

Size and Development of the Shadow Economies of 157 Worldwide Countries: Updated and New Measures from 1999 to 2013

Hassan Mai^{1*} and Schneider Friedrich²

¹Department of Middle East Economics, Center of Near and Middle Eastern Studies (CNMS), Philipps-University of Marburg, Germany

²Department of Economics, Johannes Kepler University of Linz, Austria

Abstract

This paper is a first attempt to study the size and development of the shadow economies of 157 countries between 1999 and 2013. Using a MIMIC model, we find that higher tax and regulatory burden, unemployment and self-employment rates are drivers of the shadow economy, meaning that an increase in these causal variables increases the shadow economy. Our result also confirms previous findings of Friedrich Schneider, Andreas Buehn and Claudia Montenegro. The estimated average of informality of 157 countries around the world, including developing, eastern European, central Asian and high income OECD countries averaged over 1999 to 2013 is 33.77% of official GDP. A critical discussion about the size of these macro-estimates comes to the conclusion that most likely the "true" shadow economy of these countries is only 69% of their estimated macro-MIMIC-values.

Keywords: Shadow economies of 157 countries; Quality of institutions; Tax burden; MIMIC model

Introduction

Many studies have investigated the dynamic nature of the shadow economy, yet there is no unified definition of the shadow economy. Generally, the shadow economy is known by different names such as the hidden, grey, black or informal economy. All these synonyms refer to some type of shadow economic activities. The shadow economy includes all economic activities that are deliberately hidden from official authorities for various reasons. These vary from being monetary, to regulatory, to institutional reasons. Monetary reasons include avoiding paying taxes and/or social security contributions, regulatory reasons include avoiding governmental bureaucracy or the burden of regulatory framework, while institutional reasons include corruption, low quality of political institutions and weak rule of law.

Given the purpose of our study, the shadow economy reflects mostly the 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, charitable or household activities¹. Whether we succeed in doing this is an open question, because the traditional drivers of a shadow economy (e.g. tax and regulatory burden, unemployment, etc.) are quite often also responsible for some crime activities (e.g. smuggling) and do-it-yourself actions. Although the shadow economy is unobserved and it is very challenging to reach a unified definition, it is important to define the shadow economy in view of the current study in order to correctly model the unobserved economy by including variables that lead to and reflect the existence of the shadow economy. As our goal is to estimate the size of the shadow economy in a roughly comparable way over countries, we focus mainly on the major macroeconomic variables that affect individuals' motivation to participate in market-based informal activities.

The existence of the shadow economy in a country leads to diverse effects that influence the official economic and social life of the country. The shadow economy creates inefficiencies in the labor market, is a source of resource allocation distortions, leads to biases in official indicators such as an upward bias in the unemployment

rate, and/or creates a vicious cycle of continuous increases in the tax base. However, the shadow economy is not necessarily seen as a foe to the overall economy. Individuals spend income earned in the shadow economy later in the formal economy, leading to stimulating effects. For instance, two thirds of the income earned in the shadow economy is later spent in the formal economy [1-3]. In developing countries, companies are able to either buy or manufacture secondary inputs in the shadow economy which then helps the overall economy by creating some jobs that would otherwise would be not be available. Also, individuals can buy cheaper goods or services from the shadow economy. Last but not least, the shadow economy is a safe harbor in times of turmoil and recession, acting like an employer of last resort.

The purpose of our study is twofold: First, to estimate the size of the shadow economy of 157 countries all over the world measured as a percentage of GDP by using a MIMIC model from 1999 to 2013. Second, a critical discussion about the size of the macro-estimates of these shadow economies follows, suggesting a correction factor in order to reach the "true" size. To our knowledge this has not been done before.

Our paper is organized as follows: In section 4, the MIMIC model as well as the theoretical background of the exogenous variables is explained. The MIMIC estimation of the size of the shadow economy is shown in section 5. Section 6 shows the results and implications including a critical discussion about the size of the shadow economy from these macro-estimates. Finally, section 7 concludes.

Measuring the Shadow Economy

There are different methods that can be applied to measure the size and the development of the shadow economy over time. These include

***Corresponding author:** Hassan Mai, Department of Middle East Economics, Center of Near and Middle Eastern Studies (CNMS), Philipps-University of Marburg, Germany, Tel: 0043-732-2468-7340; E-mail: mai.hassan@staff.uni-marburg.de

Received September 08, 2016; **Accepted** September 16, 2016; **Published** September 21, 2016

Citation: Hassan Mai, Schneider Friedrich (2016) Size and Development of the Shadow Economies of 157 Worldwide Countries: Updated and New Measures from 1999 to 2013. J Glob Econ 4: 218. doi: [10.4172/2375-4389.1000218](https://doi.org/10.4172/2375-4389.1000218)

Copyright: © 2016 Hassan Mai, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

¹Of course, we are aware that there are overlapping areas, like prostitution, illegal construction firms, compare e.g. Williams and Schneider (2016).

direct methods such as survey methods, indirect methods known as indicator approaches, and lastly the model as latent approach which is a statistical method such as the MIMIC model².

The MIMIC model is a special type of structural equation modelling (SEM) that is widely applied in psychometrics and social science research and is based on the statistical theory of unobserved variables developed in the 1970s by Zellner [4] and Joreskog et al. [5]. The MIMIC model is a theory-based approach to confirm the influence of a set of exogenous causal variables on the latent variable (shadow economy), and also the effect of the shadow economy on macroeconomic indicator variables [6]. At first, it is important to establish a theoretical model explaining the relationship between the exogenous variables and the latent variable. Therefore, the MIMIC model is considered to be a confirmatory rather than an explanatory method [7,8]. The hypothesized path of the relationships between the observed variables and the latent shadow economy based on our theoretical considerations is depicted in the following Figure 1.

The pioneers to apply the MIMIC model to measure the size of the shadow economy in 17 OECD countries were Frey et al. [9]. Following them, various scholars like Tafenau et al. [10], Tedds [11], Schneider et al. [7], Dell'Anno [12], Hassan et al. [13], Buehn et al. [14], Farzanegan [6], and Chaudhuri et al. [15] applied the MIMIC model to measure the size of the shadow economy.

Formally, the MIMIC model has two parts: the structural model and the measurement model. The structural model shows that the latent variable η is linearly determined by a set of exogenous causal variables which can be illustrated as follows:

$$\eta = \gamma' \chi + \zeta \tag{1}$$

Where,

χ is a vector of causal variables, γ is a vector of scalars, η is the latent variable (shadow economy) and ζ is a structural disturbance term.

The measurement model which links the shadow economy with the set of selected indicators is specified by:

$$y = \lambda \eta + \varepsilon \tag{2}$$

Where, y is a vector of indicator variables, and λ is a vector of loading factors to represent the magnitude of the expected change for a unit change in the latent variable η . The ε is the measurement error term.

The MIMIC model simultaneously takes into account different causes and indicators that directly influence the development of the size of the shadow economy over time. In the following, some theoretical considerations of the different cause and indicator variables are made.

Causal variables³

Tax burden: It is widely accepted in the literature that the most important cause leading to the proliferation of the shadow economy is the tax burden. The higher the overall tax burden, the stronger the incentives to operate informally in order to avoid paying taxes. However, it is important to note that in countries where the tax base is large, the shadow economy may not be large and this can be explained by the good institutional framework that such a country enjoys⁴. As a result of this phenomenon, we include in our model institutional

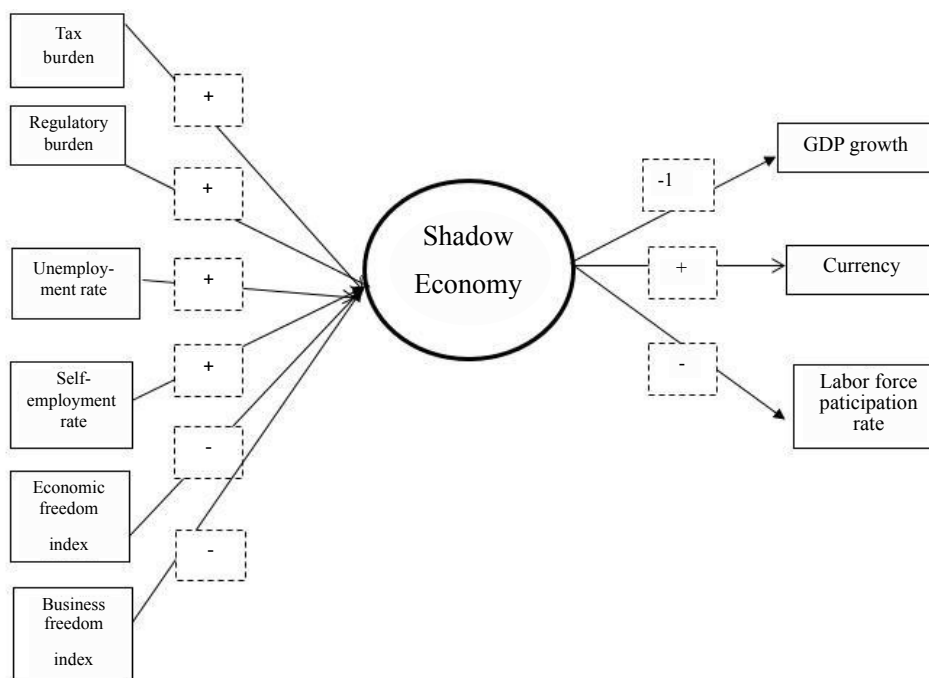


Figure 1: Hypothesized MIMIC path for estimating the shadow economy.

²As there is available a huge literature about the various methods available to measure a shadow economy, a detailed overview about it as well as the problems using these methods (including the MIMIC method) are not discussed here. See e.g. Schneider and Enste (2002), Feld and Schneider (2010), Schneider, Büehn and Montenegro (2010), Schneider (2010, 2015), Schneider and Williams (2013), Williams and Schneider (2016).

³We are aware that there are more causal variables than the five included here, but due to a lack of data we could include only the five shown.

⁴The explanation is the following: When taxpayers/voters get a high quality of goods and services from the state, they are willing to pay taxes for these publicly provided goods and services.

quality variables such as economic freedom, and business freedom indices. A statistically significant and positive effect of the tax burden on the development of the shadow economy has been found by various studies including Tanzi [16], Alañón et al. [17], Schneider [2], Buehn [18], and Hassan et al. [13]. In our MIMIC model, tax burden is proxied by total tax revenues as a percentage of GDP.

Hypothesis 1: The higher the tax burden, the larger the size of the shadow economy, *ceteris paribus*.

