

Shadow Economies and Corruption all over the World: Revised Estimates for 120 Countries

by
Friedrich Schneider*)
and
Andreas Buehn **)

Abstract:

Estimations of the shadow economies for 120 countries, including developing, Eastern Europe and Central Asian and high income OECD countries over 1999 to 2006 are presented. The average size of the shadow economy (as a percent of "official" GDP) in 2004/05 in 76 developing countries is 35.5%, in 19 Eastern and Central Asian countries 36.7% and in 25 high income OECD countries 15.5%. An increased burden of taxation and social security contributions, combined with labour market regulations are the driving forces of the shadow economy. Furthermore, the results show that the shadow economy reduces corruption in high income countries, but increases corruption in low income countries. Finally, the various estimation methods are discussed and critically evaluated.

JEL-class.: O17, O5, D78, H2, H11, H26.

Keywords: shadow economy of 120 countries, tax burden, tax moral, quality of state institutions, regulation, MIMIC and other estimation methods

*) Professor of Economics, Dr. DDr.h.c. Friedrich Schneider, Department of Economics, Johannes Kepler University of Linz, A-4040 Linz-Auhof, Austria. Phone: 0043-732-2468-8210, Fax: -8209. E-mail: friedrich.schneider@jku.at, <http://www.econ.jku.at/schneider>.

**) Dipl.-Vw. Andreas Buehn, Technische Universität Dresden, Faculty of Business and Economics, Chair for Economics, esp. Monetary Economics, 01062 Dresden.

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1 Introduction

As corruption and shadow economic activities are facts of life around the world, most societies attempt to control these activities through various measures like punishment, prosecution, economic growth or education. To gather information about the extent of corruption and the shadow economy and its relationship or who is engaged in corrupt and/or underground activities, the frequency with which these activities are occurring and magnitude of them, is crucial for making effective and efficient decisions regarding the allocations of a country's resources in this area. Unfortunately, it is very difficult to get accurate information about the relationship between corruption and shadow economy activities on the goods and labour market, because all individuals engaged in these activities wish not to be identified. Hence, doing research in these two areas can be considered as a scientific passion for knowing the unknown.

Although substantial literature¹⁾ exists on single aspects of the hidden or shadow economy and a comprehensive survey has been written by Schneider (one author of this paper) and Enste (2000), the subject is still quite controversial²⁾ as there are disagreements about the definition of shadow economy activities, the estimation procedures and the use of their estimates in economic analysis and policy aspects³⁾. Nevertheless around the world, there are some indications for an increase of the shadow economy but little is known about the development and the size of the shadow economies in developing, Eastern European and Central Asian (mostly the former transition countries) and high income OECD countries over the period 1999 to 2005/06 using the same estimation technique and almost the same data sample.

¹⁾ The literature about the "shadow", "underground", "informal", "second", "cash-" or "parallel", economy is increasing. Various topics, on how to measure it, its causes, its effect on the official economy are analyzed. See for example, survey type publications by Frey and Pommerehne (1984); Thomas (1992); Loayza (1996); Pozo (1996); Lippert and Walker (1997); Schneider (1994a, 1994b, 1997, 1998a, 2003, 2005, 2007); Johnson, Kaufmann, and Shleifer (1997), Johnson, Kaufmann and Zoido-Lobaton (1998a, 1998b); Belev (2003); Gerxhani (2003) and Pedersen (2003). For an overall survey of the global evidence of the size of the shadow economy see Bajada and Schneider (2005), Schneider and Enste (2000, 2002, 2006) and Alm, Martinez and Schneider (2004), and Kazemier (2005a)

²⁾ Compare e.g. in the Economic Journal, vol. 109, no. 456, June 1999 the feature "controversy: on the hidden economy".

³⁾ Compare the different opinions of Tanzi (1999), Thomas (1999), Giles (1999a,b) and Pedersen (2003), and Janisch and Brümmerhoff (2005).

Hence, the goal of this paper is threefold: (i) to undertake the challenging task of estimating the shadow economy for 120 countries all over the world⁴⁾, (ii) to provide some insights into the main causes of the shadow economy, and (iii) to explore the relationship between shadow and corruption. In section 2 an attempt is made to define the shadow economy and some theoretical considerations about the reasons why it is increasing. Section 3 presents the econometric estimation results and the calculation of the size of the shadow economy in 120 countries over the period 1999/2000 to 2005/06. In section 4 two hypotheses about the relationship between the shadow economy and corruption are derived and some empirical results are shown. In section 5 a summary is given and some policy conclusions are drawn. Finally in the three appendices (chapters 6, 7, and 8) the various methods to estimate the shadow economy are presented and critically evaluated, a definition of the variables and data sources are given, and the descriptive statistics of the variables are shown.

2 Some Theoretical Considerations about the Shadow Economy

2.1 Defining the Shadow Economy

Most authors trying to measure the shadow economy face the difficulty of how to define it. One commonly used working definition is all currently unregistered economic activities that contribute to the officially calculated (or observed) Gross National Product⁵⁾. Smith (1994, p. 18) defines it as "market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP." Or to put it in another way, one of the broadest definitions of it includes..."those economic activities and the income derived from them that circumvent or otherwise avoid government regulation, taxation or observation"⁶⁾.

⁴⁾ This paper focuses on the size and development of the shadow economy for countries and does not show any disaggregated values for specific regions. Lately some first studies were undertaken to measure the size of the shadow economy as well as the "grey" or "shadow" labour force for urban regions or states (e.g. California). Compare e.g. Marcelli, Pastor and Joassart (1999), Marcelli (2004), Chen (2004), Williams (2004a, b, 2005a, b, 2006), Williams and Windebank (1999, 2001a, b), Flaming, Haydamack, and Jossart (2005) and Alderslade, Talmage and Freeman (2006), and Brueck, Haisten-DeNew and Zimmermann (2006).

⁵⁾ This definition is used for example, by Feige (1989, 1994), Schneider (1994a, 2003, 2005, 2007) and Frey and Pommerehne (1984). Do-it-yourself activities are not included. For estimates of the shadow economy and the do-it-yourself activities for Germany see Karmann (1986, 1990), and Buehn, Karmann and Schneider (2009).

⁶⁾ This definition is taken from Dell'Anno (2003), Dell'Anno and Schneider (2004) and Feige (1989); see also Thomas (1999), Fleming, Roman and Farrell (2000).

In this paper the following more narrow definition of the shadow economy is used⁷⁾: The shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for the following reasons:

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

Hence, in this paper, we will not deal with typical underground, economic (classical crime) activities, which are all illegal actions that fit the characteristics of classical crimes like burglary, robbery, drug dealing, etc. we also exclude the informal household economy which consists of all household services and production. This paper also does not focus on tax evasion or tax compliance, because it would get too long, and moreover tax evasion is a different subject, where already a lot of research has been undertaken⁸⁾.

2.2 The Main Causes of the Shadow Economy

2.2.1 Tax and Social Security Contribution Burdens

In almost all studies⁹⁾ it has been ascertained that the overall tax and social security contribution burdens are among the main causes for the existence of the shadow economy. Since taxes affect labour-leisure choices, and also stimulate labour supply in the shadow economy, the distortion of the overall tax burden is a major concern for economists. The bigger the difference between the total cost of labour in the official economy and the after-tax earnings (from work), the greater is the incentive to avoid this difference and to work in the shadow economy. Since this difference depends broadly on the social security burden/payments and the overall tax burden, they latter are key features of the existence and the increase of the shadow economy.

⁷⁾ Compare also the excellent discussion of the definition of the shadow economy in Pedersen (2003, pp.13-19) and Kazemier (2005a) who use a similar one.

⁸⁾ Compare, e.g. the survey of Andreoni, Erard and Feinstein (1998) and the paper by Kirchler, Maciejovsky and Schneider (2002).

⁹⁾ See Thomas (1992); Lippert and Walker (1997); Schneider (1994a,b, 1997, 1998a,b, 2000, 2003b, 2005, 2007); Johnson, Kaufmann, and Zoido-Lobaton (1998a,1998b); Tanzi (1999); Giles (1999a); Mummert and Schneider (2001); Giles and Tedds (2002) and Dell'Anno (2003), just to quote a few recent ones.

Empirical results of the influence of the tax burden on the shadow economy is provided in the studies of Schneider (1994b, 2000, 2004, 2005, 2007) and Johnson, Kaufmann and Zoido-Lobato (1998a, 1998b); they all found statistically significant evidence for the influence of taxation on the shadow economy. This strong influence of indirect and direct taxation on the shadow economy is further demonstrated by discussing empirical results in the case of Austria and the Scandinavian countries. For Austria the driving force for the shadow economy activities is the direct tax burden (including social security payments); it has the biggest influence, followed by the intensity of regulation and complexity of the tax system. A similar result has been found by Schneider (1986) for the Scandinavian countries (Denmark, Norway and Sweden). In all three countries various tax variables: average direct tax rate, average total tax rate (indirect and direct tax rate) and marginal tax rates have the expected positive effect (on currency demand) and are highly statistically significant. These findings are supported by studies of Kirchgaessner (1983, 1984) for Germany, and by Klovland (1984) for Norway, and Sweden, too.

In this study an attempt will be made to investigate the influence of the direct and indirect tax burden as well as the social security payments on the shadow economy for developing, transition and highly developed countries over the period 1999 to 2006.

2.2.2 Intensity of Regulations

Increased intensity of regulations is another important factor which reduces the freedom (of choice) for individuals engaged in the official economy. One can think of labour market regulations, trade barriers, and labour restrictions for foreigners. Johnson, Kaufmann, and Zoido-Lobato (1998b) find significant overall empirical evidence of the influence of (labour) regulations on the shadow economy; and the impact is clearly described and theoretically derived in other studies, e.g. for Germany (Deregulation Commission 1990/91). Regulations lead to a substantial increase in labour costs in the official economy. But since most of these costs can be shifted to the employees, these costs provide another incentive to work in the shadow economy, where they can be avoided. Their empirical evidence supports the model of Johnson, Kaufmann, and Shleifer (1997), which predicts, inter alia, that countries with more general regulation of their economies tend to have a higher share of the unofficial economy in total GDP. Johnson, Kaufmann, and Zoido-Lobato (1998b) conclude that it is the enforcement of regulation which is the key factor for the burden levied on firms and individuals, and not the overall extent of regulation - mostly not enforced - which drives firms into the shadow economy. Friedman, Johnson, Kaufmann and Zoido-Lobato (2000) reach a

similar conclusion. In their study every available measure of regulation is significantly correlated with the share of the unofficial economy and the estimated sign of the relationship is unambiguous: more regulation is correlated with a larger shadow economy.

These findings demonstrate that governments should put more emphasis on improving enforcement of laws and regulations, rather than increasing their number. Some governments, however, prefer this policy option (more regulations and laws), when trying to reduce the shadow economy, mostly because it leads to an increase in power for the bureaucrats and to a higher rate of employment in the public sector.

2.2.3 Public Sector Services

An increase of the shadow economy can lead to reduced state revenues which in turn reduce the quality and quantity of publicly provided goods and services. Ultimately, this can lead to an increase in the tax rates for firms and individuals in the official sector, quite often combined with a deterioration in the quality of the public goods (such as the public infrastructure) and of the administration, with the consequence of even stronger incentives to participate in the shadow economy. Johnson, Kaufmann, and Zoido-Lobaton (1998a/b) present a simple model of this relationship. Their findings show that smaller shadow economies appear in countries with higher tax revenues if achieved by lower tax rates, fewer laws and regulations and less bribery facing enterprises. Countries with a better rule of law, which is financed by tax revenues, also have smaller shadow economies. Transition countries have higher levels of regulation leading to a significantly higher incidence of bribery, higher effective taxes on official activities and a large discretionary regulatory framework and consequently a higher shadow economy. Their overall conclusion is that "wealthier countries of the OECD, as well as some in Eastern Europe, find themselves in the 'good equilibrium' of relatively low tax and regulatory burden, sizeable revenue mobilization, good rule of law and corruption control, and a [relatively] small unofficial economy. By contrast, a number of countries in Latin American and the former Soviet Union exhibit characteristics consistent with a 'bad equilibrium': tax and regulatory discretion and burden on the firm is high, the rule of law is weak, and there is a high incidence of bribery and a relatively high share of activities in the unofficial economy." (Johnson, Kaufmann, and Zoido-Lobaton ,1998a, p. 1). First results of the influence of corruption on the shadow economy and vice versa are reported in chapter 4 of this section.

3 The Size of the Shadow Economy for 120 Countries

3.1 Econometric Results

In tables 3.1 to 3.6 the econometric estimations using the MIMIC approach (latent estimation approach) are presented for the 76 developing countries, the 19 Eastern European and Central Asian (mostly former transition) countries and the 25 high income OECD-countries of our sample¹⁰⁾. This grouping was necessary because the available data is different for these countries. For the developing countries, two estimations with and without the unemployment rate as causal variable are presented; without unemployment rate the number of development countries increase from 57 to 76. For the high income OECD countries again two estimations are shown with and without the causal variable tax morale. For the 76 developing countries and the 19 Eastern European and Central Asian countries, the estimation was done for six different points of time 1999/2000, 2001/02 2002/03, 2003/04, 2004/05, and 2005/06 and for the 25 OECD countries we have eight data points of time 1995/96, 1997/98, 1999/2000, 2001/02, 2002/03, 2003/04, 2004/05, and 2005/06.

For the developing countries we use as cause variables the following seven: share of direct taxation (direct taxes in percent of overall taxation), size of government (general government final consumption expenditure, in percent of GDP) as proxy for indirect taxation and fiscal freedom (an index consisting of top individual income tax rate, top individual corporal tax rate, and total tax revenues as percent of GDP) as three tax burden variables in a wide sense; regulatory intensity for state regulation, and the business freedom index (which has the elements: time to open a business, financial costs to start a business, minimum capital stock to start a business, and costs for obtaining a licence), the state of economy with the two variables: the unemployment rate and GDP per capita. As indicator variables we use growth rate of GDP per capita, the employment quota (people over 15 economically active in % of total population), and the annual rate of local currency per capita.¹¹ For the Eastern European and Central Asian (mostly former transition) countries, we use as cause variables the share of indirect taxes and an index of fiscal freedom as the two tax burden variables, the state regulation, the business freedom index, and for the state of the economy the unemployment

¹⁰⁾ The classification which country is a developing, or an Eastern European and Central Asian or a High Income OEC country follows the one done by the World Bank (2002) e.g. using a benchmark per capita income of USD 9,265 or less for developing countries.

