

Medina, Leandro; Schneider, Friedrich

Working Paper

Shedding Light on the Shadow Economy: A Global Database and the Interaction with the Official One

CESifo Working Paper, No. 7981

Provided in Cooperation with:

Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Medina, Leandro; Schneider, Friedrich (2019) : Shedding Light on the Shadow Economy: A Global Database and the Interaction with the Official One, CESifo Working Paper, No. 7981, Center for Economic Studies and ifo Institute (CESifo), Munich

This Version is available at:

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Leandro Medina, Friedrich Schneider

Impressum:

CESifo Working Papers

ISSN 2364-1428 (electronic version)

Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH

The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute

Poschingerstr. 5, 81679 Munich, Germany

Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de

Editor: Clemens Fuest

www.cesifo-group.org/wp

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Shedding Light on the Shadow Economy: A Global Database and the Interaction with the Official One

Abstract

Using the multiple indicator-multiple cause (MIMIC) approach, this paper generates a novel global database by estimating the size of the shadow economy for 157 countries over 1991 to 2017. The results suggest that the OECD countries are by far the lowest with values below 20% of off official GDP and the shadow economy is larger in Latin America and Sub-Saharan Africa, averaging almost 38 and 39 percent of GDP, respectively. The average over all countries and over 1991 to 2017 is 30.9 %. What is really remarkable, that the average decline of the shadow economy from 1991 to 2017 is 6.8 percentage points. The shadow economy is particularly large in countries such as Bolivia (Georgia) with 62.9(61.7) percent of GDP, and low in countries such as Switzerland(United States) with 6.4 (7.6) percent of GDP, on average. Robustness tests include the use of satellite data on night lights intensity as a proxy for the size of countries' economies and the comparison of the results with 23 countries national statistical offices' measures of informality (discrepancy method used) demonstrate stable and similar results. Finally the interaction of the shadow economy with the official one is investigated. Theoretically the effect of the shadow economy on the official is an open question; first results of this interaction in Pakistan over 1976 to 2015 show a negative (positive) effect in the short (long) run.

JEL-Codes: C390, C510, C820, H110, H260, U170.

Keywords: shadow economy, informal economy, survey, multiple indicators multiple Causes (MIMIC), comparison of different estimation methods, the light intensity approach, shadow economy results for 157 countries, interaction of the shadow economy with the official one.

Leandro Medina
Strategy, Policy and Review Department
International Monetary Fund, IMF
Washington D.C. / USA
lmedina@imf.org

Friedrich Schneider
Research Institute of Banking and Finance
Johannes Kepler University of Linz
Austria – 4040 Linz
friedrich.schneider@jku.at

December 2, 2019, 2nd version

A first version of this paper was presented at the 7th IMF Statistical Forum “Measuring the Informal Economy”, November 14 – 15, 2019, IMF-Headquarters, Washington, D.C.

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1. INTRODUCTION

The definition, size and key characteristics of the shadow economy have been the reason of many debates in both policy and academic circles. Recent global developments, such as migration waves, climate change, and trade tensions have triggered a renewed interest in the vicissitudes surrounding the shadow economy.

Its definition and measurement has been a subject of controversy. The shadow economy is known by different names, such as the hidden economy, gray economy, black economy or lack economy, cash economy or informal economy. All these synonyms refer to some type of shadow economy activities and have been used frequently, and quite inconsistently. Feige (1979, 1996) argues that the informal economy comprises economic activities that circumvent costs and are excluded from the benefits and rights incorporated in laws and administrative rules covering property relationships, commercial licensing, labor contracts, torts, financial credit and social systems.

This paper defines the shadow or informal economy as all economic activities which are hidden from official authorities for monetary, regulatory, and institutional reasons. Monetary reasons include avoiding paying taxes and all social security contributions, regulatory reasons include avoiding governmental bureaucracy or the burden of regulatory framework, while institutional reasons include corruption law, the quality of political institutions and weak rule of law. The shadow economy, in this paper, reflects mostly legal economic and productive activities that, if recorded, would contribute to national GDP, therefore the definition of the shadow economy in our study tries to avoid illegal or criminal activities, do-it-yourself, or other household activities.¹

In addition to the difficulty associated to the shadow economy definition, its size is also difficult to measure, as agents engaged in these activities try to remain undetected. The request for information about the extent of the shadow economy and its developments over time is motivated by its political and economic relevance. Moreover, total economic activity, including official and unofficial production of goods and services is essential in the design of economic policies that respond to fluctuations and economic development over time and across space. Furthermore, the size of the shadow economy is a core input to estimate the extent of tax evasion and thus for decisions on its adequate control.

Different methods have been proposed to estimate the size of the informal economy. Direct approaches, mostly based on surveys and samples, rely on voluntary replies, or tax auditing and other compliance methods to measure the informal economy; the results are sensitive to how the questionnaire is formulated and therefore unlikely to capture all informal activities.

Indirect approaches, also called indicator approaches, use indirect information to estimate the size of the informal economy. For example, the discrepancy between the official and actual labor force approach states that a decline in labor force participation in the official economy can be seen as an indication of an increase in the size of the informal economy, if total labor force participation is

¹ Of course, we are aware that there are overlapping areas, like prostitution, illegal construction firms or corruption, compare e.g. Dreher and Schneider (2009), Dreher and Katsogrannis (2009), Williams and Schneider (2016), Schneider (2017), and Medina and Schneider (2018) compare also section 2, where this problem is tackled.

assumed to be constant. Most direct and indirect methods consider just one indicator of all effects of the informal economy.

The literature has, more recently, relied on the multiple indicator-multiple cause (MIMIC) models, which explicitly consider causes and indicators of the shadow economy and treat the shadow economy as an unobserved component.²

Although widely used, MIMIC methods have been criticized, in particular for: (i) the use of GDP per capita and growth of GDP per capita as cause and indicator of the size of the shadow economy, (ii) the fact that these models need an independent study to calibrate the model, and (iii) some evidence that the coefficients may be sensitive to alternative specifications, and chosen country and time span.³

Against this background, this paper contributes to the literature and addresses concerns by: (i) developing, to our knowledge, one of the most comprehensive databases of the size of the shadow economy, which covers 157 countries over 1991-2017, which is done by using a modified version of the Multiple Indicator-Multiple Cause (MIMIC) model on a number of causes and indicator variables; (ii) addressing criticism related to the use of GDP; by using the night light intensity (night lights as measured by satellites) as alternative measure of the size of the economy; and (iii) comparing the results with the official estimations from countries' statistic offices. Additionally, and as the interaction between the shadow economy and the official one, becomes more and more important, this paper includes a brief section about this topic.

The paper is organized as follows: In section 2 a brief discussion of the methods to measure the shadow economy is undertaken. Section 3 discusses the econometric strategy, the MIMIC approach, and in section 4 the econometric MIMIC estimation findings and results at the shadow economy *for the 157 countries* over 1991 to are shown. Section 5 presents some robustness' tests. Section 6 gives some brief theoretical remarks about the interactions between the official and unofficial (shadow) economies and shows some first empirical results for Pakistan. In Section 7 a summary and policy conclusions are given.

2. METHODS TO MEASURE THE SHADOW ECONOMY

Individuals are rational calculators who weigh up costs and benefits when considering breaking the law. Their decision to partially or completely participate in the shadow economy is a choice overshadowed by uncertainty, as it involves a trade-off between gains, if their activities are not discovered, and losses, if they are discovered and penalized. Shadow economic activities SE thus negatively depend on the probability of detection p and potential fines f , and positively on the opportunity costs of remaining formal, denoted as B . The opportunity costs are positively determined by the burden of taxation T and high labor costs W – individual income generated in the shadow economy is usually categorized as labor income rather than capital income – due to labor market regulations. Hence, the higher the tax burden and labor costs, the more incentives

² Examples of this growing literature include the seminal papers by Schneider and Enste (2000, 2002), Gerxhani (2003), Feld and Schneider (2005, 2010, 2011), Hassan and Schneider (2016), Schneider (2017) and Medina and Schneider (2018)

³ For recent debates and controversies compare Kirchgaessner (2016), Feld and Schneider (2016), Breusch (2016), Feige (2016a, b), Schneider (2016) and Hashimzade and Heady (2016).

individuals have to avoid these costs by working in the shadow economy. The probability of detection p itself depends on enforcement actions A taken by the tax authority and on facilitating activities F accomplished by individuals to reduce the detection of shadow economic activities. This discussion suggests the following structural equation:

$$SE = SE \left[p \left(\overset{+}{A}, \overset{-}{F} \right); \overset{-}{f}; \overset{+}{B} \left(\overset{+}{T}, \overset{+}{W} \right) \right]$$

Hence, shadow economic activities may be defined as those economic activities and income earned that circumvent government regulation, taxation or observation. More narrowly, the shadow economy includes monetary and non-monetary transactions of a legal nature; hence all productive economic activities that would generally be taxable were they reported to the state (tax) authorities. Such activities are deliberately concealed from public authorities to avoid payment of income, value added or other taxes and social security contributions, or to avoid compliance with certain legal labor market standards such as minimum wages, maximum working hours, or safety standards and administrative procedures. The shadow economy thus focuses on productive economic activities that would normally be included in national accounts, but which remain underground due to tax or regulatory burdens.⁴ Although such legal activities would contribute to a country's value added, they are not captured in national accounts because they are produced in illicit ways. Informal household economic activities such as do-it-yourself activities and neighborly help are typically excluded from the analysis of the shadow economy.⁵

Based on these considerations. A variety of methods have been used by the literature over the years to measure the size of the shadow economy. These methods can be aggregated into direct or indirect (including the model-based ones).⁶

The most common direct approaches to measuring the size of the informal economy rely on surveys and samples based on voluntary replies, or tax auditing and other compliance methods. While providing great detail about the structure of the informal economy, the results are sensitive to the way the questionnaire is formulated and respondents' willingness to cooperate. Consequently, surveys are unlikely to capture all informal activities.⁷

Indirect approaches, alternatively called "indicator" approaches, are mostly macroeconomic in nature. These are in part based on: (i) the discrepancy between national expenditure and income statistics; (ii) the discrepancy between the official and actual labor force; (iii) the "electricity

⁴ Although classical crime activities such as drug dealing are independent of increasing taxes and the causal variables included in the empirical models are only imperfectly linked (or causal) to classical crime activities, the footprints used to indicate shadow economic activities such as currency in circulation also apply for classic crime. Hence, macroeconomic shadow economy estimates do not typically distinguish legal from illegal underground activities; instead they represent the whole informal economy spectrum.

⁵ From a social perspective, maybe even from an economic one, soft forms of illicit employment such as moonlighting (e.g. construction work in private homes) and its contribution to aggregate value added may be assessed positively. For a discussion of these issues, see Thomas (1992) and Buehn, Karmann and Schneider (2009).

⁶ This section follows Schneider and Enste (2002), and Feld and Schneider (2010), and Schneider (2017).

⁷ See Isanchen and Strom (1985), Witte (1987), Mogensen et al. (1995), and Feige (1996).

consumption” approach of Kauffman and Kaliberda (1996); (iv) the “monetary transaction” approach of Feige (1979); (v) the “currency demand” approach of Cagan (1958) and others; and (vi) the “Multiple Indicators, Multiple Causes” (MIMIC). Specifically:

- (i) ***Discrepancy between national expenditure and income statistics:*** If those working in the informal economy were able to hide their incomes for tax purposes but not their expenditure, then the difference between national income and national expenditure estimates could be used to approximate the size of the informal economy. This approach assumes that all the components of the expenditure side are measured without error and constructed so that they are statistically independent from income factors.⁸
- (ii) ***Discrepancy between official and actual labor force:*** If the total labor force participation is assumed to be constant, a decline in official labor force participation can be interpreted as an increase in the importance of the informal economy. Since fluctuation in the participation rate might have many other explanations, such as the position in the business cycle, difficulty in finding a job and education and retirement decisions, but these estimates represent weak indicators of the size of the informal economy.⁹
- (iii) ***Electricity approach:*** Kaufmann and Kaliberda (1996) endorse the idea that electricity consumption is the single best physical indicator of overall (official and unofficial) economic activity. Using findings that indicate the electricity-overall GDP elasticity is close to one, these authors suggest using the difference between growth of electricity consumption and growth of official GDP as a proxy for the growth of the informal economy. This method is simple and appealing, but has many drawbacks, including: (i) not all informal economy activities require a considerable amount of electricity (e.g. personal services) or the use of other energy sources (like coal, gas, etc.), hence only part of the informal economy growth is captured; and (ii) the electricity-overall GDP elasticity might significantly vary across countries and over time.¹⁰
- (iv) ***Transaction approach:*** Using Fischer’s quantity equation, $Money * Velocity = Prices * Transactions$, and assuming that there is a constant relationship between the money flows related to transactions and the total (official and unofficial) value added, i.e. $Prices * Transactions = k (official\ GDP + informal\ economy)$, it is reasonable to derive the following equation $Money * Velocity = k (official\ GDP + informal\ economy)$. The stock of money and official GDP estimates are known, and money velocity can be estimated. Thus, if the size of the informal economy as a ratio of the official economy is known for a benchmark year, then the informal economy can be calculated for the rest of the sample. Although theoretically attractive, this method has several weaknesses, for instance: (i) the assumption of k constant over time seems quite

⁸ See for example MacAfee (1980), and Yoo and Hyun (1998).

⁹ See for example Contini (1981), Del Boca (1981), and O’Neil (1983).

¹⁰ See for example Del Boca and Forte (1982), Portes (1996) and Johnson et al. (1997).

arbitrary; and (ii) other factors like the development of checks and credit cards could also affect the desired amount of cash holdings and thus velocity.¹¹

- (v) ***Currency demand approach:*** Assuming that informal transactions take the form of cash payments, in order not to leave an observable trace for the authorities, an increase in the size of the informal economy will, consequently, increase the demand for currency. To isolate this “excess” demand for currency, Tanzi (1980) suggests using a time series approach in which currency demand is a function of conventional factors, such as the evolution of income, payment practices and interest rates, and factors causing people to work in the informal economy, like the direct and indirect tax burden, government regulation and the complexity of the tax system. However, there are several problems associated with this method and its assumptions: (i) this procedure may underestimate the size of the informal economy, because not all transactions take place using cash as means of exchange; (ii) increases in currency demand deposits may occur because of a slowdown in demand deposits rather than an increase in currency used in informal activities; (iii) it seems arbitrary to assume equal velocity of money in both types of economies; and (iv) the assumption of no informal economy in a base year is arguable.¹²
- (vi) ***Multiple Indicators, Multiple Causes (MIMIC) approach:*** This method explicitly considers several causes, as well as the multiple effects, of the informal economy. The methodology makes use of the associations between the observable causes and the effects of an unobserved variable, in this case the informal economy, to estimate the variable itself (Loayza, 1997).¹³

3. ECONOMETRIC STRATEGY

Most of the methods described above consider only one (either direct or indirect) indicator of the informal economy, such as electricity consumption or money demand. However, there may exist more than one manifestation or symptom of the informal economy showing up simultaneously.

This paper uses the MIMIC approach, as it explicitly considers various causes, as well as several effects of the informal economy. The model exploits the associations between observable causes and effects of the unobserved informal economy to estimate the size of the informal economy itself.¹⁴ The model can be described as:

$$y = \lambda IE + \varepsilon \quad (1)$$

$$IE = \gamma' x + v \quad (2)$$

¹¹ See for example Feige (1979), Boeschoten and Fase (1984) and Langfeldt (1984).

¹² See for example Cagan (1958), Gutmann (1977), Tanzi (1999, 1980, 1983), Kirchgassner (1983), Schneider (1997) and Johnson et al. (1998a, 1998b).

¹³ See Vuletin (2009), Dell’Anno and Schneider (2009), Dell’Anno (2007), Schneider (2010); Alm and Embaye (2013), Abdi and Medina (2016), Williams and Schneider (2016) and Medina et.al. (2017).

¹⁴ See Loayza (1996).

where IE is the unobservable latent variable, $y' = (y_1, \dots, y_p)$ is a vector of indicators for IE, $x' = (x_1, \dots, x_q)$ is a vector of causes of IE, λ and γ are the (px1) and (qx1) vectors of the parameters, and ε and ν are the (px1) and scalar errors. Equation (1) relates the informal economy to its indicators, while equation (2) associates the informal economy with a set of observable causes. Assuming that the errors are normally distributed and mutually uncorrelated with $\text{var}(\nu) = \sigma_\nu^2$ and $\text{cov}(\varepsilon) = \Theta_\varepsilon$, the model can be solved for the reduced form as a function of observable variables by combining equations (1) and (2):

$$y = \pi x + \mu \quad (3)$$

where $\pi = \lambda\gamma'$, $\mu = \lambda\nu + \varepsilon$ and $\text{cov}(\mu) = \lambda\lambda'\sigma_\nu^2 + \Theta_\varepsilon$.

As y and x are data vectors, equation (3) can be estimated by maximum likelihood using the restrictions implied in both the coefficient matrix π and the covariance matrix of the errors μ . Since the reduced form parameters of equation (3) remain unaltered when λ is multiplied by a scalar and γ and σ_ν^2 are divided by the same scalar, the estimation of equations (1) and (2) requires a normalization of the parameters in equation (1), and a convenient way to achieve this is to constrain one element of λ to some pre-assigned value.

Since the estimation of λ and γ is obtained by constraining one element of λ to an arbitrary value,

it is useful to standardize the regression coefficients $\hat{\lambda}$ and $\hat{\gamma}$ as $\hat{\lambda}^s = \hat{\lambda} \begin{pmatrix} \hat{\sigma}_{IE} \\ \hat{\sigma}_y \end{pmatrix}$ and $\hat{\gamma}^s = \hat{\gamma} \begin{pmatrix} \hat{\sigma}_x \\ \hat{\sigma}_{IE} \end{pmatrix}$.

The standardized coefficient measures the expected change (in standard-deviation units) of the dependent variable due to a one standard-deviation change of a given explanatory variable, when all other explanatory variables are held constant. Using the estimates of the γ^s vector and setting the error term ν to its mean value of zero, the predicted values for the informal economy can be estimated using equation (2). Then, by using information for one country from various independent studies regarding the specific size of the informal economy measured in percent of GDP, the ordinal within-sample predictions for the informal economy can be converted into percentages of GDP.