Regulatory burden: Intensive regulation leads to bureaucracy, limits business freedom, and decreases entrepreneurship entry, thus leading to higher motivation to participate in the shadow economy. Buehn et al. [19], Johnson et al. [20], and Loayza NV [21] concluded that regulatory burden leads to larger sizes of shadow economy. In our MIMIC model, regulatory burden is proxied by total government spending as a percentage of GDP.

Hypothesis 2: The more intensive the regulatory burden is, the larger the size of the shadow economy, *ceteris paribus*.

Unemployment rate: Unemployment has an ambiguous effect on the development of the shadow economy. On one hand, some authors including Schneider et al. [7] and Dell'Anno et al. [22] found that higher unemployment rates pushed individuals to operate in the shadow economy to find jobs. On the other hand, it is argued that when the overall economy is in steady recession and unemployment continuously increases, unemployment does not play a major role in affecting the size of the shadow economy. For instance, in Egypt, unemployment does not affect the development of the shadow economy over time because the availability of jobs in both the informal and formal economy is limited as there is continuous contraction of the overall economy and the unemployment rate is always high [13]. However, we assume that, in general, unemployment creates incentives to work in the shadow economy. In the MIMIC model, the unemployment rate is measured by total unemployment as a percentage of the labor force.

Hypothesis 3: The higher the unemployment, the larger the size of the shadow economy, *ceteris paribus*.

Self-employment rate: It is accepted that self-employment has a positive and significant effect on the size of the shadow economy, as concluded by various authors like Dell'Anno et al. [22], Tedds [11] and Hassan and Schneider [13]. It is expected that the self-employed are highly motivated to avoid complying with tax regulations because they have a great number of legal and "illegal" tax deductions. Also, they enjoy direct business relationships with customers, which allows them to bargain with their customers to reach "tax saving" agreements. Last, the self-employed are more likely to employ irregular and informal employees because they have weak and lesser auditing controls relative to bigger and more formal organizations. In our model, self-employment is measured by total self-employed as a percentage of total employed.

Hypothesis 4: The higher the self-employment rate, the larger the size of the shadow economy, *ceteris paribus*.

Institutional quality: In addition to the macroeconomic variables, it is critical to examine the effect of the quality of institutions on the size and development of the shadow economy. Various authors have studied the quality of public institutions as a determining variable of the shadow economy. Based on different studies, Schneider [2], Razmi et al. [23] and Hassan and Schneider [13] concluded that the quality of institutions significantly affects people's motivations to participate in the shadow economy.

It is expected that efficient regulation and good rule of law, freedom to start a new business, secure property rights and enforceable contracts increase the benefits of remaining in the official economy and increase the costs of informality. However, corruption, bureaucracy and regulatory burden act as a barrier to conduct and open a new business in the formal economy, pushing individuals to operate in the shadow economy.

As a proxy of institutional quality in our model, we use the economic freedom index and the business freedom index provided by the Heritage Foundation. These indices range from a scale of 0 to 100 with 100 equalling the freest environment.

Hypothesis 5: The higher the economic freedom index, the smaller the size of the shadow economy, *ceteris paribus*.

Hypothesis 6: The higher the business freedom index, the smaller the size of the shadow economy, *ceteris paribus*.

In order to investigate whether there is an interaction between a good institutional framework and the tax system, we also include an interaction variable, which is (economic freedom index) \times (tax burden). As in footnote 4 and under point 4.1.1 we want to test that under a good institutional framework people are willing to pay higher taxes than under a pure institutional framework with bad governance and high corruption. For this interaction variable we expect a negative sign.

Hypothesis 7: The better the institutional framework the more people are willing to pay taxes and work less in the shadow economy, *ceteris paribus*.

A problem: Considering these causal factors as main driving forces for the shadow economy, the following problem arises:

All these causal factors, but especially;

- Tax burden
- Regulation
- Unemployment

are major driving forces for smuggling, do-it-yourself activities⁵ and neighbours' help, too. This means, that in the MIMIC and currency demand estimations these activities are (at least partly) included; hence, these estimations are considerably higher than the "true" shadow economy estimates.

Indicator variables

After considering the different causes that affect the size of the shadow economy, the MIMIC model requires the specification of different indicators that reflect the existence of the shadow economy.

Formal economy: It is widely accepted that there is a negative relationship between the shadow economy and the formal economy as the shadow economy absorbs resources and human capital from the formal economy creating a contraction in the formal economy. Several scholars including Schneider et al. [7], Loayza [21], Buehn [19], Schneider [24], Buehn [14] as well as Hassan et al. [13] found a negative and significant relationship between the shadow economy and formal economy. In our empirical model, the formal economy is proxied by GDP growth. Since the shadow economy is not directly measured, GDP growth is our reference variable in our MIMIC model and is

⁵The amount of do-it-yourself activities has been measured for Germany by Buehn, Karmann and Schneider (2009) using also the MIMIC approach. Do-it-yourself activities reached 4.2% of GDP in 1970 and 5% in 2005; including bought material. The major causal driver for do-it-yourself activities was unemployment.

assigned the value of 1.

Hypothesis 7: The larger the size of the shadow economy, the lower the official GDP growth, *ceteris paribus*.

Currency/cash outside banks: The shadow economy is expected to be reflected in an economy by the increase in the currency in circulation because individuals who participate in informal activities prefer to pay for their informal activities in cash rather than with credit/debit cards, checks or bank transactions in order to avoid any evidence of trace by official authorities. Studies by various scholars such as Alañón et al. [17], Buehn [18], Dell’Anno et al. [22], Schneider et al. [7] and Hassan and Schneider [13] concluded that there is a significant and positive relationship between the size of the shadow economy and currency held by the public. Therefore, in the MIMIC model, currency is proxied by the ratio of M1 over M2.

Hypothesis 8: The larger the size of the shadow economy, the more money held by the public, *ceteris paribus*.

Labor force participation rate: There is controversy over whether changes in the participation rate of registered labor reflect changes in the shadow economy. On one hand, the shadow economy absorbs resources from the formal economy, as human capital shifts to the shadow economy and hence moves human resources from the formal economy to the informal economy. Several authors, including Bajada et al. [25], Dell’Anno et al. [22] and Schneider et al. [7] included labor force rate as an indicator to mirror the existence of the shadow economy. Therefore, we expect that there is a negative relationship between labor force and the shadow economy. On the other hand, it is counter argued that a decline in the labor force participation rate does not truly reflect informal shadow economic activities because the registered official labor force does not totally withdraw itself from the formal economy and thus might conduct informal activities during holidays, after working hours, or on weekends. Dell’Anno [12] found evidence of a positive significant relationship between the shadow economy and labor force participation for the case of Portugal.

In our model, the labor force participation rate is measured by the total of workforce as a percentage of total population. If we find that there is a negative relationship, then registered official labor shifts from the formal economy to the informal economy, but based on our estimations, labor force participation rate is a weak indicator of the shadow economy.

Hypothesis 9: The larger the size of the shadow economy, the lower the official labor force participation rate, *ceteris paribus*.

Estimation of the Size of the Shadow Economy

After establishing an economic theoretical model explaining the expected relationship between the latent variable and the observed variables as shown in Figure 1, the MIMIC model tests these theoretical considerations and may confirm the hypothesized relationships between the latent variable η (shadow economy) and its causes and indicators. The maximum likelihood method (ML) will be applied to estimate the parameters of the MIMIC model. Then, the time series MIMIC index based on equation (1) is calculated by multiplying the coefficients of the significant causal variables with the respective time series. The MIMIC model produces only an index of the trend of the size of the shadow economy; meaning that it only tells us about changes in the ratio of the size of the shadow economy from year to year. Thus an additional step is required to calibrate this index in order to calculate the

size of the shadow economy as a percentage of GDP. This step is called the benchmarking step and it requires an exogenous estimate of the size of the shadow economy at a certain point in time. For our case, the exogenous size of the shadow economy for the different countries in our sample is extracted from Schneider et al. [7]. The benchmarking procedure and the MIMIC methodology are explained in the appendix (A1 and A2).

It is important to note that in the MIMIC model estimation we need to fix an indicator variable in the measurement equation (2) [26]. This is required in order to have a reference variable to set a unit of measurement (i.e., as percentage of GDP) for the shadow economy because it is, by nature, unobserved. In our MIMIC estimations, the reference variable is GDP growth in percentage points and the associated sign to our reference variable is -1. The strategy to determine the sign of the reference variable is called ‘*reductio ad absurdum*’ which is based on our theoretical assumptions and theory regarding the expected relationship between the exogenous variables and the unobserved shadow economy [22].

Variables/spec	MIMIC 1 5-1-3	MIMIC 2 4-1-3	MIMIC 3 4-1-2	MIMIC 4 3-1-3	MIMIC 5 5-1-3
Causes					
Tax burden	0.15** (2.07)	0.15** (2.07)	0.15* (2.06)	0.34*** (2.80)	0.17** (2.21)
Regulatory burden	0.29*** (2.74)	0.29*** (2.74)	0.29*** (2.73)	—	0.29*** (0.10)
Unemployment rate (first difference)	0.53*** (2.87)	0.53*** (2.87)	0.52*** (2.86)	—	0.55*** (2.95)
Economic Freedom Index (first difference)	-0.09* (-1.90)	-0.10* (-1.97)	-0.09** (-1.93)	-0.11 (-1.64)	-0.06 (-1.34)
Business Freedom Index (first difference)	-0.007 (-0.19)	—	—	—	—
Tax burden*economic freedom index	—	—	—	-0.25*** (-2.63)	-0.15** (-2.32)
Indicators					
GDP growth	-1*** (-2.62)	-1*** (-2.97)	-1*** (2.55)	-1*** (-2.93)	-1*** (-3.07)
Currency (first difference)	0.09** (2.49)	0.09** (2.49)	0.09*** (2.55)	0.12** (2.23)	0.10** (2.57)
Labor force rate (first difference)	-0.02 (-0.54)	-0.02 (-0.55)	—	-0.03 (-0.75)	-0.02 (-0.58)
Chi ² (pvalue)	12.12 (0.2770)	11.46 (0.1768)	5.44 (0.1423)	8.79 (0.1858)	13.09 (0.2187)
GFI	0.94	0.94	0.97	0.86	0.94
CFI	0.988	0.972	0.985	0.945	0.977
CD	0.461	0.460	0.438	0.201	0.514
RMSEA	0.010	0.014	0.019	0.015	0.012
Degrees of freedom	35	27	20	20	35
Number of observations	2,198	2,198	2,198	2,198	2,198
Number of countries	157	157	157	157	157

Notes: Absolute z-statistics are reported in parentheses. *, **, *** denote significance at 10, 5 and 1% significance levels. Goodness of fit index (GFI): values closer to 0.90 reflect a perfect fit. CFI: when the comparative fit index is closer to one, it indicates a good model fit. SRMR: The values less than 0.08 indicate a good model fit. Coefficient of Determination (CD): A perfect fit corresponds to a CD=1 (Kline, 2011). Degrees of freedom=0.5(p+q)(p+q+1)-t, where p=number of causes, q=number of indicators, t=number of free parameters. Source: Own calculations.

