

**Shadow Economies of 145 Countries
all over the World: What Do We Really Know?**

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by
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Abstract:

Estimations of the size and development of the shadow economy for 145 countries, including developing, transition and highly developed OECD economies over the period 1999 to 2003 are presented. The average size of the shadow economy (as a percent of “official” GDP) in 2002/03 in 96 developing countries is 38.7%, in 25 transition countries 40.1%, in 21 OECD countries 16.3% and in 3 Communist countries 22.3%. An increased burden of taxation and social security contributions, combined with a labor market regulation are the driving forces of the shadow economy. Finally, the various estimation methods are discussed and critically evaluated.

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Keywords: shadow economy of 145 countries, tax burden, tax moral, quality of state institutions, regulation, DYMIMIC and other estimation methods

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1 Introduction

As shadow economic activities are a fact of life around the world, most societies attempt to control these activities through various measures like punishment, prosecution, economic growth or education. Gathering statistics about who is engaged in shadow economy activities, the frequencies with which these activities are occurring and the 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 these shadow economy activities on the goods and labor market, because all individuals engaged in these activities wish not to be identified. Hence, the estimation of the shadow economy activities can be considered as a scientific passion for knowing the unknown.

Although quite a large literature¹⁾ on single aspects of the hidden or shadow economy exists and a comprehensive survey has been written by Schneider (the 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 aspects.³⁾ 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 transition, development and developed countries over the latest period 1999/2000 to 2002/2003.

Hence, the goal of this paper is twofold: to undertake the challenging task to estimate the shadow economy for 145 countries all over the world and to provide some insights about the main causes of the shadow economy. In section 2 an attempt is made to define the shadow economy and some theoretical considerations about the reasons why the shadow is increasing are undertaken. Section 3 presents the econometric estimation results and the calculation of the size of the shadow economy over 145 countries over the period 1999/2000 to 2002/03. In

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); 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 Schneider and Enste (2000, 2002), Schneider (2003, 2005) and Alm, Martinez and Schneider (2004), and Kazemier (20025a)

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).

section 4 a summary is given and some policy conclusions are drawn. Finally in the appendix (chapter 5) the various methods to estimate the shadow economy are presented and critically evaluated.

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 Product.⁴⁾ 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 other wise government regulation, taxation or observation”.⁵⁾ As these definitions still leave open a lot of questions, table 2.1 is helpful for developing a better feeling for what could be a reasonable consensus definition of the underground (or shadow) economy.

From table 2.1, it becomes clear that a broad definition of the shadow economy includes unreported income from the production of legal goods and services, either from monetary or barter transactions – and so includes all economic activities that would generally be taxable were they reported to the state (tax) authorities. In this paper the following more narrow definition of the shadow economy is used:⁶⁾ 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,

⁴⁾ This definition is used for example, by Feige (1989, 1994), Schneider (1994a, 2003, 2005) 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).

⁵⁾ This definition is taken from Del’Anno (2003), Del’Anno and Schneider (2004) and Feige (1989); see also Thomas (1999), Fleming, Roman and Farrell (2000).

⁶⁾ 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.

- (3) to avoid having to meet certain legal labor 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, I will not deal with typical underground, economic (classical crime) activities, which are all illegal actions that fits the characteristics of classical crimes like burglary, robbery, drug dealing, etc. I also include not the informal household economy which consists of all household services and production. Also this paper does not focus on tax evasion or tax compliance, because it would get to long, and moreover tax evasion is a different subject, where already a lot of research has been underway.⁷⁾

Table 2.1: A Taxonomy of Types of Underground Economic Activities¹⁾

Type of Activity	Monetary Transactions		Non Monetary Transactions	
Illegal Activities	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; smuggling; fraud; etc.		Barter of drugs, stolen goods, smuggling etc. Produce or growing drugs for own use. Theft for own use.	
	Tax Evasion	Tax Avoidance	Tax Evasion	Tax Avoidance
Legal Activities	Unreported income from self-employment; Wages, salaries and assets from unreported work related to legal services and goods	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work and neighbor help

¹⁾ Structure of the table is taken from Lippert and Walker (1997, p. 5) with additional remarks.