4. ECONOMETRIC MIMIC RESULTS AND SIZE OF THE SHADOW ECONOMY

A. Econometric MIMIC Results

As explained in the previous section, the MIMIC model assumes specific causes and indicators that can be used to measure the size of the shadow economy. The specialized literature highlights the tax burden or government distortionary policies, labor market rigidities, lack of institutional quality, and product and financial market rigidities as the main causes¹⁵

The model used in this paper covers a sample of 157 countries over the 1991-2017 time interval. The estimation relies on the following drivers of the shadow economy: (i) a measure of tax burden on the economy, as everything else equal, a larger tax burden is likely to encourage economic agents to remain outside of the formal sector;¹⁶ (ii) institutional quality, as weak institutions, such as lack of respect for the law or high levels of corruption, would encourage informal activities; (iii) openness, proxied by trade openness, as economies become more interconnected and trade more with their neighbors and other countries it would be harder to hide these activities from authorities; and (iv) unemployment, as lack of opportunities in the formal sector would force individuals to engage in informal economic activities.

The MIMIC model also uses measurable indicators, such as: (i) currency as a fraction of broad money, as people engaged in the informal economy usually conduct their activities in cash; (ii) labor force participation, as a decline in official labor force participation could signal some giving up searching for work in the formal sector, and (iii) a measure of the size of the economy.

The results for the model (MIMIC) estimation are shown in tables 1, 2 and 3, and each table includes six specifications over the period 1991–2017 for 157 countries (largest sample).¹⁷ Table 1 contains the estimation results for all countries. All cause variables (trade openness, GDP per capita, unemployment, size of government, fiscal freedom, rule of law, control of corruption, government stability), have the theoretically expected signs, and most of them are highly

¹⁵ See, for example, Schneider (2010), Feld and Larsen (2005, 2009), and Schneider and Enste (2000).

¹⁶ This paper uses two variables to proxy for these effects: (i) the share of government consumption in GDP, and (ii) a fiscal freedom index produced by the Heritage Foundation. A larger government will be required to raise more taxes which distort economic activity and push economic agents from the formal to informal sector. The fiscal freedom index is equally weighted scores from the top marginal tax rate on personal and corporate income, as well as the share of tax burden in GDP. High marginal rates on personal income will push workers towards the informal sector, just as high marginal rates on corporate income would encourage businesses to move activity to the informal sector.

¹⁷ The MIMIC regression includes 151 countries. This estimation generated the coefficients and standard deviations. Following this, during the calibration phase, eight countries were dropped as the time series were not long enough. Specifically, Afghanistan, Macao, Macedonia, Serbia, St. Lucia, St. Vincent and the Grenadines, Sudan, and Tonga. Moreover, for 15 additional countries availability on the drivers' information permitted the estimation of the informal economy, and therefore, were added to the sample. Specifically, Austria, Belgium, Ethiopia, Finland, France, Germany, Greece, Ireland, Italy, Mauritania, Netherlands, Niger, Rwanda, Togo, and United Kingdom. This completes the list of **157** countries with shadow economy estimates (shown in table A1).

statistically significant. The indicator variables also have the theoretical expected signs and are highly statistically significant. The test statistics are satisfactory.

Table 2 contains the estimation results for 102 developing countries (maximum sample). Here the cause variable rule of law is not statistically significant in specification 1, nor is control of corruption in specification 2. These variables are significant and show the expected sign in the other specifications. The indicator variable labor force is again highly statistically significant.

Finally, in table 3 results for 27 advanced countries are presented. Here trade openness is not statistically significant in all specifications, but in all other specifications most cause variables have the expected sign and are statistically significant, except government stability and size of government.¹⁸ The indicator variables are all statistically significant and have the expected signs.

B. Size of the Shadow Economy of 157 countries over 1991 to 2017 Using the MIMIC approach

In table 4 the most important results (summary statistics) for the 157 countries, listed in alphabetical order are shown.¹⁹ The mean value of the size of the shadow economy of the 157 countries over 1991 to 2017 is 30.9 % of GDP. The median is 31.2, indicating that both values are quite close to each other, so there is not a strong deviation. The three largest shadow economies are Bolivia with 62.9%, Georgia with 61.7% and Nigeria with 56.8 % of GDP. The three smallest shadow economies are Switzerland with 6.4%, United States with 7.6%, and Austria with 7.9% of GDP. The average shadow economy of 30.9% comes close to the Dominican Republic with 31.1% and Cameroon with 30.8%. of official GDP. Finally, in figures 1 and 2 results of the size of the shadow economy of 15 highest and 15 lowest countries are shown. In Figures 3 and 4 we present some disaggregated results Figure 3 presents the shadow economy by region. What is really remarkable that for all 7 regions we have a negative (falling) trend of the size of the shadow economy over time; meaning that the average size of the shadow economy is considerable lower in the time span 2010-17 compared to 1991-99 The average decline from 1991 to 2017 was 6.8 percentage points. The OECD countries are by far the lowest with values below 20 percent and the Sub Saharan African countries and Latin American countries are the highest with average values above 36 percent (both averages over 1991-2017). Figure 4 presents the results grouped by income. High income countries have the lowest shadow economy and low income countries vice versa.²⁰

¹⁸ This is plausible, as in advanced countries one would already expect good institutions.

¹⁹ For a detailed of the results over all 157 countries and all years see table A1 of the appendix.

²⁰ Many countries, especially in the middle east , have been affected by massive refugee inflows in the last years.. Unfortunately our model does not capture this dimension and therefore, the shadow economies such as Jordan, Lebanon or Turkey could potentially be underestimated. For the same reason Syria's results should be taken with caution. Also China's results should be taken with caution, too, as it is partly a market economy and partly a planned economy. Hence the results might be capturing the informal economy only partly.

5. ROBUSTNESS TESTS

A. Night Lights Intensity Approach

The standard MIMIC model has been used quite widely in the literature for many years. It has also been the subject of criticism, mainly on the use of GDP (GDP per capita and growth of GDP per capita) as cause and indicator variables.²¹

To address this issue, instead of using GDP per capita and growth of GDP per capita as cause and indicator variables, we use the night lights approach by Henderson, Storeygard, and Weil (2012) to independently capture economic activity.²² In their paper, they use data on light intensity from outer space as a proxy for the “true” economic growth achieved by countries.²³ They also use the estimated elasticity of light intensity with respect to economic growth to produce new estimates of national output for countries deemed to have low statistical capacity. Therefore, by using the night lights approach we address MIMIC criticisms related to the endogeneity of GDP in a novel way, which is totally independent from problematic GDP measures traditionally used (See Medina et al. (2017)).

The main results are showed in table 5, which includes six alternative specifications for the period 1991–2017 for different country samples depending on data availability, using light intensity as an indicator variable. All cause variables (trade openness, unemployment, size of government, fiscal freedom, rule of law, control of corruption, government stability), have the theoretically expected signs, and most of them are highly statistically significant. The indicator variables also have the theoretical expected signs and are mostly highly statistically significant. The test statistics are satisfactory.

B.

1) MIMIC Results Versus National Accounts (Discrepancy Method) Results: OECD Countries

The first comparison will be made between the calculation of the shadow economy of the System of National Accounts – discrepancy method and the MIMIC method (macro and adjusted)²⁴. The results are shown in Table 6 which contains 16 OECD countries for the years 2011 and 2012 (averages). For most countries, the MIMIC results are considerably larger, especially in the cases of Norway, Mexico, Belgium and Israel. Remarkably, some MIMIC estimates come very close to

²¹ Other criticisms include the fact that the methodology relies on another independent study to calibrate from standardized values to estimate the size of shadow economy in percent of GDP, and that the estimated coefficients are sensitive to alternative specifications, the country sample and time span chosen. These are extensively discussed in Schneider (2016).

²² Light intensity offers many benefits as a proxy for economic activity. However, there are some weaknesses of light intensity as well which are worth considering. In rural areas, for example, you can have economic activity in the absence of additional light.

²³ Data on night lights used in this paper has been obtained from Henderson, Storeygard, and Weil database.

²⁴ See Appendix B for a detailed explanation of the adjustment process. The adjusted shadow economy values are an attempt to exclude all criminal activities, do-it-yourself and house hold work and legally bought material, which is included in the non-adjusted macro values. Hence the adjusted values are considerably lower.

the National Accounts Discrepancy method (both macro and adjusted). For example, in Austria the non-observed economy is 7.5 percent by the National Accounts Discrepancy method and 8.4 percent using the macro MIMIC estimation while the adjusted figure is only 5.5 percent, hence, even lower than the National Accounts Discrepancy method. Also somewhat close are the results for the Czech Republic and for the Slovak Republic, but the MIMIC macro results are considerably higher than those achieved with the National Accounts Discrepancy method. If one makes a comparison between the MIMIC adjusted values and the National Accounts Discrepancy method, the differences shrink considerably. While we have large differences for Norway with 9.7 percentage points, the Slovak Rep. with -7.9 (here the MIMIC adjusted value is lower than that from the National Accounts) and Belgium with 7.1 percentage points, for a number of countries the differences are less than three to four percentage points.

What can we conclude from Table 6? There are still considerable differences between the macro MIMIC approach and the National Accounts Discrepancy method, however, the variance, especially in the National Accounts Discrepancy method, is quite large and the MIMIC results for at least for two or three countries come quite close to this calculation of the shadow economy. Hence, the statement by Gyomai and van de Ven (2014) that the estimates by Schneider would be on average three times as large as the estimates for the non-observed economy in the System of National Accounts and 6.7 times larger than the relevant underground economy estimates should be reconsidered. Also, their statement that macroeconomic MIMIC models produce a large size for the shadow economy and the differences are likely to be in great part caused by unrealistic model assumptions and calibration decisions, at least with the adjusted MIMIC results, should be reconsidered.

2) MIMIC Results versus National Accounts (Discrepancy – Method) Results: Developing countries

Table 7 shows a comparison between the National Accounts Statistics Discrepancy method and the MIMIC results for eight Sub-Saharan African countries over 2010 to 2014. Here we have exactly the opposite result compared to Table 6. For most countries, the discrepancy method is considerably higher than the MIMIC results; the same is true when compared to the MIMIC adjusted results. Hence, again, the criticism that the MIMIC estimates are unrealistically large and high may be not true, at least not for these eight Sub-Saharan African countries. In seven out of the eight Sub-Saharan African countries the MIMIC estimation is considerably lower than that obtained using the discrepancy method. For example, in Guinea-Bissau the National Accounts Statistics Discrepancy method estimate is 53.4% and the MIMIC result is 37.6%, a difference of 15.8 percentage points.

Although some countries provide estimates of the size of the informal economy, using the discrepancy method the data generated by MIMIC model in sections 5A and 5B is still extremely useful. First, not all countries publish own estimations of the shadow economy, second, methodologies and sampling methods may affect the comparability of cross-country estimates. Finally, estimates may be rooted in approaches that fail to take account of recent changes in the domestic economy. In contrast, MIMIC produces panel data for most countries that is comparable and can be used to test statistical relationships.

Table 6. Comparison of the MIMIC (macro and adjusted) results with National Accounts Method; 16 OECD Countries, year 2011/2012 (av.)

No.	Country	NOE ¹⁾ (1)	MIMIC		Difference (MIMIC-NOE)	
		percent of GDP	Macro (2)	Adj. (3)	(2)–(1)	(3)–(1)
2	<i>Norway</i>	1	16.48	10.7	15.48	9.7
5	<i>Mexico</i>	15.9	29.89	19.4	13.99	3.5
4	<i>Belgium</i>	4.6	18.00	11.7	13.40	7.1
3	<i>Israel</i>	6.6	19.63	12.8	13.03	6.2
1	Slovenia	10.2	22.53	14.6	12.33	4.4
7	Sweden	3	14.49	9.4	11.49	6.4
6	Hungary	10.9	22.07	14.3	11.17	3.4
8	Canada	2.2	10.87	7.1	8.67	4.9
11	UK	2.3	9.99	6.5	7.69	4.2
14	Italy	17.5	25.0	16.3	7.54	-1.2
12	Netherlands	2.3	8.10	5.3	5.80	3.0
13	France	6.7	11.95	7.8	5.25	1.1
9	Poland	15.4	19.19	12.5	3.79	-2.9
10	Czech Rep.	8.1	11.59	7.5	3.49	-0.6
16	Austria	7.5	8.4	5.5	0.94	-2.0
15	Slovak Rep.	15.6	11.9	7.7	-3.72	-7.9

Source: Gyomai and van de Ven (2014, p. 6) and own calculations.

Table 7 Comparison between National Accounts Statistics and MIMIC results for eight Sub-Saharan African countries over 2010–2014

Country	Methods (averages over 2010–2014)			Differences	
	(1) National Accounts Statistics ¹⁾	(2) MIMIC	(3) MIMIC Adjusted	(2)–(1)	(3)–(1)
Mali	55	32.3	21.0	-22.7	-34.0
Guinea-Bissau	53.4	37.6	24.4	-15.8	-29.0
Burkina Faso	43.1	31.6	20.5	-11.5	-22.6
Senegal	47.5	37.9	24.6	-9.6	-22.9
Guinea	48.1	39.5	25.7	-8.6	-22.4
Togo	40.1	34.8	22.6	-5.3	-17.5
Benin	55.6	52.1	33.9	-3.5	-21.7
Côte d'Ivoire	34	41.9	27.2	7.9	-6.8
Correlation: 0.73					
Spearman's Rank Correlation: 0.857***					

1) Mostly the Discrepancy method is used.

Source: Medina et al. (2017), p. 28 and own calculations.

6. SOME REMARKS ABOUT THE INTERACTIONS BETWEEN THE OFFICIAL AND UNOFFICIAL (SHADOW) ECONOMIES

A. Theoretical Ones

Obviously there are many interactions between the official (registered) and unofficial (shadow) economies all over the world. Hence, a strict separation of these two parts of the economy is not possible. Therefore, it is not surprising that there is a continuous interaction between the official and unofficial economies. Schneider (2005, 2010) and Schneider and Enste (2000, 2002) emphasize that the official part of the economy could never work efficiently if it were totally separated (disentangled) from the unofficial part. A study carried out by the OECD highlights these concerns further, that the shadow economy permanently competes with the official economy; on the other hand, Lubell (1991) and Schneider (2005) state that the formal and informal economies also complement each other. Other studies (Besozzi (2001) and Schneider (2005)) show that a certain influence of the shadow economy on the efficient functioning and development of the official economy cannot be denied.

In principle, these interactions stem from three main topics that are influenced by the shadow economy, namely taxation, general locations and biased effects of economic policies. The interactions and their effects originating from these three main sources are shown in Table 7.

Various studies, for example Schneider (2005, 2006) and Williams and Schneider (2016) demonstrate that the interaction between the official and the shadow economy takes place but still their results are discussed controversially, especially whether the positive effects dominate over negative ones or vice versa. As these effects always depend on the concrete size of the shadow economy, the intensity of the interaction between the formal and informal sectors and the specific economic situation of a country, an answer can only be given after a careful empirical analysis is undertaken for concrete countries.

In order to study the effects of the underground economy on the official one, the underground economy or shadow economy has been integrated into macroeconomic models. This ends in an extended macro model of the business cycle, as well as tax and monetary policy linkages with the shadow economy. As a result, it becomes clear that these effects should be taken into account for tax and regulatory policies. The presence of a shadow economy tends to overstate the inflationary effect of a fiscal or monetary stimulus and tends to understate the respective effects of unemployment. When the growth of the shadow economy and the official economy are positively related (which is likely to be the case when entry costs into the shadow economy are low due to the probability of enforcement), an expenditure fiscal policy has a positive stimulus for both the formal and the informal economies. The underground economy is a beneficiary in so far as it responds to the economic environmental demands for urban services and small scale manufacturing. These sectors provide the economy with dynamic and entrepreneurial spirit and can strengthen competition, increase efficiency, and put effective limits on government activities. These sectors contribute to the creation of markets, increase financial resources and transform the legal, social and economic institutions necessary for accumulation. Moreover, a substantial part (up to 70% of the earnings gained in the shadow economy) is quickly spent in the official sector

and thus boosts the demand in the official economy. These expenditures tend to raise consumer expenditures as well as (mostly indirect) tax revenues. Theoretically, the effect of the shadow economy on the official one and vice versa is an open question. It is really an empirical question which will be investigated for the case of Pakistan.

B. Interaction between Official Sector and Shadow Economy in Pakistan over 1976 to 2015 Empirical Results²⁵

One of the main research questions about existence of shadow economy is how it effects the official sector? This question is investigated in a study by Mughal and Schneider(2019) for Pakistan The authors found out, that, the literature may have mixed views in this regard but the effect might differ across various economies owing to the economic structure both in informal and formal sectors. For example Loayza (1996) in his growth model concluded that in economies where the statutory tax burden is larger than the optimal tax burden and the implementation of obedience is too weak, the increase of the relative size of informal economy generates a reduction of economic growth. While on the other hand shadow economy stimulates the economic activity by giving jobs to the unemployed and providing services in the far-flung areas of an economy where the official sector has not yet reached. Schneider and Hametner (2007) for Columbia and Kemal (2007) for Pakistan and Dell’ Anno (2008) for Latin American Countries found a positive relation between the GDP growth and shadow economy. Therefore, we summarize our hypothesis: *Increase in shadow economy may have a positive or negative effect on the growth of official economy.*

Although the informal sector may have a positive or negative impact, yet it would be interesting to differentiate between long and short run impact of informal sector on the official one. By using ARDL model we can have long and short run estimates of shadow economy on the economic growth. This is one of the novelties in our research paper for which the authors have found no evidence in past literature. The empirical analysis is carried out by using a log-log model with Log of GDP per capita as the dependent variable and log of shadow economy (as percentage of GDP) as exogenous variable along with other control variables for the yearly data from 1973-2015. All the variables have been tested for Unit roots by using Dicky Fuller tests to make sure that none of the variables are I(2), as already discussed; ARDL can only have I(0) and I(1) variables. Akaike Information Criteria has been used to check for the optimal number of lags to be employed in the model. The following model is estimated:

$$\begin{aligned} \Delta \ln \text{GDPPC}_t = & \beta_0 + \beta_1 \ln \text{GDPPC}_{t-1} + \beta_2 \ln \text{TINVPC}_{t-1} + \beta_3 \ln \text{DEVHEXP}_{t-1} + \beta_4 \ln \text{TVIENROLL}_{t-1} + \beta_5 \ln \text{UNIENROLL}_{t-1} \\ & + \beta_5 \ln \text{INFL}_{t-1} + \beta_6 \ln \text{SE}_{t-1} + \sum_{i=1}^n \gamma_{1i} \Delta \ln \text{TINVPC}_{t-i} + \sum_{i=0}^n \gamma_{2i} \Delta \ln \text{DEVHEXP}_{t-i} + \sum_{i=0}^n \gamma_{3i} \Delta \ln \text{TVIENROLL}_{t-i} \\ & + \sum_{i=0}^n \gamma_{4i} \Delta \ln \text{UNIENROLL}_{t-i} + \sum_{i=0}^n \gamma_{5i} \Delta \ln \text{INFL}_{t-i} + \sum_{i=0}^n \gamma_{6i} \Delta \ln \text{SE}_{t-i} + \mu_t \dots \dots \dots (4) \end{aligned}$$

where

- GDPPC is GDP per capita as the dependent variable
- TINVPC is Total Investment per Capita

²⁵ Section 6 B closely follows Mughal and Schneider (2019). The authors thank Khurram Mughal for the permission to present their results.