Table 1: MIMIC estimation of the size of the shadow economy from 1999 to 2013, yearly data.

In our MIMIC estimations, we use annual data from 1999 to 2013 for the 157 countries in our sample. Variables and sources are defined in the appendix table (A1). As presented in Table 1, various MIMIC specifications have been run in order to estimate the magnitude and the effect of different causal variables on the size of the shadow economy for the 157 countries all over the world.

As indicated in Tables 1 and 2, the GDP growth is our reference variable and is assigned the value of -1 in all specifications. We started with a general specification testing for significance of all of the causal variables [27,28]. Considering the result of our MIMIC estimations in Table 1 we clearly see that the tax burden has a positive (theoretically expected) sign and is statistically significant at the 5% confidence level. The regulatory burden variable (size of government) has also the theoretically expected sign and is highly statistically significant at the 1% confidence level. The estimated coefficient of the unemployment rate is also highly statistically significant and has the expected positive sign. The economic freedom index has the expected negative sign and is statistically significant at the 10% confidence level. The business freedom index is not statistically significant. Our interaction variable (tax burden) × (economic freedom index) has the expected negative

sign and is highly statistically significant. However, the economic freedom index is no longer statistically significant, with the z-statistic just dropping below the 10% significance level. Considering the indicators, GDP growth and currency rate have the expected sign and are highly statistically significant, while the labor force participation rate is found to be insignificant and thus a weak indicator for the shadow economy.

While in specifications MIMIC 2 and MIMIC 3 in Table 1, the insignificant business freedom index was removed in order to be able to determine the most important variables that lead to the existence as well as the development of the shadow economy in the different countries in our sample. The calibration of the size of the shadow economy is based on specification MIMIC 2 including four causal variables and three indicators that reflect the existence and lead to the proliferation of the shadow economy. The choice of MIMIC specification 2 (4-1-3) is based on the better fit statistics when compared to MIMIC specification 3 (4-1-2).

Furthermore, we have estimated other MIMIC specifications for a reduced sample of 117 countries that included self-employment as an additional causal variable to our set of causal variables in order to have an additional view and understanding of the major determinants of the shadow economy. As indicated in Table 2, we have also run different MIMIC specifications starting with a general specification including all six causal variables until we reached the best MIMIC specification indicating the significant causal variables that influence the development of the size of the shadow economy. If we consider again first the causal variables, we see that the tax burden, regulatory burden and unemployment rate have the expected positive sign and are statistically significant, at least at the 5% confidence level. Moreover, the self-employment rate has the expected positive sign and is statistically significant at the 5% confidence level, as well as the economic freedom index [29,30].

To summarize, the signs associated with the causal and indicator variables are as expected and the most significant variables leading to the existence and development of the shadow economy are:

- Tax burden
- Regulatory burden
- Unemployment rate
- Self-employment rate
- Economic freedom index

Results and Implications

MIMIC estimation result

With reference to the MIMIC specification MIMIC 3 (4-1-2) in Table 1, we are able to estimate the size of the shadow economy from 1999 to 2013. The ranking of the size of the shadow economy of the 157 countries from smallest to largest is presented in Table 2⁶. The sizes of the shadow economy for the smaller sample based on MIMIC specification MIMIC 2 (5-1-2) are shown in Table 4. If we first consider the results of Table 3, we clearly see that Switzerland has an average shadow economy of 9.09% (rank 1), followed by United States with

⁶We also used the estimations of MIMIC 5-1-3) from table 1 with the interaction term (tax burden) × (economic freedom index) for calibration. We found only minor differences to the results in table 3 (without interaction term). For example the average of all 157 countries and the average over all years 1994 to 2013 is 33.82 in table 3 without the interaction term and 33.86 with the interaction term. Due to this single country results are not reported here.

Variables/specification	MIMIC 1 6-1-2	MIMIC 2 5-1-2	MIMIC 3 4-1-2
Causes			
Tax burden	0.08* (1.70)	0.08* (1.70)	0.07* (1.70)
Regulatory burden	0.26*** (3.04)	0.26*** (3.04)	0.24*** (2.82)
Unemployment rate (first difference)	0.43*** (3.27)	0.43*** (3.27)	0.41*** (3.03)
Self-employment rate (first difference)	0.12** (2.20)	0.10** (2.20)	0.10** (2.14)
Economic Freedom Index (first difference)	-0.06* (-1.66)	-0.06* (-1.74)	
Business Freedom Index (first difference)	-0.01 (-0.38)		
Indicators			
GDP growth	-1*** (-3.34)	-1*** (-3.33)	-1*** (-3.08)
Currency	0.11*** (2.79)	0.11** (2.79)	0.10*** (2.59)
Fit statistics			
Chi ² (pvalue)	9.93 (0.0773)	9.66 (0.0465)	3.44 (0.3282)
GFI	0.96	0.96	0.98
CFI	0.975	0.973	0.995
CD	0.325	0.324	0.283
RMSEA	0.025	0.029	0.010
Degrees of freedom	35	27	20
Number of observations	1,638	1,638	1,638
Number of countries	117	117	117

Notes: Absolute z-statistics are reported in parentheses. *, **, *** denote significance at 10, 5 and 1% significance levels. Goodness of fit index (GFI): values closer to 0.90 reflect a perfect fit. CFI: when the comparative fit index is closer to one, it indicates a good model fit. SRMR: The values less than 0.08 indicate a good model fit. Coefficient of Determination (CD): A perfect fit corresponds to a CD=1 (Kline, 2011). Degrees of freedom=0.5(p+q)(p+q+1)-t, where p=number of causes, q=number of indicators, t=number of free parameters.

Table 2: MIMIC estimation of the size of the shadow economy from 1999 to 2013, yearly data for the reduced sample.