2.2 The Main Causes of Determining the Shadow Economy

2.2.1 Tax and Social Security Contribution Burdens

In almost all studies⁸⁾ it has been found out, that the tax and social security contribution burdens are one of the main causes for the existence of the shadow economy (compare figure 2.1). Since taxes affect labor-leisure choices, and also stimulate labor supply in the shadow

⁷⁾ Compare, e.g. the survey of Andreoni, Erard and Feinstein (1998) and the paper by Kirchler, Maciejovsky and Schneider (2002).

⁸⁾ See Thomas (1992); Lippert and Walker (1997); Schneider (1994a,b, 1997, 1998a,b, 2000, 2003b, 2005); 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.

economy, the distortion of the overall tax burden is a major concern of economists. The bigger the difference between the total cost of labor in the official economy and the after-tax earnings (from work), the greater is the incentive to avoid this difference and to work in the shadow economy. Since this difference depends broadly on the social security burden/payments and the overall tax burden, they are key features of the existence and the increase of the shadow economy.

But even major tax reforms with major tax rate deductions will not lead to a substantial decrease of the shadow economy.⁹⁾ Such reforms will only be able to stabilize the size of the shadow economy and avoid a further increase. Social networks and personal relationships, the high profit from irregular activities and associated investments in real and human capital are strong ties which prevent people from transferring to the official economy. For Canada, Spiro (1993) found similar reactions of people facing an increase in indirect taxes (VAT, GST). This fact makes it even more difficult for politicians to carry out major reforms because they may not gain a lot from them.

Empirical results of the influence of the tax burden on the shadow economy is provided in the studies of Schneider (1994b, 2000, 2004, 2005) and Johnson, Kaufmann and Zoido-Lobaton (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 achieved 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 sign (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,

⁹⁾ See Schneider (1994b, 1998b) for a similar result of the effects of a major tax reform in Austria on the shadow economy. Schneider shows that a major reduction in the direct tax burden did not lead to a major reduction in the shadow economy. Because legal tax avoidance was abolished and other factors, like regulations, were not changed; hence for a considerable part of the tax payers the actual tax and regulation burden remained unchanged.

transition and highly developed countries. Hence, for the first time this influence is investigated for developing, transition and highly developed countries for the same time period and using the same estimation technique.

2.2.2 Intensity of Regulations

The increase of the intensity of regulations (often measured in the numbers of laws and regulations, like licenses requirements) is another important factor, which reduces the freedom (of choice) for individuals engaged in the official economy (compare figure 2.2).¹⁰⁾ One can think of labor market regulations, trade barriers, and labor restrictions for foreigners. Johnson, Kaufmann, and Zoido-Lobaton (1998b) find an overall significant empirical evidence of the influence of (labor) regulations on the shadow economy, the impact is clearly described and theoretically derived in other studies, e.g. for Germany (Deregulation Commission 1990/91). Regulations lead to a substantial increase in labor costs in the official economy. But since most of these costs can be shifted on the employees, these costs provide another incentive to work in the shadow economy, where they can be avoided. Empirical evidence supporting 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, is found in their empirical analysis. A one-point increase of the regulation index (ranging from 1 to 5, with 5 = the most regulation in a country), ceteris paribus, is associated with an 8.1 percentage point increase in the share of the shadow economy, when controlled for GDP per capita (Johnson et. al. (1998b), p. 18). They 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 drive firms into the shadow economy. Friedman, Johnson, Kaufmann and Zoido-Lobaton (1999) reach a similar result. In their study every available measure of regulation is significantly correlated with the share of the unofficial economy and the sign of the relationship is unambiguous: more regulation is correlated with a larger shadow economy. A one point increase in an index of regulation (ranging from 1-5) is associated with a 10 % increase in the shadow economy for 76 developing, transition and developed countries.