¹¹ Here we have the problem that in some developing and Eastern European and Central Asian countries, the US Dollar (or the Euro) is also a widely used currency, which is not considered here, because we could not obtain

rate, inflation rate and openness (sum of export and imports of goods and services, in percent of GDP). As indicator variables, we use GDP per capita, the growth rate of total labour force, and the growth rate of local money per capita. For the 25 high income OECD countries, we use for the two tax burden variables the total tax burden (total tax revenues in percent of GDP), the fiscal freedom index, for the state regulatory burden the two variables business freedom (index) and regulatory burden (index, Heritage Foundation), and for the state of the economy the unemployment rate. As indicator variables, we use GDP per capita, the labour force participation rate and currency as ratio of M2.

The estimations results for 57 developing countries, including the unemployment rate over the period 1999 up to 2006 are shown in table 3.1.1 and the estimation results for 76 developing countries (excluding the unemployment rate) over the same period are shown in table 3.1.2. In both estimations, all estimated coefficients of the cause variables have the theoretically expected signs. All cause variables are statistically significant, at least at the 90-percent confidence level. In both estimations, the share of direct taxation and the size of government are highly statistically significant, as well as the regulatory burden (although the level of significance is lower in the estimation for the 76 developing countries) and the business freedom variable. The unemployment variable has the expected positive sign, and GDP per capita is in both equations highly statistically significant with the expected negative sign. If we turn to the indicator variables, the employment quota and the growth rate of local money per capita are in both equations highly statistically significant. The test statistics are quite satisfactory too.

In Table 3.2, the MIMIC estimations results for the 19 Eastern European and Central Asian (mostly former transition) countries over the period 1999 to 2006 are presented. If we begin with the cause variables, the share of indirect taxes and the fiscal freedom variable, both capturing the overall state burden, are highly statistically significant and have the expected sign. Turning to regulation, the business freedom variable has the expected negative sign and is highly statistically significant. As these countries experienced periods of high inflation, the inflation rate has the expected positive sign and is highly statistically significant. The variable openness, modelling in a certain way the transition process, is not statistically significant. Considering the indicator variables, the growth rate of the total labour force is statistically

any reliable figures of the amount of US Dollar (Euro) in these countries.

significant, as well as the growth rate of local money per capita. Also, here the test statistics are quite satisfactory.

Finally, in tables 3.3.1 and 3.3.2, the estimation results for the 25 high income OECD countries are shown. Table 3.3.1 shows the estimation without the tax morale variable for 25 countries over a data set from 1996 up to 2006, and table 3.3.2 the results including the tax morale variable for only 15 high income OECD countries from 1996 up to 2005. If we consider first table 3.3.1, the results without the tax morale variable, the two variables capturing government burden (total tax burden and fiscal freedom) are highly statistically significant and have the expected sign. The unemployment rate has the expected sign and is at 90 percent confidence level statistically significant. Turning to the indicator variables, the labour force participation rate and currency as ratio of M2 are both highly statistically significant. Also, the test statistics for this equation is quite satisfactory. Turning to table 3.3.2, where we present the results including tax morale as an additional cause variable, we have fewer countries and fewer observations but see that the tax morale variable is highly statistically significant and has the expected sign, as well as the other cause variables.¹²

Summarizing the econometric (MIMIC) results, we can demonstrate that for all three groups of countries, the theoretical consideration of the causes of the shadow economy in section 2 can be confirmed. Tax burden variables (direct and/or indirect and/or overall tax burden or other indices) as well as indices measuring the fiscal freedom in a country are driving forces for the growth of the shadow economy in all three types of countries. Followed by the measures of regulation (measured in the business freedom variable and regulatory intensity) and by measures of the official economy, the unemployment rate, and for the developing countries, GDP per capita have a highly statistically significant influence.

¹² The importance of this variable with respect to theory and empirical investigations is also shown in Frey (1997), Feld and Frey (2002, 2002a and 2005), and Torgler and Schneider (2005).

Table 3.1.1. MIMIC Estimation Results for 57 Developing Countries (including unemployment rate) over 1999/2000 to 2005/06.

Causal Variables	Estimated Coefficients
Share of direct taxation (in % of total taxation)	0.13*** (3.75)
Size of Government (General Government final consumption expenditure in % of GDP)	0.21*** (5.76)
Fiscal freedom (index 0 = highest fiscal burden, 100 = lowest fiscal burden)	-0.06* (-1.75)
Regulatory burden (Index, Heritage Foundation 1 = most freedom, 5 = least freedom)	0.10*** (3.06)
Business freedom (Index 0 = least business freedom, 100 = most freedom)	-0.11*** (-3.27)
Unemployment rate (% of total labour force)	0.14*** (3.85)
GDP per capita	-0.33*** (-5.89)
Indicator Variables	
Growth rate of GDP per capita	-1.00
Employment quota (in % of total population)	-0.56*** (-5.12)
Growth rate of local money per capita	-0.51*** (-4.76)
Test Statistics	
RMSEA (p-value) ¹⁾	0.00 (1.00)
Chi-square (p-value) ²⁾	36.13 (0.42)
AGFI ³⁾	0.98
Degrees of freedom ⁴⁾	35
Observations	549
Notes: t-statistics are given in parentheses *, **, *** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level. All variables are used as their standardized deviations from mean.	
¹⁾ Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.	
²⁾ If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix).	
³⁾ Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.	
⁴⁾ The degrees of freedom are determined by $0.5(p + q)(p + q + 1) - t$; with p = number of indicators; q = number of causes; t = the number for free parameters.	

Table 3.1.2. MIMIC Estimation Results for 76 Developing Countries (excluding unemployment rate) over 1999/2000 to 2005/06.

Causal Variables	Estimated Coefficients
Share of direct taxation (in % of total taxation)	0.12*** (3.70)
Size of Government (General Government final consumption expenditure in % of GDP)	0.21*** (6.25)
Fiscal freedom (index 0 = highest fiscal burden, 100 = lowest fiscal burden)	-0.06* (-1.84)
Regulatory burden (Index, Heritage Foundation 1 = most freedom, 5 = least freedom)	0.06* (1.88)
Business freedom (Index 0 = least business freedom, 100 = most freedom)	-0.10*** (-3.07)
GDP per capita	-0.34*** (-6.73)
Indicator Variables	
Growth rate of GDP per capita	-1.00
Employment quota (in % of total population)	-0.26*** (-2.79)
Growth rate of local money per capita	-0.56*** (-5.28)
Test Statistics	
RMSEA (p-value) ¹⁾	0.00 (1.00)
Chi-square (p-value) ²⁾	19.67 (0.84)
AGFI ³⁾	0.99
Degrees of freedom ⁴⁾	27
Observations	720
Notes: t-statistics are given in parentheses *; **; *** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level. All variables are used as their standardized deviations from mean.	
¹⁾ Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.	
²⁾ If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix).	
³⁾ Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.	
⁴⁾ The degrees of freedom are determined by $0.5(p + q)(p + q + 1) - t$; with p = number of indicators; q = number of causes; t = the number for free parameters.	

Table 3.2. MIMIC Estimation Results for 19 Eastern European and Central Asian (mostly former transition) countries over 1999/2000 to 2005/06.

Causal Variables	Estimated Coefficients
Business freedom (Index 0 = least business freedom, 100 = most freedom)	-0.33*** (-7.85)
Fiscal freedom (index 0 = highest fiscal burden, 100 = lowest fiscal burden)	-0.29*** (-3.95)
Unemployment rate (% of total labour force)	0.12** (2.08)
Share of indirect taxes (% of total revenues)	0.13*** (2.79)
Inflation rate (annual rate of GDP deflation)	0.57*** (2.88)
Openness (sum of exports and imports of goods and services in % of GDP)	-0.05 (-0.71)
Indicator Variables	
GDP per capita	-1.00
Growth rate of total labour force (annual labour force growth rate)	-0.45*** (-3.51)
Growth rate of local money per capita	-0.21** (-2.30)
Test Statistics	
RMSEA (<i>p</i> -value) ¹⁾	0.00 (1.00)
Chi-square (<i>p</i> -value) ²⁾	12.73 (0.91)
AGFI ³⁾	0.97
Degrees of freedom ⁴⁾	27
Observations	132
Notes: t-statistics are given in parentheses *; **; *** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level. All variables are used as their standardized deviations from mean. Estimated the model using the government share of the real GDP per capita as proxy for indirect taxation gives similar results.	
¹⁾ Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0. ²⁾ If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix). ³⁾ Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit. ⁴⁾ The degrees of freedom are determined by $0.5(p + q)(p + q + 1) - t$; with p = number of indicators; q = number of causes; t = the number for free parameters.	

Table 3.3.1 Estimation Results for 25 High Income OECD Countries over 1995/96 to 2005/06.

Causal Variables	Estimated Coefficients
Total tax burden (total tax revenues in % of GDP)	0.07** (2.15)
Fiscal freedom (Index 0 = highest fiscal burden, 100 = lowest fiscal burden)	-0.11*** (-3.12)
Unemployment rate (% of total labor force)	0.07* (1.96)
Business freedom (Index 0 = least business freedom, 100 = most freedom)	-0.34*** (-12.13)
Regulatory quality (Index 0 = most regulation, 100 = least regulation)	-0.32*** (-9.10)
Indicator Variables	
GDP per capita	-1.00
Labour force participation rate	-0.73*** (-7.93)
Currency/M2 (ratio)	0.66*** (6.71)
Test Statistics	
RMSEA (p-value) ¹⁾	0.00 (0.88)
Chi-square (p-value) ²⁾	17.74 (0.60)
AGFI ³⁾	0.95
Degrees of freedom ⁴⁾	20
Observations	145
<p>Notes: t-statistics are given in parentheses *; **, *** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level. All variables are used as their standardized deviations from mean. Estimated the model using alternative measures for the tax burden (i.e. direct and indirect taxation separately) gives similar results.</p> <p>¹⁾ Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.</p> <p>²⁾ If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix).</p> <p>³⁾ Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.</p> <p>⁴⁾ The degrees of freedom are determined by $0.5(p + q)(p + q + 1) - t$; with p = number of indicators; q = number of causes; t = the number for free parameters.</p>	

Table 3.3.2 Estimation Results for 15 High Income OECD Countries (including the tax morale variable) over 1996 to 2005

Causal Variables	Estimated Coefficients
Total tax burden (total tax revenues in % of GDP)	0.11*** (2.66)
Fiscal freedom (Index 0 = highest fiscal burden, 100 = lowest fiscal burden)	-0.11*** (-2.49)
Tax moral (World Value Index; 0 = lowest moral, 10 = highest moral)	-0.15*** (-2.79)
Unemployment rate (% of total labour force)	0.09* (1.89)
Business freedom (Index 0 = least business freedom, 100 = most freedom)	-0.23*** (-5.70)
Regulatory quality (Index 0 = most regulation, 100 = least regulation)	-0.26*** (-6.26)
Indicator Variables	
GDP per capita	-1.00
Labour force participation rate	-0.68*** (-4.08)
Currency/M2 (ratio)	0.82*** (4.63)
Test Statistics	
RMSEA (p-value) ¹⁾	0.00 (1.00)
Chi-square (p-value) ²⁾	12.75 (0.99)
AGFI ³⁾	0.93
Degrees of freedom ⁴⁾	27
Observations	74
<p>Notes: t-statistics are given in parentheses *, **, *** means the t-statistics are statistically significant at the 90%, 95%, or 99% confidence level. All variables are used as their standardized deviations from mean. Estimated the model using alternative measures for the tax burden gives similar results. Estimated the model using alternative measures for the tax burden (i.e. direct and indirect taxation separately) gives similar results. We have also used the share of people who find it justifiable claiming government benefits to which they are not entitled to proxy tax morality but find no significant impact of this variable.</p> <p>¹⁾ Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.</p> <p>²⁾ If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix).</p> <p>³⁾ Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.</p> <p>⁴⁾ The degrees of freedom are determined by $0.5(p + q)(p + q + 1) - t$; with p = number of indicators; q = number of causes; t = the number for free parameters.</p>	

3.2 The Size of the Shadow Economies for 120 Countries for 1999/2000 to 2005/2006

In order to calculate the size and development of the shadow economies of 120 countries, we have to overcome the disadvantage of the MIMIC approach, which is, that one gets only relatively estimated sizes of the shadow economy and one has to use another approach to get absolute figures. In order to calculate absolute figures of the size of the shadow economies from these MIMIC estimation results, we use the already available estimations from the currency demand approach for Australia, Austria, Germany, Hungary, Italy, India, Peru, Russia and the United States (from studies of Schneider (2007), Chatterjee, Chaudhury and Schneider (2006), Dell'Anno and Schneider (2004), Bajada and Schneider (2003, 2005), Alexeev and Pyle (2003), Schneider and Enste (2002) and Lacko (2000)). As we have absolute values of the shadow economy (in % of GDP) for various years for the above mentioned countries, we can use a benchmark procedure to transform the index of the shadow economy from the MIMIC estimations into absolute values.¹³

When showing the size of the shadow economies over the five periods of time (1999/2000, 2001/2002, 2002/2003, 2003/2004 and 2004/2005) for the 120 countries which are quite different in location and developing stage, one should be aware that such country comparisons give only a rough picture of the ranking of the size of the shadow economy in these countries and over time, because the MIMIC and the currency demand methods have shortcomings; these are discussed in the appendix (chapter 6)¹⁴. Due to these shortcomings a detailed discussion of the (relative) ranking of the size of the shadow economies is not conducted.

3.2.1 76 Developing Countries¹⁵

As we presented two different MIMIC estimates with respect to the developing countries due to the fact that the unemployment variable was only available for a much smaller country sample (57 developing countries instead of 76), the calibration of the size and development of

¹³) This procedure is described in great detail in the paper Dell'Anno and Schneider (2005, 2009).

¹⁴) See also Thomas (1992, 1999), Tanzi (1999), Pedersen (2003) and Ahumada, Alveredo, Cavanese A and P. Cavanese (2004), Janisch and Brümmerhoff (2005), Schneider (2005) and Breusch (2005a, 2005b).