No	Countryname	Size of the shadow economy															
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Averages
1	Switzerland	8.80	9.21	9.13	9.12	10.05	9.65	9.16	8.75	8.44	8.47	9.42	8.79	8.87	9.18	9.35	9.09
2	United States	8.80	8.90	9.03	9.39	8.99	8.51	8.43	8.68	9.36	10.50	10.58	10.45	8.95	8.63	8.29	9.17
3	Austria	10.00	9.28	10.03	9.97	9.99	9.90	9.67	9.31	9.23	9.83	10.11	10.05	9.75	10.18	10.13	9.83
4	Luxembourg	10.00	9.37	10.00	10.91	11.33	11.23	11.56	10.20	10.26	10.38	11.16	10.85	10.63	11.63	13.47	10.87
5	Qatar	18.70	15.67	15.56	13.97	13.34	12.87	12.62	12.22	10.99	8.97	12.18	10.24	9.77	10.06	10.45	12.51
6	Macao SAR, China	13.30	12.30	12.82	12.6	12.73	11.50	11.38	10.84	12.36	14.03	14.29	14.51	14.50	14.72	12.64	12.97
7	Bahrain	18.60	14.72	15.40	15.67	15.16	14.48	12.67	11.00	9.89	9.04	10.11	10.58	10.94	14.57	13.59	13.09
8	New Zealand	13.00	12.35	12.23	12.24	12.37	12.45	13.10	13.96	13.85	15.24	14.93	14.32	13.91	13.76	13.13	13.39
9	Singapore	13.30	14.13	15.64	15.41	14.31	12.49	12.01	12.39	12.45	14.16	13.46	13.35	11.95	12.61	13.44	13.41
10	China	13.20	13.19	14.77	13.81	13.46	13.01	13.11	13.37	13.85	13.24	13.57	13.71	13.11	13.92	13.79	13.54
11	United Kingdom	12.80	12.33	12.89	12.94	13.50	13.55	13.74	13.99	14.00	15.03	15.08	15.26	14.43	13.84	13.26	13.78
12	Japan	11.40	11.72	12.59	13.61	12.92	13.52	12.87	12.65	13.89	14.56	15.53	15.34	15.44	15.50	15.56	13.81
13	Australia	14.40	14.15	14.68	14.36	14.24	14.10	14.26	14.20	14.04	14.53	14.32	14.28	13.79	14.28	14.82	14.30
14	Kuwait	20.10	16.12	18.21	19.78	17.31	15.98	11.52	9.87	10.60	10.13	15.09	14.26	13.13	13.00	12.58	14.51
15	Netherlands	13.30	12.60	12.90	13.94	14.88	14.50	14.39	13.94	14.12	14.38	16.18	16.56	16.01	16.21	16.38	14.69
16	France	15.70	14.32	14.44	15.09	15.63	15.41	15.77	15.17	14.79	15.10	16.37	14.86	14.43	14.98	15.03	15.14
17	Oman	19.10	16.20	16.30	18.14	16.14	15.90	15.40	14.42	13.69	10.45	14.80	13.44	12.92	15.03	16.07	15.20
18	Germany	16.40	15.74	15.27	16.57	17.40	16.78	16.45	14.31	13.94	14.66	16.27	15.65	15.18	15.91	15.96	15.77
19	Canada	16.30	15.48	15.40	16.20	16.48	15.18	15.35	15.36	16.19	16.55	17.56	17.45	15.85	16.66	16.58	16.17
20	Iceland	16.00	15.91	16.04	16.72	17.05	16.66	16.28	16.95	16.60	17.36	17.53	17.57	16.71	15.42	15.76	16.57
21	Ireland	16.10	14.33	14.18	15.88	16.20	16.47	16.26	16.66	17.55	20.17	21.14	20.22	17.77	16.65	15.56	17.01
22	Vietnam	15.80	14.87	14.55	14.49	14.53	15.60	14.39	14.65	16.21	15.98	16.37	22.80	21.41	21.78	24.14	17.17
23	Saudi Arabia	18.70	19.13	21.48	19.17	19.33	18.08	15.82	16.68	15.99	13.19	16.55	16.16	15.23	16.52	17.73	17.32
24	Iran, Islamic Rep.	19.10	20.85	20.02	16.99	12.45	17.17	16.04	21.89	14.54	16.81	21.12	20.10	16.94	16.84	16.71	17.84
25	Jordan	19.40	21.76	20.44	19.43	17.91	18.01	17.94	20.04	18.34	17.52	17.38	16.60	17.06	17.58	16.14	18.37
26	Sweden	19.60	17.87	17.86	18.13	19.45	19.33	19.25	18.43	18.26	18.54	19.90	18.84	18.53	18.65	18.95	18.77
27	Finland	18.40	18.08	16.70	17.70	18.70	18.66	18.90	17.73	17.43	18.79	20.32	20.09	19.47	20.44	20.68	18.81
28	Czech Republic	19.30	18.87	18.02	20.36	20.60	20.18	19.73	17.23	16.76	18.00	19.66	19.99	18.58	18.48	18.47	18.95
29	Denmark	18.40	17.65	17.85	18.07	18.37	18.70	17.88	17.82	18.47	19.38	21.39	21.51	20.05	20.15	19.91	19.04
30	Chile	19.90	18.22	18.54	18.21	19.19	17.75	18.26	18.25	20.05	21.15	20.34	20.59	19.19	19.81	19.74	19.28
31	Indonesia	19.70	22.01	20.40	19.44	20.24	22.69	19.30	19.31	16.17	16.99	18.56	17.33	19.39	19.25	20.25	19.40
32	Norway	19.20	19.06	20.57	21.22	21.05	20.83	19.80	18.23	18.69	18.99	20.56	20.99	20.43	20.52	19.92	20.01
33	Hong Kong SAR, China	17.00	15.16	20.65	24.34	24.26	21.56	19.49	19.38	19.50	21.75	22.04	22.58	19.93	21.81	23.66	20.87
34	Israel	22.70	23.01	23.33	24.00	23.90	21.63	20.65	20.28	20.04	19.94	19.39	19.80	19.56	19.82	20.45	21.23
35	Mongolia	18.40	20.84	23.41	21.64	22.08	24.41	21.62	23.53	23.07	23.51	21.44	21.41	19.76	18.44	21.35	21.66
36	India	23.20	23.77	21.47	20.71	21.54	21.20	20.67	22.18	21.04	21.72	22.43	22.22	20.71	22.25	21.24	21.76
37	Slovak Republic	18.90	19.24	18.00	26.56	21.98	21.14	19.29	19.08	22.14	27.00	26.47	24.77	23.52	23.71	19.85	
38	Mauritius	23.30	21.55	21.09	21.52	25.18	24.63	24.12	22.90	19.13	19.77	22.86	23.46	24.11	23.23	23.89	22.72
39	Belgium	22.70	20.81	22.32	22.75	23.76	23.16	22.90	21.82	21.70	23.22	23.91	23.79	23.45	24.56	25.34	23.08
40	Eritrea	38.10	32.53	27.57	26.33	29.20	25.11	24.53	20.74	20.65	20.89	18.38	19.84	18.17	12.74	12.78	23.17
41	Angola	48.80	42.24	26.90	19.51	21.69	16.49	16.98	18.90	18.27	20.74	19.84	18.11	19.43	18.14	23.30	23.29
42	Maldives	30.30	34.63	25.29	25.12	22.69	24.71	24.73	24.71	22.86	20.12	18.94	18.33	19.93	19.23	18.32	23.33
43	Spain	23.00	18.87	19.60	20.59	22.54	21.47	22.17	21.57	24.99	28.85	30.40	30.86	28.59	27.62	28.11	24.61
44	Chad	45.80	43.78	40.30	35.82	32.13	26.39	22.92	21.02	18.66	16.80	14.55	13.30	14.74	16.05	15.72	25.20
45	Portugal	23.00	23.26	23.99	25.49	26.02	25.74	26.45	25.37	24.12	25.29	26.02	26.94	27.30	25.97	26.42	25.43
46	Hungary	25.40	23.49	24.30	25.64	27.10	26.42	26.18	25.76	25.47	26.84	28.97	27.94	25.20	24.37	23.88	25.80
47	Botswana	33.90	31.54	29.01	29.64	27.29	26.93	22.43	20.98	22.96	25.89	25.46	21.71	22.33	23.79	25.11	25.93
48	United Arab Emirates	26.30	23.27	27.35	30.53	27.85	31.58	26.28	24.96	22.05	22.05	30.47	25.11	23.90	21.27	28.41	26.09
49	Argentina	25.20	27.84	29.29	26.10	24.51	17.96	19.73	20.06	22.00	24.08	27.64	28.06	28.85	35.08	36.10	26.17
50	Latvia	30.80	28.53	26.71	26.11	26.20	23.95	23.59	22.64	24.35	33.94	34.75	31.07	24.29	20.96	19.92	26.52
51	Bahamas, The	26.30	25.73	26.68	27.80	27.62	26.26	22.69	22.85	22.78	28.41	30.70	31.71	25.99	26.03	29.11	26.71
52	Malta	27.40	27.16	28.48	31.03	30.70	31.70	30.06	32.53	32.46	21.83	22.42	21.84	21.29	21.50	21.62	26.80
53	Poland	27.70	32.78	31.20	28.80	29.42	26.36	23.37	22.00	21.46	24.18	27.49	28.48	27.76	26.87	26.62	26.97
54	Equatorial Guinea	32.70	23.65	18.18	28.51	17.76	20.32	17.35	20.67	18.26	19.85	35.16	38.12	37.43	40.84	42.48	27.42

55	Slovenia	27.30	26.95	25.96	27.70	28.00	27.03	26.90	25.86	25.16	26.28	28.14	29.01	29.48	29.97	29.49	27.55
56	Estonia	33.00	33.14	23.17	24.70	24.96	25.41	22.48	19.69	21.08	35.64	43.86	37.82	24.96	21.70	22.94	27.64
57	Italy	27.80	25.55	26.00	26.35	26.73	27.03	26.75	28.47	27.48	29.16	31.58	30.22	31.22	32.02	32.01	28.56
58	Lithuania	33.80	35.38	28.75	28.93	25.07	25.49	24.79	24.87	26.41	34.52	39.13	34.36	26.00	21.85	21.95	28.75
59	Croatia	33.80	36.71	30.34	27.09	23.01	25.92	25.91	24.26	25.48	26.06	29.83	30.34	31.66	32.10	31.61	28.94
60	Namibia	31.40	30.74	28.98	26.79	26.71	27.79	27.37	26.17	32.72	33.92	31.99	25.77	21.42	30.25	33.54	29.04
61	South Africa	28.40	28.49	29.29	28.43	27.10	27.37	28.48	27.88	28.73	30.38	31.00	31.58	30.71	30.06	30.62	29.23
62	Yemen, Rep.	27.70	27.68	26.91	23.79	24.82	25.22	22.63	26.27	25.16	27.87	31.34	36.13	37.68	37.02	38.92	29.28
63	Guinea-Bissau	40.40	46.21	37.24	37.30	36.89	32.24	29.03	27.52	26.09	20.47	21.19	24.70	21.46	20.70	18.00	29.30
64	Kenya	33.70	32.53	34.89	35.71	33.56	29.04	31.12	24.86	25.97	27.73	27.06	26.07	25.58	25.32	26.37	29.30
65	Colombia	39.40	32.45	29.91	27.95	28.15	27.28	28.06	26.30	28.76	28.45	31.30	29.36	29.16	29.18	29.85	29.70
66	Fiji	32.90	32.55	33.61	32.24	30.66	28.27	28.84	36.39	34.93	32.31	28.23	26.99	24.71	26.26	25.52	30.29
67	Suriname	39.70	40.48	34.45	27.86	30.66	28.15	24.95	25.11	30.04	32.07	30.52	29.36	27.52	33.37	30.44	30.98
68	Trinidad and Tobago	34.70	26.77	30.39	29.63	28.16	25.58	28.25	31.63	27.43	30.16	36.13	35.61	32.74	33.80	34.10	31.01
69	Mexico	30.80	31.05	31.34	30.82	31.47	30.49	30.92	29.79	29.13	32.72	35.07	31.97	30.42	32.91	31.51	31.36
70	Togo	34.40	35.38	33.14	28.70	29.85	29.44	29.81	31.55	27.19	29.35	31.03	28.55	28.25	34.86	39.14	31.38
71	Costa Rica	26.10	26.14	30.17	31.62	30.53	29.89	28.74	27.57	28.91	32.97	34.87	37.16	34.44	35.45	36.73	31.42
72	Pakistan	37.00	30.74	30.47	31.11	31.52	28.27	26.59	26.25	29.41	31.63	31.87	34.87	31.31	34.28	36.05	31.43
73	Central African	42.80	41.91	37.15	37.32	29.81	32.46	31.68	25.17	25.66	26.67	26.33	28.60	26.71	27.32	34.66	31.62
74	Lebanon	34.10	34.82	31.45	36.49	34.98	32.92	31.98	32.89	28.66	29.67	29.32	28.50	29.43	28.33	32.16	31.71
75	Cyprus	29.20	28.64	27.77	29.61	33.11	33.18	34.26	34.35	36.42	37.26	29.34	29.75	30.59	32.64	33.79	31.99
76	Korea, Rep.	28.30	25.57	27.84	29.15	31.36	31.66	32.64	32.30	33.81	35.12	36.24	33.49	34.36	34.15	34.77	32.05
77	Greece	28.50	28.11	27.61	30.02	28.80	28.17	29.46	28.47	29.85	30.65	35.72	37.62	42.34	43.67	39.39	32.56
78	Algeria	34.20	39.30	34.84	30.87	28.47	24.58	25.66	30.22	30.05	36.89	35.21	37.79	46.42	29.80	27.24	32.77
79	Romania	34.30	35.30	35.01	31.56	37.12	32.61	33.98	30.16	30.80	33.13	35.29	33.50	31.90	32.13	30.65	33.16
80	Venezuela, RB	33.80	29.92	39.16	36.64	35.39	32.03	26.08	26.68	29.03	34.72	50.10	37.89	32.50	32.98	31.64	33.91
81	Lesotho	31.70	33.62	32.26	36.12	31.78	35.11	31.36	34.04	32.94	30.65	32.59	39.05	37.53	36.51	33.35	33.91
82	Macedonia, FYR	39.00	31.68	41.52	41.19	39.25	39.33	31.84	29.32	30.06	32.12	32.75	30.21	32.66	30.73	29.93	34.11
83	Serbia	34.30	33.04	35.59	39.17	41.52	39.07	36.53	32.19	28.51	29.44	31.58	37.35	34.74	32.42	27.95	34.23
84	Bhutan	29.60	37.77	35.99	34.91	35.10	35.09	37.03	36.49	32.15	32.68	35.48	32.44	31.75	33.04	34.60	34.28
85	Bulgaria	36.00	42.52	37.56	31.63	31.86	31.65	32.49	33.15	33.11	34.42	35.97	37.30	33.99	33.59	35.55	34.72
86	Cameroon	33.30	31.70	32.63	31.81	30.70	32.03	30.98	30.49	33.39	34.44	44.69	37.62	45.22	37.43	37.40	34.92
87	Papua New Guinea	35.50	33.53	35.84	32.90	33.28	33.60	34.09	34.27	34.75	35.16	35.58	38.71	37.27	33.89	35.84	34.95
88	Montenegro	34.30	36.79	40.18	40.34	39.93	37.57	39.72	38.20	31.00	33.70	32.52	31.82	33.50	31.35	28.75	35.31
89	Malaysia	32.20	31.65	40.70	39.41	36.45	36.72	32.27	32.75	31.98	34.00	36.49	34.08	35.34	38.41	37.35	35.32
90	Cabo Verde	36.50	37.30	37.15	36.96	36.39	39.01	38.70	39.83	36.84	36.06	35.66	39.02	37.11	22.44	20.98	35.33
91	Bosnia and Herzegovina	34.30	30.24	38.06	36.87	36.69	36.99	38.82	34.96	34.71	32.37	36.08	37.13	39.44	38.41	36.45	36.10
92	Ecuador	34.20	35.05	36.27	34.72	29.81	29.89	30.44	29.63	32.96	36.98	45.16	43.80	42.49	45.57	47.21	36.94
93	Morocco	36.50	35.77	34.89	36.96	35.12	36.79	39.11	37.76	34.76	38.34	37.10	36.57	38.76	40.69	40.72	37.32
94	Turkey	32.70	29.51	38.50	43.00	38.64	34.65	36.08	32.63	38.26	41.27	43.30	40.56	36.70	41.38	32.70	37.33
95	Egypt, Arab Rep.	35.50	41.03	37.40	37.31	38.15	39.02	38.22	38.43	32.97	31.85	37.37	38.39	39.39	39.53	39.35	37.59
96	Philippines	43.80	45.74	44.43	38.38	38.51	31.70	34.05	29.63	36.81	35.45	36.31	36.56	36.20	39.15	38.72	37.69
97	Malawi	39.90	39.48	42.04	37.51	36.72	34.41	36.09	34.58	33.76	36.20	39.34	35.59	41.01	40.58	44.07	38.09
98	Dominican Republic	32.40	37.39	41.48	42.65	37.28	36.75	33.79	31.17	35.27	39.60	36.02	39.40	38.43	46.14	43.54	38.09
99	Timor-Leste	35.50	40.99	41.35	39.72	36.60	35.40	33.70	35.44	35.09	33.52	39.89	41.35	42.44	41.62	42.20	38.32
100	Rwanda	40.50	34.47	41.50	36.12	38.95	30.05	46.90	44.94	41.61	36.07	37.42	35.73	34.87	37.50	38.55	38.35
101	Bangladesh	36.00	38.69	33.14	38.10	43.97	39.27	41.25	31.10	47.17	44.73	34.46	34.45	37.12	40.31	42.61	38.83
102	Swaziland	43.50	42.35	40.46	40.13	37.80	37.65	37.70	35.25	36.51	35.10	40.69	46.54	41.29	43.17	36.33	39.63
103	Tunisia	38.70	38.24	39.10	39.65	39.73	38.21	39.10	36.56	36.07	40.25	40.89	44.50	43.60	43.64	39.45	39.85
104	Guyana	33.40	41.38	42.77	44.01	48.78	46.45	45.23	37.67	37.03	41.29	40.05	40.26	31.94	33.65	34.30	39.88
105	Zambia	49.30	50.33	49.21	46.00	44.88	42.73	40.42	37.60	37.05	35.37	32.20	31.66	34.02	33.19	36.65	40.04
106	Mauritania	35.50	36.39	36.40	44.00	46.87	45.23	45.29	40.60	45.06	39.51	40.39	39.14	33.12	36.79	39.04	40.22
107	Jamaica	36.40	36.31	36.25	35.60	33.45	34.72	37.75	38.37	42.16	45.72	47.55	45.30	44.45	46.72	45.17	40.40
108	Brazil	40.80	39.40	40.31	43.15	39.97	41.56	40.88	41.55	41.72	41.00	41.08	40.54	38.02	37.52	41.18	40.58
109	Paraguay	38.00	43.28	48.36	37.37	36.80	29.03	39.02	35.26	35.44	36.19	43.92	41.47	41.51	49.98	53.73	40.62
110	Barbados	33.80	32.24	34.62	37.72	45.13	41.94	39.16	34.54	42.23	45.03	47.12	48.22	49.26	41.05	39.94	40.80