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

¹⁰⁾See for a (social) psychological, theoretical foundation of this feature, Brehm (1966, 1972), and for a (first) application to the shadow economy, Pelzmann (1988).

shadow economy, mostly because it leads to an increase in power of the bureaucrats and to a higher rate of employment in the public sector. In this study the effect of government regulation on the development of the shadow economy will be investigated for developing, transition and highly developed countries.

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 (compare figure 2.3). 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 the 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 framework of regulations and consequently to 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 [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. I). Unfortunately, due to lacking data, for example the effect of corruption on the size of the shadow economy could not be investigated.

2.2.4 Public Opinion about the Shadow Economy

The perception of citizen/voters about the shadow economy and their (moral) reaction to this phenomenon is also an important factor, under which circumstances people decide to work in the shadow economy. There are a number of empirical studies, which investigate the tax

moral of people and their attitudes against the shadow economy ¹¹. In this short section some results for Germany are shown which clearly demonstrate that people have no bad (moral) feeling when working in the shadow economy. In table 2.2 for the year 2003 it is investigated, whether people regularly work in the shadow economy or not. 25 % of the German respondents say “yes”, and 46 % of the respondents regularly demand shadow economy activities. In table 2.3 some reasons are asked, why shadow economy activities are demanded. The most important result is, one saves money – or shadow economy activities are much cheaper than the official ones. The second most important reason is, that the tax and social security burden is too high (73 % of the respondents) and reason number 3 is, that due to the much higher labour costs in the official economy, one would not demand this activities. Especially the third answer is interesting, because this result clearly demonstrates that only 23 % of the demanded shadow economy activities have substitutive character (i.e. they would demanded in the official economy if there would be no shadow economy) and only 9 % of the respondents answer, they would do by themselves. From this survey result one can conclude that roughly 70% of these activities would not be taken place if there would be no shadow economy. In table 2.4 examples of some hourly wage rates of shadow economy activities in Germany are shown and what is here surprising, is the huge range of wage rates in the shadow economy, for example varying for an hours work of a painter between € 9 an € 17. Table 2.4 clearly demonstrates also the large difference (a multiplicative factor between 4 and 5) between the wage rates in the shadow economy and in the official one.

In table 2.5 important attitudes of the German population are shown, concentrating on the issue, what are “Kavaliersdelikte”. These results convincingly demonstrate over the years 1996 to 2003 that roughly two thirds of the German population treat shadow economy activities as a “Kavalierdelikt”, where is “Stealing a newspaper from a box”, only a third treats such a small theft as a “Kavaliersdelikt”. In table 2.6 values statements of the German population with respect to the shadow economy are shown, again two thirds say that without shadow economy earnings one can not keep the achieved standard of living and only a third of the asked population means that shadow economy activities lead to great losses of tax revenues and social security payments to the state. What is most amazing in table 2.6, are the attitudes of the German population with respect to punishment of shadow economy activities: only between 9 % and 3 % of the asked German population are convinced, that shadow economy workers should be reported to the authorities and prosecuted! A similar extreme low figure one gets, when asking if a shadow economy worker is detected, he should severely be

¹¹Compare Halla and Schneider (2005), Torgler (2002), Torgler and Schneider (2005), Feld and Frey (2005).

punished. Only between 7% and 3% of the asked population say, “yes” this clearly shows that there is no bad (moral) feeling about working in the shadow economy among the German population. The results are quite similar for Austria.

Table 2.2: Work in the Shadow Economy – Survey Results for 2003

(1) Do you work regularly in the shadow economy? (in order to earn 300 Euro and more per month)	Values in percent
No	72
Yes	25 (17% male)
No answer	2
(2) Do you demand regularly shadow economy activities?	Values in percent
No	54
Yes	46
Representative Questionnaire, Germany, May 2003, Source: Schneider (2004)	

Table 2.3: Reasons, for Shadow Economy Activities – Survey Results for Germany, May 2003