¹⁵) For an extensive and excellent literature survey of the research about the shadow economy in developing countries see Gerxhani (2003), who stresses throughout her paper that the distinction between developed and developing countries with respect to the shadow economy is of great importance. Due to space reasons this point is not further elaborated here; nor are the former results and literature discussed. Compare Schneider and Enste (2000)

the shadow economy of the developing countries is done for both sets of estimations.¹⁶ In Tables 3.4.1 and 3.4.2, the size of the shadow economy in 57 developing countries (including the unemployment variable in the MIMIC estimation) is presented in Table 3.4.1 in alphabetical order, and in Table 3.4.2 with respect to the size. If we first consider the development of the average of these 57 countries over time, in the year 1999 the size was 34.0% and modestly increased up to the year 2006 to 34.4%. The three countries with the smallest shadow economy are China, Singapore and Vietnam with an average country size of 13.3, 13.4 and 15.7 percent respectively.¹⁷ In a middle size position we have the countries Botswana, Kenya and Ecuador, with an average size of 33.4, 34.2 and 34.2 percent of GDP. The highest shadow economies have Peru, Panama and Bolivia with a size of 60.1, 64.3 and 67.3 percent of GDP.

In tables 3.4.3 and 3.4.4, the size and development of the shadow economy of 76 developing countries are presented using the MIMIC estimation for the developing countries without the unemployment rate. The size of the shadow economies of those countries are in both samples quite similar. The average size of the shadow economy of these 76 developing countries was 34.9% in 1999 and modestly increased to 35.2% in the year 2005/06. The lowest size of the shadow economy average of the period 1999 to 2006 have again Singapore, China and Vietnam; the middle position now have Egypt, Bangladesh and Trinidad and Tobago with 35.1, 35.5 and 35.7 %. The highest shadow economies now have Peru, Panama and Bolivia with 60.1, 64.2 and 67.3 %. Large shadow economies in some developing countries is only to some extent an issue of tax burden and regulation, given the simple fact that the limited local economy means that citizens are often unable to earn a living wage in a legitimate manner. Working in the shadow economy is often the only way of achieving a minimal standard of living. It should also be noted that the average size of the Asian shadow economies are smaller than the shadow economies of African and Latin American countries..

¹⁶ Calibration is performed separately for each country. Having calculated the ordinal MIMIC index by applying the estimated coefficients to the standardized time series, we add a constant to this MIMIC index in order to satisfy the usual condition that the shadow economy as percentage of official GDP is in the base period equal to the chosen base value. Changes of the shadow economy are then determined by the dynamics of this index. The base values for the high income OECD countries and the eastern European and central Asian countries originate from the year 2005. Regarding the developing countries we opted for base values originating from the year 2000 because of better data availability in that year compared to 2005.

¹⁷ It should be mentioned that Mainland China and Vietnam are still communist countries with partly market economies, so that the figures of these two countries may be biased.

Table 3.4.1. Size of the Shadow Economy in 57 Developing Countries (% of GDP)¹⁾

Nr.	Country	Years								Country
		1999	2000	2001	2002	2003	2004	2005	2006	Average
1	Algeria	33.5	34.1	33.9	34.1	34.6	35.0	35.6	35.8	34.6
2	Argentina	25.4	25.4	25.1	25.3	25.4	25.6	26.0	- ²⁾	25.5
3	Bangladesh	-	35.6	35.4	35.2	35.0	35.2	35.4	-	35.3
4	Benin	-	-	48.2	48.3	-	-	-	-	48.3
5	Bolivia	67.1	67.1	67.1	67.1	67.1	67.2	67.7	68.1	67.3
6	Botswana	33.0	33.4	33.4	33.4	33.4	33.7	34.0	-	33.4
7	Brazil	39.6	39.8	39.9	39.8	39.7	39.9	40.0	-	39.8
8	Cameroon	32.4	32.8	32.6	32.7	32.7	32.9	33.3	-	32.8
9	Chile	19.8	19.8	19.8	19.6	19.9	19.9	20.3	20.5	19.9
10	China	13.0	13.1	13.0	12.9	13.1	13.4	13.6	13.9	13.2
11	Colombia	38.8	39.1	39.2	39.1	39.2	39.7	39.9	40.5	39.4
12	Congo, Rep.	47.7	48.2	48.2	48.1	48.4	48.5	49.1	-	48.3
13	Costa Rica	26.4	26.2	25.8	25.8	25.9	26.1	26.4	26.9	26.2
14	Côte d'Ivoire	43.6	43.2	43.3	43.3	43.2	43.3	43.4	43.5	43.4
15	Dominican Republic	32.0	32.1	31.8	32.0	32.0	32.3	32.4	32.7	32.2
16	Ecuador	33.4	34.4	34.0	34.2	34.1	34.5	34.9	-	34.2
17	Egypt, Arab Rep.	35.1	35.1	35.1	34.8	34.9	34.9	35.2	35.4	35.0
18	El Salvador	46.3	46.3	46.4	46.4	46.5	46.5	46.6	46.7	46.4
19	Ghana	41.5	41.9	42.4	42.1	42.0	42.1	42.3	-	42.1
20	Guatemala	51.6	51.5	51.1	51.1	51.3	51.4	51.7	51.8	51.5
21	Guinea	40.4	40.6	40.8	40.7	41.0	40.9	41.5	-	40.9
22	Honduras	49.5	49.6	49.5	49.4	49.4	49.6	49.6	-	49.5
23	India	23.1	23.1	23.3	23.5	23.7	24.0	24.4	24.6	23.7
24	Indonesia	19.3	19.4	19.2	19.0	18.9	18.6	19.5	-	19.1
25	Iran, Islamic Rep.	19.2	18.9	18.9	19.3	19.6	19.7	19.6	19.6	19.4
26	Israel	22.0	21.9	21.9	21.7	21.8	22.3	22.8	22.8	22.2
27	Jamaica	36.5	36.4	36.6	36.7	36.7	36.8	37.4	37.0	36.8
28	Jordan	-	-	20.5	20.6	20.8	21.3	21.8	21.5	21.1
29	Kenya	33.9	34.3	34.4	34.0	33.6	34.0	34.3	34.7	34.2
30	Kuwait	20.3	20.3	20.2	20.1	20.3	20.5	20.6	20.8	20.4
31	Madagascar	-	39.6	39.8	39.1	39.6	40.2	41.0	-	39.9
32	Malaysia	30.9	31.1	30.7	30.7	30.7	30.9	31.1	-	30.9
33	Malta	-	27.1	26.7	27.0	26.6	26.7	27.0	26.9	26.8
34	Mauritania	-	36.1	36.1	36.5	36.4	36.8	37.0	-	36.5
35	Mauritius	-	-	-	-	-	25.9	25.8	25.7	25.8
36	Mexico	30.0	30.1	30.2	30.2	30.7	30.8	31.1	-	30.4
37	Mongolia	-	18.4	18.3	18.4	18.5	19.1	19.7	-	18.8

Table 3.4.1. Size of the Shadow Economy in 57 Developing Countries (% of GDP)¹⁾
(cont.)

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
38	Morocco	36.2	36.4	36.5	36.7	36.9	36.8	36.8	-	36.6
39	Namibia	-	31.4	31.6	32.0	32.0	32.6	32.7	-	32.0
40	Nicaragua	44.9	45.2	45.2	45.2	45.3	45.4	45.4	45.5	45.3
41	Pakistan	36.7	36.8	36.9	36.9	37.1	37.4	37.7	37.6	37.1
42	Panama	63.9	64.1	63.9	63.9	64.2	64.7	65.1	-	64.3
43	Papua New Guinea	36.2	36.1	-	-	-	-	-	-	36.1
44	Paraguay	27.2	27.4	27.7	27.4	27.7	28.0	28.1	28.6	27.8
45	Peru	59.7	59.9	59.7	60.0	59.9	60.1	60.4	60.6	60.1
46	Philippines	43.2	43.3	43.4	43.6	43.9	44.1	44.5	44.9	43.9
47	Saudi Arabia	18.4	18.4	18.2	18.4	18.9	19.2	19.4	-	18.7
48	Singapore	13.2	13.1	12.9	12.9	13.2	13.7	13.9	14.0	13.4
49	South Africa	28.3	28.4	28.3	28.4	28.4	28.6	28.8	29.0	28.5
50	Sri Lanka	44.6	44.6	44.6	44.3	44.6	44.6	44.8	44.5	44.6
51	Swaziland	-	41.4	41.5	41.5	41.6	-	-	-	41.5
52	Syrian Arab Republic	19.5	19.3	19.4	19.2	19.3	19.1	19.6	-	19.3
53	Trinidad and Tobago	-	-	35.1	35.3	35.5	35.9	36.0	36.4	35.7
54	Tunisia	38.3	38.4	38.4	38.5	38.6	39.0	39.1	39.5	38.7
55	United Arab Emirates	26.3	26.4	26.2	26.1	26.6	27.2	27.2	-	26.6
56	Vietnam	15.6	15.6	15.5	15.6	15.7	15.8	16.2	-	15.7
57	Yemen, Rep.	27.5	27.4	27.1	27.0	27.0	27.0	27.3	-	27.2
	Time Average	34.0	34.0	33.9	33.9	33.8	33.7	34.0	34.3	

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009, p. 122), other interpolated ones.

²⁾ “-“ means no value available.

Source: Own calculations.

Table 3.4.2. Size of the Shadow Economy in 57 Developing Countries (% of GDP): Size Ranking of Countries¹⁾

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
1	China	13.0	13.1	13.0	12.9	13.1	13.4	13.6	13.9	13.2
2	Singapore	13.2	13.1	12.9	12.9	13.2	13.7	13.9	14.0	13.4
3	Vietnam	15.6	15.6	15.5	15.6	15.7	15.8	16.2	- ²⁾	15.7
4	Saudi Arabia	18.4	18.4	18.2	18.4	18.9	19.2	19.4	-	18.7
5	Mongolia	-	18.4	18.3	18.4	18.5	19.1	19.7	-	18.8
6	Indonesia	19.3	19.4	19.2	19.0	18.9	18.6	19.5	-	19.1

Table 3.4.2. Size of the Shadow Economy in 57 Developing Countries (% of GDP): Size Ranking of Countries ¹⁾ (cont.)

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
7	Syrian Arab Republic	19.5	19.3	19.4	19.2	19.3	19.1	19.6	-	19.3
8	Iran, Islamic Rep.	19.2	18.9	18.9	19.3	19.6	19.7	19.6	19.6	19.4
9	Chile	19.8	19.8	19.8	19.6	19.9	19.9	20.3	20.5	19.9
10	Kuwait	20.3	20.3	20.2	20.1	20.3	20.5	20.6	20.8	20.4
11	Jordan	-	-	20.5	20.6	20.8	21.3	21.8	21.5	21.1
12	Israel	22.0	21.9	21.9	21.7	21.8	22.3	22.8	22.8	22.2
13	India	23.1	23.1	23.3	23.5	23.7	24.0	24.4	24.6	23.7
14	Argentina	25.4	25.4	25.1	25.3	25.4	25.6	26.0	-	25.5
15	Mauritius	-	-	-	-	-	25.9	25.8	25.7	25.8
16	Costa Rica	26.4	26.2	25.8	25.8	25.9	26.1	26.4	26.9	26.2
17	United Arab Emirates	26.3	26.4	26.2	26.1	26.6	27.2	27.2	-	26.6
18	Malta	-	27.1	26.7	27.0	26.6	26.7	27.0	26.9	26.8
19	Yemen, Rep.	27.5	27.4	27.1	27.0	27.0	27.0	27.3	-	27.2
20	Paraguay	27.2	27.4	27.7	27.4	27.7	28.0	28.1	28.6	27.8
21	South Africa	28.3	28.4	28.3	28.4	28.4	28.6	28.8	29.0	28.5
22	Mexico	30.0	30.1	30.2	30.2	30.7	30.8	31.1	-	30.4
23	Malaysia	30.9	31.1	30.7	30.7	30.7	30.9	31.1	-	30.9
24	Namibia	-	31.4	31.6	32.0	32.0	32.6	32.7	-	32.0
25	Dominican Republic	32.0	32.1	31.8	32.0	32.0	32.3	32.4	32.7	32.2
26	Cameroon	32.4	32.8	32.6	32.7	32.7	32.9	33.3	-	32.8
27	Botswana	33.0	33.4	33.4	33.4	33.4	33.7	34.0	-	33.4
28	Kenya	33.9	34.3	34.4	34.0	33.6	34.0	34.3	34.7	34.2
29	Ecuador	33.4	34.4	34.0	34.2	34.1	34.5	34.9	-	34.2
30	Algeria	33.5	34.1	33.9	34.1	34.6	35.0	35.6	35.8	34.6
31	Egypt, Arab Rep.	35.1	35.1	35.1	34.8	34.9	34.9	35.2	35.4	35.0
32	Bangladesh	-	35.6	35.4	35.2	35.0	35.2	35.4	-	35.3
33	Trinidad and Tobago	-	-	35.1	35.3	35.5	35.9	36.0	36.4	35.7
34	Papua New Guinea	36.2	36.1	-	-	-	-	-	-	36.1
35	Mauritania	-	36.1	36.1	36.5	36.4	36.8	37.0	-	36.5
36	Morocco	36.2	36.4	36.5	36.7	36.9	36.8	36.8	-	36.6
37	Jamaica	36.5	36.4	36.6	36.7	36.7	36.8	37.4	37.0	36.8
38	Pakistan	36.7	36.8	36.9	36.9	37.1	37.4	37.7	37.6	37.1
39	Tunisia	38.3	38.4	38.4	38.5	38.6	39.0	39.1	39.5	38.7
40	Colombia	38.8	39.1	39.2	39.1	39.2	39.7	39.9	40.5	39.4
41	Brazil	39.6	39.8	39.9	39.8	39.7	39.9	40.0	-	39.8
42	Madagascar	-	39.6	39.8	39.1	39.6	40.2	41.0	-	39.9

Table 3.4.2. Size of the Shadow Economy in 57 Developing Countries (% of GDP): Size Ranking of Countries ¹⁾ (cont.)

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
43	Guinea	40.4	40.6	40.8	40.7	41.0	40.9	41.5	-	40.9
44	Swaziland	-	41.4	41.5	41.5	41.6	-	-	-	41.5
45	Ghana	41.5	41.9	42.4	42.1	42.0	42.1	42.3	-	42.1
46	Côte d'Ivoire	43.6	43.2	43.3	43.3	43.2	43.3	43.4	43.5	43.4
47	Philippines	43.2	43.3	43.4	43.6	43.9	44.1	44.5	44.9	43.9
48	Sri Lanka	44.6	44.6	44.6	44.3	44.6	44.6	44.8	44.5	44.6
49	Nicaragua	44.9	45.2	45.2	45.2	45.3	45.4	45.4	45.5	45.3
50	El Salvador	46.3	46.3	46.4	46.4	46.5	46.5	46.6	46.7	46.4
51	Benin	-	-	48.2	48.3	-	-	-	-	48.3
52	Congo, Rep.	47.7	48.2	48.2	48.1	48.4	48.5	49.1	-	48.3
53	Honduras	49.5	49.6	49.5	49.4	49.4	49.6	49.6	-	49.5
54	Guatemala	51.6	51.5	51.1	51.1	51.3	51.4	51.7	51.8	51.5
55	Peru	59.7	59.9	59.7	60.0	59.9	60.1	60.4	60.6	60.1
56	Panama	63.9	64.1	63.9	63.9	64.2	64.7	65.1	-	64.3
57	Bolivia	67.1	67.1	67.1	67.1	67.1	67.2	67.7	68.1	67.3

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ "--" means no value available.