111	Niger	41.70	37.47	32.69	35.10	38.05	43.69	43.05	42.83	42.86	42.47	44.51	44.74	40.83	41.46	41.20	40.84
112	Cote d'Ivoire	41.40	43.70	38.68	39.03	43.45	43.37	43.57	42.12	42.57	41.02	39.20	39.26	32.67	44.36	41.04	41.03
113	Nepal	37.20	43.23	36.62	34.57	34.92	36.71	38.50	35.45	39.90	43.69	48.71	47.56	48.06	49.87	49.38	41.62
114	Kyrgyz Republic	41.40	41.00	44.15	44.44	36.43	35.90	39.19	38.58	41.91	41.82	42.56	42.57	43.16	47.93	44.82	41.72
115	Albania	35.70	27.77	32.64	39.03	40.10	39.04	42.15	41.06	42.58	45.28	46.97	47.21	49.51	50.78	51.96	42.12
116	Madagascar	40.10	44.33	44.85	36.95	36.07	34.95	38.02	44.58	56.10	46.81	41.02	43.65	44.69	42.70	44.82	42.64
117	Russian Federation	36.00	33.71	38.92	42.19	41.34	40.05	44.45	43.14	44.65	48.46	49.51	45.64	42.38	44.94	46.37	42.78
118	Comoros	39.30	35.82	42.84	42.54	38.75	37.56	37.47	38.92	38.61	45.65	47.44	46.86	51.01	52.96	46.11	42.79
119	Mozambique	36.00	31.76	35.03	36.02	36.82	41.49	42.35	42.28	39.67	42.68	46.56	48.10	50.56	53.54	63.09	43.06
120	Uganda	43.50	50.51	48.16	52.61	50.92	40.01	49.16	47.32	47.49	41.59	36.22	36.24	45.79	31.76	32.80	43.61
121	Ghana	42.00	40.96	39.82	38.30	40.75	41.90	52.85	34.12	39.97	38.55	39.74	36.44	55.49	61.09	57.01	43.93
122	Mali	42.50	40.63	40.51	42.95	48.71	48.26	44.55	47.32	45.49	44.49	45.22	45.13	44.85	44.82	46.61	44.80
123	Solomon Islands	31.70	35.08	34.57	31.09	30.23	36.63	43.26	45.88	48.50	51.18	53.54	57.13	57.02	60.57	66.23	45.51
124	Congo, Rep.	49.50	41.58	45.61	58.27	54.62	50.68	41.71	45.97	52.55	38.11	42.61	38.92	34.74	46.14	42.47	45.57
125	Armenia	46.60	48.25	56.59	55.03	53.63	39.92	43.99	37.28	35.12	30.62	41.99	50.74	50.54	44.82	48.47	45.57
126	Kazakhstan	43.80	39.50	43.33	42.67	47.04	52.78	37.52	35.83	42.97	42.60	49.84	47.37	50.91	56.58	55.69	45.90
127	Belarus	48.30	45.01	53.02	48.35	52.08	49.61	51.44	51.84	52.62	51.03	45.71	41.66	37.35	36.71	37.67	46.83
128	Georgia	34.00	16.65	22.46	28.76	26.80	38.91	49.97	41.84	61.11	78.74	74.47	61.46	57.13	57.27	53.20	46.85
129	Azerbaijan	61.00	62.81	51.10	36.29	42.10	46.32	44.41	49.68	46.34	43.94	46.76	45.43	43.32	46.23	46.54	47.48
130	Burundi	39.10	33.56	35.27	34.42	39.16	42.37	42.32	43.99	58.79	62.07	57.54	64.44	56.88	52.74	49.74	47.49
131	Guinea	39.70	40.97	41.11	49.96	43.21	39.52	40.13	49.89	39.53	48.80	50.24	67.98	57.10	56.29	53.60	47.87
132	Sri Lanka	45.20	45.66	45.53	56.06	52.93	52.08	52.45	60.20	56.72	62.60	66.31	52.49	36.45	27.62	18.44	48.72
133	Cambodia	50.40	49.71	42.75	48.72	46.21	41.66	34.77	31.84	48.85	54.75	57.06	58.51	57.23	58.26	57.48	49.21
134	Burkina Faso	41.30	47.00	56.34	46.58	46.28	49.02	46.44	50.72	55.47	49.92	48.10	48.68	48.72	51.53	52.60	49.25
135	Nicaragua	45.70	47.92	46.53	45.30	50.63	52.29	48.75	49.25	51.28	53.19	54.25	53.97	49.09	44.49	46.49	49.27
136	Nigeria	46.00	56.21	55.41	37.84	32.86	37.08	43.47	40.52	51.28	74.29	79.42	47.77	48.03	46.42	42.94	49.30
137	Senegal	45.00	48.59	40.08	43.77	45.28	51.10	49.52	49.07	48.86	48.43	52.87	55.27	52.45	57.01	52.58	49.33
138	Congo, Dem. Rep.	34.00	9.82	21.76	34.32	29.71	38.23	42.75	56.04	53.89	51.87	67.53	60.72	81.85	78.47	89.20	50.01
139	Lao PDR	30.90	31.19	39.01	34.17	35.83	40.23	44.18	45.66	50.79	58.83	64.98	59.73	62.95	74.05	80.41	50.19
140	El Salvador	46.50	45.37	51.45	47.40	48.12	48.06	47.16	51.14	47.80	51.10	51.62	54.26	52.77	54.12	58.60	50.37
141	Belize	45.20	37.07	40.53	48.20	51.11	50.08	48.85	48.37	51.32	55.78	58.05	62.45	56.81	55.80	52.81	50.83
142	Tajikistan	43.50	34.28	38.50	40.55	41.53	48.47	60.72	51.83	48.49	52.96	63.57	64.12	69.77	53.03	63.76	51.67
143	Ukraine	52.70	52.57	48.52	47.09	47.09	44.92	50.23	52.76	53.88	52.77	60.07	59.49	53.60	54.24	53.53	52.23
144	Sierra Leone	48.60	62.06	56.55	61.02	54.49	48.09	47.31	49.27	43.62	48.42	54.14	52.95	51.53	52.80	54.74	52.37
145	Uruguay	50.50	50.81	48.34	48.36	48.27	52.99	55.01	56.55	48.70	49.55	52.68	53.62	55.34	56.70	58.35	52.38
146	Gabon	46.20	42.21	60.74	56.87	58.12	56.81	51.01	49.83	53.02	49.00	56.03	50.32	45.69	57.82	53.43	52.47
147	Haiti	54.80	58.21	58.29	60.49	54.23	48.56	54.43	55.38	51.32	52.53	48.41	44.97	46.75	50.87	54.73	52.93
148	Moldova	36.00	25.40	40.49	51.57	53.85	49.79	49.41	58.98	55.58	62.37	72.20	70.66	61.45	62.37	55.80	53.73
149	Liberia	44.20	43.57	41.16	31.39	33.50	54.90	54.60	51.91	62.21	76.93	64.90	67.76	70.76	76.84	82.04	57.11
150	Thailand	53.40	52.18	49.50	51.46	54.73	55.66	58.27	55.64	56.97	60.21	60.67	60.49	63.07	63.68	68.70	57.64
151	Peru	60.10	57.33	57.88	61.68	59.73	58.15	61.91	61.23	57.28	58.91	59.49	55.47	57.06	62.23	61.90	59.36
152	Benin	51.20	50.55	53.65	55.12	59.64	58.05	59.24	58.42	60.49	65.63	67.85	68.71	65.74	67.39	66.52	60.55
153	Gambia, The	46.10	52.83	52.57	52.82	54.57	54.68	51.35	52.19	59.54	74.62	81.35	79.77	78.65	64.30	64.80	61.34
154	Tanzania	58.60	63.70	57.32	55.30	65.01	66.60	76.27	69.43	76.46	63.86	70.58	65.35	65.93	66.78	68.24	65.96
155	Guatemala	51.60	53.98	69.76	78.31	74.69	70.03	61.02	63.47	65.42	71.00	73.33	72.35	68.53	70.86	70.82	67.68
156	Honduras	50.30	57.28	63.34	65.52	67.53	72.43	64.83	60.49	71.07	76.41	81.45	78.60	71.67	69.22	72.41	68.17
157	Bolivia	67.00	72.33	71.70	76.91	73.86	73.83	78.62	70.98	67.20	64.20	75.55	81.20	76.92	68.17	66.04	72.30
	Time Average	33.02	32.56	33.04	33.22	33.01	32.63	32.67	32.18	33.00	34.41	36.28	35.71	34.90	35.21	35.45	33.82

