	43.4	41.6	40.8	39.8	38.5	40.8

107	Malawi	39.9	40.3	42.5	44.4	43.4	42.5	42.6	41.3	39.4	41.8
108	Malaysia	32.2	31.1	31.6	31.5	31.2	30.7	30.4	30.0	29.6	30.9
109	Maldives	30.3	30.3	30.0	29.4	29.2	28.9	29.6	29.3	28.6	29.5
110	Mali	42.5	42.3	40.8	40.2	39.9	40.6	40.1	39.9	39.9	40.7
111	Mauritania	35.5	36.1	36.0	35.8	35.8	35.1	34.4	31.7		35.1
112	Mauritius	23.3	23.1	22.9	23.0	22.7	22.4	22.4	22.2	21.9	22.7
113	Mongolia	18.4	18.4	18.3	18.0	17.7	17.4	17.1	16.7	16.4	17.6
114	Morocco	36.5	36.4	35.7	35.5	35.0	34.2	34.9	33.1	33.1	34.9
115	Mozambique	41.1	40.3	40.4	39.8	39.8	39.7	38.9	38.6	-	39.8
116	Namibia	31.4	31.4	31.2	31.3	30.7	29.7	29.6	28.8	28.5	30.3
117	Nepal	37.2	36.8	36.7	37.1	36.9	36.8	36.7	36.3	36.0	36.7
118	Nicaragua	45.7	45.2	45.3	45.5	45.0	44.2	43.8	43.5	43.1	44.6
119	Niger	41.7	41.9	40.9	40.3	39.7	40.7	39.7	38.6	-	40.4
120	Nigeria	58.0	57.9	57.8	57.6	56.3	55.1	53.8	53.0	-	56.2
121	Oman	19.1	18.9	18.5	18.5	18.4	18.3	18.0	17.6	-	18.4
122	Pakistan	37.0	36.8	37.0	36.8	36.2	35.3	34.9	33.8	33.6	35.7
123	Panama	64.8	64.1	64.7	65.1	64.4	63.5	61.7	60.0	-	63.5
124	Papua New Guinea	35.5	36.1	36.8	37.1	37.1	37.0	37.2	37.1	36.5	36.7
125	Paraguay	38.0	39.8	39.7	40.1	39.1	38.3	38.2	37.4	-	38.8
126	Peru	60.1	59.9	60.2	59.1	58.6	57.9	57.2	55.7	53.7	58.0
127	Philippines	43.8	43.3	43.0	42.5	42.0	41.6	40.1	39.5	38.3	41.6
128	Qatar	-	19.0	19.3	19.0	19.6	17.4	18.4	-	-	14.1
129	Rwanda	40.5	40.3	40.6	39.9	40.7	40.2	39.3	39.1	-	40.1
130	Saudi Arabia	18.7	18.4	18.7	19.2	18.3	17.7	17.4	17.4	16.8	18.1
131	Senegal	45.0	45.1	44.5	45.1	44.4	43.2	42.3	42.4	41.7	43.7
132	Sierra Leone	48.6	48.6	47.6	45.4	44.8	44.4	44.3	43.6	42.9	45.6
133	Solomon Islands	31.7	33.4	34.5	34.8	34.7	33.8	33.4	33.2	32.7	33.6
134	South Africa	28.4	28.4	28.4	28.0	27.8	27.1	26.5	26.0	25.2	27.3
135	Sri Lanka	45.2	44.6	44.6	44.1	43.8	43.9	43.4	42.9	42.2	43.9
136	Sudan	34.1	-	-	-	-	-	-	-	-	34.1
137	Suriname	39.7	39.8	39.3	38.9	38.1	36.9	36.5	35.9	35.1	37.8
138	Swaziland	43.5	41.4	41.3	40.9	40.2	40.1	39.3	38.9	-	40.7
139	Syrian	19.3	19.3	19.2	19.1	19.3	19.1	19.0	18.7	18.5	19.1
140	Tanzania	58.6	58.3	57.7	56.9	56.6	56.0	55.4	54.7	53.7	56.4
141	Thailand	53.4	52.6	52.4	51.5	50.2	49.6	49.0	48.5	48.2	50.6
142	Togo	34.4	35.1	35.4	34.5	34.9	35.0	35.0	34.6	-	34.9
143	Trinidad & Tobago	34.7	34.4	34.3	34.4	33.4	33.1	32.9	31.9	31.5	33.4
144	Tunisia	38.7	38.4	37.8	37.8	37.4	36.9	36.7	35.9	35.4	37.2
145	Uganda	43.5	43.1	42.9	42.9	42.5	42.4	42.2	41.0	40.3	42.3
146	United Arab Emi.	26.3	26.4	27.0	27.4	26.3	25.4	24.8	23.5	-	25.9
147	Uruguay	50.5	51.1	51.7	54.0	53.6	51.1	49.2	48.5	46.1	50.6
148	Venezuela. RB	33.8	33.6	33.5	35.5	36.9	34.9	33.5	32.0	30.9	33.8
149	Vietnam	15.8	15.6	15.5	15.3	15.2	15.1	14.7	14.6	14.4	15.1
150	Yemen. Rep.	27.7	27.4	27.3	27.2	27.0	27.0	26.6	26.8	26.8	27.1
151	Zambia	49.3	48.9	48.3	48.1	47.5	46.8	46.3	45.0	43.9	47.1
152	Zimbabwe	59.6	59.4	61.5	62.8	63.7	62.3	62.0	62.3	62.7	61.8
	Average	37.5	37.3	37.2	37.2	37.0	36.5	36.1	35.9	35.4	
Remaining countries											
153	Brunei Darussalam	31.3	31.1	31.0	30.2	29.9	31.2	31.8	30.8	31.2	30.9
154	Cambodia	50.4	50.1	49.6	50.0	49.2	48.8	47.8	46.8	46.0	48.7
155	Cyprus	29.2	28.7	28.2	27.8	28.2	28.1	27.7	27.3	26.5	28.0
156	Hong Kong	17.0	16.6	16.6	16.6	16.4	15.9	15.5	15.0	14.7	16.0
157	Israel	22.7	21.9	22.3	22.7	22.7	22.1	21.8	21.2	20.7	22.0
158	Macao	13.3	13.1	13.0	12.9	12.5	12.1	11.9	11.7	11.1	12.4
159	Malta	27.4	27.1	27.3	27.3	27.5	27.6	27.3	27.0	26.5	27.2
160	Myanmar	51.6	52.6	51.5	50.7	49.0	49.1	47.8	-	-	50.3