Source: Own calculations.

Table 3.4.3. Size of the Shadow Economy in 76 Developing Countries (% of GDP) ¹⁾

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
1	Algeria	33.7	34.1	34.0	34.1	34.6	34.9	35.4	35.6	34.6
2	Argentina	25.4	25.4	25.2	25.2	25.4	25.6	25.8	- ²⁾	25.4
3	Bahrain	26.2	26.4	26.3	26.4	26.7	27.1	27.5	-	26.7
4	Bangladesh	35.5	35.6	35.7	35.4	35.2	35.3	35.5	-	35.5
5	Benin	48.2	48.2	48.1	48.1	48.2	48.2	48.4	-	48.2
6	Bolivia	67.1	67.1	67.1	67.1	67.1	67.2	67.6	67.9	67.3
7	Botswana	33.2	33.4	33.5	33.5	33.6	33.9	34.1	-	33.6
8	Brazil	39.6	39.8	39.9	39.9	39.7	40.0	40.1	-	39.9
9	Burkina Faso	41.3	41.1	41.0	40.8	41.0	41.1	41.3	-	41.1
10	Cameroon	32.4	32.8	32.6	32.7	32.7	32.9	33.2	-	32.8
11	Central African Republic	-	-	45.4	45.4	45.2	45.3	45.4	-	45.3
12	Chad	46.1	46.2	46.5	46.5	46.7	47.6	47.3	-	46.7

Table 3.4.3. Size of the Shadow Economy in 76 Developing Countries (% of GDP) ¹⁾ (cont.)

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
13	Chile	19.8	19.8	19.8	19.6	19.9	20.0	20.3	20.4	20.0
14	China	13.1	13.1	13.0	13.0	13.3	13.5	13.8	14.0	13.4
15	Colombia	38.8	39.1	39.1	39.0	39.1	39.5	39.7	40.2	39.3
16	Congo, Rep.	47.7	48.2	48.2	48.2	48.4	48.5	49.1	-	48.3
17	Costa Rica	26.4	26.2	25.9	25.8	26.0	26.1	26.5	26.8	26.2
18	Côte d'Ivoire	43.5	43.2	43.3	43.3	43.2	43.4	43.4	43.5	43.4
19	Dominican Republic	32.0	32.1	31.9	32.1	32.0	32.3	32.5	32.7	32.2
20	Ecuador	33.7	34.4	34.1	34.3	34.2	34.5	35.0	-	34.3
21	Egypt, Arab Rep.	35.1	35.1	35.1	34.9	35.0	35.0	35.3	35.5	35.1
22	El Salvador	46.3	46.3	46.4	46.3	46.5	46.5	46.6	46.7	46.5
23	Ethiopia	40.5	40.3	40.6	40.4	40.4	40.8	41.3	-	40.6
24	Fiji	33.8	33.6	33.7	34.2	34.2	34.5	34.6	-	34.1
25	Ghana	41.6	41.9	42.3	42.1	42.1	42.2	42.4	-	42.1
26	Guatemala	51.6	51.5	51.1	51.1	51.2	51.4	51.7	51.7	51.4
27	Guinea	40.4	40.6	40.8	40.8	41.0	41.0	41.5	-	40.9
28	Honduras	49.5	49.6	49.5	49.4	49.5	49.6	49.7	-	49.5
29	India	23.1	23.1	23.2	23.4	23.6	23.8	24.2	24.4	23.6
30	Indonesia	19.3	19.4	19.3	19.2	19.1	18.9	19.6	-	19.3
31	Iran, Islamic Rep.	19.2	18.9	18.9	19.3	19.5	19.7	19.6	19.5	19.3
32	Israel	21.9	21.9	21.8	21.8	21.9	22.3	22.5	22.5	22.1
33	Jamaica	36.4	36.4	36.6	36.6	36.6	36.7	37.1	36.8	36.7
34	Jordan	20.4	20.5	20.6	20.7	20.9	21.3	21.8	21.6	21.0
35	Kenya	34.0	34.3	34.4	34.1	33.7	34.1	34.4	34.7	34.2
36	Kuwait	20.2	20.2	20.1	20.1	20.3	20.6	20.7	20.8	20.4
37	Lao PDR	30.6	30.6	30.8	31.0	31.1	31.1	31.1	-	30.9
38	Lesotho	31.3	31.3	31.6	31.6	31.5	31.9	32.1	32.5	31.7
39	Madagascar	39.6	39.6	39.8	39.1	39.6	40.1	40.7	-	39.8
40	Malawi	40.0	40.3	40.2	40.2	40.4	40.6	40.7	-	40.3
41	Malaysia	30.8	31.1	30.8	30.8	30.8	31.0	31.1	-	30.9
42	Mali	41.6	42.3	42.5	42.6	42.7	42.7	42.5	42.6	42.4
43	Malta	26.9	27.1	26.8	27.0	26.7	26.8	27.1	27.0	26.9
44	Mauritania	36.0	36.1	36.1	36.4	36.3	36.7	36.9	-	36.4
45	Mauritius	23.1	23.1	23.3	23.3	23.0	22.9	23.0	22.8	23.1
46	Mexico	30.0	30.1	30.2	30.2	30.6	30.8	31.1	-	30.4
47	Mongolia	18.5	18.4	18.4	18.6	18.8	19.1	19.6	-	18.8
48	Morocco	36.3	36.4	36.5	36.7	36.8	36.8	36.8	-	36.6
49	Mozambique	40.1	40.3	40.3	40.4	40.4	40.6	40.4	-	40.4

Table 3.4.3. Size of the Shadow Economy in 76 Developing Countries (% of GDP) ¹⁾ (cont.)

Nr.	Country	Years								Country
		1999	2000	2001	2002	2003	2004	2005	2006	Average
50	Namibia	31.1	31.4	31.6	31.9	31.9	32.5	32.6	-	31.9
51	Nepal	38.5	38.4	38.8	38.9	38.9	38.9	39.1	39.2	38.8
52	Nicaragua	45.0	45.2	45.2	45.3	45.3	45.4	45.5	45.6	45.3
53	Niger	42.0	41.9	42.1	42.5	42.7	42.3	42.7	-	42.3
54	Oman	18.4	18.9	18.9	18.8	18.8	19.1	19.5	-	18.9
55	Pakistan	36.6	36.8	36.9	36.9	37.0	37.3	37.5	37.4	37.1
56	Panama	63.9	64.1	64.0	64.0	64.2	64.6	64.9	-	64.2
57	Papua New Guinea	36.2	36.1	-	-	-	-	-	-	36.2
58	Paraguay	27.3	27.4	27.6	27.5	27.8	28.0	28.1	28.5	27.8
59	Peru	59.8	59.9	59.8	60.1	60.1	60.3	60.5	60.6	60.1
60	Philippines	43.2	43.3	43.4	43.6	43.8	44.1	44.4	44.6	43.8
61	Rwanda	40.4	40.3	40.0	40.2	40.2	40.7	41.0	-	40.4
62	Saudi Arabia	18.4	18.4	18.2	18.3	18.8	19.1	19.3	-	18.6
63	Sierra Leone	43.7	43.8	43.8	43.9	44.1	44.3	-	-	43.9
64	Singapore	13.2	13.1	12.8	12.9	13.2	13.6	13.8	13.9	13.3
65	South Africa	28.3	28.4	28.3	28.4	28.4	28.6	28.8	28.9	28.5
66	Sri Lanka	44.6	44.6	44.6	44.3	44.6	44.7	44.8	44.5	44.6
67	Swaziland	40.5	41.1	41.2	41.3	41.4	-	-	-	41.1
68	Syrian Arab Republic	19.5	19.3	19.4	19.3	19.4	19.3	19.7	-	19.4
69	Tanzania	58.2	58.3	58.4	58.5	58.4	58.7	58.8	-	58.5
70	Togo	34.9	35.1	34.9	35.2	35.0	35.1	34.7	-	35.0
71	Trinidad and Tobago	-	-	35.1	35.3	35.5	35.8	35.9	36.3	35.7
72	Tunisia	38.4	38.4	38.4	38.4	38.5	38.8	39.0	39.3	38.7
73	Uganda	48.8	48.9	48.9	48.6	48.8	48.8	49.1	49.2	48.9
74	United Arab Emirates	26.4	26.4	26.2	26.1	26.5	27.1	27.2	-	26.6
75	Vietnam	15.6	15.6	15.6	15.7	15.7	15.8	16.2	-	15.7
76	Yemen, Rep.	27.3	27.4	27.1	27.1	27.1	27.1	27.4	-	27.2
	Time Average	34.9	35.0	35.1	35.1	35.2	35.4	35.5	34.9	

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ "--" means no value available.

Source: Own calculations.

Table 3.4.4. Size of the Shadow Economy in 76 Developing Countries (% of GDP): Ranking of Countries ¹⁾

Nr.	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
1	Singapore	13.2	13.1	12.8	12.9	13.2	13.6	13.8	13.9	13.3
2	China	13.1	13.1	13.0	13.0	13.3	13.5	13.8	14.0	13.4
3	Vietnam	15.6	15.6	15.6	15.7	15.7	15.8	16.2	- ²⁾	15.7
4	Saudi Arabia	18.4	18.4	18.2	18.3	18.8	19.1	19.3	-	18.6
5	Mongolia	18.5	18.4	18.4	18.6	18.8	19.1	19.6	-	18.8
6	Oman	18.4	18.9	18.9	18.8	18.8	19.1	19.5	-	18.9
7	Indonesia	19.3	19.4	19.3	19.2	19.1	18.9	19.6	-	19.3
8	Iran, Islamic Rep.	19.2	18.9	18.9	19.3	19.5	19.7	19.6	19.5	19.3
9	Syrian Arab Republic	19.5	19.3	19.4	19.3	19.4	19.3	19.7	-	19.4
10	Chile	19.8	19.8	19.8	19.6	19.9	20.0	20.3	20.4	20.0
11	Kuwait	20.2	20.2	20.1	20.1	20.3	20.6	20.7	20.8	20.4
12	Jordan	20.4	20.5	20.6	20.7	20.9	21.3	21.8	21.6	21.0
13	Israel	21.9	21.9	21.8	21.8	21.9	22.3	22.5	22.5	22.1
14	Mauritius	23.1	23.1	23.3	23.3	23.0	22.9	23.0	22.8	23.1
15	India	23.1	23.1	23.2	23.4	23.6	23.8	24.2	24.4	23.6
16	Argentina	25.4	25.4	25.2	25.2	25.4	25.6	25.8	-	25.4
17	Costa Rica	26.4	26.2	25.9	25.8	26.0	26.1	26.5	26.8	26.2
18	United Arab Emirates	26.4	26.4	26.2	26.1	26.5	27.1	27.2	-	26.6
19	Bahrain	26.2	26.4	26.3	26.4	26.7	27.1	27.5	-	26.7
20	Malta	26.9	27.1	26.8	27.0	26.7	26.8	27.1	27.0	26.9
21	Yemen, Rep.	27.3	27.4	27.1	27.1	27.1	27.1	27.4	-	27.2
22	Paraguay	27.3	27.4	27.6	27.5	27.8	28.0	28.1	28.5	27.8
23	South Africa	28.3	28.4	28.3	28.4	28.4	28.6	28.8	28.9	28.5
24	Mexico	30.0	30.1	30.2	30.2	30.6	30.8	31.1	-	30.4
25	Lao PDR	30.6	30.6	30.8	31.0	31.1	31.1	31.1	-	30.9
26	Malaysia	30.8	31.1	30.8	30.8	30.8	31.0	31.1	-	30.9
27	Lesotho	31.3	31.3	31.6	31.6	31.5	31.9	32.1	32.5	31.7
28	Namibia	31.1	31.4	31.6	31.9	31.9	32.5	32.6	-	31.9
29	Dominican Republic	32.0	32.1	31.9	32.1	32.0	32.3	32.5	32.7	32.2
30	Cameroon	32.4	32.8	32.6	32.7	32.7	32.9	33.2	-	32.8
31	Botswana	33.2	33.4	33.5	33.5	33.6	33.9	34.1	-	33.6
32	Fiji	33.8	33.6	33.7	34.2	34.2	34.5	34.6	-	34.1
33	Kenya	34.0	34.3	34.4	34.1	33.7	34.1	34.4	34.7	34.2
34	Ecuador	33.7	34.4	34.1	34.3	34.2	34.5	35.0	-	34.3
35	Algeria	33.7	34.1	34.0	34.1	34.6	34.9	35.4	35.6	34.6
36	Togo	34.9	35.1	34.9	35.2	35.0	35.1	34.7	-	35.0
37	Egypt, Arab Rep.	35.1	35.1	35.1	34.9	35.0	35.0	35.3	35.5	35.1
38	Bangladesh	35.5	35.6	35.7	35.4	35.2	35.3	35.5	-	35.5

Table 3.4.4. Size of the Shadow Economy in 76 Developing Countries (% of GDP): Ranking of Countries ¹⁾
(cont.)