Table 3: Ranking of 157 countries according to the size of the shadow economy.

9.2%, followed by Austria with 9.8% and Bolivia has the largest shadow economy with an average value of 72.19%, followed by Honduras with 86.2% and Guatemala with 67.87%.

If we consider Table 4, the sample shrinks to 117 countries but here we included the causal variable "self-employment". Singapore has the lowest ranking with an average value of 7.24%, followed by Switzerland with 9.03% and the United States with 9.35%. Bolivia has the highest one with 69.9%, followed by Honduras with 68.74% and Tanzania with

66.73%. We are aware that the size and development of the shadow economy is quite high for some countries, but we would argue that for developing countries we estimate a parallel economy, which we will discuss in 4.2. Of course, in order to undertake a detailed investigation about the size of the shadow economy a country by country study should be undertaken. One should be aware that when estimating so many countries in one sample, it is not possible to take into consideration the distinct differences in the institutions and economic development of all of the countries.

No.	Countryname	Size of the shadow economy															Averages
		1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	
1	Switzerland	8.80	8.96	9.02	9.23	10.05	9.65	9.01	8.67	8.33	8.33	9.31	8.74	8.82	9.14	9.31	9.03
2	United States	8.80	8.84	9.12	9.63	9.26	8.76	8.56	8.76	9.46	10.83	11.08	10.84	9.19	8.78	8.37	9.35
3	Austria	10.00	9.27	9.93	9.89	9.93	9.86	9.71	9.41	9.21	9.85	10.22	10.14	9.77	10.18	10.19	9.84
4	Luxembourg	10.00	9.21	9.99	10.93	11.61	11.43	11.65	10.13	10.17	10.46	11.36	11.07	10.75	11.80	13.11	10.91
5	Macao SAR, China	13.30	12.12	12.54	12.21	12.13	10.49	10.27	9.51	10.70	12.15	12.63	12.40	11.93	12.12	10.47	11.67
6	Bahrain	18.60	14.77	15.41	15.75	15.32	14.33	12.78	11.24	10.09	9.24	10.50	10.91	11.32	14.41	13.58	13.22
7	New Zealand	13.00	12.14	12.05	12.10	12.24	12.31	12.96	13.77	13.84	15.35	15.13	14.66	14.23	13.90	13.18	13.39
8	Japan	11.40	11.59	12.44	13.38	12.73	13.20	12.54	12.29	13.36	14.08	15.07	14.83	14.92	14.98	15.04	13.46
9	Singapore	13.3	14.3	16	16	14.9	12.9	12.3	12.6	12.6	14.4	13.6	13.6	12.1	12.7	13.5	13.65
10	United Kingdom	12.80	12.24	12.91	13.14	13.81	13.88	14.09	14.31	14.30	15.40	15.74	15.83	14.84	14.23	13.59	14.07
11	Australia	14.40	13.99	14.44	14.19	14.00	13.82	13.97	13.89	13.78	14.34	14.34	14.42	13.82	14.30	14.80	14.17
12	Netherlands	13.30	12.54	12.95	14.11	15.17	14.78	14.57	14.17	14.27	14.67	16.74	17.08	16.58	16.80	17.05	14.98
13	France	15.70	13.99	14.24	15.13	15.80	15.58	15.88	15.22	14.83	15.22	16.71	15.65	15.16	15.62	15.66	15.36
14	Vietnam	15.80	13.83	13.71	13.48	13.31	12.32	11.32	12.19	15.52	15.29	15.67	20.49	19.04	19.57	21.73	15.55
15	Germany	16.40	15.72	15.46	16.74	17.58	17.03	16.55	14.36	13.73	14.50	16.23	15.69	15.15	15.80	15.93	15.79
16	Canada	16.30	15.25	15.43	16.32	16.58	15.29	15.37	15.47	16.25	16.93	18.15	17.94	16.28	17.00	16.98	16.37
17	Iceland	16.00	15.94	16.23	16.77	17.15	16.60	16.47	16.97	16.57	17.59	18.20	18.20	17.13	15.82	16.12	16.78
18	Ireland	16.10	13.91	14.22	16.17	16.52	16.70	16.42	16.80	17.91	21.26	22.64	21.49	18.59	17.22	15.92	17.46
19	Iran	19.10	21.50	20.68	17.62	13.23	17.67	16.82	22.13	14.38	16.64	20.72	20.16	16.82	16.40	16.54	18.03
20	Jordan	19.40	21.92	20.47	19.29	17.31	17.45	16.96	19.28	17.34	17.35	17.37	16.55	17.28	17.72	16.09	18.12
21	Chile	19.90	17.85	18.33	18.37	19.08	17.39	17.23	16.76	18.50	20.52	20.34	20.21	18.30	19.19	19.42	18.76
22	Sweden	19.60	17.64	17.86	18.38	19.73	19.60	19.40	18.50	18.19	18.76	20.30	19.12	18.73	18.93	19.36	18.94
23	Finland	18.40	17.74	16.70	17.72	18.75	18.74	18.96	17.88	17.55	19.16	21.08	20.81	19.93	20.94	21.28	19.04
24	Denmark	18.40	17.54	17.90	18.29	18.60	18.78	17.81	17.77	18.24	19.46	21.73	21.84	20.22	20.19	19.85	19.11
25	Hong Kong SAR, China	17.00	14.47	19.71	23.09	23.09	19.91	17.39	16.93	16.95	19.74	20.15	20.23	17.65	19.38	21.04	19.12
26	Czech Republic	19.30	18.98	18.17	20.58	20.95	20.29	19.59	17.27	16.72	18.14	20.22	20.52	18.94	18.57	18.60	19.12
27	Norway	19.20	18.48	20.08	20.89	20.89	20.41	19.20	17.51	17.98	18.30	20.38	20.60	19.90	20.03	19.77	19.58
28	Indonesia	19.70	22.55	21.80	21.33	21.98	23.88	19.91	20.04	17.23	18.05	19.31	16.61	17.40	17.93	19.36	19.80
29	Mongolia	18.40	20.30	22.81	21.63	21.23	22.96	19.27	20.91	20.46	21.76	19.69	19.40	17.33	16.87	19.48	20.17
30	Slovak Republic	18.90	22.12	19.63	18.34	24.16	20.34	19.32	17.46	17.03	20.38	25.27	24.66	22.63	21.29	21.55	20.87
31	Israel	22.70	22.61	23.17	24.04	23.87	21.44	20.35	19.93	19.72	20.00	19.47	19.70	19.41	19.87	20.58	21.12
32	India	23.20	23.50	21.62	20.70	21.25	20.79	20.31	21.19	20.07	20.98	21.57	21.11	19.92	21.52	20.96	21.25
33	Maldives	30.30	34.90	25.50	25.38	22.69	24.65	24.37	24.28	22.16	19.30	16.00	15.32	16.36	18.17	17.76	22.48
34	Mauritius	23.30	21.19	21.06	21.73	25.69	25.26	24.69	22.98	18.97	19.47	22.55	23.18	23.99	22.93	23.88	22.72
35	Belgium	22.70	20.21	22.12	23.03	24.14	23.43	23.14	22.08	21.79	23.48	24.53	24.34	23.94	25.14	26.11	23.35
36	Argentina	25.20	28.12	29.62	25.36	22.76	15.64	17.69	18.22	20.32	22.83	26.70	26.77	27.41	33.33	34.67	24.98
37	Spain	23.00	18.13	19.09	20.31	22.48	21.44	22.02	21.46	25.11	29.82	32.05	32.06	29.99	28.93	29.30	25.01
38	Portugal	23.00	23.33	24.32	25.99	26.22	26.09	26.57	25.58	24.13	25.52	26.60	27.38	27.63	26.23	26.70	25.69
39	United Arab Emirates	26.30	23.78	27.40	30.14	27.61	30.06	25.43	23.83	21.93	21.86	31.35	25.79	23.58	21.12	25.51	25.71
40	Hungary	25.40	23.56	24.56	26.03	27.48	26.63	26.52	26.03	25.36	26.76	28.86	27.85	25.16	24.13	23.55	25.86
41	Latvia	30.80	27.90	26.34	25.74	25.97	23.56	22.75	21.63	23.70	34.14	35.11	31.43	24.02	20.33	19.57	26.20
42	Poland	27.70	33.76	32.28	29.28	29.39	26.12	22.90	21.15	20.31	23.71	27.79	29.11	28.05	27.01	26.86	27.03
43	Malta	27.40	26.97	28.60	30.95	30.67	31.24	29.39	31.73	31.30	23.62	24.29	23.69	22.95	23.25	23.35	27.29
44	Estonia	33.00	32.19	23.42	24.93	25.47	25.58	22.31	19.62	21.39	35.44	43.20	37.60	25.22	21.82	23.40	27.64
45	Slovenia	27.30	26.45	26.01	27.77	28.12	27.24	27.50	26.08	24.99	26.57	29.44	30.72	30.61	30.94	30.64	28.02
46	Lithuania	33.80	35.55	28.98	28.52	24.21	24.21	23.01	23.18	24.48	33.24	39.09	34.58	25.73	21.52	21.75	28.12
47	Bahamas, The	26.30	25.08	27.18	28.72	28.88	27.06	23.20	23.41	23.46	30.70	33.80	34.33	28.80	29.17	32.66	28.18
48	Croatia	33.80	36.86	29.93	26.67	22.34	25.64	25.26	23.35	24.46	25.40	30.22	30.97	32.08	31.86	31.20	28.67
49	Italy	27.80	25.48	26.04	26.52	27.15	27.42	27.19	28.51	27.65	29.56	32.28	30.97	31.88	32.54	32.76	28.92
50	Namibia	31.40	30.39	28.46	25.85	26.22	26.79	26.59	25.22	33.08	34.11	32.99	27.30	21.89	30.01	33.56	28.92
51	South Africa	28.40	28.66	29.39	28.62	27.47	27.31	28.14	27.05	27.60	29.61	30.96	31.78	30.94	30.14	30.53	29.11
52	Yemen, Rep.	27.70	27.78	26.97	24.18	23.38	23.07	20.67	25.95	25.79	28.67	32.11	36.73	38.66	38.70	41.00	29.42
53	Colombia	39.40	35.79	32.39	28.21	27.91	26.32	27.25	24.62	28.13	28.45	32.31	29.57	28.44	28.16	28.85	29.72