- DEVHEXP is Development expenditure in health sector
- TVIENROLL is enrollment in Technical and Vocational Institutes
- UNIENROLL is enrollment in Universities
- INFL is Rate of Inflation
- SE is the Shadow Economy as Percentage of GDP, own estimates.

All the variables appear in log form. The variables TINVPC, DEVHEXP, TVIENROLL, and UNIENROLL are expected to have a positive sign while INFL is expected to have negative effect on economic growth. The error correction term (Adjustment Term) is expected to have a negative significant sign. As already discussed, due to varying effects of shadow economy on the official sector, we might expect a positive or negative sign with the variable.

The results are placed at Table 8. All the variables appear with expected signs in short and long run except UNIENROLL, which is not statistically significant. In long run Total Investment per capita, Technical & Vocational Institute Enrollment and Shadow economy as percentage of GDP have significant impacts. All these variables are significant at 1% level.

The short run results are also as expected. The most interesting part is that shadow economy has significant negative impact in the short run, which is different from long run effect. The shadow sector is a burden to the economy owing to tax evasion. This results into greater tax burden in the official sector hence a negative impact. The positive impact of shadow economy on economic growth in long run depicts the situation that it is a safe haven for poor population, which is highly likely in a developing country like Pakistan with growing population. Many rural areas are deprived of basic facilities coupled with high unemployment rate, which as seen in the estimations section was causing an increased demand for currency. Hence it is evident that the officially unemployed have found means to earn income while staying hidden from the government documentation. Hence, tax evasion and sales tax skimming might be a major part of this positive impact. Additionally with excessive government control in the economy, the bureaucratic power itself might drive people towards alternate means to achieve a given legal right. The positive impact of shadow sector is further authenticated by the recent events in 2015-16, when owing to increase in Bank withholding tax rates on tax filers and non-filers, many businessmen went on strikes against the Government. This clearly shows that tax evasion is from the productive sector of the society as well. Further if we consider the factor of intensity of regulations and control that increases bureaucratic power, it is a possibility that absence of such formalities may bring efficiency in business processes in the unofficial sector. Still it cannot be ignored that the hidden sector might also consist of illegal activities, and hence an increase in shadow economy might also contain a part of increase in illegal activities.

Table 9 gives the Bounds test statistic for cointegration while Table 10 below presents diagnostic test statistics for the above results:

Since the F-statistic of 7.584 in Table 9 is above the upper bound critical value, there is long run cointegration among the variables. The Breusch-Godfrey LM test for autocorrelation and Breusch-Pagan/Cook-Weisberg test for heteroskedasticity clearly show that there is no problem of heteroskedasticity or serial correlation in the model, since we cannot reject the null hypothesis in each case. The CUSUM and CUSUM squared graphs also confirm stability of the model and are placed at Annex A. Based on the above model Log run normalized equation is:

$$\begin{aligned} \ln GDPPC_t = & 4.428 + 1.054 \ln TINVPC + 0.123 \ln DEVHEXP + 0.395 \ln TVIENROLL - \\ & 0.024 \ln UNIENROLL - 0.048 \ln INFL + 0.573 \ln SE \end{aligned}$$

The above equation shows that a 1 percentage increase in SE would lead to 0.573 percentage increase in GDP per Capita. In order to empirically determine the relative and absolute influence of the shadow economy on official sector, for the study period, simulations are carried out. By using a dynamic simulation, the difference between official and theoretical real GDP per capita can be determined. Based on our estimates in table 8; shadow economy has positively and negatively contributed to GDP per capita in long and short runs respectively, hence by multiplying yearly variation in shadow economy with its estimated long run and short run coefficients and then subtracting long run result and adding short run result from the official recorded GDP per capita gives us the influence of Shadow Economy on the official economy of Pakistan, i.e. “What the official GDP per capita had been if the Shadow Economy had not been there?”. The simulation results are shown in Figure 5. The figure consists of three columns, the official GDP per capita, long run effect of Shadow Sector, and the last column is one where the short run effects are also accounted for by adding back the negative influence of shadow economy in the short run. .

Figure above clearly shows that when the influence of Shadow Economy is removed using the estimated coefficient, the officially published figures are distorted, hence showing true picture of GDP per capita. Since the shadow economy has had positive effect on it in the Long run, therefore, if there had been no shadow economy the actual GDP per capita would have been lower. The same is presented in the table 11 below for some years.

7. SUMMARY AND CONCLUSIONS

Using the multiple indicator-multiple cause (MIMIC) approach, this paper generates a novel global database by estimating the size of the shadow economy for 157 countries over 1991 to 2017. The results suggest that the OECD countries are by far the lowest w.... values below 20% of off official GDP and the shadow economy is larger in Latin America and Sub-Saharan Africa, averaging almost 38 and 39 percent of GDP, respectively. The average over all countries and over 1991 to 2017 is 30.9 %. What is really remarkable, that the average decline of the shadow economy from 1991 to 2017 is 6.8 percentage points. The shadow economy is particularly large in countries such as Bolivia (Georgia) with 62.9 (61.7) percent of GDP, and low in countries such as Switzerland (United States) with 6.4 (7.6) percent of GDP, on average. Robustness tests include the use of satellite data on night lights intensity as a proxy for the size of countries' economies and the comparison of the results with 23 countries national statistical offices' measures of informality (discrepancy method used) demonstrate stable and similar results.

Additionally we investigated the interaction of the shadow economy with the official one. We come to the conclusion, that theoretically the effect of the shadow economy on the official one and vice versa is open. For an empirical investigation we used the paper by Mughal and Schneider (2019) for Pakistan over the period 1976 to 2015. The results are, that in the short run the shadow economy has a negative impact on the official one and a positive one in the long run. However these are preliminary results where further investigations are needed to test the robustness of these findings.

We conclude:

- (1) Size of the shadow economy is quite large in some regions (LAC and SSA).
- (2) Sizable heterogeneity within regions.
- (3) Informal sector acts as a safety net.
- (4) Informal sector has low productivity and keeps productivity low in a vicious cycle.
- (5) A balanced approach is needed for transitioning from the informal to the formal sector.
- (6) Key policy recommendations to formalize the informal sector:
 - (i) Improve *Governance*, a necessary condition.
 - (ii) Enhance *Doing Business* and *Competitiveness Indicators*, focusing on the indicators where the gap is largest compared to countries with smaller informal sectors.
 - (iii) Financial inclusion (fintech)

Finally we argue:

In every country the government faces the challenge to undertake policy measures which reduce a shadow economy and tax evasion.

However, the crucial question is: “Is this a blessing or a curse?”

Answers:

- (1) If one assumes, that roughly 50% of all shadow economy activities complement those of the official sector (i.e. those goods would not be produced in the official sector) the development of the total (official + shadow economy) GDP is always higher than the “pure” official one.
- (2) A decline of the shadow economy will only increase the total welfare in every country if the policy maker succeeds in transferring a shadow economic activity into the official economy.
- (3) Therefore, a policy maker has to favor and choose such policy measures that strongly increase the incentives to transfer the production from the shadow (black) to the official sector.

Only then the decline of the shadow economy will be a blessing for the whole economy.

8. REFERENCES

- Alm, James & Abel Embaye, (2013), Using Dynamic Panel Methods to Estimate Shadow Economies Around the World, 1984–2006, Working Papers 1303, Tulane University, Department of Economics.
- Abdih, Y. and Medina, L. (2013), Measuring the Informal Economy in the Caucasus and Central Asia, *International Monetary Fund*, WP/13/137.
- Besozzi, C., (2001), Illegal, legal – egal?: Illegal, legal - egal? Zur Entstehung, Struktur und Auswirkungen illegaler Märkte, Bern: Haupt Verlag.
- Breusch, V. (2016), Estimating the Underground Economy using MIMIC models, *Journal of Tax Administration*, Vol. 2, No. 1.
- Boeschoten, W.C. and M.M.G. Fase (1984), The Volume of Payments and the Informal Economy in the Netherlands 1965–1982, M. Nijhoff, Dordrecht.
- Buehn, A., Karmann, A. and Schneider, F. (2009), Shadow Economy and Do-it-Yourself Activities: The German Case, *Journal of Institutional and Theoretical Economics (JITE)* 165/4, 701–722.
- Buehn, A. and Schneider, F. (2012), Shadow Economies around the World: novel insights, accepted knowledge, and new estimates; *International Tax and Public Finance* 19/1, ; pp.139- - 171.
- Cagan, P. (1958), The demand for currency relative to the total money supply, *Journal of Political Economy*, 66, pp. 302–328.
- Contini, B. (1981), Labor market segmentation and the development of the parallel economy: the Italian experience, *Oxford Economic Papers*, 33, pp. 401–412.
- Del Boca, D. (1981), Parallel economy and allocation of time, *Micros (Quarterly Journal of Microeconomics)*, 4, pp. 13–18.
- Del Boca, D. and F. Forte (1982), Recent empirical surveys and theoretical interpretations of the parallel economy in Italy, in: V. Tanzi (ed.), *The Underground Economy in the United States and Abroad*, Lexington Books, Lexington, MA, pp. 160–178.
- Dell’Anno R. (2007), The Shadow Economy in Portugal: An Analysis with the MIMIC Approach, *Journal of Applied Economics*, 10, pp. 253–277.
- Dell’Anno, Roberto (2008) “What is the Relationship between Unofficial and Official Economy? An analysis in Latin American Countries”, *European Journal of Economics, Finance and Administrative Sciences*, Issue 12 (2008): 185-203.
- Dell’Anno, R. and F. Schneider (2009), A complex approach to estimate shadow economy: the structural equation modelling, in M. Faggini and T. Looks (eds.), *Coping with the Complexity of Economics*, Springer, Berlin, pp. 110–30.
- Dreher, A. and F. Schneider (2009), Corruption and the Shadow Economy: An Empirical Analysis, *Public Choice*, 144/2, pp. 215–277.
- Dreher, A., Kotsogiannis, C. and S. McCorriston (2009), How Do Institutions Affect Corruption and the Shadow Economy?, *International Tax and Public Finance*, 16/4, pp. 773–796.
- Enste, D. and Schneider, F., (2006), Umfang und Entwicklung der Schattenwirtschaft in 145 Ländern, in: Schneider F. und Enste, D. (eds), *Jahrbuch Schattenwirtschaft 2006/07: Zum Spannungsfeld von Politik und Ökonomie*, Berlin LIT Verlag, pp 55-80.

- Feige, E. (1979), How Big is the Irregular Economy?, *Challenge*, 22(5), pp. 5–13.
- Feige, E.L. (1996), Overseas holdings of U.S. currency and the underground economy. In: Pozo, S. (Ed.), *Exploring the Underground Economy*. W.E. Upjohn Institute for Employment Research, Kalamazoo, MI, pp. 5–62.
- Feige, E.L. (2016a), Reflections on the Meaning and Measurement of Unobserved Economies: What do we really know about the “Shadow Economy”?, *Journal of Tax Administration*, Vol 2:2.
- Feige, Edward L. (2016b), Professor Schneider’s Shadow Economy (SSE): What Do We Really Know? A Rejoinder, *Journal of Tax Administration*, 2/2.
- Feld, L.P. and B.S. Frey (2007), Tax Compliance as the Result of a Psychological Tax Contract: The Role of Incentives and Responsive Regulation, *Law and Policy*, 29/1, pp. 102–120.
- Feld, L.P. and C. Larsen (2005), Black Activities in Germany in 2001 and 2004: A Comparison Based on Survey Data, Study no. 12, Copenhagen: Rockwool Foundation Research Unit.
- Feld, L.P. and C. Larsen (2009), Undeclared Work in Germany 2001–2007 – Impact of Deterrence, Tax Policy, and Social Norms: An Analysis Based on Survey Data, Springer, Berlin.
- Feld, L. and Schneider, F. (2010). Survey on the Shadow Economy and Undeclared Earnings in OECD Countries, *German Economic Review*, 11(2), 109–149.
- Feld, L.P. and Schneider, F. (2016), " Reply to Gebhard Kirchgaessner", *German Economic Review*, 18/1, pp.112-117.
- Fleming, M., Roman, J., Farrell, G., (2000), The Shadow Economy. *Journal of International Affairs*, 53(2), 387-409.
- Gerxhani, K. (2003), The informal sector in developed and less-developed countries: A literature survey, *Public Choice*, 114/3–4, pp. 295–318.
- Giles, D.E.A. (1999a), Measuring the Hidden Economy: Implications for Econometric Modelling, *Economic Journal*, 109/3, pp. 370–380.
- Gutmann, P.M. (1977), The subterranean economy, *Financial Analysts Journal*, 34/1, pp. 24– 27.
- Gyomai, G., van de Ven, P. (2014), The non-observed economy in the system of national accounts, Statistics Brief No. 18.
- Hashimzade, N. and Heady C. (2016), Reflections on the meaning and measurement of unobserved economies: An editorial comment, *Journal of Tax Administration* 2:2.
- Hassan, M. and Scheider, F. (2016), Size and development of the shadow economies of 157 worldwide countries: Updated and new measures from 1999 to 2013, *Journal of Global Economics* 4:3.
- Henderson, V. J., Storeygard, A. and Weil, D. N. (2012), Measuring Economic Growth from Outer Space, *American Economic Review*, 102(2): 994–1028.
- Isachsen, A.J. and S. Strøm (1985), The Size and Growth of the Hidden Economy in Norway, *Review of Income and Wealth*, 31/1, pp. 21–38.
- Johnson, S., Kaufmann, D. and A. Shleifer (1997), The unofficial economy in transition, Brookings Papers on Economic Activity, Fall, Washington D.C.

- Johnson, S., Kaufmann, D. & Zoido-Lobaton, P. (1998a). Regulatory Discretion and the Unofficial Economy, *The American Economic Review*, 88(2): 387–392.
- Johnson, S., Kaufmann D. and P. Zoido-Lobaton (1998b), Corruption, Public Finances and the Unofficial Economy, World Bank Policy Research Working Paper Series No. 2169, The World Bank, Washington, D.C.
- Kemal M. Ali, (2007). “A Fresh Assessment of Underground Economy and Tax Evasion in Pakistan: Causes, Consequences and Linkages with the Formal Economy”, Pakistan Institute of Development Economics Working Paper 2007: 13, Islamabad, Pakistan.
- Kirchgässner, G. (1983), Size and development of the West German shadow economy, 1955–1980, *Zeitschrift für die Gesamte Staatswissenschaft*, 139, pp. 197–214.
- Kirchgaessner, G. (2016), "On ESTIMATING THE size of the SHADOW economy", *German Economic Review* 18/1, pp. 99-111.
- Kucera, D. and L. Roncolato (2008), Informal Employment: Two Contested Policy Issues, *International Labor Review*, 147/3, pp. 321–348.
- Langfeldt, E. (1984), The unobserved economy in the Federal Republic of Germany, in: Feige, E.L. (ed.), *The Unobserved Economy*, Cambridge University Press, Cambridge, UK, pp. 236–260.
- Loayza, N. V. (1996), The economics of the informal sector: a simple model and some empirical evidence from Latin America, *Carnegie-Rochester Conference Series on Public Policy*, 45, pp. 129–162.
- Lubell, H., (1991), *The Informal Sector in the 1980s and 1990s*. Paris: OECD Publishing.
- MacAfee, K. (1980), A glimpse of the hidden economy in the national accounts, *Economic Trends*, 136, pp. 81–87.
- Medina, L., A. Jonelis, and M. Cangul, (2017), The Informal Economy in Sub-Saharan Africa: Size and Determinants, *International Monetary Fund*, WP/17/156.
- Medina, L. and Schneider, F. (2018), Shadow economies around the world: What did we learn over the last 20 years?, IMF Working Paper WP018, IMF, Washington DC, USA
- McGee, R.T., Feige, E.L., (1989), Policy Illusion, Macroeconomic Instability, and the Unrecorded Economy. In E.L. Feige (ed.), *The Underground Economies: Tax Evasion and Information Distortion*. Cambridge: Cambridge University Press, pp. 81-
- Mogensen, G.V., Kvist, H.K., Kfrmendi, E. and S. Pedersen (1995), The Shadow Economy in Denmark 1994: Measurement and Results, Study no. 3, The Rockwool Foundation Research Unit, Copenhagen.
- Mughal, Khurram and Schneider, (2019), “How the Informal Sector Affects the Formal Economy in Pakistan? A lesson for Developing Countries” *Discussion Paper; University of Linz, Linz, Austria*; revised version, a first one (2018) appeared in: <https://mpira.ub.uni-muenchen.de/87087/>.
- Portes, A. (1996), The informal economy, in: Pozo, S. (ed.), *Exploring the Underground Economy*, W.E. Upjohn Institute for Employment Research, Kalamazoo, pp. 147–165.
- Schneider, F. (2005), Shadow economies around the world: what do we really know?, *European Journal of Political Economy*, 21(4), pp. 598–642.