Nr.	Country	Years								Country
		1999	2000	2001	2002	2003	2004	2005	2006	Average
39	Trinidad and Tobago	-	-	35.1	35.3	35.5	35.8	35.9	36.3	35.7
40	Papua New Guinea	36.2	36.1	-	-	-	-	-	-	36.2
41	Mauritania	36.0	36.1	36.1	36.4	36.3	36.7	36.9	-	36.4
42	Morocco	36.3	36.4	36.5	36.7	36.8	36.8	36.8	-	36.6
43	Jamaica	36.4	36.4	36.6	36.6	36.6	36.7	37.1	36.8	36.7
44	Pakistan	36.6	36.8	36.9	36.9	37.0	37.3	37.5	37.4	37.1
45	Tunisia	38.4	38.4	38.4	38.4	38.5	38.8	39.0	39.3	38.7
46	Nepal	38.5	38.4	38.8	38.9	38.9	38.9	39.1	39.2	38.8
47	Colombia	38.8	39.1	39.1	39.0	39.1	39.5	39.7	40.2	39.3
48	Madagascar	39.6	39.6	39.8	39.1	39.6	40.1	40.7	-	39.8
49	Brazil	39.6	39.8	39.9	39.9	39.7	40.0	40.1	-	39.9
50	Malawi	40.0	40.3	40.2	40.2	40.4	40.6	40.7	-	40.3
51	Mozambique	40.1	40.3	40.3	40.4	40.4	40.6	40.4	-	40.4
52	Rwanda	40.4	40.3	40.0	40.2	40.2	40.7	41.0	-	40.4
53	Ethiopia	40.5	40.3	40.6	40.4	40.4	40.8	41.3	-	40.6
54	Guinea	40.4	40.6	40.8	40.8	41.0	41.0	41.5	-	40.9
55	Burkina Faso	41.3	41.1	41.0	40.8	41.0	41.1	41.3	-	41.1
56	Swaziland	40.5	41.1	41.2	41.3	41.4	-	-	-	41.1
57	Ghana	41.6	41.9	42.3	42.1	42.1	42.2	42.4	-	42.1
58	Niger	42.0	41.9	42.1	42.5	42.7	42.3	42.7	-	42.3
59	Mali	41.6	42.3	42.5	42.6	42.7	42.7	42.5	42.6	42.4
60	Côte d'Ivoire	43.5	43.2	43.3	43.3	43.2	43.4	43.4	43.5	43.4
61	Philippines	43.2	43.3	43.4	43.6	43.8	44.1	44.4	44.6	43.8
62	Sierra Leone	43.7	43.8	43.8	43.9	44.1	44.3	-	-	43.9
63	Sri Lanka	44.6	44.6	44.6	44.3	44.6	44.7	44.8	44.5	44.6
64	Nicaragua	45.0	45.2	45.2	45.3	45.3	45.4	45.5	45.6	45.3
65	Central African Republic	-	-	45.4	45.4	45.2	45.3	45.4	-	45.3
66	El Salvador	46.3	46.3	46.4	46.3	46.5	46.5	46.6	46.7	46.5
67	Chad	46.1	46.2	46.5	46.5	46.7	47.6	47.3	-	46.7
68	Benin	48.2	48.2	48.1	48.1	48.2	48.2	48.4	-	48.2
69	Congo, Rep.	47.7	48.2	48.2	48.2	48.4	48.5	49.1	-	48.3
70	Uganda	48.8	48.9	48.9	48.6	48.8	48.8	49.1	49.2	48.9
71	Honduras	49.5	49.6	49.5	49.4	49.5	49.6	49.7	-	49.5
72	Guatemala	51.6	51.5	51.1	51.1	51.2	51.4	51.7	51.7	51.4
73	Tanzania	58.2	58.3	58.4	58.5	58.4	58.7	58.8	-	58.5
74	Peru	59.8	59.9	59.8	60.1	60.1	60.3	60.5	60.6	60.1

Table 3.4.4. Size of the Shadow Economy in 76 Developing Countries (% of GDP): Ranking of Countries ¹⁾ (cont.)

Nr.	Country	Years								Country
		1999	2000	2001	2002	2003	2004	2005	2006	Average
75	Panama	63.9	64.1	64.0	64.0	64.2	64.6	64.9	-	64.2
76	Bolivia	67.1	67.1	67.1	67.1	67.1	67.2	67.6	67.9	67.3

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ “-“ means no value available.

Source: Own calculations.

3.2.2 19 Eastern European and Central Asian (mostly former transition) Countries

The measurement of the size and development of the shadow economies in the transition countries has been undertaken since the late 1980s starting with the work of Kaufmann and Kaliberda (1996), Johnson et al. (1997) and Lacko (2000). They all use the physical input (electricity) method and come up with quite large figures. In the work of Alexeev and Pyle (2003) and Belev (2003) the above mentioned studies are critically evaluated arguing that the estimated sizes of the unofficial economies are to a large extent a historical phenomenon and partly determined by institutional factors.

In Tables 3.5.1 and 3.5.2 the size and development of 19 Eastern European and Central Asian (mostly former transition) countries in percent of GDP are presented¹⁸. Table 3.5.1 presents again the countries in alphabetical order and 3.5.2 with respect to size. If we first consider the average of the shadow economy of these 19 Eastern European and Central Asian countries, it was 35.8% in 1999 and increased to 36.9% in 2006. The three countries with the smallest shadow economy are the Czech and Slovak Republic and Hungary with an average size over the period 1999 to 2006 of 17.2, 18.0 and 23.4 percent. In the middle position are Albania, Bulgaria, and Romania with 34.1, 35.4, and 36.2 percent. The highest shadow economies have the countries Moldavia, Ukraine and Georgia with 48.2, 54.3 and 67.8 percent.

3.2.3 25 High Income OECD-Countries

The size and development of the shadow economies of 25 High Income OECD countries is shown in Tables 3.6.1 and 3.6.2. Table 3.6.1 presents again the countries in alphabetical order and 3.6.2 with respect to size. If we first consider the average development of the shadow

¹⁸ Only 19 countries could be included because for the Republic of Kyrgyzstan we have only one observation

economies of the 25 High Income OECD countries with respect to the size, the size was in the year 1996 14.2% and increased to 15.8% in the year 2006. Some high income OECD countries, like Greece has up's and down's, others (like Belgium, Australia) show a steady increase. The lowest shadow economies have Switzerland, the United States and Austria with an average size of the shadow economy over the period 1996 to 2006 from 7.0, 7.9 and 8.1 percent. The highest shadow economies among these 25 high income OECD countries have Mexico with 31.5, Korea with 26.6 and Greece with 25.3 percent.

In tables 3.6.3 and 3.6.4, the size and development of the shadow economies of 15 high income countries are presented; for these 15 countries we could include the tax morale variable. Due to the fewer data points for the tax morale variable a comparison is difficult between the two estimations; however, one result is that those countries, which have high tax morale, have a somewhat lower shadow economy, *ceteris paribus*.

Table 3.5.1. Size of the Shadow Economy in 19 Eastern Europe and Central Asian Countries (% of GDP) ¹⁾

	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
1	Albania	- ²⁾	-	-	33.7	33.7	33.7	34.3	35.1	34.1
2	Bulgaria	35.0	34.8	34.9	35.0	35.4	35.4	36.5	36.4	35.4
3	Croatia	33.3	33.0	33.1	33.7	33.1	32.6	34.1	34.2	33.4
4	Czech Republic	17.7	18.1	17.7	17.9	17.9	17.8	18.3	18.3	18.0
5	Estonia	36.8	37.1	37.1	37.5	37.8	37.5	38.2	38.1	37.5
6	Georgia	67.7	68.0	67.5	67.5	67.5	67.3	68.0	68.7	67.8
7	Hungary	23.0	22.8	23.2	23.3	23.2	23.3	24.3	24.3	23.4
8	Kazakhstan	43.2	43.2	43.2	43.3	43.2	43.7	44.6	44.5	43.6
9	Latvia	37.6	37.3	37.6	37.7	38.2	38.7	39.4	39.2	38.2
10	Lithuania	28.3	28.2	28.4	28.9	29.2	29.2	30.2	30.5	29.1
11	Moldavia	47.8	47.5	48.0	48.1	48.0	48.0	49.1	48.9	48.2
12	Poland	25.9	26.0	26.1	26.1	26.1	26.0	27.3	26.7	26.3
13	Romania	35.6	35.6	35.8	35.9	36.0	36.2	36.9	37.5	36.2
14	Russian Federation	46.0	46.2	46.5	46.6	46.6	46.6	47.3	46.9	46.6
15	Slovak Republic	16.7	16.5	16.9	17.1	17.1	17.1	18.2	18.3	17.2
16	Slovenia	25.8	26.5	26.6	26.7	26.8	26.9	27.3	27.2	26.7
17	Tajikistan	-	45.1	45.1	45.2	45.3	45.4	-	-	45.2
18	Turkey	33.8	33.8	33.2	33.5	33.8	34.0	34.3	34.6	33.9
19	Ukraine	53.7	53.8	53.8	54.0	54.2	54.4	55.3	55.1	54.3
	Time Average	35.8	36.3	36.4	36.4	36.5	36.5	36.9	36.9	

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ “-” means no value available.

Source: Own calculations.

Table 3.5.2. Size of the Shadow Economy in 19 Eastern Europe and Central Asian Countries (% of GDP): Ranking of Countries ¹⁾

	Country	Years								Country Average
		1999	2000	2001	2002	2003	2004	2005	2006	
1	Slovak Republic	16.7	16.5	16.9	17.1	17.1	17.1	18.2	18.3	17.2
2	Czech Republic	17.7	18.1	17.7	17.9	17.9	17.8	18.3	18.3	18.0
3	Hungary	23.0	22.8	23.2	23.3	23.2	23.3	24.3	24.3	23.4
4	Poland	25.9	26.0	26.1	26.1	26.1	26.0	27.3	26.7	26.3
5	Slovenia	25.8	26.5	26.6	26.7	26.8	26.9	27.3	27.2	26.7
6	Lithuania	28.3	28.2	28.4	28.9	29.2	29.2	30.2	30.5	29.1
7	Croatia	33.3	33.0	33.1	33.7	33.1	32.6	34.1	34.2	33.4
8	Turkey	33.8	33.8	33.2	33.5	33.8	34.0	34.3	34.6	33.9
9	Albania	- ²⁾	-	-	33.7	33.7	33.7	34.3	35.1	34.1
10	Bulgaria	35.0	34.8	34.9	35.0	35.4	35.4	36.5	36.4	35.4
11	Romania	35.6	35.6	35.8	35.9	36.0	36.2	36.9	37.5	36.2
12	Estonia	36.8	37.1	37.1	37.5	37.8	37.5	38.2	38.1	37.5
13	Latvia	37.6	37.3	37.6	37.7	38.2	38.7	39.4	39.2	38.2
14	Kazakhstan	43.2	43.2	43.2	43.3	43.2	43.7	44.6	44.5	43.6
15	Tajikistan	-	45.1	45.1	45.2	45.3	45.4	-	-	45.2
16	Russian Federation	46.0	46.2	46.5	46.6	46.6	46.6	47.3	46.9	46.6
17	Moldavia	47.8	47.5	48.0	48.1	48.0	48.0	49.1	48.9	48.2
18	Ukraine	53.7	53.8	53.8	54.0	54.2	54.4	55.3	55.1	54.3
19	Georgia	67.7	68.0	67.5	67.5	67.5	67.3	68.0	68.7	67.8

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ “-” means no value available.

Source: Own calculations

Table 3.6.1. Size of the Shadow Economy in 25 High Income OECD Countries (% of GDP) ¹⁾

	Country	Years								Country Average
		1996	1998	2000	2002	2003	2004	2005	2006	
1	Australia	10.8	11.5	11.7	12.0	12.3	12.4	12.8	13.0	12.1
2	Austria	7.4	7.8	8.3	8.2	8.0	8.0	9.3	9.5	8.3
3	Belgium	17.9	18.0	18.4	18.8	18.9	19.0	19.6	19.9	18.8
4	Canada	11.8	12.6	12.8	13.2	13.1	13.3	14.1	14.1	13.1
5	Denmark	14.5	15.3	15.3	16.1	16.2	16.2	16.1	16.5	15.8
6	Finland	13.8	14.5	14.8	15.4	15.5	15.4	15.8	15.8	15.1
7	France	11.7	12.2	11.8	12.1	12.5	12.5	13.2	13.2	12.4
8	Germany	13.5	14.0	14.7	14.8	14.7	14.6	15.3	15.4	14.6
9	Greece	24.6	24.4	24.9	25.5	25.7	25.2	26.3	26.0	25.3
10	Iceland	12.1	12.8	13.0	13.5	13.4	13.7	14.1	14.1	13.3
11	Ireland	12.1	13.0	13.3	13.5	13.4	13.3	14.1	14.5	13.4
12	Italy	21.2	21.9	22.1	22.3	22.6	22.7	23.2	23.1	22.4
13	Japan	7.4	7.5	7.9	7.2	7.6	7.9	8.8	8.9	7.9
14	Korea, Rep.	26.1	25.6	26.2	26.7	26.5	26.6	27.5	27.3	26.6
15	Luxembourg	7.5	7.9	8.5	8.7	8.6	8.6	9.3	9.4	8.6
16	Mexico	31.9	31.1	30.9	31.6	31.3	31.6	31.7	32.1	31.5
17	Netherlands	9.7	10.3	10.7	10.6	10.4	10.4	11.1	11.2	10.6
18	New Zealand	9.9	11.0	9.8	9.9	10.3	10.4	10.9	10.9	10.4
19	Norway	15.5	16.2	15.4	15.6	15.9	16.1	16.8	16.6	16.0
20	Portugal	19.0	19.5	19.0	19.9	19.6	19.5	20.4	20.3	19.7
21	Spain	18.6	19.4	19.7	19.8	19.7	19.8	20.5	20.2	19.7
22	Sweden	14.8	15.0	15.3	15.6	15.7	15.8	16.3	16.3	15.6
23	Switzerland	7.2	8.1	8.4	8.3	8.1	7.8	8.5	8.3	8.1
24	United Kingdom	9.2	10.2	9.7	9.6	9.6	10.0	10.3	10.9	9.9
25	United States	5.9	6.8	6.9	6.6	6.8	7.0	7.9	8.0	7.0
	Time Average	14.2	14.7	14.8	15.0	15.1	15.1	15.8	15.8	

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

Source: Own calculations.