109	Moldova	36.00	28.04	44.49	55.48	56.46	50.01	49.49	60.60	55.47	63.68	75.84	74.47	64.99	66.13	59.56	56.05
110	Thailand	53.40	47.32	47.13	50.61	52.01	52.95	55.61	54.68	56.45	59.05	60.76	60.25	63.03	64.93	70.13	56.55
111	Liberia	44.20	42.96	40.09	28.41	30.93	56.45	56.16	52.86	65.05	82.64	68.40	69.06	72.58	79.90	85.64	58.36
112	Peru	60.10	58.44	60.23	64.43	63.41	59.75	60.70	57.55	53.59	55.66	58.22	53.62	54.02	59.39	60.43	58.64
113	Benin	51.20	50.26	52.62	54.18	59.47	58.13	58.91	58.25	59.60	64.58	68.63	68.86	66.42	68.29	67.98	60.49
114	Tanzania	58.60	63.78	57.43	56.49	67.02	70.22	79.95	73.82	81.30	67.23	75.68	65.94	63.31	59.86	60.29	66.73
115	Guatemala	51.6	55.9	76.2	84.8	79	68.7	55.4	57.1	59.7	66.1	68.2	71.3	71.2	74.6	72.3	67.46
116	Honduras	50.30	56.62	64.10	67.20	68.54	70.21	63.94	60.07	71.60	77.21	84.81	81.73	72.71	69.38	72.62	68.74
117	Bolivia	67.00	70.59	71.51	74.54	71.96	72.28	78.37	69.43	64.09	59.48	70.74	75.50	72.63	65.63	65.32	69.94
	Time Average	31.59	31.25	31.94	32.30	32.40	31.66	31.45	30.78	31.56	33.39	35.65	35.24	33.91	33.99	34.12	32.75

Table 4: Ranking of 117 countries according to the size of the shadow economy including self-employment as causal variable.

Pos.	Kinds of shadow economy activities (rough estimates!)	Estonia		Germany	
		Size in % of official GDP average 2009-2015	Proportion of total shadow economy	Size in % of official GDP average 2009-2015	Proportion of total shadow economy
1	Total shadow economy (estimated by the MIMIC and calibrated by the currency demand procedures)	28.0	100%	16.2	100%
2	Legally bought material for shadow economy and DIY activities	6.0	21%	3.1	19.1%
3	Illegal activities (smuggling etc.)	2.0	7%	1.2	7.4%
4	Do-it-yourself activities and neighbours' help1)	2.0	7%	1.5	9.2%
	Sum (2) and (4)	10.0	35%	5.8	35.7%
5	"Adjusted" shadow economy (position (1) minus position (5)) Without legally bought material which is included in (2)	18.0	65%	10.2	64.3%

Table 5: Decomposition of the shadow economy activities in the Baltic countries: Example: Estonia and Germany.

A critical discussion of the macro-MIMIC estimates

As briefly and critically discussed in chapter 4, macro estimates using the MIMIC and/or currency demand approach lead to quite high estimates of the shadow economy. One reason for this is that in the macro shadow economy estimates DIY (do-it-yourself) activities, neighbours and friends help and criminal activities (like smuggling, etc.) are (at least partly) included. We now try to consider this criticism and undertake an attempt to "correct" these macro estimates. In Table 5 such an attempt is undertaken for Estonia and Germany.

We argue that these corrections are rough approximations, but have a valid basis. First, we deduct legally bought material for shadow economy⁷ and do-it-yourself activities, this is done in line 2, varying between 19.1% and 21% of the macro estimates of shadow economy activities (100%). Next, we subtract illegal activities (smuggling, drug dealing, etc.) which vary around 7% of total shadow economy activities, this is done in line 3. Finally, we deduct do-it-yourself activities and neighbours' and friends' help in line (4), varying between 7% and 9% between Estonia and Germany. If we sum these factors roughly 65% of the macro shadow economy size remains which should more accurately reflect the "true" size. We are aware that there are rough adjustments for which further research has to be done, but we think we can justify the adjusted values of the shadow economies of these 157 countries.

In Table 6 we show the averages for the shadow economies of the 157 large countries and of the 117 small sample countries, where we included the self-employment variable in the MIMIC estimates. In this table we also include the adjusted shadow economy values for both country samples. Table 6 clearly shows that including the self-employment variable has only a minor effect on the size of the shadow economy. Only for the lower countries do we see greater differences

⁷In some developing countries material is also illegal by being smuggled into the country, hence there may an interchange between legally bought material and smugglers, i.e., in developing countries the proportion of legally bought material may be smaller but smuggling will be higher.

in the size of the shadow economy: Serbia has an average value of 36.16% with self-employment and 30.34% without self-employment; Singapore has an average value of 13.65% with self-employment and 13.44% without.

Summary and Conclusion

For the first time, our paper presents estimations of the shadow economy for 157 countries including developing, eastern European, central Asian and high income OECD countries from 1999 to 2013 using the MIMIC estimation method. According to our estimates the average size of the shadow economy (as a percentage of official GDP) of the 157 countries averaged over 1999 to 2013 is 33.77%; for the 117 countries including self-employment data the average is 32.75%. We also find that an increased burden of taxation combined with labor market regulations and institutional quality are driving forces of the shadow economy.

We are aware that these macro sizes of the shadow economy are quite high. Due to this, for the first time, we have tried to "correct" these macro estimates by subtracting legally bought material for shadow economy and do-it-yourself activities, illegal activities and do-it-yourself activities; all three are included in the macro estimates by the MIMIC and/or currency demand approach. Our first calculations lead to an average reduction of the macro estimates of the shadow economy by 35% which in our opinion is plausible. Let us repeat, this is a first attempt and a rough calculation, where much more research is needed. The knowledge/insights with respect to the size of the shadow economy of 157 countries lead to the following three conclusions:

The **first** conclusion from these results is that for all countries investigated, the shadow economy has reached a large size, with an unweighted average of the shadow economy of 33.77% of official GDP for 157 countries from 1999 to 2007. We have no clear pattern of development over time, except that in most countries the shadow economies strongly rose in 2009 and 2010 due to the world economic

No.	Countryname	Shadow Economies				
		Averages based on MIMIC 4-1-2	Averages base MIMIC 5-1-2 (incl. self-employ.)	Differences	Adjusted averages based on MIMIC 4-1-2	Adjusted averages based on MIMIC 5-1-2 (incl. self-empl.)
1	Albania	42.12	40.97	1.15	27.38	26.63
2	Algeria	32.77	31.30	1.47	21.30	20.35
3	Argentina	26.17	24.98	1.19	17.01	16.23
4	Armenia	45.57	45.16	0.41	29.62	29.36
5	Australia	14.30	14.17	0.13	9.29	9.21
6	Austria	9.83	9.84	-0.01	6.39	6.39
7	Azerbaijan	47.48	45.43	2.06	30.87	29.53
8	Bahamas, The	26.71	28.18	-1.47	17.36	18.32
9	Bahrain	13.09	13.22	-0.12	8.51	8.59
10	Bangladesh	38.83	36.94	1.88	25.24	24.01
11	Barbados	40.80	41.65	-0.85	26.52	27.07
12	Belgium	23.08	23.35	-0.27	15.00	15.18
13	Belize	50.83	49.75	1.08	33.04	32.34
14	Benin	60.55	60.49	0.06	39.36	39.32
15	Bhutan	34.28	34.13	0.15	22.28	22.18
16	Bolivia	72.30	69.94	2.36	47.00	45.46
17	Bosnia and Herzegovina	36.10	34.37	1.73	23.47	22.34
18	Brazil	40.58	39.82	0.76	26.38	25.88
19	Bulgaria	34.72	34.01	0.71	22.57	22.11
20	Burundi	47.49	47.43	0.06	30.87	30.83
21	Cambodia	49.21	46.16	3.06	31.99	30.00
22	Cameroon	34.92	35.05	-0.12	22.70	22.78
23	Canada	16.17	16.37	-0.20	10.51	10.64
24	Chile	19.28	18.76	0.52	12.53	12.19
25	Colombia	29.70	29.72	-0.02	19.31	19.32
26	Costa Rica	31.42	31.40	0.02	20.42	20.41
27	Cote d'Ivoire	41.03	41.08	-0.05	26.67	26.70
28	Croatia	28.94	28.67	0.27	18.81	18.64
29	Cyprus	31.99	32.04	-0.04	20.80	20.82
30	Czech Republic	18.95	19.12	-0.17	12.32	12.43
31	Denmark	19.04	19.11	-0.07	12.38	12.42
32	Ecuador	36.94	36.30	0.64	24.01	23.60
33	Egypt, Arab Rep.	37.59	37.61	-0.01	24.44	24.45
34	El Salvador	50.37	49.70	0.67	32.74	32.30
35	Estonia	27.64	27.64	0.00	17.96	17.97
36	Fiji	30.29	30.58	-0.28	19.69	19.87
37	Finland	18.81	19.04	-0.23	12.22	12.38
38	France	15.14	15.36	-0.22	9.84	9.98
39	Georgia	46.85	48.30	-1.45	30.45	31.39
40	Germany	15.77	15.79	-0.03	10.25	10.26
41	Greece	32.56	32.20	0.36	21.16	20.93
42	Guatemala	67.68	67.46	0.21	43.99	43.85
43	Guinea	47.87	48.45	-0.58	31.12	31.49
44	Honduras	68.17	68.74	-0.57	44.31	44.68
45	Hong Kong SAR, China	20.87	19.12	1.76	13.57	12.43
46	Hungary	25.80	25.86	-0.06	16.77	16.81
47	Iceland	16.57	16.78	-0.21	10.77	10.91
48	India	21.76	21.25	0.51	14.14	13.81
49	Indonesia	19.40	19.80	-0.40	12.61	12.87
50	Iran, Islamic Rep.	17.84	18.03	-0.19	11.59	11.72
51	Ireland	17.01	17.46	-0.45	11.06	11.35
52	Israel	21.23	21.12	0.11	13.80	13.73
53	Italy	28.56	28.92	-0.36	18.56	18.80