161	Singapore	13.3	13.1	13.3	13.3	13.1	12.8	12.7	12.4	12.2	12.9
162	Taiwan	25.7	25.4	25.7	25.4	25.2	24.7	24.5	24.2	23.9	25.0
	Average	28.2	28.0	27.9	27.7	27.4	27.2	26.9	24.0	23.6	
	Overall average	34.0	33.7	33.6	33.6	33.3	32.9	32.5	32.1	31.2	

Table 4 Average informality weighted by total GDP in 2005

Region	Mean	Median	Min	Max	SD
East Asia and Pacific	17.5	12.7	12.7	50.6	10.6
Europe and Central Asia	36.4	32.6	18.1	65.8	8.4
Latin America and the Caribbean	34.7	33.8	19.3	66.1	7.9
Middle East and North Africa	27.3	32.5	18.3	37.2	7.7
High income OECD	13.4	11.0	8.5	28.0	5.7
Other high income countries	20.8	19.4	12.4	33.4	4.9
South Asia	25.1	22.2	22.2	43.9	5.9
Sub-Saharan Africa	37.6	33.2	18.4	61.8	11.7
World	17.1	13.2	8.5	66.1	9.9

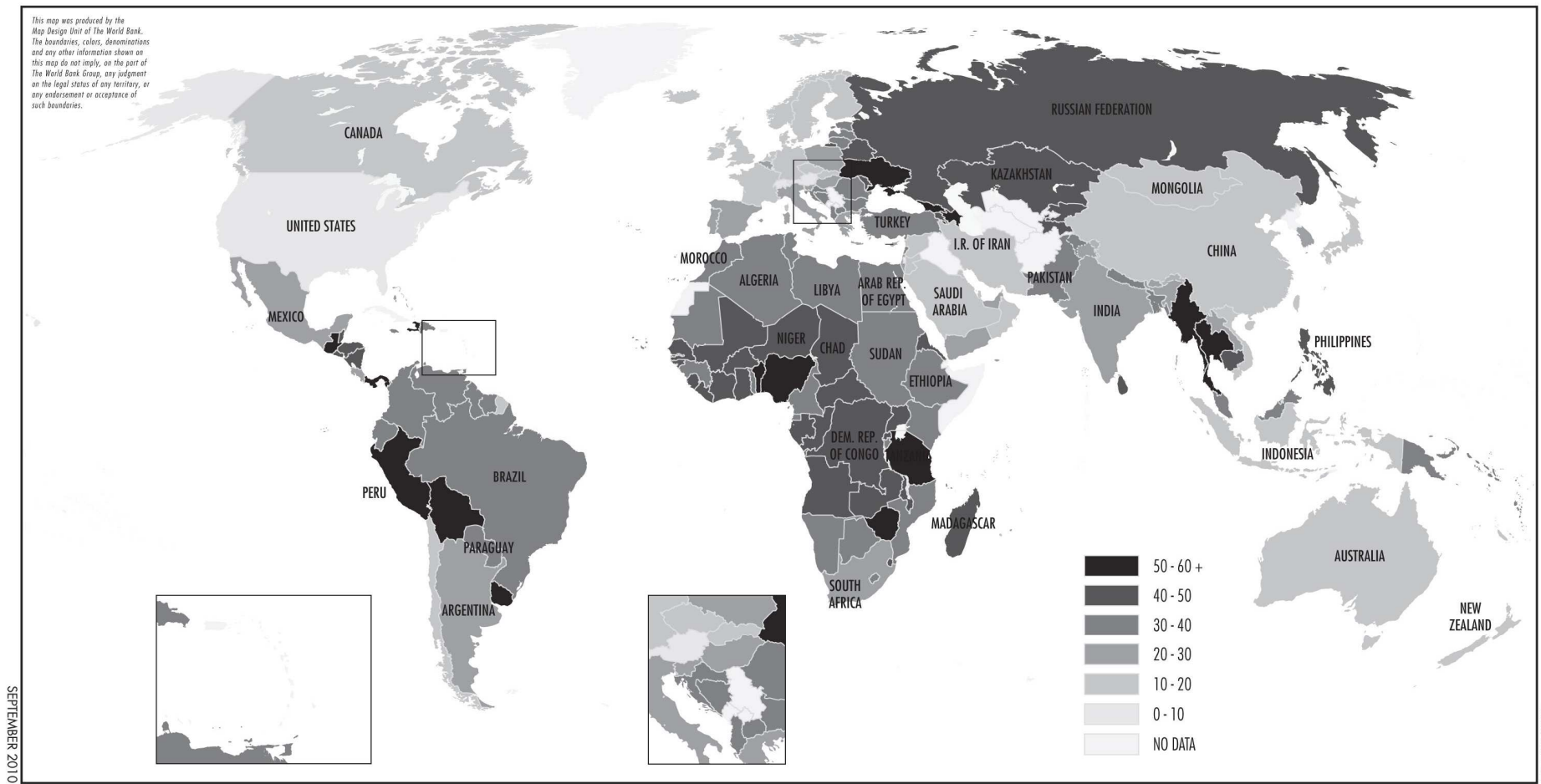


Fig. 1 World view of informality

Appendix

Variable	Description	Source
Authority	Dummy variable taking the value 1 if sub-national governments have extensive taking, spending, or regulatory authority, zero otherwise	Teorell et al. (2010)
Business freedom	Measures the time and efforts of business activity ranging; 0 = least business freedom, and 100 = maximum business freedom	Heritage Foundation
Currency	M0 over M1; currency outside the banks (M0) as a proportion of M1 (specification 4 and 5 use currency over M2 because of higher data availability (Source: ECB)	International Monetary Fund
Economic freedom	Economic Freedom Index; 0 = least economic freedom, and 100 = maximum economic freedom	Heritage Foundation
Fiscal freedom	Measures the fiscal burden in an economy, i.e., top tax rates on individual and corporate income; 0 = least fiscal freedom, and 100 = maximum degree of fiscal freedom	Heritage Foundation
GDP per capita	GDP per capita based on purchasing power parity (PPP), (constant 2005 international \$)	World Bank