Table 3.6.2. Size of the Shadow Economy in 25 High Income OECD Countries (% of GDP): Ranking of Countries ¹⁾

	Country	Years								Country Average
		1996	1998	2000	2002	2003	2004	2005	2006	
1	United States	5.9	6.8	6.9	6.6	6.8	7.0	7.9	8.0	7.0
2	Japan	7.4	7.5	7.9	7.2	7.6	7.9	8.8	8.9	7.9
3	Switzerland	7.2	8.1	8.4	8.3	8.1	7.8	8.5	8.3	8.1
4	Austria	7.4	7.8	8.3	8.2	8.0	8.0	9.3	9.5	8.3
5	Luxembourg	7.5	7.9	8.5	8.7	8.6	8.6	9.3	9.4	8.6
6	United Kingdom	9.2	10.2	9.7	9.6	9.6	10.0	10.3	10.9	9.9
7	New Zealand	9.9	11.0	9.8	9.9	10.3	10.4	10.9	10.9	10.4
8	Netherlands	9.7	10.3	10.7	10.6	10.4	10.4	11.1	11.2	10.6
9	Australia	10.8	11.5	11.7	12.0	12.3	12.4	12.8	13.0	12.1
10	France	11.7	12.2	11.8	12.1	12.5	12.5	13.2	13.2	12.4
11	Canada	11.8	12.6	12.8	13.2	13.1	13.3	14.1	14.1	13.1
12	Iceland	12.1	12.8	13.0	13.5	13.4	13.7	14.1	14.1	13.3
13	Ireland	12.1	13.0	13.3	13.5	13.4	13.3	14.1	14.5	13.4
14	Germany	13.5	14.0	14.7	14.8	14.7	14.6	15.3	15.4	14.6
15	Finland	13.8	14.5	14.8	15.4	15.5	15.4	15.8	15.8	15.1
16	Sweden	14.8	15.0	15.3	15.6	15.7	15.8	16.3	16.3	15.6
17	Denmark	14.5	15.3	15.3	16.1	16.2	16.2	16.1	16.5	15.8
18	Norway	15.5	16.2	15.4	15.6	15.9	16.1	16.8	16.6	16.0
19	Belgium	17.9	18.0	18.4	18.8	18.9	19.0	19.6	19.9	18.8
20	Portugal	19.0	19.5	19.0	19.9	19.6	19.5	20.4	20.3	19.7
21	Spain	18.6	19.4	19.7	19.8	19.7	19.8	20.5	20.2	19.7
22	Italy	21.2	21.9	22.1	22.3	22.6	22.7	23.2	23.1	22.4
23	Greece	24.6	24.4	24.9	25.5	25.7	25.2	26.3	26.0	25.3
24	Korea, Rep.	26.1	25.6	26.2	26.7	26.5	26.6	27.5	27.3	26.6
25	Mexico	31.9	31.1	30.9	31.6	31.3	31.6	31.7	32.1	31.5

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

Source: Own calculations.

Table 3.6.3. Size of the Shadow Economy in 15 High Income OECD Countries (% of GDP) (WVS Estimation) ¹⁾

	Country	Years								Country Average
		1996	1998	2000	2002	2003	2004	2005	2006	
1	Australia	11.7	11.9	12.1	12.3	12.5	12.6	12.8	- ²⁾	12.3
2	Finland	14.3	14.9	15.2	15.6	15.7	15.6	15.8	-	15.3
3	France	-	-	12.5	12.7	13.0	12.9	13.2	-	12.9
4	Germany	14.3	14.5	14.9	15.1	15.0	14.9	15.3	-	14.9
5	Italy	-	-	22.5	22.6	22.8	22.9	23.2	-	22.8
6	Japan	8.1	8.3	8.6	8.0	8.3	8.4	8.8	-	8.4
7	Korea, Rep.	26.7	26.1	26.6	27.0	26.8	26.8	27.5	-	26.8
8	Mexico	-	-	31.1	31.7	31.4	31.7	31.7	-	31.5
9	Netherlands	-	-	11.1	11.0	10.8	10.8	11.1	-	11.0
10	New Zealand	10.7	10.6	10.5	10.5	10.7	10.8	10.9	-	10.7
11	Spain	18.9	19.7	20.1	20.1	20.0	20.1	20.5	-	19.9
12	Sweden	15.6	15.5	15.6	16.0	16.0	16.0	16.3	-	15.9
13	Switzerland	8.1	8.5	8.8	8.7	8.5	8.2	8.5	-	8.5
14	United Kingdom	-	-	10.0	10.0	9.9	10.2	10.3	-	10.1
15	United States	6.2	7.2	7.4	7.2	7.3	7.4	7.9	-	7.2
	Time Average	13.5	13.7	15.1	15.2	15.2	15.3	15.6	-	

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ “-” means no value available.

Source: Own calculations.

Table 3.6.4. Size of the Shadow Economy in 15 High Income OECD Countries (% of GDP) (WVS Estimation): Ranking of Countries ¹⁾

	Country	Years								Country Average
		1996	1998	2000	2002	2003	2004	2005	2006	
1	United States	6.2	7.2	7.4	7.2	7.3	7.4	7.9	- ²⁾	7.2
2	Japan	8.1	8.3	8.6	8.0	8.3	8.4	8.8	-	8.4
3	Switzerland	8.1	8.5	8.8	8.7	8.5	8.2	8.5	-	8.5
4	United Kingdom	-	-	10.0	10.0	9.9	10.2	10.3	-	10.1
5	New Zealand	10.7	10.6	10.5	10.5	10.7	10.8	10.9	-	10.7
6	Netherlands	-	-	11.1	11.0	10.8	10.8	11.1	-	11.0
7	Australia	11.7	11.9	12.1	12.3	12.5	12.6	12.8	-	12.3
8	France	-	-	12.5	12.7	13.0	12.9	13.2	-	12.9
9	Germany	14.3	14.5	14.9	15.1	15.0	14.9	15.3	-	14.9
10	Finland	14.3	14.9	15.2	15.6	15.7	15.6	15.8	-	15.3
11	Sweden	15.6	15.5	15.6	16.0	16.0	16.0	16.3	-	15.9
12	Spain	18.9	19.7	20.1	20.1	20.0	20.1	20.5	-	19.9
13	Italy	-	-	22.5	22.6	22.8	22.9	23.2	-	22.8
14	Korea, Rep.	26.7	26.1	26.6	27.0	26.8	26.8	27.5	-	26.8
15	Mexico	-	-	31.1	31.7	31.4	31.7	31.7	-	31.5

¹⁾ Bold values calibrated ones (method Dell'Anno and Schneider (2009), p.122), other interpolated ones.

²⁾ “-” means no value available.

Source: Own calculations.

4 Corruption and the Shadow Economy: Substitutes or Complements?¹⁹⁾

Quite often shadow economy and corruption²⁰⁾ are seen as "twins", who need each other or fight against each other. This means for a social scientist that, theoretically, corruption and the shadow economy can be either complements or substitutes. Choi and Thum (2005) present a model where the option of entrepreneurs to go underground constrains a corrupt official's ability to ask for bribes. Dreher, Kotsogiannis, and McCorriston (2005a/b) extend the model to the explicit specification of institutional quality. The model shows that corruption and shadow economy are substitutes in the sense that the existence of the shadow economy reduces the propensity of officials to demand graft.

Johnson et al. (1997), on the contrary, model corruption and the shadow economy as complements. In their full-employment model, labour can be either employed in the official sector or in the underground economy. Consequently, an increase in the shadow economy always decreases the size of the official market. In their model, corruption increases the shadow economy, as corruption can be viewed as one particular form of taxation and regulation (driving entrepreneurs underground). Hindriks et al. (1999) also show that the shadow economy is a complement to corruption. This is because, in this case, the tax payer colludes with the inspector so the inspector under-reports the tax liability of the tax payer in exchange for a bribe²¹⁾. More recently, Echazu and Bose (2008) also demonstrate – considering different types of corrupt bureaucrats in the official and the shadow economies – that corruption and the shadow economy can be complements.

Theoretically, the relationship between corruption and the shadow economy is thus unsettled. There is, however, reason to believe that the relationship might differ among high and low income countries. In high income countries, the official sector provides public goods like the rule of law, enforcement of contracts, and protection by an efficient police. Usually, only craftsmen or very small firms have (or take) the option of going underground. In this case, the shadow economy is hidden from tax inspectors and other officials. In other words, there are

¹⁹⁾ This section is taken from Dreher and Schneider (2006), pages 4, 5 and 14 as well as table 4.1.

²⁰⁾ According to Dreher and Schneider (2006), corruption is commonly defined as the misuse of public power for private benefit.

no bribes necessary or possible to buy the way out of the official sector. In high income countries – typically showing comparably small levels of corruption – individuals confronted with a corrupt official always have the choice to bring the official to court. Moreover, in high income countries corruption quite often takes place, for example, to bribe officials to get a (huge) contract from the public sector (e.g. in the construction sector). This contract is then handled in the official economy and not in the shadow economy. Hence, corruption in high income countries can be a means to achieve certain benefits which make work in the official economy easier, e.g., winning a contract from a public authority, getting a licence (e.g. for operating taxes or providing other services or getting the permission to convert land into "construction ready" land, etc.). In high income countries people thus bribe in order to be able to engage in more official economic activities. As Schneider and Enste (2000) point out, at least two thirds of the income earned in the shadow economy is immediately spent in the official sector. The shadow economy and the official sector might thus be complements. The corresponding increase in government revenue and strengthened institutional quality is likely to decrease corruption. The prediction of a negative (substitutive) relation between corruption and the shadow economy in high income countries is in line with the models of Choi and Thum (2005) and Dreher, Kotsogiannis, and McCorrison (2005a).²²⁾

In low income countries, on the contrary, we expect different mechanisms to prevail. Instead of working partly in the official sector and offering additional services underground as in high-income countries, enterprises completely engage in underground activity. Examples for enterprises operating completely underground are restaurants, bars, or haircutters – and even big production companies. One reason for this is that public goods provided by the official sector are, in many developing countries, less efficient compared to high income countries or do not exist at all. Big companies, however, are comparably easy to detect and – in order to escape taxation and punishment – they have to bribe officials, thereby increasing corruption. Corruption often takes place in order to pay for activities in the shadow economy, so that the shadow economy entrepreneur can be sure not to be detected by public authorities. Here, the shadow economy and corruption are likely to reinforce each other, as corruption is needed to expand shadow economy activities and – at the same time – underground activities require bribes and corruption. To get some additional income from the shadow economy entrepreneur, it is natural for public officials to ask for bribes and thus benefit from the

²¹⁾ See Dreher and Siemers (2005) for a formalization of this argument.

²²⁾ Consequently, Dreher, Kotsogiannis, and McCorrison (2005a) test their model employing data for OECD countries only.

shadow market. In low income countries, we therefore expect a positive (complementary) relationship between corruption and the shadow economy. This corresponds to the predictions of the models of Johnson et al. (1997), Hindriks et al. (1999), and Echazu and Bose (2008).

In summary, we thus formulate the following two hypotheses:

Hypothesis 1: In low income countries, shadow economy activities and corruption are complements.

Hypothesis 2: In high income countries, shadow economy activities and corruption are substitutes.

To begin with, the two hypotheses are tested for a cross-section of 120 countries and a panel of 70 countries for the period 1994 to 2002.²³⁾ Table 4.1 summarizes the empirical results of Dreher and Schneider (2006). Overall, they show that an increase in perceived corruption over time also increases the shadow economy. This confirms the models of Johnson et al. (1997) and Hindriks et al. (1999). Across countries, however, greater perceived corruption does not lead to a greater shadow economy. To some extent this also supports the results of Méon and Sekkat (2004) showing the within-country variation to be important in their analysis of corruption on foreign direct investment and exports.

Regarding the impact of the shadow economy on perceived corruption, these results for the overall sample are similar to those for the other way round. In the cross-country regressions, all coefficients are completely insignificant. An increase in the shadow economy over time increases corruption according to the fixed and random effects estimator, but not when the endogeneity of the shadow is controlled for. Turning to the sub-samples, the results show that higher perceived corruption significantly reduces the shadow economy in high income countries, confirming the models of Choi and Thum (2005) and Dreher, Kotsogiannis, and McCorriston (2005a). In low income countries, on the contrary, corruption tends to increase with a higher shadow economy, again confirming the models of Johnson et al. (1997) and Hindriks et al. (1999). This is true for the impact of perceived corruption in the within-groups specification and actual corruption in all specifications.

²³⁾ For the description of the data, the estimation techniques used, and the various specification see Dreher and Schneider (2006, chapters 3 and 4).

Table 4.1: Empirical Results of the Relationship between the Shadow Economy and Corruption

Dependent Variable:	Shadow Economy			Corruption		
Independent Variable:	Corruption			Shadow Economy		
Estimation technique	All	Low	High	All	Low	High
ICRG index of corruption						
OLS	1.88 (1.20)	3.57 (1.34)	-0,84 (0.97)	0.00 (0.41)	0.01 (1.14)	-0.07 (3.57***)
Robust regression	1.32 (0.82)	-	-	0.00 (0.43)	-	-
IV, set 1	3.72 (1.17)	3.12 (0.86)	5.41 (1.40)	-0.03 (1.28)	-0.01 (0.42)	-0.09 (1.57)
IV, set 2	-4.04 (1.33)	5.14 (0.78)	-1.85 (1.91*)	-0.02 (0.66)	-0.02 (0.46)	-0.11 (1.45)
Panel, fixed effects	1.34 (2.63**)	1.36 (1.42)	0.69 (1.98**)	0.09 (2.88***)	0.10 (2.77***)	0.09 (0.76)
Panel, random effects	1.59 (4.81***)	-	-	0.02 (2.64***)	-	-
Panel IV	3.46 (3.48***)	-	-	0.01 (0.12)	-	-
TI index of corruption						
OLS	-	-	-	-	-	-0.06 (2.35**)
World Bank Index of corruption						
OLS	-	-	-	-	-	-0.01 (2.76**)
DKM index of corruption						
OLS	-	-	-	0.04 (1.77*)	0.06 (2.49**)	-0.10 (1.50)
Robust regression	-	-	-	0.04 (1.69*)	-	-
IV, set 1	-	-	-	0.14 (2.59**)	0.10 (2.65**)	-0.32 (1.22)
IV, set 2	-	-	-	0.12 (2.45**)	0.12 (2.50**)	0.04 (0.19)

Notes: Higher values represent more corruption; corruption indices used: ICRG International Country Risk Guide; TI=Transparency International; World Bank Index of Corruption; and DKM-Index of Dreher, Kotsogiannis and McCorrison.

Instruments for the shadow economy are: (1) Credit Market Regulations (Fraser), Minimum Wage Regulation (Fraser), Government Effectiveness (World Bank); (2) Starting a Business (Duration), Starting a Business (Costs), Flexibility to Hire, Flexibility to Fire.