- Schneider, F. (2010), The Influence of Public Institutions on the Shadow Economy: An Empirical Investigation for OECD Countries, *European Journal of Law and Economics*, 6/3, pp. 441–468.
- Schneider, F. (ed.) (2011), *Handbook on the Shadow Economy*, Edward Elgar, Cheltenham.
- Schneider, F. (2016), Comment on Feige's Paper, Reflections on the Meaning and Measurement of Unobserved Economies: What do we really know about the "Shadow Economy?", *Journal of Tax Administration*, Vol 2:2, pp. 82–92.
- Schneider, Friedrich (2017), Estimating a Shadow Economy: Results, Methods, Problems, and Open Questions, De Gruyter Open, *Open Economics* 2017/1, pp. 1–29.
- Schneider, F. and D. Enste (2000), Shadow economies: size, causes and consequences, *Journal of Economic Literature*, 38/1, pp. 77–114.
- Schneider, F. and D. Enste (2002), *The Shadow Economy: Theoretical Approaches, Empirical Studies, and Political Implications*, Cambridge University Press, Cambridge (UK).
- Schneider, F., Hametner, B. (2014), The Shadow Economy in Columbia: Size and Effects on Economic Growth, *Peace Economics, Peace Science and Public Policy*, 20(2), 293–325.
- Tanzi, V. (1999), Uses and Abuses of Estimates of the Underground Economy, *Economic Journal*, 109/3, pp. 338–347.
- Tanzi, V. (1980), The underground economy in the United States: estimates and implications, *Banca Nazionale del Lavoro*, 135, pp. 427–453.
- Tanzi, V. (1983), The underground economy in the United States: annual estimates, 1930–1980, *IMF Staff Papers*, 30, pp. 283–305.
- Teobaldelli, D. (2011), Federalism and the Shadow Economy, *Public Choice*, 146/3, pp. 269–269.
- Thomas, J. J. (1992), *Informal Economic Activity*, LSE, Handbooks in Economics, Harvester Wheatsheaf, London.
- Torgler, B. and F. Schneider (2009), The Impact of Tax Morale and Institutional Quality on the Shadow Economy, *Journal of Economic Psychology*, 30/3, pp. 228–245.
- Vuletin, G.J. (2008), Measuring the Informal Economy in Latin America and the Caribbean, *International Monetary Fund*, Working Paper No. 08/102.
- Williams, C. C. and Schneider, F. (2016). *Measuring the Global Shadow Economy: The Prevalence of Informal Work and Labour*. Edward Elgar Publishing, UK.
- Witte, A.D. (1987), The nature and extent of unreported activity: a survey concentrating on a recent US research, in: Alessandrini, S. and B. Dallago (eds.), *The Unofficial Economy: Consequences and Perspectives in Different Economic Systems*, Gower, Aldershot.
- Yoo, T. and Hyun, J. K. (1998), International Comparison of the Black Economy: Empirical Evidence Using Micro-Level Data, paper presented at 1998 Congress of Int. Institute Public Finance, Cordoba, Argentina.
- Zellner, A. (1970). Estimation of Regression Relationships Containing Unobservable Independent Variables. *International Economic Review*, 11(3), 441–454.

9. TABLES AND FIGURES

Table 1. MIMIC Model Estimation Results: 1991-2017, All Countries

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Causes</i>						
Trade Openness	-0.077***	-0.074***	-0.097***	-0.063**	-0.062**	-0.097***
GDP Per Capita	-0.299***	-0.304***	-0.347***	-0.244***	-0.256***	-0.290***
Unemployment Rate	0.002	0.004	0.026	-0.001	0.003	0.044*
Size of Government	0.110***	0.115***	0.140***			
Fiscal Freedom				-0.097***	-0.101***	-0.105***
Rule of Law	-0.043*			-0.057**		
Control of Corruption		-0.067***			-0.062***	
Government Stability			-0.045*			-0.038
<i>Indicators</i>						
Currency	1	1	1	1	1	1
Labor Force Participation Rate	-0.523***	-0.525***	-0.410***	-0.529***	-0.523***	-0.389***
GDP Per Capita Growth	-0.051	-0.100	-0.241***	0.088	0.048	-0.097*
<i>Statistical Tests</i>						
RMSEA	0.061	0.052	0.057	0.051	0.043	0.048
Chi-square (model vs. saturated)	87.902	66.165	89.216	61.262	46.931	58.653
Chi-square (baseline vs. saturated)	419.447	401.916	582.586	340.457	326.345	432.786
Observations	2106	2100	2450	1980	1979	2109
Countries	150	150	122	147	147	120

Source: Own calculations.

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 2. MIMIC Model Estimation Results: 1991-2017, Developing Countries

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Causes</i>						
Trade Openness	-0.064**	-0.063**	-0.084***	-0.056*	-0.053*	-0.088***
GDP Per Capita	-0.301***	-0.301***	-0.339***	-0.256***	-0.258***	-0.295***
Unemployment Rate	-0.002	-0.030	-0.003	-0.037	-0.037	0.017
Size of Government	0.149***	0.146***	0.171***			
Fiscal Freedom				-0.088***	-0.088***	-0.089***
Rule of Law	-0.001			-0.010		
Control of Corruption		-0.042*			-0.039	
Government Stability			-0.059**			-0.055*
<i>Indicators</i>						
Currency	1	1	1	1	1	1
Labor Force Participation Rate	-0.439***	-0.432***	-0.337***	-0.500***	-0.489***	-0.272***
GDP Per Capita Growth	-0.243***	-0.250***	-0.335***	-0.144*	-0.158*	-0.199***
<i>Statistical Tests</i>						
RMSEA	0.051	0.051	0.057	0.051	0.043	0.048
Chi-square (model vs. saturated)	46.76	46.948	63.393	40.436	40.557	49.655
Chi-square (baseline vs. saturated)	250.120	246.883	377.723	189.131	187.305	257.792
Observations	1441	1435	1728	1349	1348	1462
Countries	102	102	82	99	99	80

Source: Own calculations.

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 3. MIMIC Model Estimation Results: 1991-2017, Advanced Countries

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Causes</i>						
Trade Openness	-0.030	0.015	-0.088*	-0.016	0.024	-0.043
GDP Per Capita	-0.224***	-0.301***	-0.303***	-0.121	-0.185**	-0.168***
Unemployment Rate	0.137*	0.114*	0.106***	0.119*	0.128**	0.147***
Size of Government	-0.047	-0.022	-0.053			
Fiscal Freedom				-0.192***	-0.200***	-0.122***
Rule of Law	-0.110*			-0.107*		
Control of Corruption		-0.156***			-0.153***	
Government Stability			-0.071*			-0.029
<i>Indicators</i>						
Currency	1	1	1	1	1	1
Labor Force Participation Rate	-0.863***	-0.834***	-1.150***	-0.816***	-0.879***	-1.351***
GDP Per Capita Growth	-0.06	-0.267	-0.134	0.058	-0.198	-0.329
<i>Statistical Tests</i>						
RMSEA	0.132	0.121	0.115	0.127	0.109	0.095
Chi-square (model vs. saturated)	61.556	53.68	67.885	57.713	45.355	44.581
Chi-square (baseline vs. saturated)	132.743	133.402	234.006	140.224	145.208	177.878
Observations	296	296	439	296	296	382
Countries	27	27	27	27	27	27

Source: Own calculations.

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 4. Summary statistics of the shadow economy of 157 countries, 1991-17

Country	ISO	Average	Standard Deviation	Median	Min.	Max.
Albania	ALB	32.4	4.6	32.4	27.0	42.1
Algeria	DZA	32.3	3.7	32.7	25.5	37.9
Angola	AGO	44.5	5.9	45.5	35.2	52.7
Argentina	ARG	24.8	2.0	25.0	20.9	28.5
Armenia	ARM	42.2	4.3	43.2	34.5	48.7
Australia	AUS	12.2	1.6	12.2	9.4	15.2
Austria	AUT	7.9	0.9	7.8	6.4	9.1
Azerbaijan, Rep. of	AZE	53.4	6.7	54.6	42.4	64.9
Bahamas, The	BHS	28.5	3.0	27.8	24.6	34.2
Bahrain, Kingdom of	BHR	17.3	2.3	16.9	13.9	20.3
Bangladesh	BGD	33.1	3.6	35.0	25.9	36.9
Belarus	BLR	43.9	6.3	46.6	33.1	52.9
Belgium	BEL	18.4	1.8	18.3	15.5	20.9
Belize	BLZ	46.2	4.4	45.0	41.0	56.9
Benin	BEN	49.4	4.0	50.0	40.0	56.2
Bhutan	BTN	25.6	3.3	26.5	19.0	29.6
Bolivia	BOL	62.9	6.3	65.1	50.7	70.5
Bosnia & Herzegovina	BIH	32.4	2.9	31.9	26.9	39.5
Botswana	BWA	29.8	4.4	29.1	22.6	35.3
Brazil	BRA	36.7	4.3	38.5	28.2	41.5
Brunei Darussalam	BRN	28.8	3.3	30.1	21.5	32.9
Bulgaria	BGR	29.9	4.5	30.8	22.9	35.3
Burkina Faso	BFA	37.4	4.6	38.1	29.3	43.6
Burundi	BDI	37.0	2.5	36.6	32.7	41.5
Cambodia	KHM	49.4	4.4	49.6	40.1	57.9
Cameroon	CMR	30.9	2.8	31.1	26.4	35.0
Canada	CAN	13.3	1.6	13.2	11.1	16.6
Cape Verde	CPV	33.3	5.1	34.9	26.1	41.3
Central African Rep.	CAF	38.2	3.0	38.8	32.8	43.0
Chad	TCD	41.7	4.5	40.8	34.4	47.4
Chile	CHL	17.1	1.8	17.2	14.1	19.3
China,P.R.: Mainland	CHN	13.9	1.8	14.1	11.0	16.5
Colombia	COL	33.5	4.8	36.1	25.2	40.1
Comoros	COM	32.7	4.4	33.4	25.6	39.6
Congo, Dem. Rep. of	COD	49.7	4.8	49.0	41.7	56.5
Congo, Republic of	COG	45.9	6.2	46.5	35.1	56.4
Costa Rica	CRI	23.5	1.2	23.7	21.2	26.0

Table 4. Summary statistics of the shadow economy of 157 countries, 1991-17 (cont.)

Country	ISO	Average	Standard Deviation	Median	Min.	Max.
Côte d'Ivoire	CIV	38.5	4.0	39.3	31.7	44.1
Croatia	HRV	27.5	3.9	26.6	21.6	34.4
Cyprus	CYP	28.2	2.9	27.5	23.1	34.5
Czech Republic	CZE	15.0	2.3	15.9	11.7	18.6
Denmark	DNK	13.4	1.5	13.3	10.9	15.8
Dominican Republic	DOM	31.1	1.9	31.7	27.5	34.7
Ecuador	ECU	33.6	2.7	34.1	29.2	37.5
Egypt	EGY	33.8	2.8	35.1	29.9	37.6
El Salvador	SLV	44.2	3.7	44.6	38.6	51.3
Equatorial Guinea	GNQ	31.6	3.8	32.8	23.9	36.2
Estonia	EST	24.1	3.3	23.7	19.3	29.1
Ethiopia	ETH	34.5	4.2	35.6	26.9	40.3
Fiji	FJI	29.7	3.4	30.0	23.4	35.2
Finland	FIN	12.1	1.4	11.5	9.7	14.7
France	FRA	12.9	1.4	12.6	10.1	15.3
Gabon	GAB	51.2	4.1	51.8	42.3	57.8
Gambia, The	GMB	45.0	1.8	45.1	41.6	48.9
Georgia	GEO	61.7	6.1	62.8	50.4	69.1
Germany	DEU	11.4	1.5	11.2	8.7	13.3
Ghana	GHA	41.0	5.2	42.5	31.8	48.3
Greece	GRC	24.9	2.1	25.3	19.7	27.7
Guatemala	GTM	50.3	4.1	50.5	42.0	56.2
Guinea	GIN	36.1	2.7	37.5	30.7	40.0
Guinea-Bissau	GNB	34.8	4.0	36.8	26.9	40.2
Guyana	GUY	30.3	3.2	31.5	24.5	34.8
Haiti	HTI	53.8	4.8	54.7	46.7	62.7
Honduras	HND	47.5	3.2	47.8	41.0	52.8
Hong Kong SAR	HKG	15.0	1.7	15.4	11.8	17.1
Hungary	HUN	23.5	3.5	22.6	18.9	30.1
Iceland	ISL	13.4	1.3	13.9	10.8	15.0
India	IND	23.6	3.2	24.0	18.5	27.8
Indonesia	IDN	23.7	1.9	24.0	20.5	26.9
Iran, I.R. of	IRN	17.1	2.3	17.0	13.2	20.5
Ireland	IRL	12.8	1.8	12.6	9.5	15.7
Israel	ISR	21.4	2.8	21.9	17.0	25.9
Italy	ITA	21.8	2.2	21.2	18.1	26.2
Jamaica	JAM	34.4	2.3	34.5	29.9	38.8
Japan	JPN	11.3	1.0	11.5	9.2	13.0
Jordan	JOR	17.3	2.2	17.7	14.1	19.9

Table 4. Summary statistics of the shadow economy of 157 countries, 1991-17 (cont.)

Country	ISO	Average	Standard Deviation	Median	Min.	Max.
Kazakhstan	KAZ	40.0	4.8	41.6	31.1	45.9
Kenya	KEN	31.9	3.6	33.3	24.4	36.3
Korea, Republic of	KOR	26.0	2.4	26.4	21.8	29.4
Kuwait	KWT	18.6	2.2	19.2	14.5	22.5
Kyrgyz Republic	KGZ	36.0	4.6	37.7	28.0	41.2
Lao People's Dem.Rep	LAO	29.7	3.0	30.7	23.7	33.8
Latvia	LVA	22.5	3.4	22.5	17.9	27.8
Lebanon	LBN	32.0	3.4	32.5	27.1	37.2
Lesotho	LSO	29.6	1.9	29.9	25.9	32.2
Liberia	LBR	41.8	2.6	41.5	38.2	47.0
Libya	LBY	34.2	4.6	36.3	22.5	39.4
Lithuania	LTU	25.7	4.1	25.3	19.7	31.6
Luxembourg	LUX	9.6	1.0	9.8	7.9	10.9
Madagascar	MDG	39.1	1.7	39.2	34.5	42.4
Malawi	MWI	35.8	3.4	34.9	29.7	43.4
Malaysia	MYS	31.0	2.7	31.1	26.9	37.2
Maldives	MDV	28.6	2.4	29.6	24.9	32.1
Mali	MLI	37.3	3.6	37.9	32.2	44.6
Malta	MLT	25.7	3.2	26.9	18.6	30.3
Mauritania	MRT	32.8	3.3	32.9	27.2	38.2
Mauritius	MUS	21.6	1.9	22.1	17.8	24.3
Mexico	MEX	30.5	2.7	30.1	26.6	35.8
Moldova	MDA	41.5	4.2	41.8	34.7	48.7
Mongolia	MNG	17.2	1.9	17.5	14.0	20.8
Morocco	MAR	33.6	3.4	34.3	28.3	38.8
Mozambique	MOZ	38.0	4.2	39.2	30.0	46.4
Myanmar	MMR	47.0	4.7	48.4	36.4	52.7
Namibia	NAM	27.9	3.4	28.5	22.9	32.1
Nepal	NPL	36.4	2.4	36.8	31.1	40.8
Netherlands	NLD	9.9	1.0	9.8	8.4	11.5
New Zealand	NZL	11.2	0.9	11.3	9.5	13.2
Nicaragua	NIC	42.0	4.9	43.0	33.8	50.8
Niger	NER	39.1	3.2	40.1	33.4	43.7
Nigeria	NGA	56.8	4.4	57.8	47.6	64.0
Norway	NOR	12.6	1.5	12.7	9.4	14.8
Oman	OMN	17.7	2.6	18.4	12.6	20.7
Pakistan	PAK	34.2	2.7	34.3	30.1	39.3
Papua New Guinea	PNG	34.0	3.6	35.6	27.8	39.3

Paraguay	PRY	35.2	2.9	35.6	30.7	39.8
Peru	PER	53.5	5.8	56.6	43.6	60.0
Philippines	PHL	40.8	3.7	41.0	34.9	45.8
Poland	POL	24.4	3.5	25.3	19.4	29.9
Portugal	PRT	19.7	2.0	20.0	16.1	22.5
Qatar	QAT	17.8	2.8	17.8	13.1	22.0
Romania	ROM	28.9	3.7	30.1	23.0	34.4
Russian Federation	RUS	39.6	4.2	40.4	32.5	46.3
Rwanda	RWA	34.8	4.4	36.5	27.7	40.7
Saudi Arabia	SAU	16.3	2.3	16.8	12.2	19.4
Senegal	SEN	42.1	3.0	43.2	36.8	46.3
Sierra Leone	SLE	40.7	5.3	42.7	28.4	48.6
Singapore	SGP	11.7	1.4	11.8	9.4	13.9
Slovak Republic	SVK	15.8	2.4	15.3	12.6	19.8
Slovenia	SVN	23.0	2.7	23.1	18.3	27.9
Solomon Islands	SLB	30.7	3.8	30.8	24.5	36.1
South Africa	ZAF	26.8	2.7	27.3	21.9	30.4
Spain	ESP	22.2	2.1	21.4	18.6	26.4
Sri Lanka	LKA	43.9	4.2	45.9	35.5	48.9
Suriname	SUR	37.8	4.6	38.5	30.3	45.0
Swaziland	SWZ	40.6	2.9	40.5	35.2	44.9
Sweden	SWE	11.9	1.7	11.5	9.5	15.2
Switzerland	CHE	6.4	0.9	6.6	5.1	7.6
Syrian Arab Republic	SYR	19.3	1.2	19.3	16.1	21.7
Taiwan Province of China	TWN	29.8	4.8	28.7	22.8	37.8
Tajikistan	TJK	41.2	4.0	41.6	34.0	47.8
Tanzania	TZA	56.0	6.3	57.7	45.4	67.0
Thailand	THA	49.6	4.2	50.2	41.9	55.4
Togo	TGO	33.4	3.0	33.8	28.7	39.3
Trinidad and Tobago	TTO	34.1	3.8	33.0	28.9	40.4
Tunisia	TUN	34.7	3.8	35.6	26.4	40.0
Turkey	TUR	30.4	2.9	30.6	25.8	35.2
Uganda	UGA	37.0	5.8	40.3	28.0	43.7
Ukraine	UKR	45.5	6.0	44.5	34.9	55.7
United Arab Emirates	ARE	25.7	3.3	26.1	20.7	30.4
United Kingdom	GBR	10.5	1.1	10.6	8.7	12.7
United States	USA	7.6	1.0	7.8	5.7	9.5
Uruguay	URY	43.0	3.9	43.4	36.3	48.4
Venezuela, Rep. Bol.	VEN	34.3	3.0	35.4	28.7	38.3
Vietnam	VNM	17.8	2.6	18.7	12.5	21.3

Yemen, Republic of	YEM	26.2	2.9	26.6	21.5	31.1
Zambia	ZMB	45.4	6.4	48.6	32.5	55.7
Zimbabwe	ZWE	53.9	4.7	54.0	46.0	60.1

Table 5. MIMIC Model Estimation Results (night lights instead of GDP): 1991-2017, All Countries

	(1)	(2)	(3)	(4)	(5)	(6)
<i>Causes</i>						
Trade Openness	-0.115***	-0.114***	-0.160***	-0.094***	-0.092***	-0.145***
Unemployment Rate	0.073***	0.077***	0.016	0.049*	0.052*	0.076***
Size of Government	0.087***	0.085***	0.025			
Fiscal Freedom				-0.183***	-0.195***	-0.206***
Rule of Law	-0.111***			-0.087***		
Control of Corruption		-0.067***			-0.061**	
Government Stability			-0.021			0.043*
<i>Indicators</i>						
Currency	1	1	1	1	1	1
Labor Force Participation Rate	-0.382***	-0.403**	-0.672***	-0.388***	-0.374***	-0.335***
Night Lights	-0.061	-0.106	-1.000**	-0.107	-0.127	-0.249***
<i>Statistical Tests</i>						
RMSEA	0.075	0.074	0.089	0.073	0.071	0.079
Chi-square (model vs. saturated)	100.687	97.652	154.228	89.342	85.249	111.394
Chi-square (baseline vs. saturated)	229.236	201.404	386.432	246.099	230.385	352.713
Observations	2042	2036	2300	1926	1925	2047
Countries	147	147	120	145	145	118

Source: Own calculations.