Government effectiveness	Captures the quality of public and civil services, the degree of its independence from political pressures, the quality of policy formulation and implementation; scores between -2.5 and 2.5, with higher scores corresponding to better outcomes	World Bank Governance Indicators
Inflation rate	Inflation, GDP deflator (annual %)	United Nations Statistical Database
Labor force participation rate	Labor force participation, total (% of total population)	International Labor Organization
Openness	Sum of exports and imports of goods and services (% of GDP)	United Nations Statistical Database
Regulatory quality	Measures the incidence of market-unfriendly policies; scores between -2.5 and 2.5, with higher scores corresponding to better outcomes	World Bank Governance Indicators
Share of direct taxes	Direct taxes as a proportion of total overall taxation	World Bank and Penn World Table (PWT 6.2)
Rules	Average of the country-specific answers to the following question: <i>To what extent would you</i>	Dahlström et al. (2010)

	<i>say that public sector employees strive to follow rules in the country you have chosen to submit your answer for [ranges between 1 (Not at all) and 7 (To a very large extent)]</i>	
Size of government	General government final consumption expenditure (% of GDP)	United Nations Statistical Database
SUBEMPL	Share of sub-national government employment in total civilian government employment	International Labor Organization
SUBEXP	Share of sub-national government expenditures	IMF Government Finance Statistics
Total labor force	Labor force, total	International Labor Organization
Unemployment rate	Unemployment, total (% of total labor force); Given that this data set contains many missing values, the source was complemented with data from some national statistical offices' websites, and also from the World Bank's Development Data Platform.	International Labor Organization