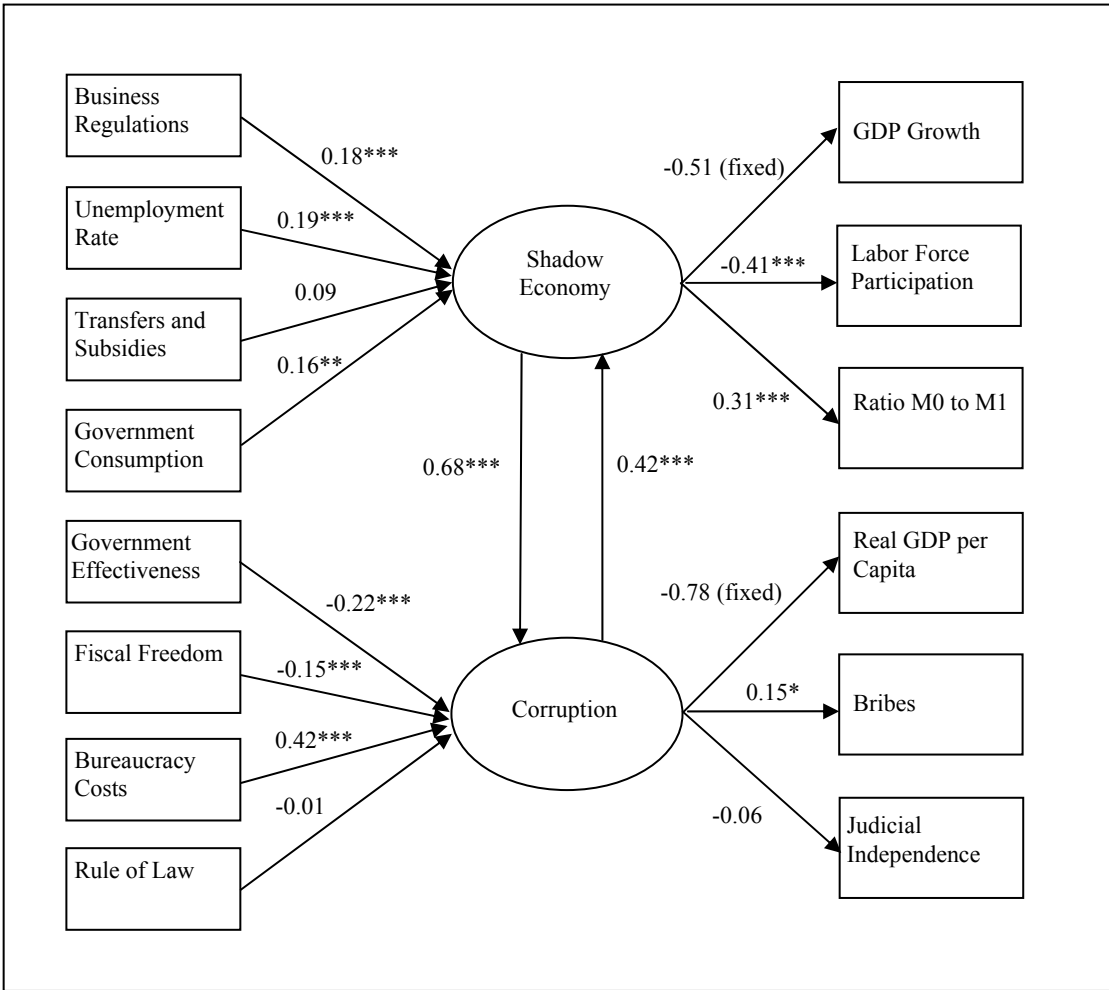
Instruments for corruption are: (1) Fiscal Burden (Heritage), Regulation of Prices (Fraser), Rule of Law (World Bank), Democracy; (2) Ethnic Fractionalization, Religious Fractionalization, Latitude, French Legacy, Socialist Legacy, German Legacy, Scandinavian Legacy.

* denotes significant at 10% level; ** significant at 5% level; *** significant at 1% level

Source: Dreher and Schneider (2006, table 12).

Buehn and Schneider (2009) – modelling corruption and the shadow economy as unobservable variables using a structural equation model with two latent variables – provide evidence for a complementary relationship between corruption and the shadow economy. Their analysis considers 51 countries around the world over the period 2000 to 2005, the majority of them being developing countries. Using the typical determinants for corruption and the shadow economy, they can confirm most of the findings of previous theoretical and empirical research for both latent variables. Figure 1 shows specification (1) of their estimations.

Figure 4.1. Structural Equation Model for Corruption and the Shadow Economy



Note: *, **, *** indicate significance of the coefficients at the 90%, 95%, and 99% confidence level.

The estimated coefficients for the paths between corruption and the shadow economy and vice versa measure the influence of the latent variables (i.e. corruption and the shadow economy) on each other. Although the mutual relationship between corruption and the shadow economy is positive across all estimated specification (not shown here), the coefficients for the two

paths differ substantially in magnitude. That is, the causal effect of the shadow economy on corruption is stronger than the effect of corruption on the shadow economy. One possible explanation for this is that corruption functions as an additional tax in the official economy – which, in turn, increases the size of the shadow economy. Likewise, the shadow economy induces higher corruption as bureaucrats exploit their positions of power and as firms or individuals willingly pay bribes and hide their underground activities. In addition, the shadow economy can also be seen as an indication of overall deterioration of social and cultural norms, which results in even more widespread corruption.

Clearly, the structural equation model presented in Buehn and Schneider (2009) is only an additional step in furthering our understanding of corruption and the shadow economy. The findings however reveal that a large shadow economy is linked to high levels of corruption. In countries with large shadow economies, firms and individuals often rely to a large extent on shadow economic activities. In order to avoid detection, taxation, and punishment, they bribe bureaucrats. Moreover, low tax revenues reduce the quality of public services and infrastructure. This in turn reduces the incentives to remain in the official economy. Weaker legal systems and unstable conditions for economic activity increase corruption. Acting like an extra tax corruption drives individuals underground. Thus, the empirical relationship between corruption and the shadow economy analyzed using a structural equation model confirms the findings of Johnson, Kaufmann, and Shleifer (1997), Johnson, Kaufmann, and Zoido-Lobaton (1998b), Hindriks, Muthoo, and Keen (1999), Friedman et al. (2000), and Echazu and Bose (2008).

5 Summary and Conclusions

There have been many obstacles to overcome to measure the size of the shadow economy, to analyze its consequences on the official economy and the interaction between corruption and the shadow economy, but as this paper shows some progress has been made. We provided estimates of the size of the shadow economies for 120 countries for five periods of time (1999/2000, 2001/2002, 2002/2003, 2003/04, 2004/05 and 2005/06) using the MIMIC procedure for the econometric estimation, and the currency demand approach for calibrating the estimated values of the size of the shadow economy into absolute ones. Coming back to the headline of this paper, some new knowledge/insights are gained with respect to the size and development of the shadow economy of 120 countries,²⁴⁾ and to the relationship between the shadow economy and corruption leading to four conclusions:

The first conclusion from these results is that for all countries investigated the shadow economy has reached a remarkably large size of an average value of 32.3% of official GDP over 120 countries over 1999/00 to 2005/06. However, the average size of the shadow economies of all three groups of countries (76 developing countries, 19 Eastern European and Central Asian (mostly transition) countries, and 25 high income OECD countries) increased only modestly from 31.8% of official GDP in 1999/00 to 32.7% of official GDP in 2005/06.

The second conclusion is that shadow economies are a complex phenomenon present to an important extent in all type of economies (developing, transition and highly developed). People engage in shadow economic activity for a variety of reasons, among the most important of which we can count are government actions, most notably, taxation and regulation.

Considering a public choice perspective a **third conclusion** for highly developed countries is that a government may not have a great interest to reduce the shadow economy due to the fact that:

- (i) tax losses may be moderate, as at least 2/3 of the income earned in the shadow economy is immediately spent in the official economy,
- (ii) income earned in the shadow economy increases the standard of living of at least 1/3 of the working population,

(iii) between 40 and 50% of the shadow economy activities have a complementary character, which means that additional value added is created, which increases the official (overall) GDP, and

(iv) people who work in the shadow economy have less time for other things like going to demonstrations, etc.

Considering these three conclusions, it is obvious that one of the big challenges for every government is to undertake efficient incentive orientated policy measures in order to make work less attractive in the shadow economy and hence to make the work in the official economy more attractive. In a number of OECD countries this policy direction has been successfully implemented and this has led to a stabilisation or even reduction of the size of the shadow economy.

The fourth conclusion is that the shadow economy reduces corruption in high income countries (substitution effect) and increases corruption in low income countries (complementary effect).

²⁴⁾ In the appendix some critical discussion of these two methods is given; they have well known weaknesses (compare also Pedersen, 2003).

6 Appendix 1: Methods to Estimate the Size of the Shadow Economy: The DYMIMIC and Currency Demand Approach

It has already been mentioned in chapter 3, estimating the size and development of a shadow economy is a difficult and challenging task. In this appendix, we give a short but comprehensive overview of the currency demand and the MIMIC approach; each is briefly discussed as well as critically evaluated.²⁵⁾

6.1 The Currency Demand Approach

The currency demand approach, which is also called an "indicator" approach, is a macroeconomic one and uses various economic and other indicators that contain information about the development of the shadow economy (over time), and leaves some "traces" of the shadow economy. This approach was first used by Cagan (1958), who calculated a correlation of the currency demand and the tax pressure (as one cause of the shadow economy) for the United States over the period 1919 to 1955. 20 years later, Gutmann (1977) used the same approach but without any statistical procedures. Cagan's approach was further developed by Tanzi (1980, 1983), who econometrically estimated a currency demand function for the United States for the period 1929 to 1980 in order to calculate the shadow economy. His approach assumes that shadow (or hidden) transactions are undertaken in the form of cash payments, so as to leave no observable traces for the authorities. An increase in the size of the shadow economy will therefore increase the demand for currency. To isolate the resulting "excess" demand for currency, an equation for currency demand is econometrically estimated over time. All conventional possible factors, such as the development of income, payment habits, interest rates, and so on, are controlled for. Additionally, such variables as the direct and indirect tax burden, government regulation and the complexity of the tax system, which are assumed to be the major factors causing people to work in the shadow economy, are included in the estimation equation. The basic regression equation for the currency demand, proposed by Tanzi (1983), is the following:

$$\ln (C / M_2)_t = \beta_0 + \beta_1 \ln (1 + TW)_t + \beta_2 \ln (WS / Y)_t + \beta_3 \ln R_t + \beta_4 \ln (Y / N)_t + u_t$$

with $\beta_1 > 0$, $\beta_2 > 0$, $\beta_3 < 0$, $\beta_4 > 0$

where

\ln denotes natural logarithms,

C / M_2 is the ratio of cash holdings to current and deposit accounts,

TW is a weighted average tax rate (to proxy changes in the size of the shadow economy),

WS / Y is a proportion of wages and salaries in national income (to capture changing payment and money holding patterns),

R is the interest paid on savings deposits (to capture the opportunity cost of holding cash) and

Y / N is the per capita income.²⁶⁾

Any "excess" increase in currency, or the amount unexplained by the conventional or normal factors (mentioned above) is then attributed to the rising tax burden and the other reasons leading people to work in the shadow economy. Figures for the size and development of the shadow economy can be calculated in a first step by comparing the difference between the development of currency when the direct and indirect tax burden (and government regulations) are held at their lowest value, and the development of currency with the current (much higher) burden of taxation and government regulations. Assuming in a second step the same velocity for currency used in the shadow economy as for legal M1 in the official economy, the size of the shadow can be computed and compared to the official GDP.

The currency demand approach is one of the most commonly used approaches. It has been applied to many OECD countries,²⁷⁾ but has nevertheless been criticized on various grounds.²⁸⁾ The most commonly raised objections to this method are:

- (i) Not all transactions in the shadow economy are paid in cash. Isachsen and Strom (1985) used the survey method to find out that in Norway, in 1980, roughly 80% of all transactions in the hidden sector were paid in cash. The size of the total shadow economy (including barter) may thus be even larger than previously estimated.

²⁵⁾ A discussion and critical evaluation of all used approaches is given in Schneider (2005, 2007).

²⁶⁾ The estimation of such a currency demand equation has been criticized by Thomas (1999) but part of this criticism has been considered by the work of Giles (1999a,b) and Bhattacharyya (1999), who both use the latest econometric techniques.

²⁷⁾ See Karmann (1986 and 1990), Schneider (1997, 1998a, 2005), Johnson, Kaufmann, and Zoido-Lobaton (1998a), and Williams and Windebank (1995).

²⁸⁾ See Thomas (1992, 1999); Feige (1986); Pozo (1996); Pedersen (2003) and Ahumada, Alvareda, Canavese A., and P. Canavese (2004); Janisch and Brümmerhof (2005); and Breusch (2005a,b).

- (ii) Most studies consider only one particular factor, the tax burden, as a cause of the shadow economy. But others (such as the impact of regulation, taxpayers' attitudes toward the state, "tax morality" and so on) are not considered, because reliable data for most countries are not available. If, as seems likely, these other factors also have an impact on the extent of the hidden economy, it might again be higher than reported in most studies.²⁹⁾
- (iii) As discussed by Garcia (1978), Park (1979), and Feige (1996), increases in currency demand deposits are due largely to a slowdown in demand deposits rather than to an increase in currency caused by activities in the shadow economy, at least in the case of the United States.
- (iv) Blades (1982) and Feige (1986, 1996), criticize Tanzi's studies on the grounds that the US dollar is used as an international currency. Instead, Tanzi should have considered (and controlled) the presence of US dollars, which are used as an international currency and are held in cash abroad.³⁰⁾ Moreover, Frey and Pommerehne (1984) and Thomas (1986, 1992, 1999) claim that Tanzi's parameter estimates are not very stable.³¹⁾
- (v) Most studies assume the same velocity of money in both types of economies. As argued by Hill and Kabir (1996) for Canada and by Klovland (1984) for the Scandinavian countries, there is already considerable uncertainty about the velocity of money in the official economy, and the velocity of money in the hidden sector is even more difficult to estimate. Without knowledge about the velocity of currency in the shadow economy, one has to accept the assumption of "equal" money velocity in both sectors.

²⁹⁾ One (weak) justification for the use of only the tax variable is that this variable has by far the strongest impact on the size of the shadow economy in the studies known to the authors. The only exception is the study by Frey and Weck-Hannemann (1984) where the variable "tax immorality" has a quantitatively larger and statistically stronger influence than the direct tax share in the model approach. In the study of Pommerehne and Schneider (1985), for the U.S., besides various tax measures, data for regulation, tax immorality, minimum wage rates are available, the tax variable has a dominating influence and contributes roughly 60-70% of the size of the shadow economy. See also Zilberfarb (1986).

³⁰⁾ In another study by Tanzi (1982, esp. pp. 110-113) he explicitly deals with this criticism. A very careful investigation of the amount of US-\$ used abroad and the US currency used in the shadow economy and to "classical" crime activities has been undertaken by Rogoff (1998), who concludes that large denomination bills are the major driving force for the growth of the shadow economy and classical crime activities are due largely to reduced transactions costs.