Note: *** p<0.01, ** p<0.05, * p<0.1

Table 6. Comparing results with countries own statistics (Rank correlation of 85 percent in Sub-Saharan African Countries)

Country	National Account Stat. ¹⁾	MIMIC ²⁾
Benin	55.6	49.0
Mali	55.0	40.4
Guinea-Bissau	53.4	38.0
Guinea	48.1	37.0
Senegal	47.5	40.0
Burkina Faso	43.1	32.0
Togo	40.1	28.0
Cote d'Ivoire	34.0	35.0

¹⁾ Mostly discrepancy method.

²⁾ Our results.

Source: own computations and Medina et.al 2017 for the National Account Stat.

Table 7: Interactions between the shadow and the official economy

The shadow economy influences	Through	Effects on official economy and overall economic performance¹
Tax system	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">↓</div> <div style="display: flex; flex-direction: column; align-items: center;"> <div style="margin-bottom: 10px;">→ Tax evasion</div> <div>→ Additional tax revenues</div> </div> </div>	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">→</div> <div> <p>Redistribution policies to finance qualitative and quantitative improvements of public goods are impaired, thus economic growth may be negatively affected (Schneider (2005, 2010))</p> <p>If the shadow economy activity is complementary to the official economy, extra income is generated via the shadow economy which is then (at least partly) spent in the official economy for goods and services (Schneider (2005, 2010))</p> </div> </div>
Allocations	→ Stronger competition and stimulation of markets	<div style="display: flex; align-items: center;"> <div style="margin-right: 10px;">→</div> <div> <p>More efficient use of scarce resources (Schneider (2005, 2010))</p> <p>→ Incentives for firms and individuals, stimulation of creativity and innovation</p> <p>→ Enlargement of market supply through additional good and services</p> <p>→ Cost advantages of producers acting from the shadow economy may lead to ruinous competition</p> <p>→ Problems in information flows for producers and consumers due to reduction in transparency and lack of structure in unofficial sector</p> </div> </div>
Policy decisions	→ Bias in officially published data	→ Stabilizing, re-distributional and fiscal policies may fail desired effects

Source: Schneider and Hametner (2014, p. 298).

¹⁾ For a more detailed discussion on outcomes of economic policy based on biased data compare McGee and Feige (1989), Fleming, Roman, and Farrell (2000), Schneider (2005, 2010), Schneider and Enste (2002).

Table 8: Interaction between Official and Unofficial Sectors

Dependent Variable: 1st Difference of GDP Per Capita (D.lngdppc)					Number of
Obs: 39					
	Variable	Description	Coefficient	Std Error	P>t
ADJ	L1.lngdppc	GDP per Capita	-.4119078***	0.0665079	0.000
LR	L1.lntinvpc	Total Inv per Capita	.4342535***	0.0695511	0.000
	L1.lndevhexp	Development Health Expenditure	.0507818	.034773	0.160
	L1.lntvienroll	Enrollment (TVI)	.1626005***	0.0450507	0.002
	L1.lnunienroll	Enrollment (Uni)	-.0098421	0.0314684	0.758
	L1.lninfl_gdp	Rate of Inflation	-.0196076	0.0117744	0.111
	L1.lnse	SE as %age of GDP	.235977***	0.0418765	0.000
SR	L1D.lngdppc	GDP per Capita	-.5374779***	0.1673397	0.004
	L2D.		-.669267***	0.1501029	0.000
	L3D		-.236711*	0.134136	0.093
	D1.lntinvpc	Total Inv per Capita	.1788724***	0.0366556	0.000
	D1.lndevhexp	Development Health Expenditure	.0209174	0.0147898	0.173
	D1.lntvienroll	Enrollment (TVI)	.0669764***	0.0224458	0.007
	D1.lnunienroll	Enrollment (Uni)	-.0221736	0.0179311	0.231
	L1D.		-.0141002	0.0208296	0.506
	L2D.		.0567216***	0.01978	0.010
	L3D.		.0622178***	0.0192151	0.004
	D1.lninfl_gdp	Rate of Inflation	-.0080765	0.0046839	0.100
	D1.lnse	SE as %age of GDP	.0152208	0.0142467	0.298
	L1D.		-.0502593***	0.0168271	0.007
	L2D.		-.0364915**	0.0174465	0.049
	L3D.		-.0300869**	0.0135103	0.038
	_cons	Constant Term	1.82392***	0.3673542	0.000
	R-squared				0.80589672
Legend: * p<.1; ** p<.05; *** p<.01					

Source: Mughal and Schneider (2019).

Table 9 : Bounds Test for Cointegration

F-statistics calculated	Lower Bound Critical Value at 95%	Upper Bound Critical Value at 95%	Decision
7.584	2.45	3.61	Co-integration exists

Source: Moughal and Schneider (2018).

Table 10: Diagnostic Tests for Interaction Model

Breusch-Godfrey LM test for autocorrelation <i>H0: no serial correlation</i>	chi2 = 0.121	Prob > chi2 = 0.7285
Breusch-Pagan/Cook-Weisberg test for heteroskedasticity <i>Ho: Constant variance</i>	chi2 = 2.91	Prob > chi2 = 0.0879
Cameron & Trivedi's decomposition of IM-test		
Heteroskedasticity	chi2 =40.00	Prob > chi2 = 0.4256
Skewness	chi2 =7.13	Prob > chi2 = 0.7134
Kurtosis	chi2 =2.29	Prob > chi2 = 0.1299
Total	chi2 =49.42	Prob > chi2 = 0.4965

Source: Moughal and Schneider (2018).

Table 11: Influence of Shadow Economy of Official Sector

year	Official GDP per Capita (Pak Rupees)	GDP per capita with no Shadow Economy (LR Effect Only)	GDP per capita with no Shadow Economy (LR and SR Effect)
1980	24917.80	21233.24	21540.01
1985	29562.80	25759.60	26193.74
1990	33320.60	31748.93	32501.56
1995	38512.40	29920.80	30414.39
2000	41114.90	37271.55	37594.46
2005	47803.90	45611.52	45961.90
2010	51251.30	40917.82	41481.42
2015	56061.20	48208.04	48879.25

Source: Moughal and Schneider (2018)

Figure 1. Size of the Shadow Economy in % of GDP of the 15 countries with the highest and the lowest shadow economy – Part (I) highest; average over 1991 to 2017

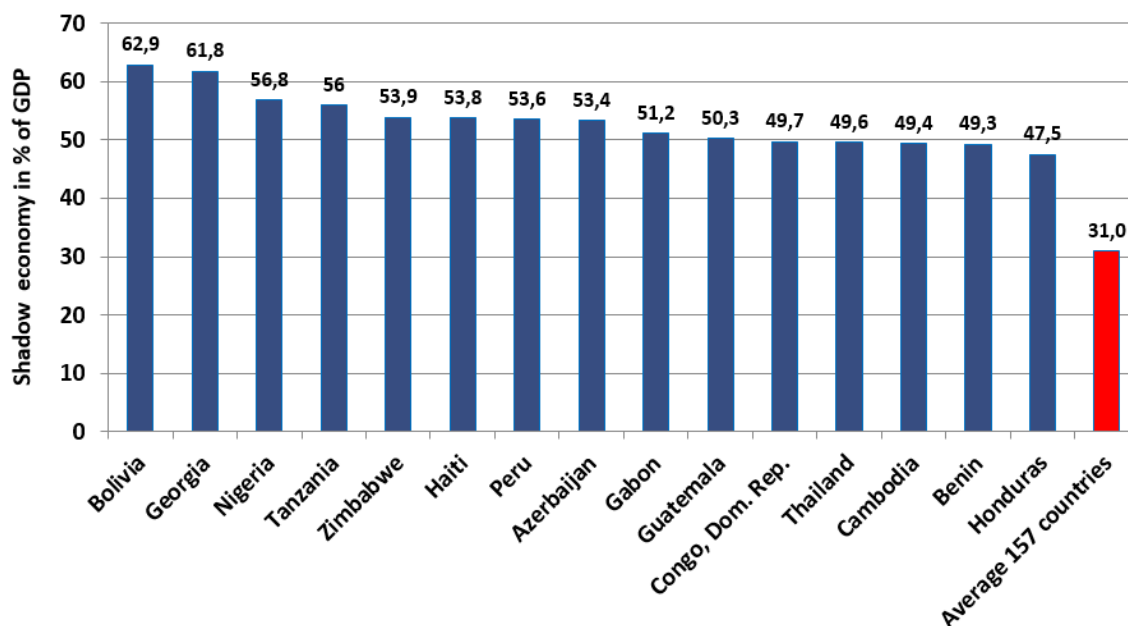


Figure 2. Size of the Shadow Economy in % of GDP of the 15 countries with the highest and the lowest shadow economy – Part (II) lowest, average over 1991 to 2017

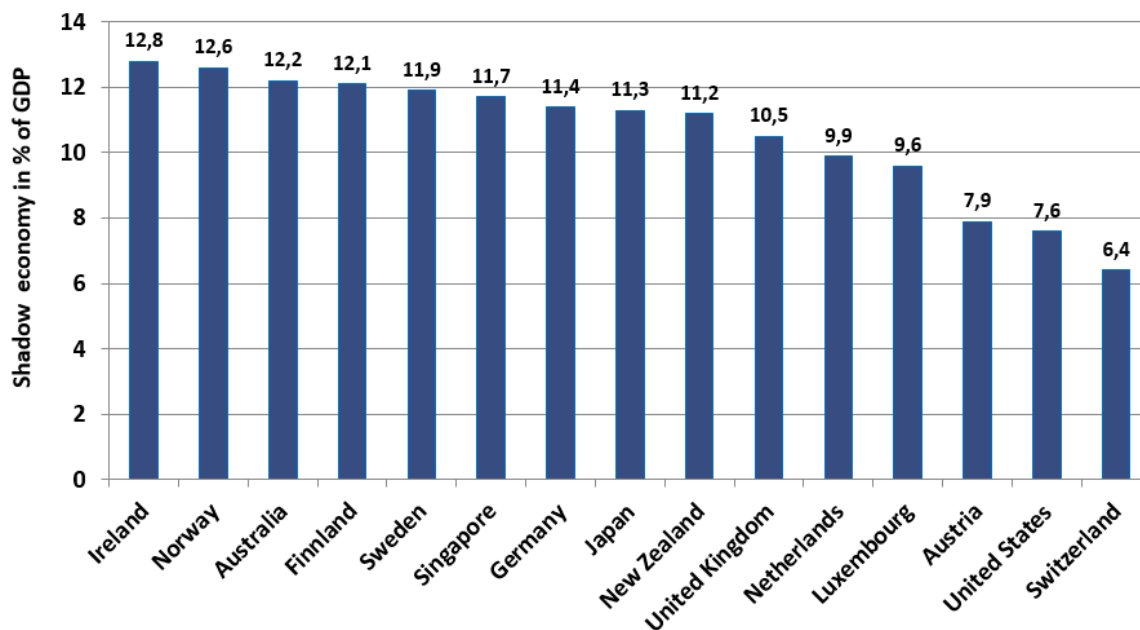


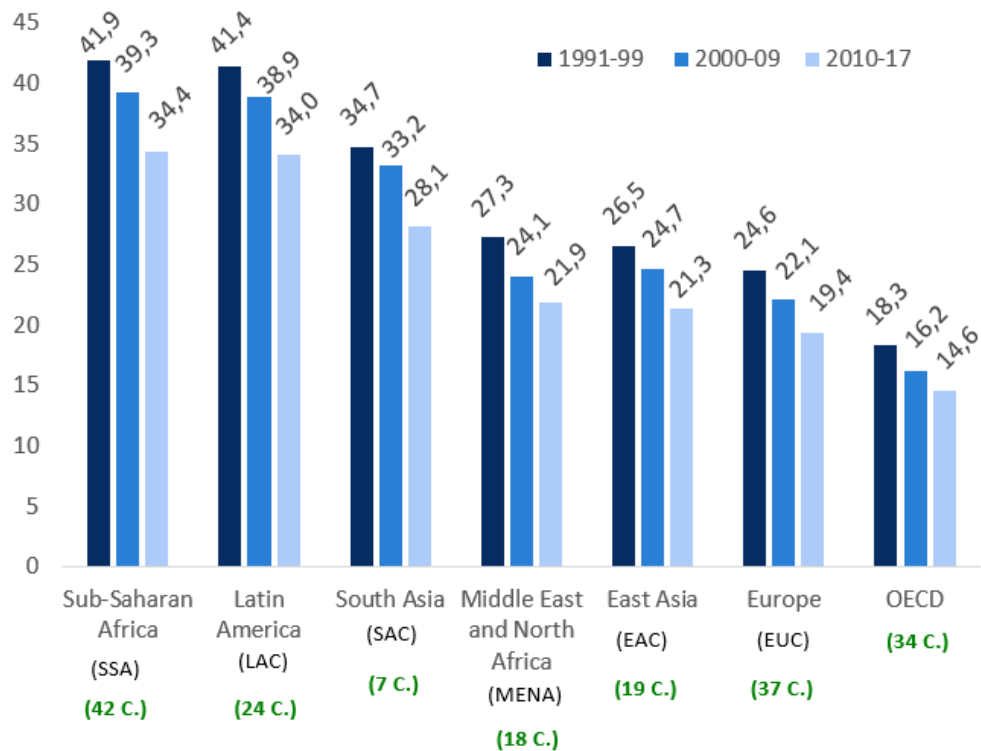
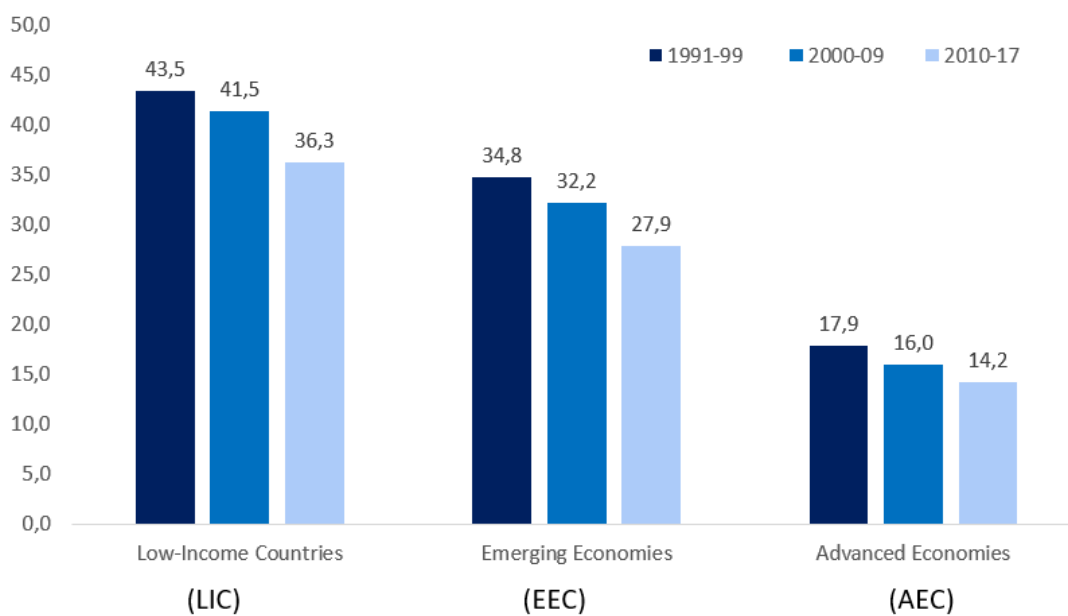
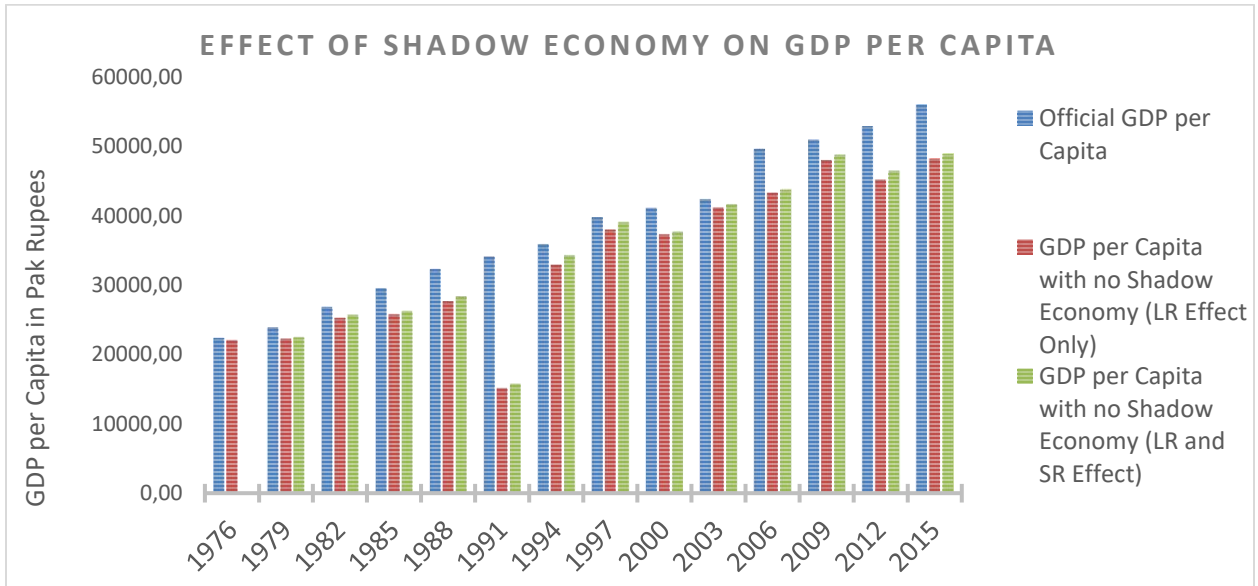
Figure 3. Shadow Economy by Region (average, percent of GDP)**Figure 4. Shadow Economy by Income Level (average, percent of GDP)**

Figure 5. Influence of Shadow Economy on Official Sector of Pakistan



Source: Mughal and Schneider (2018)

10. APPENDIX A

Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part I (1991–2004)