54	Jamaica	40.40	40.09	0.31	26.26	26.06
55	Japan	13.81	13.46	0.35	8.97	8.75
56	Jordan	18.37	18.12	0.25	11.94	11.78
57	Kazakhstan	45.90	42.73	3.16	29.83	27.78
58	Korea, Rep.	32.05	31.79	0.26	20.83	20.66
59	Kyrgyz Republic	41.72	40.32	1.40	27.12	26.21
60	Lao PDR	50.19	46.25	3.94	32.63	30.06
61	Latvia	26.52	26.20	0.32	17.24	17.03
62	Lebanon	31.71	30.96	0.75	20.61	20.12
63	Liberia	57.11	58.36	-1.24	37.12	37.93
64	Lithuania	28.75	28.12	0.63	18.69	18.28
65	Luxembourg	10.87	10.91	-0.04	7.06	7.09
66	Macao SAR, China	12.97	11.67	1.31	8.43	7.58
67	Macedonia, FYR	34.11	34.21	-0.10	22.17	22.24
68	Madagascar	42.64	45.32	-2.68	27.72	29.46
69	Malaysia	35.32	35.53	-0.21	22.96	23.09
70	Maldives	23.33	22.48	0.85	15.16	14.61
71	Mali	44.80	43.93	0.87	29.12	28.56
72	Malta	26.80	27.29	-0.49	17.42	17.74
73	Mauritius	22.72	22.72	-0.01	14.77	14.77
74	Mexico	31.36	30.96	0.40	20.38	20.12
75	Moldova	53.73	56.05	-2.32	34.92	36.43
76	Mongolia	21.66	20.17	1.49	14.08	13.11
77	Montenegro	35.31	36.90	-1.58	22.95	23.98
78	Morocco	37.32	36.92	0.41	24.26	24.00
79	Namibia	29.04	28.92	0.11	18.87	18.80
80	Netherlands	14.69	14.98	-0.30	9.55	9.74
81	New Zealand	13.39	13.39	0.00	8.70	8.70
82	Nicaragua	49.27	48.92	0.36	32.03	31.80
83	Norway	20.01	19.58	0.43	13.00	12.72
84	Pakistan	31.43	31.93	-0.51	20.43	20.76
85	Paraguay	40.62	38.78	1.84	26.41	25.21
86	Peru	59.36	58.64	0.72	38.58	38.11
87	Philippines	37.69	36.47	1.22	24.50	23.71
88	Poland	26.97	27.03	-0.06	17.53	17.57
89	Portugal	25.43	25.69	-0.26	16.53	16.70
90	Romania	33.16	32.56	0.61	21.56	21.16
91	Russian Federation	42.78	42.23	0.55	27.81	27.45
92	Senegal	49.33	48.91	0.41	32.06	31.79
93	Serbia	34.23	36.16	-1.93	22.25	23.50
94	Singapore	13.41	13.65	-0.24	8.71	8.87
95	Slovak Republic	22.11	20.87	1.24	14.37	13.57
96	Slovenia	27.55	28.02	-0.48	17.91	18.22
97	South Africa	29.23	29.11	0.13	19.00	18.92
98	Spain	24.61	25.01	-0.40	16.00	16.26
99	Sri Lanka	48.72	50.94	-2.22	31.67	33.11
100	Sweden	18.77	18.94	-0.17	12.20	12.31
101	Switzerland	9.09	9.03	0.07	5.91	5.87
102	Tajikistan	51.67	49.80	1.87	33.59	32.37
103	Tanzania	65.96	66.73	-0.76	42.88	43.37
104	Thailand	57.64	56.55	1.09	37.47	36.76
105	Trinidad and Tobago	31.01	30.03	0.98	20.15	19.52
106	Tunisia	39.85	39.69	0.15	25.90	25.80
107	Turkey	37.33	36.15	1.17	24.26	23.50
108	Uganda	43.61	43.16	0.45	28.34	28.05
109	Ukraine	52.23	51.76	0.47	33.95	33.65
110	United Arab Emirates	26.09	25.71	0.38	16.96	16.71
111	United Kingdom	13.78	14.07	-0.30	8.95	9.15

112	United States	9.17	9.35	-0.19	5.96	6.08
113	Uruguay	52.38	51.53	0.86	34.05	33.49
114	Venezuela, RB	33.91	33.13	0.78	22.04	21.53
115	Vietnam	17.17	15.55	1.62	11.16	10.11
116	Yemen, Rep.	29.28	29.42	-0.15	19.03	19.13
117	Zambia	40.04	39.65	0.39	26.03	25.77
	Averages	33.03	32.75	0.28	21.47	21.29

Table 6: Summary table without and with adjustments.

and financial crises in 2008/2009. The same holds for the development of the size of shadow economies after 2009.

The **second** conclusion is that the shadow economy is present to an important extent in all types of economies (developing, transition and highly developed countries). People engage in shadow economy activities for very different reasons. However, the most important are government actions like taxation and regulations.

The **third** conclusion is that there are large regional disparities in the level of informality. At the top level of informality are South America and Africa. At the lowest level of informality are highly developed OECD countries.

Considering these three conclusions, it is obvious that every government needs to institute incentive-oriented economic policies in order to make work in the official economy more attractive. Successful implementation of such policy may lead to stabilization or even reduction in the size of the shadow economy over time.

Finally, even after 30 years of intensive research, the size, causes and consequences of the shadow economy are still controversially debated in the literature and further research is necessary to improve our understanding of the shadow economy. The question of the “correct” size of a shadow economy is an especially controversial topic. We make a first attempt in this paper to tackle this question and to demonstrate that the macro size, obtained by MIMIC and/or currency demand methods, needs to be corrected for legally bought material, crime activities and do-it-yourself activities.

References

- Schneider F, Enste D (2002) *The shadow economy: An international survey*. Cambridge University Press, UK.
- Schneider F (2010) The influence of public institutions on the shadow economy: An empirical investigation for OECD countries. *Review of Law and Economics* 6: 113-140.
- Williams CC, Schneider F (2016) *Measuring the global shadow economy the prevalence of informal work and labour*. Edward Elgar Publishing, UK.
- Zellner A (1970) Estimation of regression relationships containing unobservable independent variables. *International Economic Review* 11: 441-454.
- Joreskog KG, Goldberger AS (1975) Estimation of a model with multiple indicators and multiple causes of a single latent variable. *Journal of the American Statistical Association* 70: 631-639.
- Farzanegan MR (2009) Illegal trade in the Iranian economy: Evidence from a structural model. *Eur J Polit Econ* 25: 489-507.
- Schneider F, Buehn A, Montenegro CE (2010) New estimates for the shadow economies all over the world. *Int Econ J* 24: 443-461.
- Feld L, Schneider F (2010) Survey on the shadow economy and undeclared earnings in OECD countries. *Ger Econ Rev* 11: 109-149.
- Frey BS, Weck-Hanneman H (1984) The hidden economy as an “unobserved” variable. *Eur Econ Rev* 26: 33-53.
- Tafenau E, Herwartz H, Schneider F (2010) Regional estimates of the shadow economy in Europe. *Int Econ J* 24: 629-636.
- Tedds L (2005) *The underground economy in Canada*. Ashgate Publishing, UK.
- Dell’Anno R (2007) The shadow economy in Portugal: An analysis with the MIMIC approach. *J Appl Econ* 2: 253-277
- Hassan M, Schneider F (2016) Modelling Egyptian shadow economy: A MIMIC model and a currency demand approach. *Journal of Economics and Political Economy* 3: 309-339.
- Buehn A, Farzanegan MR (2013) Impact of education on the shadow economy: Institutions matter. *Econ Bull* 33: 2052-2063.
- Chaudhuri K, Schneider F, Chattopadhyay S (2006) The size and development of the shadow economy: An empirical investigation from states of India. *J Dev Econ* 80: 428-443.
- Tanzi V (1999) Uses and abuses of estimates of the underground economy. *Econ J* 109: 338-347.
- Alañón A, Gómez-Antonio M (2005) Estimating the size of the shadow economy in Spain: a structural model with latent variables. *Appl Econ* 37: 1011-1025.
- Buehn A (2012) The shadow economy in German regions: An empirical assessment. *Ger Econ Rev* 13: 275-290.
- Buehn A, Schneider F (2008) MIMIC Models, cointegration and error correction: an application to the French shadow economy. IZA Working Paper No. 3306.
- Johnson, Simon Kauffman, Daniel Zoido-Lobaton P (1997) Regulatory discretion and the unofficial economy. *American Economic Review Papers and Proceedings* 88: 387-393.
- Loayza NV (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: 129-162.
- Dell’Anno R, Gómez-Antonio M, Pardo A (2007) The shadow economy in three Mediterranean countries: France, Spain and Greece. A MIMIC approach. *Empir Econ* 33: 51-84.
- Razmi MJ, Falahi MA, Montazeri S (2013) Institutional quality and underground economy of 51 OIC member countries. *Universal Journal of Management and Social Sciences* 3: 1-14.
- Schneider F, Williams CC (2013) *The shadow economy*. The Institute of Economic Affairs, IEA, London, UK.
- Bajada C, Schneider F (2005) The shadow economies of the Asia-Pacific. *Pac Econ Rev* 10: 379-401.
- Bollen KA (1989) *Structural equations with latent variables*. Wiley, New York.
- Buehn, Andreas, Karmann, Alexander, Schneider, et al. (2009) Shadow economy and do-it-yourself activities: the German case. *J Inst Theoretical Econ* 165: 701-722.
- Schneider F (2015) Size and development of the shadow economy of 31 European and 5 other OECD countries from 2003 to 2015: different developments.
- Dell’Anno R, Schneider F (2009) A complex approach to estimate the shadow economy: the structural equation modelling. *Coping with Complexity of Economics*. Springer.
- Satorra A, Bentler PM (1994) Corrections to test statistics and standard errors in covariance structure analysis.