³¹⁾ However in studies for European countries Kirchgaessner (1983, 1984) and Schneider (1986) reach the conclusion that the estimation results for Germany, Denmark, Norway and Sweden are quite robust when using the currency demand method. Hill and Kabir (1996) find for Canada that the rise of the shadow economy varies with respect to the tax variable used; they conclude "when the theoretically best tax rates are selected and a range of plausible velocity values is used, this method estimates underground economic growth between 1964 and 1995 at between 3 and 11 percent of GDP." (Hill and Kabir [1996, p. 1553]).

- (vi) Ahumada, Alvaredo, Canavese A., and P. Canavese (2004) show that the currency approach, together with the assumption of equal income velocity of money in both the reported and the hidden transaction is only correct if the income elasticity is 1. As this is not the case for most countries, the calculation has to be corrected.
- (vii) Finally, the assumption of no shadow economy in a base year is open to criticism. Relaxing this assumption would again imply an upward adjustment of the size of the shadow economy.

6.2 The Model Approach³²

All methods described so far that are designed to estimate the size and development of the shadow economy consider just one indicator that "must" capture all effects of the shadow economy. However, it is obvious that shadow economy effects show up simultaneously in the production, labour, and money markets. An even more important critique is that the causes that determine the size of the shadow economy are taken into account only in some of the monetary approach studies that usually consider one cause, the burden of taxation. The model approach explicitly considers multiple causes leading to the existence and growth of the shadow economy, as well as the multiple effects of the shadow economy over time.

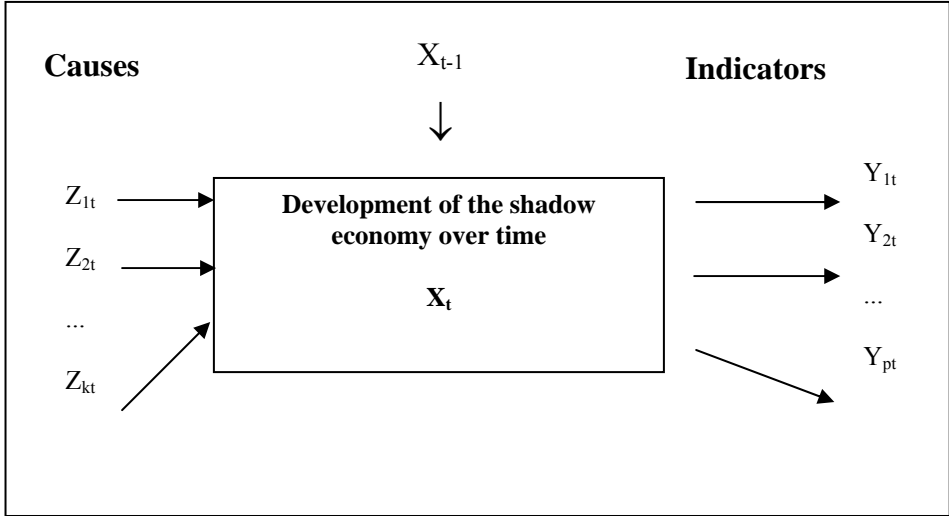
The empirical method used is quite different from those used so far. It is based on the statistical theory of unobserved variables, which considers multiple causes and multiple indicators of the phenomenon to be measured. For the estimation, a factor-analytic approach is used to measure the hidden economy as an unobserved variable over time. The unknown coefficients are estimated in a set of structural equations within which the "unobserved" variable cannot be measured directly. The MIMIC (multiple indicators multiple causes) model consists in general of two parts, with the measurement model linking the unobserved variables to observed indicators.³³⁾ The structural equations model specifies causal relationships among

³²⁾ This part is derived from a longer study by Aigner, Schneider, and Ghosh (1988, p. 303), applying this approach for the United States over time for the first time; for Germany this approach has been applied by Karmann (1986 and 1990). The pioneers of this approach are Weck (1983), Frey and Weck-Hannemann (1984), who applied this approach to cross-section data from the 24 OECD countries for various years. Before turning to this approach they developed the concept of "soft modeling" (Frey, Weck, and Pommerehne (1982), Frey and Weck (1983a and 1983b)), an approach which has been used to provide a ranking of the relative size of the shadow economy in different countries.

³³⁾ The latest papers dealing extensively with the MIMIC approach, its development and its weaknesses are from Dell'Anno (2003) and the excellent study by Giles and Tedds (2002), as well as Breusch (2005a, 2005b), Schneider (2005, 2007), Pickhardt and Sarda-Pous (2006) Buehn, Karmann, and Schneider (2009), and for a detailed discussion of the strengths and weaknesses see Dell'Anno and Schneider (2009).

the unobserved variables. In this case, there is one unobserved variable, or the size of the shadow economy; this is assumed to be influenced by a set of indicators for the shadow economy's size, thus capturing the structural dependence of the shadow economy on variables that may be useful in predicting its movement and size in the future. The interaction over time between the causes Z_{it} ($i = 1, 2, \dots, k$), the size of the shadow economy X_t , in time t , and the indicators Y_{jt} ($j = 1, 2, \dots, p$) is shown in Figure 6.1.

Figure 6.1: Development of the shadow economy over time.



There is a large body of literature³⁴⁾ on the possible causes and indicators of the shadow economy, in which the following three types of causes are distinguished:

Causes

- (i) The burden of direct and indirect taxation, both actual and perceived. A rising burden of taxation provides a strong incentive to work in the shadow economy.
- (ii) The burden of regulation as proxy for all other state activities. It is assumed that increases in the burden of regulation give a strong incentive to enter the shadow economy.
- (iii) The "tax morality" (citizens' attitudes toward the state), which describes the readiness of individuals (at least partly) to leave their official occupations and enter the shadow

³⁴⁾ Thomas (1992); Schneider (1994a, 1997, 2003, 2005, 2007); Pozo (1996); Johnson, Kaufmann and Zoido-Lobaton (1998a, 1998b); Giles (1997a, 1997b, 1999a, 1999b, 1999c); Giles and Tedds (2002), Giles, Tedds and Werkneh (2002), Dell'Anno (2003), Dell'Anno and Schneider (2004), and Buehn, Karmann, and Schneider (2009).

economy: it is assumed that a declining tax morality tends to increase the size of the shadow economy.³⁵⁾

Indicators

A change in the size of the shadow economy may be reflected in the following indicators:

- (i) Development of monetary indicators. If activities in the shadow economy rise, additional monetary transactions are required.
- (ii) Development of the labour market. Increasing participation of workers in the hidden sector results in a decrease in participation in the official economy. Similarly, increased activities in the hidden sector may be expected to be reflected in shorter working hours in the official economy.
- (iii) Development of the production market. An increase in the shadow economy means that inputs (especially labour) move out of the official economy (at least partly), and this displacement might have a depressing effect on the official growth rate of the economy.

The latest use of the model approach has been undertaken by Giles (1999a, 1999b, 1999c) and by Giles, Tedds and Werkneh (2002), Giles and Tedds (2002), Chatterjee, Chaudhury and Schneider (2006), Bajada and Schneider (2005), Pickhardt and Sarda-Pous (2006), Schneider (2007), and Buehn, Karmann, and Schneider (2009). They basically estimate a comprehensive (sometime dynamic) MIMIC model to get a time series index of the hidden/measured output of New Zealand, Canada, Germany, India or Australia, and then estimate a separate "cash-demand model" to obtain a benchmark for converting this index into percentage units. Unlike earlier empirical studies of the hidden economy, they paid proper attention to the non-stationary, and possible co-integration of time series data in both models. Again this MIMIC model treats hidden output as a latent variable, and uses several (measurable) causal and indicator variables. The former include measures of the average and marginal tax rates, inflation, real income and the degree of regulation in the economy. The latter include changes in the (male) labour force participation rate and in the cash/money supply ratio. In their cash-demand equation they allow for different velocities of currency circulation in the hidden and recorded economies. Their cash-demand equation is not used as an input to determine the variation in the hidden economy over time – it is used only to obtain the long-run average

³⁵⁾ When applying this approach for European countries, Frey and Weck-Hannemann (1984) had difficulty in obtaining reliable data for the cause series, besides the ones for the direct and indirect tax burden. Hence, their study was criticized by Helberger and Knepel (1988), who argue that the results were unstable with respect to changing variables in the model and over the years.

value of hidden/measured output, so that the index for this ratio predicted by the MIMIC model can be used to calculate a level and the percentage units of the shadow economy. Overall, this latest combination of the currency demand and MIMIC approach clearly shows that some progress in the estimation technique of the shadow economy has been achieved and a number of critical points have been overcome.

However, objections can also be raised against the (DY)MIMIC method³⁶, i.e.:

- (1) instability in the estimated coefficients with respect to sample size changes,
- (2) instability in the estimated coefficients with respect to alternative specifications,
- (3) difficulty of obtaining reliable data on cause variables other than tax variables, and
- (4) the reliability of the variables grouping into "causes" and "indicators" in explaining the variability of the shadow economy.

³⁶ See also Dell'Anno and Schneider (2009) for a detailed description and critique of this method.

7 Appendix 2. Variable Definitions and Data Sources

Variable	Definition	Source
Causes		
Business freedom	Subcomponent of the Economic Freedom Index; Measures time and effort of business activity; Ranging from 0 to 100, 0 = least economic freedom, 100 = maximum economic freedom	Heritage Foundation
Fiscal freedom	Subcomponent of the Economic Freedom Index; Measures the fiscal burden in an economy, i.e., top tax rates on individual and corporate income; Ranging from 0 to 100; 0 = least fiscal freedom, 100 = maximum degree of fiscal freedom	Heritage Foundation
Unemployment rate	Unemployment, total (% of total working force)	World Bank
Inflation rate	Inflation, GDP deflator (annual %)	World Bank, OECD
Openness	Sum of exports and imports of goods and services as share of domestic products	World Bank
Regulatory burden	Index of regulation; Scores between 1 and 5; Score of 1 = environment is most conducive to economic freedom, score of 5 = least economic freedom	Heritage Foundation
Regulatory quality	Index measuring the ability of the government to provide regulations promoting private sector development; Ranging from 0 to 100, 0 = lowest quality, 100 = highest quality	World Bank

Variable	Definition	Source
Causes		
GDP per capita	GDP per capita, PPP adjusted, current international \$	World Bank
Share of indirect taxes	Indirect taxes as a proportion of total overall taxation	World Bank, Penn World Table (PWT) 6.2
Share of direct taxes	Direct taxes as a proportion of total overall taxation	World Bank, PWT 6.2
Size of government	General government final consumption expenditure (% of GDP)	World Bank
Total tax burden	Total tax revenue / GDP	OECD
Tax morale	Share of people responding to the question that cheating on taxes if you have a chance is 1=never justifiable, 6-10=justifiable, 10=always justifiable	World Value Survey
Indicators		
Employment quota	Employment to population ratio (people 15+ that are economically active in % of total population)	World Bank
GDP per capita	GDP per capita, PPP adjusted (current international \$)	World Bank
Growth rate of GDP per capita	Growth rate of GDP per capita, PPP adjusted (constant 2005 international \$)	World Bank
Labour force participation rate	Labour force participation rate, total (% of total population aging 15-64)	World Bank
Growth rate of labour force	Annual labour force growth rate	World Bank
Currency	Currency/M2	ECB
Growth rate of money per capita	Growth rate of M1	World Bank

8 Appendix 3. Descriptive Statistics

Sample 1: 25 High Income OECD Countries

Variable	Mean	Standard deviation	Min	Max
Business freedom	65.47	16.57	50.00	96.10
Currency	0.05	0.03	0.01	0.15
Fiscal freedom	69.51	9.46	51.39	87.10
GDP per capita	28852.18	5812.84	13643.67	43958.76
Labour force participation rate	73.06	6.20	58.30	87.50
Regulatory quality	1.41	0.34	0.33	2.01
Total tax burden	37.53	7.25	20.05	51.79
Unemployment rate	6.57	3.09	2.04	21.96

Sample 2: 15 High Income OECD Countries (WVS Estimation)

Variable	Mean	Standard deviation	Min	Max
Business freedom	61.22	14.68	50.00	96.07
Currency	0.06	0.03	0.02	0.15
Fiscal freedom	68.76	8.74	51.39	87.10
GDP per capita	28635.10	4682.18	16735.30	41825.84
Labour force participation rate	73.13	5.44	60.30	86.60
Regulatory quality	1.45	0.30	0.79	2.01
Tax moral	0.09	0.03	0.03	0.25
Total tax burden	37.43	7.04	25.52	51.79
Unemployment rate	7.29	3.50	2.31	21.96

Sample 3: Eastern European and Central Asian Countries

Variable	Mean	Standard deviation	Min	Max
Business freedom	48.48	17.21	30.00	90.37
Fiscal freedom	82.53	7.31	67.85	95.10
GDP per capita	10205.15	5352.60	1217.70	24879.66
Growth rate of money per capita	27.21	17.98	-5.86	96.73
Growth rate of total labour force	0.00	0.02	-0.14	0.06
Inflation rate	10.25	12.35	-0.92	72.39
Openness	106.07	31.88	38.73	174.40
Share of indirect taxes	74.57	12.04	32.50	96.90
Unemployment rate	10.60	4.14	1.20	19.90

Sample 4: 57 Developing Countries

Variable	Mean	Standard deviation	Min	Max
Business freedom	46.10	17.44	10.00	94.58
Fiscal freedom	82.16	8.80	51.81	100.00
GDP per capita	6920.92	8398.70	283.37	48810.29
Growth rate of GDP per capita	2.38	3.23	-15.13	14.31
Growth rate of money per capita	23.55	230.21	-35.39	5439.86
Labour force participation rate	65.10	9.55	44.00	90.20
Regulatory burden	57.37	10.32	25.36	88.60
Share of direct taxation	27.66	14.59	2.44	82.40
Size of Government	13.85	5.15	4.36	31.16
Unemployment rate	13.81	9.58	0.68	41.40

Sample 5: 76 Developing Countries (Estimation excluding the Unemployment Rate)

Variable	Mean	Standard deviation	Min	Max
Business freedom	44.48	17.89	10.00	94.58
Fiscal freedom	81.90	9.08	51.81	100.00
GDP per capita	6222.42	8056.93	283.37	48810.29
Growth rate of GDP per capita	2.33	3.59	-17.61	28.93
Growth rate of money per capita	21.23	201.41	-35.39	5439.86
Labour force participation rate	66.73	10.31	44.00	92.20
Regulatory burden	57.48	10.51	25.36	88.60
Share of direct taxation	25.66	13.95	2.44	82.40
Size of Government	14.04	5.33	4.36	31.16

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