Country	ISO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Albania	ALB	42.1	38.2	36.9	37.8	37.5	35.9	36.5	37.1	35.8	35.3	34.3	34.5	33.6	32.4
Algeria	DZA	34.9	35.7	36.6	37.1	36.1	36.3	36.0	37.9	36.3	34.2	34.4	33.8	32.7	30.9
Angola	AGO	50.7	51.5	50.1	51.5	52.0	48.6	51.9	50.2	52.7	48.8	46.4	47.3	47.2	45.5
Argentina	ARG	25.6	24.6	26.9	26.3	26.3	24.9	25.0	24.4	25.9	25.4	26.4	28.5	27.8	27.0
Armenia	ARM	48.1	48.7	47.4	43.5	45.2	46.2	45.8	45.6	46.6	46.6	45.8	44.4	43.2	43.6
Australia	AUS	14.4	15.2	14.9	14.2	13.6	13.6	13.0	12.9	13.4	13.1	12.8	12.8	12.4	12.2
Austria	AUT	8.6	8.6	9.1	9.0	8.7	8.8	8.9	8.8	9.0	8.8	8.6	8.4	8.0	7.6
Azerbaijan	AZE	59.3	55.8	62.1	64.9	58.3	59.8	58.4	60.7	60.4	60.6	58.7	57.0	55.6	54.6
Bahamas, The	BHS	33.7	33.9	33.3	34.2	33.5	33.1	28.9	27.8	27.1	26.2	27.0	26.2	26.4	26.3
Bahrain	BHR	20.0	20.1	20.0	19.8	19.8	20.0	19.5	20.3	19.9	18.4	18.9	18.6	18.1	16.9
Bangladesh	BGD	35.1	35.9	36.9	36.7	35.2	35.5	35.5	36.2	35.6	35.6	34.7	35.7	36.3	36.1
Belarus	BLR	52.9	46.5	46.6	47.7	50.8	49.9	49.4	48.2	49.6	48.1	49.8	50.0	49.1	47.4
Belgium	BEL	20.7	20.4	20.9	20.4	19.6	19.9	19.9	20.3	19.9	19.9	20.1	20.1	19.4	18.3
Belize	BLZ	56.9	51.6	53.2	53.3	51.4	49.9	51.2	49.9	47.9	43.8	45.1	46.0	45.4	44.7
Benin	BEN	56.2	56.2	53.9	55.5	52.5	51.0	52.4	50.0	49.5	50.2	51.1	50.0	50.6	50.0
Bhutan	BTN	28.8	28.5	28.3	27.8	26.1	29.6	29.3	28.5	27.8	29.4	29.1	29.0	28.1	27.0
Bolivia	BOL	66.2	67.0	68.0	68.0	67.4	64.9	67.0	65.1	69.0	67.1	70.5	69.3	69.9	69.1
Bosnia and Herzegovina	BIH	30.4	30.8	31.1	37.4	39.5	35.8	34.4	32.5	32.8	34.1	33.6	37.9	35.7	33.5
Botswana	BWA	33.2	34.4	35.2	35.3	34.8	34.6	33.3	34.5	33.5	33.4	33.4	33.5	30.8	29.1
Brazil	BRA	40.0	40.4	40.5	38.4	41.5	40.6	39.9	40.7	41.2	39.8	39.9	40.5	39.9	38.5
Brunei Darussalam	BRN	30.7	30.7	31.6	32.6	30.7	29.2	30.1	32.9	32.7	31.1	32.0	31.3	30.2	29.6
Bulgaria	BGR	34.8	34.9	34.6	33.6	32.6	32.8	30.7	34.8	34.5	35.3	34.7	34.0	34.1	32.1
Burkina Faso	BFA	39.2	41.9	41.6	43.6	42.2	43.1	42.1	41.3	39.2	41.4	43.3	41.4	39.1	38.1
Burundi	BDI	32.8	36.6	38.4	37.3	37.3	41.5	38.6	39.3	40.4	39.5	39.5	39.7	40.7	40.5
Cabo Verde	CPV	39.0	40.1	41.3	40.2	40.2	36.7	39.0	36.8	36.9	36.1	35.1	35.7	35.9	34.9
Cambodia	KHM	49.6	51.5	54.4	57.9	54.2	55.5	54.4	52.7	51.6	50.1	49.7	54.1	53.2	49.5
Cameroon	CMR	34.3	34.2	35.0	33.5	33.7	34.5	32.3	32.2	33.7	32.8	33.4	33.0	32.1	31.1

Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part I (1991–2004) (cont.)

Country	ISO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Canada	CAN	16.5	16.6	16.3	15.6	15.0	14.9	14.1	14.0	13.6	13.4	13.6	14.0	13.7	13.1
Central African Republic	CAF	37.3	37.6	38.9	42.0	39.2	39.9	39.3	39.4	42.7	42.6	43.0	41.9	41.1	41.0
Chad	TCD	46.4	46.6	47.4	47.3	46.6	46.2	46.8	45.7	47.0	46.2	46.3	41.7	43.9	40.8
Chile	CHL	18.7	18.5	18.8	18.6	18.0	18.9	18.4	19.0	19.3	18.9	19.0	18.9	18.5	17.2
China	CHN	15.7	15.8	15.5	15.4	14.9	14.9	15.0	15.5	16.4	16.5	16.0	15.6	14.9	14.1
Colombia	COL	37.1	37.4	36.4	36.1	36.1	38.0	38.1	39.0	40.1	39.1	37.9	38.5	36.8	36.3
Comoros	COM	34.0	33.4	34.0	37.9	36.1	36.3	37.5	38.1	37.6	39.6	38.1	37.1	34.5	33.4
Congo, Dem. Rep.	COD	48.4	50.0	48.4	54.7	54.5	55.1	56.3	56.4	56.5	48.0	55.4	54.9	53.2	53.1
Congo, Rep.	COG	54.7	54.7	56.4	52.3	50.0	48.6	51.2	54.2	49.6	48.2	48.9	49.8	47.8	46.5
Costa Rica	CRI	26.0	25.0	24.9	25.1	24.6	24.4	23.9	22.8	24.1	23.9	24.7	24.3	23.9	23.8
Cote d'Ivoire	CIV	43.9	44.1	43.7	42.7	39.5	38.5	42.1	40.6	41.5	43.2	42.8	41.6	41.6	40.3
Croatia	HRV	27.6	28.7	29.6	31.4	34.4	33.8	31.9	33.3	33.4	32.0	30.4	29.8	27.9	26.6
Cyprus	CYP	34.5	34.0	33.6	33.0	26.8	27.5	28.5	29.4	29.4	28.7	29.4	29.9	30.0	27.8
Czech Republic	CZE	18.6	17.7	17.8	17.9	16.9	16.4	16.8	16.1	16.7	16.8	16.2	17.0	17.2	15.9
Denmark	DNK	15.3	15.0	15.8	15.1	14.3	14.6	14.3	14.6	14.6	14.6	14.5	14.6	13.9	13.2
Dominican Republic	DOM	34.7	32.4	32.5	32.4	32.3	31.7	32.5	31.7	32.4	32.1	32.9	33.1	32.4	32.2
Ecuador	ECU	37.5	36.5	37.0	36.6	36.4	35.3	36.1	35.5	37.5	34.4	35.1	34.6	34.9	34.1
Egypt, Arab Rep.	EGY	36.2	35.2	35.1	35.3	35.3	34.4	36.1	35.6	36.6	35.1	35.9	37.6	37.6	37.0
El Salvador	SLV	51.3	50.5	48.9	47.9	46.8	48.4	46.2	46.7	46.8	46.3	46.4	45.7	44.6	43.6
Equatorial Guinea	GNQ	35.1	35.3	36.2	35.0	35.4	34.2	34.3	35.8	33.8	32.8	32.6	32.9	32.1	31.4
Estonia	EST	22.5	23.7	28.2	28.4	29.1	29.0	26.8	26.8	27.3	27.7	26.8	26.7	26.0	24.7
Ethiopia	ETH	35.4	34.8	35.6	36.4	36.2	36.5	36.0	37.0	39.1	40.3	38.7	39.8	40.3	38.5
Fiji	FJI	34.7	34.9	35.2	32.1	31.2	30.0	31.7	33.1	31.2	33.6	33.9	32.6	30.6	28.0
Finland	FIN	14.4	14.7	14.7	14.0	13.2	13.5	13.1	12.7	12.7	12.5	12.6	12.7	12.1	11.5
France	FRA	14.1	14.2	15.3	14.9	14.2	14.3	14.6	14.0	14.0	13.8	13.7	14.5	13.6	12.6
Gabon	GAB	54.1	55.2	56.8	52.3	51.8	50.7	50.3	54.8	52.6	48.0	57.8	56.1	56.1	54.1
Gambia, The	GMB	43.9	44.6	44.7	43.9	43.1	41.6	44.3	41.7	44.2	45.1	48.8	48.9	48.2	45.8

Appendix A

Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part I (1991–2004) (cont.)

Country	ISO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Georgia	GEO	64.4	64.2	62.6	61.4	67.8	68.8	67.2	69.1	68.1	67.3	66.7	66.9	65.5	65.5
Germany	DEU	13.0	13.1	13.3	13.1	12.5	13.0	12.9	12.7	12.8	12.9	12.7	12.8	12.2	11.2
Ghana	GHA	44.8	46.8	48.3	47.7	46.4	46.5	45.1	45.1	44.1	41.9	42.5	42.8	43.6	44.2
Greece	GRC	27.6	26.9	27.7	27.2	27.2	26.3	26.9	26.4	26.6	26.1	26.6	26.4	24.7	23.2
Guatemala	GTM	56.2	56.0	55.8	54.6	53.6	54.4	52.3	52.6	53.1	51.5	53.8	52.5	53.1	50.5
Guinea	GIN	38.1	37.6	37.6	37.8	37.2	37.5	37.6	37.5	38.5	39.7	40.0	38.9	38.5	38.3
Guinea-Bissau	GNB	38.2	37.4	38.2	37.2	37.2	38.7	35.6	40.2	37.3	39.6	38.8	38.7	38.5	36.8
Guyana	GUY	32.1	31.6	31.5	31.8	31.5	30.9	31.8	31.7	32.5	33.6	33.8	34.0	34.8	34.5
Haiti	HTI	55.5	59.9	54.7	62.7	56.1	61.4	57.8	56.2	53.9	55.4	57.7	60.0	58.0	54.1
Honduras	HND	52.7	52.8	51.8	50.6	49.4	48.8	47.8	47.9	49.3	49.6	50.4	50.0	49.4	47.5
Hong Kong SAR, China	HKG	17.1	16.8	16.3	15.9	15.9	16.2	15.3	16.4	16.6	16.6	16.7	17.1	17.0	16.3
Hungary	HUN	29.1	29.2	30.1	28.9	27.2	26.3	26.2	25.5	25.7	25.1	25.1	24.5	24.2	22.6
Iceland	ISL	14.3	14.6	15.0	14.8	14.7	14.6	14.3	14.2	14.3	14.3	14.7	14.8	14.3	13.1
India	IND	27.3	27.0	27.1	26.1	26.1	25.1	26.5	26.9	27.8	26.7	27.2	26.5	25.2	24.0
Indonesia	IDN	26.8	26.9	26.5	25.6	24.9	24.1	24.0	22.3	24.2	23.7	24.0	25.1	25.6	25.1
Iran, Islamic Rep.	IRN	14.3	14.2	20.2	20.4	20.5	19.5	19.5	20.0	19.5	18.9	19.4	18.3	17.6	17.1
Ireland	IRL	15.7	15.6	15.6	15.4	14.8	14.7	14.2	13.8	13.4	13.4	13.2	13.2	13.0	12.5
Israel	ISR	25.9	25.1	24.8	24.3	24.2	23.4	24.0	23.8	23.3	21.9	23.2	23.6	23.5	22.1
Italy	ITA	25.8	25.1	26.2	25.2	23.1	21.9	23.1	22.3	23.0	22.7	23.7	23.0	22.0	21.1
Jamaica	JAM	38.8	36.7	37.9	35.1	34.5	35.7	36.1	36.4	36.2	36.4	36.4	36.2	36.5	34.2
Japan	JPN	12.7	12.3	11.5	10.8	9.9	11.0	11.7	12.5	11.7	11.2	12.3	13.0	12.4	11.5
Jordan	JOR	19.9	19.2	19.3	19.5	19.4	19.5	19.8	19.7	19.8	19.4	19.3	19.5	18.8	17.7
Kazakhstan	KAZ	45.6	45.3	45.0	42.5	45.1	45.9	44.6	44.0	43.6	43.2	44.3	43.1	42.4	41.6
Kenya	KEN	35.8	35.3	33.3	33.6	32.9	34.1	34.2	35.6	35.2	34.3	34.8	35.7	36.3	35.3
Korea, Rep.	KOR	29.3	29.3	29.0	28.1	27.1	27.5	27.0	29.4	28.2	27.5	28.1	27.6	27.6	26.4
Kuwait	KWT	22.5	20.3	19.5	19.2	20.7	20.0	20.4	20.7	21.1	20.1	20.7	20.6	19.7	18.8
Kyrgyz Republic	KGZ	40.6	40.4	40.7	40.5	41.1	38.7	38.9	38.4	40.9	41.2	40.1	39.7	37.7	37.9

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part I (1991–2004) (cont.)**

Country	ISO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Lao PDR	LAO	33.8	33.3	32.8	32.2	32.2	32.2	32.2	31.2	31.4	30.6	30.7	32.2	32.2	31.2
Latvia	LVA	19.4	22.5	23.5	23.4	27.8	27.3	26.4	27.1	26.9	26.7	25.9	26.1	25.4	24.1
Lebanon	LBN	37.2	37.2	36.3	36.1	35.1	34.2	34.7	33.9	34.7	34.1	34.9	34.1	34.1	31.7
Lesotho	LSO	31.9	31.2	31.3	31.4	31.1	30.6	31.2	31.0	32.0	31.3	32.2	31.7	30.1	28.9
Liberia	LBR	40.8	43.8	45.3	45.9	46.2	47.0	44.2	44.0	42.6	43.2	42.1	41.2	42.3	41.5
Libya	LBY	36.8	37.2	36.9	37.8	38.7	38.3	38.0	39.4	36.3	35.1	36.8	38.0	35.4	34.1
Lithuania	LTU	21.7	23.7	25.3	26.9	31.5	31.6	30.9	31.6	31.1	31.1	29.8	29.6	28.5	27.5
Luxembourg	LUX	10.7	10.9	10.8	10.5	10.5	10.8	10.8	10.5	10.1	9.8	10.3	10.2	10.2	9.8
Madagascar	MDG	42.4	41.5	40.8	39.8	39.2	41.7	40.3	40.2	39.5	39.6	40.3	40.5	39.2	36.5
Malawi	MWI	37.4	38.2	38.6	43.4	40.6	38.6	38.2	39.2	38.3	40.3	39.6	36.7	35.6	34.7
Malaysia	MYS	37.2	36.2	35.2	33.9	32.9	30.7	31.1	31.6	31.8	31.1	32.8	33.4	32.9	31.4
Maldives	MDV	31.1	30.9	31.4	31.0	30.7	29.6	30.5	30.0	30.7	30.3	30.2	29.8	29.2	29.0
Mali	MLI	41.7	41.9	41.4	39.5	37.9	39.3	38.9	44.6	41.3	42.3	40.1	39.8	38.2	38.3
Malta	MLT	28.9	29.0	30.3	30.2	28.0	29.6	28.5	28.3	27.6	27.1	28.5	27.8	26.9	27.1
Mauritania	MRT	34.4	34.4	35.0	33.8	32.9	32.4	33.8	35.5	36.7	36.1	37.0	38.0	38.2	36.5
Mauritius	MUS	23.3	23.0	23.8	24.3	23.6	23.3	23.0	22.0	23.0	23.1	22.5	22.8	22.5	22.4
Mexico	MEX	35.8	35.8	33.6	33.5	34.6	34.0	32.2	32.2	31.6	30.1	30.5	30.2	31.3	29.8
Moldova	MDA	37.8	38.8	38.8	39.8	47.8	46.7	48.7	46.6	45.6	45.1	44.3	46.7	45.3	42.3
Mongolia	MNG	18.4	19.8	19.2	20.8	18.7	18.8	18.6	18.6	18.8	18.4	18.9	18.2	17.7	17.5
Morocco	MAR	36.5	37.0	38.8	37.9	37.7	34.4	37.0	34.6	36.6	36.4	37.5	36.4	35.1	34.1
Mozambique	MOZ	40.8	43.5	44.4	46.4	42.1	41.0	40.5	40.6	40.0	40.3	41.5	39.3	39.2	38.1
Myanmar	MMR	50.8	50.0	50.0	49.5	48.8	48.8	48.1	47.9	46.5	52.6	52.7	52.6	51.3	51.8
Namibia	NAM	31.8	32.1	31.9	30.8	31.0	30.7	31.1	31.1	31.7	31.4	31.4	30.3	29.0	28.5
Nepal	NPL	40.8	38.8	38.9	37.7	38.0	36.9	36.7	37.1	38.3	36.8	36.3	37.5	38.2	37.8
Netherlands	NLD	11.4	11.3	11.5	11.3	10.8	10.8	10.6	10.6	10.4	10.5	10.5	10.8	10.4	9.8
New Zealand	NZL	13.2	13.0	12.5	11.8	11.7	11.7	11.8	12.1	11.7	11.5	11.3	11.4	11.1	10.7
Nicaragua	NIC	50.8	50.4	50.3	46.1	45.5	44.1	44.5	44.1	44.0	45.2	43.9	44.1	43.0	43.3

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part I (1991–2004) (cont.)**

Country	ISO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Niger	NER	40.1	42.5	43.7	43.3	40.9	39.5	41.5	40.6	43.4	41.9	40.5	40.2	41.8	41.8
Nigeria	NGA	60.2	60.7	62.9	64.0	60.4	59.9	57.8	60.4	60.8	57.9	58.2	59.6	57.6	61.4
Norway	NOR	14.1	14.7	14.8	14.5	14.1	13.5	13.0	13.6	13.8	12.7	12.9	14.2	14.0	12.6
Oman	OMN	20.7	20.4	20.7	20.7	20.6	19.5	19.7	20.0	19.9	18.9	19.5	19.6	19.0	18.3
Pakistan	PAK	39.3	37.6	37.5	37.7	36.7	35.7	36.8	36.6	37.0	36.8	35.3	35.5	34.3	34.5
Papua New Guinea	PNG	39.3	39.0	39.1	36.4	36.0	35.6	37.0	36.4	36.4	36.1	36.4	36.4	36.6	34.8
Paraguay	PRY	35.6	36.8	36.1	35.5	35.4	36.2	37.6	38.0	39.0	39.8	39.2	39.0	38.1	37.0
Peru	PER	57.6	57.7	57.9	57.8	57.8	58.1	57.4	59.0	60.0	59.9	59.9	58.2	58.2	56.1
Philippines	PHL	45.8	44.8	44.9	45.0	44.7	42.8	45.0	44.9	44.8	43.3	43.7	42.5	42.3	41.0
Poland	POL	29.7	29.9	29.8	29.2	27.7	27.0	26.9	25.9	26.6	26.2	26.4	26.1	25.9	25.3
Portugal	PRT	22.0	21.5	22.5	22.1	21.3	20.8	21.3	20.7	21.1	21.4	21.8	21.2	20.6	19.9
Qatar	QAT	21.1	20.9	21.0	22.0	21.1	21.8	20.7	20.9	20.3	19.0	18.6	18.8	18.4	17.8
Romania	ROM	33.7	31.8	31.1	32.0	30.3	29.6	30.2	30.1	33.5	34.4	33.0	32.5	32.7	30.7
Russian Federation	RUS	43.1	35.2	43.6	44.4	44.1	44.9	46.3	45.0	40.5	41.9	41.9	42.9	42.8	40.9
Rwanda	RWA	37.0	37.6	37.2	35.4	36.7	37.9	35.1	36.5	39.5	40.3	39.9	40.7	40.1	39.0
Saudi Arabia	SAU	19.4	18.7	18.5	18.5	18.1	17.8	18.3	19.1	18.6	18.4	18.5	18.3	17.4	16.8
Senegal	SEN	44.0	43.7	45.3	45.6	44.1	45.5	46.3	44.8	45.4	45.1	45.7	43.9	42.5	40.4
Sierra Leone	SLE	43.3	42.7	44.1	43.6	43.0	44.9	44.3	45.0	46.7	48.6	46.0	46.6	44.1	42.9
Singapore	SGP	13.3	13.0	12.9	12.2	11.8	12.4	12.1	13.2	12.7	13.1	13.6	13.9	13.2	12.0
Slovak Republic	SVK	18.9	19.8	19.4	18.2	17.8	18.8	17.7	18.3	17.5	17.6	17.3	17.3	16.7	15.3
Slovenia	SVN	25.1	27.2	27.9	26.8	25.0	24.5	24.8	23.6	24.7	25.2	25.6	25.0	24.2	23.1
Solomon Islands	SLB	33.0	33.4	33.1	30.1	30.8	28.9	28.7	29.6	31.2	33.4	34.6	35.8	35.6	35.7
South Africa	ZAF	29.5	29.6	30.4	30.3	27.8	29.6	29.1	28.6	29.1	28.4	29.1	29.4	28.5	26.7
Spain	ESP	25.1	25.2	26.4	25.7	24.8	23.7	24.2	23.3	23.5	22.7	23.2	22.7	21.4	20.9
Sri Lanka	LKA	48.0	47.3	46.5	46.4	47.1	45.9	46.1	45.5	45.3	44.6	45.9	46.4	46.1	45.9
Suriname	SUR	45.0	44.5	43.1	41.6	42.4	42.5	42.1	42.3	40.4	39.8	40.4	39.8	39.0	38.5
Swaziland	SWZ	43.8	42.4	44.4	44.0	42.1	43.0	44.9	44.7	44.8	41.4	41.6	41.3	39.6	40.5

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part I (1991–2004) (cont.)**

Country	ISO	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sweden	SWE	13.8	14.4	15.2	14.3	13.3	13.5	13.1	13.3	13.0	12.6	12.8	13.1	12.4	11.4
Switzerland	CHE	7.3	7.6	7.6	7.4	7.1	7.2	7.1	6.8	7.0	6.8	6.9	7.1	7.0	6.6
Syrian Arab Republic	SYR	21.7	20.9	20.3	20.4	20.8	19.3	19.3	19.3	19.3	19.3	19.3	18.7	19.6	19.1
Taiwan	TWN	37.8	37.2	36.5	35.9	34.9	34.8	33.6	33.6	31.7	33.6	31.8	31.0	30.3	28.7
Tajikistan	TJK	39.0	47.7	47.8	46.3	45.2	46.8	45.1	45.0	43.9	43.2	43.2	42.8	41.6	42.4
Tanzania	TZA	67.0	66.9	65.5	64.3	60.4	59.7	59.8	57.7	58.7	58.3	58.1	58.5	57.8	58.2
Thailand	THA	54.3	54.1	54.0	53.0	51.5	50.1	53.1	54.1	55.4	52.6	54.6	52.8	52.4	51.0
Togo	TGO	36.5	34.8	39.3	39.1	36.9	35.4	35.5	35.0	35.7	35.1	35.8	34.0	33.3	33.6
Trinidad and Tobago	TTO	39.9	40.4	40.2	38.7	39.0	37.9	38.6	36.7	37.7	34.4	36.0	35.0	33.9	33.0
Tunisia	TUN	40.0	38.6	39.1	38.4	37.4	37.5	37.9	38.1	37.4	38.4	37.1	37.8	36.8	34.0
Turkey	TUR	35.0	35.2	34.8	33.5	31.9	32.3	31.7	31.2	33.3	32.1	32.8	32.9	31.4	29.8
Uganda	UGA	41.0	41.8	42.8	42.4	40.0	40.4	40.8	41.4	40.9	43.1	42.8	43.7	42.8	41.3
Ukraine	UKR	48.7	49.2	48.5	50.6	50.9	52.2	55.7	55.7	51.1	52.2	49.6	48.5	47.7	44.5
United Arab Emirates	ARE	29.9	30.1	30.4	30.2	29.4	28.1	28.5	29.6	29.3	26.4	27.5	27.0	26.3	24.9
United Kingdom	GBR	12.7	12.7	12.6	12.3	11.5	11.3	10.8	10.6	10.8	10.8	11.0	11.1	10.8	10.4
United States	USA	9.5	9.3	9.1	8.8	8.5	8.5	8.1	7.9	7.8	7.6	7.8	8.1	7.9	7.8
Uruguay	URY	48.4	47.1	47.6	46.2	45.9	47.6	43.4	43.3	45.7	46.1	46.8	47.9	46.4	44.4
Venezuela, RB	VEN	36.2	36.2	36.2	36.0	35.9	33.2	37.6	37.7	38.3	36.0	38.2	37.4	37.5	35.4
Vietnam	VNM	21.3	20.1	20.8	21.0	20.9	20.6	20.5	20.1	19.7	19.2	19.2	19.3	19.0	18.7
Yemen, Rep.	YEM	29.7	29.8	30.5	31.1	29.1	28.4	28.7	29.4	28.4	27.4	27.4	28.0	26.7	25.7
Zambia	ZMB	55.7	49.5	51.0	48.6	49.0	51.9	51.0	51.6	50.1	48.9	48.9	48.5	49.4	49.2
Zimbabwe	ZWE	55.7	60.1	57.2	56.8	56.4	53.2	54.0	53.8	57.8	59.4	58.2	58.9	59.5	60.1

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part II (2005–2017)**

Country	ISO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Albania	ALB	31.6	30.5	28.7	27.3	28.0	27.9	27.0	27.7	27.5	27.0	28.2	27.8	27.0
Algeria	DZA	28.8	27.9	27.2	25.5	29.4	28.8	28.6	28.4	28.0	28.6	32.4	32.9	32.0
Angola	AGO	43.8	42.0	40.5	37.7	39.9	39.2	36.9	36.1	36.3	35.2	38.8	40.6	39.1
Argentina	ARG	26.3	25.7	24.9	23.8	25.3	23.3	21.5	22.0	22.2	23.1	22.4	22.3	20.9
Armenia	ARM	42.3	42.0	39.3	36.2	41.8	40.5	38.9	36.5	36.2	35.9	38.4	36.7	34.5
Australia	AUS	12.1	11.6	11.1	10.3	10.9	11.1	10.1	9.8	9.8	9.4	10.5	11.8	11.6
Austria	AUT	7.6	7.3	6.4	6.4	7.8	7.6	6.9	7.0	7.0	6.6	7.3	7.4	7.1
Azerbaijan	AZE	52.4	50.9	49.1	45.6	49.3	47.5	44.1	43.6	42.4	42.7	48.1	49.8	48.6
Bahamas, The	BHS	25.1	25.1	24.6	25.6	28.3	28.3	28.7	28.0	27.8	27.1	27.4	27.6	28.0
Bahrain	BHR	16.1	15.8	15.1	14.2	16.4	15.9	14.6	14.4	13.9	14.1	15.4	15.6	15.1
Bangladesh	BGD	35.0	34.9	33.9	32.1	31.6	31.0	29.1	29.4	28.6	27.6	26.9	26.6	25.9
Belarus	BLR	47.2	45.1	42.4	37.7	40.5	38.7	34.5	33.5	33.3	33.1	37.8	39.2	37.5
Belgium	BEL	18.1	17.7	16.1	15.5	17.4	16.9	16.0	16.7	16.6	15.9	17.2	16.9	16.5
Belize	BLZ	44.3	41.8	42.6	41.8	46.0	45.0	42.8	41.4	41.2	41.1	41.0	43.9	43.7
Benin	BEN	50.2	50.4	46.6	45.7	49.0	48.9	48.3	47.3	43.9	40.0	47.6	44.9	41.5
Bhutan	BTN	26.5	25.8	23.6	23.6	24.9	23.1	22.2	22.3	21.6	21.0	20.6	20.6	19.0
Bolivia	BOL	67.5	63.3	61.6	58.0	61.7	58.1	54.5	52.0	51.1	50.7	57.1	58.2	55.8
Bosnia and Herzegovina	BIH	32.7	31.6	31.3	30.0	32.4	31.9	30.5	30.9	29.7	29.3	30.1	28.9	26.9
Botswana	BWA	28.4	28.1	26.9	27.3	29.0	26.1	23.3	22.6	23.1	22.8	25.3	25.6	26.0
Brazil	BRA	38.5	37.3	35.9	33.6	35.1	30.8	28.2	29.1	29.3	29.9	33.6	34.6	33.8
Brunei Darussalam	BRN	28.1	27.2	27.7	24.0	27.1	26.3	22.1	21.5	22.7	24.9	29.8	30.3	30.2
Bulgaria	BGR	30.8	29.6	26.6	25.5	26.4	26.2	24.4	24.5	24.8	24.2	24.9	24.0	22.9
Burkina Faso	BFA	37.0	37.2	37.2	34.0	33.7	31.9	29.6	29.3	30.5	31.4	34.0	34.0	33.1
Burundi	BDI	36.5	35.0	36.7	35.1	35.9	35.5	34.7	34.6	34.5	34.4	34.6	36.4	32.7
Cabo Verde	CPV	34.2	30.4	28.0	26.1	28.6	29.0	27.4	27.4	27.4	27.5	29.3	28.6	27.3
Cambodia	KHM	45.4	42.2	40.1	48.4	47.9	47.9	47.0	46.3	47.1	46.3	47.4	49.7	40.8

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part II (2005–2017)**

Country	ISO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cameroon	CMR	30.3	28.9	27.6	26.6	29.0	28.6	27.8	28.3	27.7	26.4	28.9	29.3	28.0
Canada	CAN	12.7	12.0	11.6	11.5	13.2	12.2	11.7	11.6	11.5	11.1	12.1	12.3	12.0
Central African Republic	CAF	39.4	38.0	36.5	35.4	35.3	34.7	32.8	32.9	38.8	36.2	35.7	35.9	34.5
Chad	TCD	39.3	38.4	38.0	37.0	38.5	37.1	35.8	36.1	36.2	34.4	38.0	39.9	39.3
Chile	CHL	16.4	15.4	15.0	14.9	16.7	15.2	14.1	14.1	14.3	14.8	15.9	16.9	16.8
China	CHN	14.0	13.9	13.2	12.6	12.8	12.1	11.8	11.9	11.6	11.0	11.5	11.3	11.1
Colombia	COL	33.7	31.9	31.3	28.9	31.4	29.9	25.7	25.2	25.8	26.0	28.6	30.0	29.9
Comoros	COM	33.1	32.4	32.2	29.2	29.5	28.5	26.4	26.5	25.6	25.6	29.1	30.1	27.9
Congo, Dem. Rep.	COD	51.8	50.9	48.0	46.7	49.0	46.0	45.0	45.0	43.1	41.7	43.4	44.5	43.0
Congo, Rep.	COG	45.1	42.3	43.4	38.3	41.6	37.8	35.1	37.7	37.2	37.5	43.7	43.7	42.2
Costa Rica	CRI	23.2	22.9	22.7	22.1	23.7	23.4	23.1	22.4	22.2	22.0	21.7	21.4	21.2
Cote d'Ivoire	CIV	39.3	38.5	37.7	35.6	35.2	34.6	34.5	34.2	33.2	31.7	33.0	33.6	33.7
Croatia	HRV	25.8	25.1	23.6	21.6	24.4	24.6	23.7	24.6	24.0	23.8	24.7	23.6	22.7
Cyprus	CYP	27.5	26.7	24.7	23.1	26.0	26.0	26.2	27.1	27.0	25.6	26.6	26.7	25.2
Czech Republic	CZE	15.1	14.3	13.0	12.1	13.8	13.5	12.4	12.5	12.7	12.1	12.2	12.3	11.7
Denmark	DNK	12.6	11.8	11.2	10.9	13.3	13.0	12.0	12.4	11.9	11.1	12.0	12.1	11.7
Dominican Republic	DOM	31.5	31.0	30.4	30.3	31.8	30.3	29.2	29.0	28.6	28.0	28.6	27.5	27.5
Ecuador	ECU	33.0	32.3	31.8	30.8	33.9	31.8	30.0	29.7	29.2	29.2	31.0	31.3	30.6
Egypt, Arab Rep.	EGY	36.3	35.4	32.8	30.1	31.0	30.5	31.3	29.9	30.3	31.0	30.3	30.0	30.7
El Salvador	SLV	43.4	43.0	42.1	41.4	44.7	43.2	40.8	40.2	39.6	38.6	38.8	39.1	39.2
Equatorial Guinea	GNQ	28.7	29.0	26.7	23.9	27.6	26.4	26.0	26.0	28.1	29.1	34.0	35.6	35.1
Estonia	EST	23.7	22.3	21.0	21.1	24.1	22.7	20.1	20.0	19.6	19.3	21.0	20.9	20.1
Ethiopia	ETH	37.8	36.0	34.5	33.3	32.9	33.5	31.7	29.4	29.6	28.0	27.2	27.0	26.9
Fiji	FJI	26.7	27.3	26.6	27.6	30.1	29.6	27.9	27.5	26.9	24.9	25.3	24.4	23.4
Finland	FIN	11.3	10.9	10.1	9.7	11.3	11.1	10.6	11.1	11.1	10.6	11.5	11.4	10.8
France	FRA	12.5	11.8	10.8	10.1	12.1	11.8	11.1	11.7	11.6	11.4	12.2	12.2	11.7

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part II (2005–2017)**

Country	ISO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Gabon	GAB	49.7	50.3	48.8	44.0	51.6	46.7	42.3	44.6	45.7	48.6	52.6	53.9	52.1
Gambia, The	GMB	45.8	45.9	44.4	44.4	45.5	45.6	46.4	45.5	42.5	45.3	45.8	45.3	44.0
Georgia	GEO	65.2	62.2	62.0	60.8	62.8	59.8	54.9	52.5	51.2	50.4	53.5	53.4	51.5
Germany	DEU	10.9	10.0	8.9	8.7	11.0	10.6	9.5	9.9	9.9	9.2	10.2	10.7	10.4
Ghana	GHA	46.1	39.8	38.6	38.0	37.8	35.7	38.5	36.2	31.9	34.3	33.9	33.2	31.8
Greece	GRC	23.5	22.5	20.9	19.7	22.8	23.1	23.0	24.3	23.7	23.6	25.3	25.4	24.8
Guatemala	GTM	50.4	49.5	48.8	48.2	50.2	48.2	46.6	46.8	46.7	44.8	43.4	43.4	42.0
Guinea	GIN	39.4	36.8	32.9	32.1	33.9	34.4	34.8	33.2	33.8	33.1	33.5	31.8	30.7
Guinea-Bissau	GNB	36.9	35.7	32.7	30.3	30.8	31.5	27.6	32.0	30.4	32.0	30.1	29.1	26.9
Guyana	GUY	34.7	30.6	29.3	29.3	29.0	27.7	26.9	25.5	26.1	26.7	26.4	24.8	24.5
Haiti	HTI	54.7	53.4	55.7	51.2	51.2	49.2	48.4	48.3	47.5	46.7	47.3	47.9	47.2
Honduras	HND	47.2	47.3	46.7	46.1	49.1	46.7	43.4	44.5	45.8	42.9	41.5	42.6	41.0
Hong Kong SAR, China	HKG	15.4	14.8	14.2	14.1	14.7	13.8	13.2	13.1	12.8	12.4	12.3	12.4	11.8
Hungary	HUN	22.3	21.5	19.7	18.9	21.2	20.7	19.7	20.4	19.9	19.8	20.8	20.5	19.8
Iceland	ISL	12.1	12.0	10.9	12.0	13.9	13.5	12.9	12.9	12.7	12.1	12.2	11.6	10.8
India	IND	23.1	21.7	20.9	21.6	22.8	21.1	20.6	20.1	19.7	19.5	19.6	19.0	18.5
Indonesia	IDN	24.5	24.5	23.7	22.9	24.3	22.1	20.8	20.9	21.2	21.0	22.1	21.6	20.5
Iran, Islamic Rep.	IRN	17.0	17.0	15.4	15.0	15.8	15.1	13.7	13.2	14.4	15.6	17.2	16.6	15.9
Ireland	IRL	12.2	11.8	11.4	11.8	12.6	12.3	12.0	12.0	11.7	11.0	9.5	9.7	9.6
Israel	ISR	21.6	21.0	20.0	19.0	20.5	19.2	17.7	18.3	17.7	17.1	17.6	17.6	17.0
Italy	ITA	21.2	20.5	18.4	18.1	21.2	20.8	18.9	20.0	20.0	19.7	20.9	20.6	19.8
Jamaica	JAM	34.3	32.5	32.2	31.0	35.4	34.5	32.5	32.6	32.6	31.9	31.5	31.7	29.9
Japan	JPN	11.5	11.6	11.5	10.7	11.0	10.0	9.3	9.2	10.7	10.8	11.7	11.1	10.8
Jordan	JOR	16.7	16.6	16.0	14.3	15.9	15.5	15.1	14.6	14.4	14.1	14.4	14.9	14.9
Kazakhstan	KAZ	40.0	38.3	37.4	34.7	37.9	35.5	32.9	33.2	31.1	32.3	35.6	37.7	35.8
Kenya	KEN	34.1	31.4	30.9	30.8	31.2	29.7	28.7	27.4	27.3	25.9	26.7	26.0	24.4

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part II (2005–2017)**

Country	ISO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Korea, Rep.	KOR	25.6	25.4	24.0	25.1	26.1	24.1	22.9	23.1	23.0	22.5	23.2	22.7	21.8
Kuwait	KWT	17.3	16.4	15.8	14.5	17.3	16.7	15.3	14.9	15.5	16.6	18.9	19.4	18.9
Kyrgyz Republic	KGZ	37.7	36.8	33.7	31.4	33.4	33.0	30.4	30.9	28.8	28.0	30.4	30.6	29.0
Lao PDR	LAO	31.0	29.4	28.9	27.7	30.5	28.5	27.1	26.3	26.6	24.8	25.1	24.3	23.7
Latvia	LVA	22.8	21.6	19.8	19.5	21.3	20.8	19.3	18.7	18.4	17.9	19.1	18.8	18.0
Lebanon	LBN	31.9	32.5	31.3	29.4	28.1	27.2	27.1	27.3	27.6	28.2	28.7	28.9	28.6
Lesotho	LSO	28.2	28.0	29.7	29.3	29.9	28.0	25.9	26.7	27.7	27.8	27.8	28.5	26.5
Liberia	LBR	41.3	39.2	39.8	42.4	42.2	40.9	39.9	38.9	39.4	38.2	38.6	38.3	38.6
Libya	LBY	31.0	29.3	26.9	22.5	29.5	27.4	35.8	26.5	29.2	33.7	37.0	39.1	37.0
Lithuania	LTU	26.4	25.6	23.8	22.5	25.2	24.1	22.0	21.5	20.5	20.0	21.3	21.0	19.7
Luxembourg	LUX	9.8	9.1	8.1	7.9	9.2	8.8	8.4	9.0	8.7	7.9	8.5	8.7	8.8
Madagascar	MDG	38.9	38.4	39.4	34.5	37.1	39.1	37.6	37.9	38.5	37.4	39.1	38.3	38.1
Malawi	MWI	34.5	34.9	33.7	32.3	32.6	30.6	29.7	32.5	33.2	32.2	33.1	33.9	33.9
Malaysia	MYS	29.8	29.1	28.8	28.4	31.2	28.7	28.0	28.4	28.4	26.9	29.3	28.8	28.4
Maldives	MDV	31.4	32.1	28.1	25.5	27.4	26.9	25.7	26.1	25.7	24.9	25.4	25.0	24.9
Mali	MLI	36.6	34.8	34.6	33.1	34.7	34.1	34.8	33.3	32.7	32.2	33.6	33.4	33.1
Malta	MLT	25.8	25.1	23.2	23.2	24.0	23.5	23.1	23.8	22.6	21.9	21.5	20.1	18.6
Mauritania	MRT	34.4	32.2	32.1	30.6	31.6	29.5	27.2	27.3	27.2	28.9	30.6	30.8	29.5
Mauritius	MUS	22.1	21.5	19.1	17.8	20.8	20.0	18.2	17.8	19.5	19.5	20.7	21.5	21.0
Mexico	MEX	28.7	28.1	27.7	28.1	31.4	29.2	27.7	27.7	27.4	26.6	28.0	28.8	28.1
Moldova	MDA	41.9	43.5	41.8	39.8	43.3	40.2	37.1	36.8	35.5	34.7	37.6	38.2	35.7
Mongolia	MNG	17.4	17.3	17.1	16.6	17.2	16.2	14.0	14.0	14.2	14.1	15.0	15.2	14.5
Morocco	MAR	34.3	33.1	31.1	28.3	30.5	29.8	29.2	30.6	30.1	29.3	30.4	30.3	29.2
Mozambique	MOZ	36.9	36.4	35.3	33.2	34.5	35.1	32.5	30.0	31.3	31.3	34.6	39.5	37.2
Myanmar	MMR	51.0	50.1	48.4	47.3	46.5	43.8	41.5	41.1	40.8	40.3	41.4	40.0	36.4
Namibia	NAM	27.7	26.0	25.9	23.4	24.4	24.4	22.9	23.1	24.3	24.8	25.1	24.5	24.4

Appendix A**Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part II (2005–2017)**

Country	ISO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Nepal	NPL	38.1	36.7	36.8	36.5	37.9	35.5	33.7	34.7	32.7	32.0	32.0	34.0	31.1
Netherlands	NLD	9.6	9.4	8.8	8.4	9.4	9.4	8.9	9.1	9.0	8.6	9.0	9.1	8.8
New Zealand	NZL	11.0	11.3	10.7	10.9	11.7	11.0	10.3	10.4	9.9	9.5	10.0	10.1	9.7
Nicaragua	NIC	41.7	42.4	41.3	39.9	40.8	39.9	37.3	36.4	35.7	35.2	35.1	34.1	33.8
Niger	NER	40.8	39.5	39.1	37.5	36.9	34.0	33.7	34.0	33.4	34.1	37.7	38.0	36.7
Nigeria	NGA	59.1	54.2	56.3	53.8	56.7	53.2	50.2	49.9	49.7	47.6	51.8	54.9	53.8
Norway	NOR	11.8	10.8	10.3	9.4	12.4	11.7	10.9	10.8	10.9	11.1	12.5	13.1	12.7
Oman	OMN	17.8	16.9	15.9	12.6	15.7	14.1	13.5	13.3	13.7	14.8	17.3	18.4	17.4
Pakistan	PAK	32.8	33.0	32.9	32.1	32.9	31.8	30.9	31.2	31.2	30.6	30.6	31.7	30.1
Papua New Guinea	PNG	36.6	33.9	33.3	32.9	33.1	31.8	29.8	28.4	29.1	27.8	28.9	29.1	28.7
Paraguay	PRY	36.8	36.1	34.5	31.8	34.6	32.2	31.0	33.0	31.1	30.7	32.6	32.3	31.0
Peru	PER	56.6	54.1	52.1	49.8	51.7	47.2	44.4	43.6	44.0	45.6	46.9	47.3	45.9
Philippines	PHL	39.6	39.1	38.5	37.6	40.2	38.1	37.0	37.5	36.4	35.2	35.5	35.4	34.9
Poland	POL	24.6	24.0	22.5	20.9	22.3	21.5	20.0	20.3	19.9	19.4	20.2	20.4	19.9
Portugal	PRT	20.0	19.6	18.0	17.2	19.1	18.6	17.6	17.7	17.5	16.7	17.4	17.1	16.1
Qatar	QAT	16.6	15.8	15.5	14.6	16.9	15.8	13.8	13.1	13.5	13.9	16.3	16.8	16.6
Romania	ROM	31.0	29.7	27.1	25.5	27.4	26.5	24.4	25.1	23.7	23.2	23.7	23.8	23.0
Russian Federation	RUS	40.0	39.3	37.7	35.9	40.4	36.7	32.6	32.5	32.5	33.0	37.0	38.4	36.5
Rwanda	RWA	38.1	37.1	34.9	32.2	31.9	31.4	29.8	29.1	28.6	28.6	28.0	28.5	27.7
Saudi Arabia	SAU	15.7	15.1	14.3	12.9	15.0	13.8	12.7	12.2	12.7	13.4	15.6	14.8	15.1
Senegal	SEN	39.2	39.6	38.9	36.8	40.5	41.1	39.3	38.3	37.6	40.7	43.2	43.3	36.8
Sierra Leone	SLE	42.0	41.4	39.6	39.2	40.0	39.2	36.1	33.0	29.1	28.4	34.1	36.6	35.4
Singapore	SGP	11.5	11.2	10.7	10.7	11.4	10.5	9.7	9.4	9.8	9.6	10.3	10.5	10.2
Slovak Republic	SVK	14.9	14.4	13.2	12.6	14.3	13.9	12.9	13.1	12.9	12.9	13.6	13.2	13.1
Slovenia	SVN	22.9	21.8	19.2	18.3	21.3	21.9	20.9	21.7	20.8	19.7	20.7	20.2	19.0
Solomon Islands	SLB	36.1	35.8	33.3	30.8	31.9	29.6	26.5	25.4	25.1	25.2	26.1	25.4	24.5

Appendix A: Table A.1: Size and development of the shadow economy, 1991 to 2017 – Part II (2005–2017)

Country	ISO	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
South Africa	ZAF	26.2	22.8	22.5	23.5	25.6	23.7	21.9	23.3	24.1	24.7	26.0	27.3	26.9
Spain	ESP	20.6	19.9	18.7	18.6	21.3	21.3	20.6	21.3	21.1	20.9	21.9	21.3	20.3
Sri Lanka	LKA	46.2	47.0	46.6	46.8	48.9	41.0	38.9	38.3	38.3	37.3	36.9	36.6	35.5
Suriname	SUR	37.9	37.1	35.9	33.5	34.8	32.9	31.6	30.7	30.3	30.7	32.1	35.3	35.7
Swaziland	SWZ	39.4	38.7	38.9	40.5	40.4	37.5	35.5	35.2	36.2	36.6	39.0	41.6	39.3
Sweden	SWE	11.4	10.7	9.6	9.5	11.5	10.3	9.5	10.2	10.2	10.1	10.7	10.9	10.7
Switzerland	CHE	6.4	6.1	5.5	5.3	6.0	5.6	5.1	5.3	5.3	5.1	5.4	5.4	5.4
Syrian Arab Republic	SYR	17.6	16.5	16.1	19.4	18.3	18.5	18.7	19.1	19.6	19.3	19.4	20.0	20.0
Taiwan	TWN	28.2	27.7	26.8	27.1	28.5	25.7	25.3	25.2	24.7	23.3	23.3	23.2	22.8
Tajikistan	TJK	42.6	40.5	38.4	36.9	39.2	38.0	37.4	35.3	34.9	34.0	37.0	38.7	40.4
Tanzania	TZA	56.5	57.6	55.6	51.7	54.0	51.6	50.0	49.1	47.2	45.4	47.2	47.1	46.9
Thailand	THA	50.2	49.1	48.0	46.6	49.8	46.4	44.7	43.7	43.0	44.2	45.0	44.3	41.9
Togo	TGO	33.9	33.6	33.8	30.5	30.7	29.8	28.7	29.9	29.2	28.7	30.4	31.6	32.1
Trinidad and Tobago	TTO	32.1	32.2	31.2	28.9	32.9	31.7	30.2	30.1	29.3	28.9	29.9	31.7	31.4
Tunisia	TUN	33.6	32.0	29.5	26.4	29.4	28.5	30.4	30.9	31.5	31.2	34.3	35.6	35.6
Turkey	TUR	28.8	28.9	28.1	26.9	30.6	28.5	26.2	26.5	25.8	26.2	27.7	29.1	28.6
Uganda	UGA	40.3	38.4	36.3	33.5	31.6	30.9	31.9	28.4	28.1	28.0	28.8	29.4	29.8
Ukraine	UKR	44.2	42.9	39.0	34.9	42.9	41.0	36.7	36.3	36.3	39.6	43.6	43.0	42.3
United Arab Emirates	ARE	23.5	22.5	22.2	20.7	26.1	25.9	23.1	22.0	21.5	20.8	23.1	22.7	22.1
United Kingdom	GBR	10.3	9.4	9.1	9.4	10.7	10.3	9.9	9.7	9.5	8.7	9.2	9.7	9.4
United States	USA	7.4	7.1	7.0	7.0	7.8	7.4	7.0	6.7	6.6	6.1	6.1	5.9	5.7
Uruguay	URY	43.4	42.7	41.9	40.2	41.5	38.8	36.9	37.4	36.9	36.3	37.9	40.2	39.7
Venezuela, RB	VEN	33.3	32.9	32.4	30.5	33.1	29.3	31.2	29.7	29.7	28.7	33.7	34.8	35.4
Vietnam	VNM	17.6	17.6	17.1	16.5	16.7	16.4	15.6	15.2	14.8	14.2	14.0	13.2	12.5
Yemen, Rep.	YEM	24.8	24.5	24.0	23.4	24.4	23.1	23.3	22.9	21.8	21.5	22.1	25.4	26.6
Zambia	ZMB	49.9	47.6	45.6	41.9	44.6	38.1	35.6	34.7	32.5	34.7	38.3	40.4	39.3
Zimbabwe	ZWE	58.1	54.4	53.7	51.9	53.5	51.0	49.5	48.0	47.0	47.4	46.5	46.5	46.0

Appendix B: The problem of “double counting”

One big problem with macro approaches such as the MIMIC or CDA is that they use causal factors like tax burden, unemployment, self-employment and regulation, which are also responsible for people undertaking do-it-yourself activities or asking friends and neighbors to do things. Hence, do-it-yourself activities, neighbors’ or friends help and legally bought material for shadow economy activities are included in these macro approaches. This means that in these macro approaches (including the electricity approach, too) a “total” shadow economy is estimated which includes do-it-yourself activities, neighbors’ help, legally bought material and smuggling²⁶.

In Table B1 a decomposition of the shadow economy activities for the countries Estonia and Germany is undertaken. Table B1 starts with line (1) of the macro MIMIC estimates of 24.94 percent in Estonia as an average value for 2009 to 2015 and 9.37 percent for Germany for an average over 2009 to 2015. Legally bought material for shadow economy or do-it-yourself activities and friends’ help are deducted. Then illegal activities such as smuggling are deducted. Furthermore, do-it-yourself activities and neighbors’ help are deducted. Due to these factors from lines (2) to (4) one gets a corrected shadow economy which is roughly two thirds of the macro size of the shadow economy. It is 65 percent for Estonia and 64.2 percent for Germany. In the following, this correction factor is used to calculate an adjusted size of the shadow economy using the MIMIC method. The results for 31 European countries for 2017 are presented in Figure B1. The adjusted shadow economy values appear considerably smaller and this might be a more realistic value of the actual size of the shadow economy using a macro method.

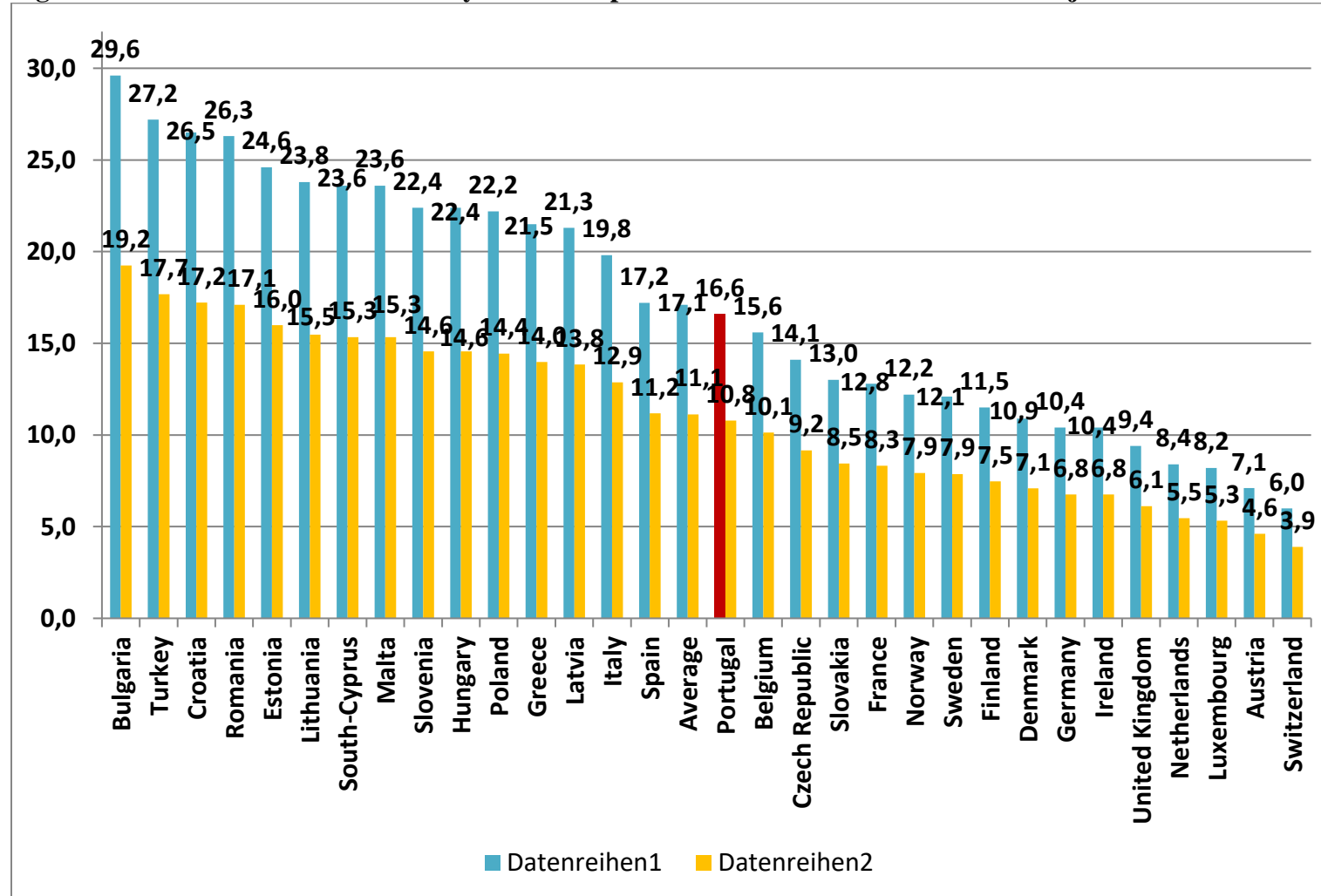
²⁶ A more elaborated and extended discussion is done in Feld and Schneider (2016), and in Medina and Schneider (2018)

Table B1. Decomposition of shadow economy activities in Estonia and Germany

No.	Kinds of shadow economy activities (rough estimates!)	Estonia		Germany	
		Size in percent of official GDP average 2009–2015	Proportion of total shadow economy (percent)	Size in percent of official GDP average 2009–2015	Proportion of total shadow economy (percent)
1	Total shadow economy (estimated by the MIMIC and calibrated by the currency demand procedures)	24.94	100	9.37	100
2	Legally bought material for shadow economy and DIY activities	5.24	21	1.79	19.1
3	Illegal activities (smuggling etc.)	1.75	7	0.69	7.4
4	Do-it-yourself activities and neighbors' help ¹⁾	1.75	7	0.86	9.2
5	Sum (2), (3) and (4)	8.73	35	3.35	35.7
6	“Corrected” shadow economy, but legal activities (position (1) minus position (5))	16.21	65	6.02	64.2
	¹⁾ Without legally bought material which is included in (2)				

Source: Own calculations based on the work of Enste and Schneider (2006) and Buehn and Schneider (2012), p.12., and Feld and Schneider (2016)

Figure B1: Size of the shadow economy of 31 European countries in 2017 – macro and adjusted MIMIC estimates



Source: Own calculations.