Reasons, why shadow economy activities are demanded	Values in percent
(1) One saves money – or they are much cheaper than in the official one	90%
(2) The tax and social security burden is much too high	73%
(3) Due to the high labour costs in the official economy one would not demand these activities (extreme assumption no shadow economy: 23% demand these activities in the official economy, 9% make do-it-yourself)	68%
(4) The firms offer them from themselves	52%
(5) It’s so easy to become quick and reliable persons	31%
Representative questionnaire, Germany, May 2003, Source: Schneider(2004)	

Table 2.4: Hourly wage rates of shadow economy activities – Survey Results for Germany, 2004

Activity/Type of Worker	Town/Area	Wage rate in the shadow economy (in €)	Wage rate in the official economy (in €)
Painter	Berlin	10 – 17	42
	München	9 – 15	
	Rhein/Rhur	10 – 12	
Mechanics	Hamburg	13 – 23	58
	Berlin	15 – 19	
	München	15 – 23	
Cost of a household moving (distance 300km)	Berlin	300 – 380	1.800
	München	400 – 450	
	Rhein/Rhur	350 – 420	
Representative questionnaire, May 2003, Source: Schneider (2004)			

Table 2.5: Values/Attitudes of the German population regarding shadow economy Question: What are „Kavaliersdelikte“ (negligible delicts)?

Statement	German Population (in % Yes)				
	May 1996	May 1998	May 2001	Nov./Dec. 2002	Nov./Dec. 2003
To demand activities in the shadow economy	55	64	60	68	67
To drive too quick with a car	42	43	44	45	46
To undertake oneself shadow economy activities	36	41	33	36	38
Stealing a newspaper from a box	28	29	31	30	28
Not to send children to school	25	27	24	18	16
Not to be honest with the tax declaration	22	22	18	-	18
Not to go to work (make „blue“ on a Monday)	18	17	16	13	12
To drive drunken	9	4	7	3	4
Source: Schneider (2005)					

Table 2.6: Values/Attitudes of the German population regarding shadow economy Statements

Statement	German Population (in % Yes)				
	May 1996	May 1998	May 2001	Nov./Dec. 2002	Nov./Dec. 2003
Without shadow economy earnings one cannot keep up the standard of living	62	69	69	70	71
It's the state/government own fault that the shadow economy is so popular and large, because the tax and social security burden is too high	63	67	57	66	67
In the last 2-3 years I have demanded shadow economy activities	26	38	34	36	39
Due to shadow economy activities the state looses a great amount of tax revenues and social security payments	29	25	30	28	26
In the neighbourhood one observes a lot of shadow economy activities	-	-	24	28	32
I think, shadow economy workers should be reported to the authorities and prosecuted	9	4	6	3	3
If a shadow economy worker is detected he should be punished severely (high financial fines)	7	4	5	7	3
Source: Schneider (2004)					

2.2.5 Summary of the Main Causes of the Shadow Economy

In table 2.7 an overview of a number of empirical studies is given which summarizes the empirical results of the various factors influencing the shadow economy. In table 2.7 we have to two columns, showing the various factors influencing the shadow economy with and without the independent variable, "tax moral". This table clearly demonstrates that the increase of the tax and social security contribution burdens is by far most important single influence of the increase of the shadow economy. This factor does "explain" between 35 - 38% or 45 - 52% of the variance of the shadow economy with and without including the variable "tax moral", then follows the variable tax moral which "explains" between 22 - 25%

of the variance of the shadow economy ¹²and finally follows a third factor, “intensity of state regulation “(mostly for the labour market). In general table 2.7 shows, that the independent variables tax and social security burden followed by variables tax moral and by intensity of state regulations are the three major driving forces of the shadow economy.

Table 2.7: Main Causes of the Increase of the Shadow Economy

Factors Influencing the Shadow Economy		
The most important driving forces are:	Influence on the shadow economy (in%) 1)	
(1) Increase of the Tax and Social Security Contribution Burdens	35-38%	45-52%
(2) Intensity of State Regulations	8-10%	10-15%
(3) Social Transfers	5-7%	5-8%
(4) Specific Labor Market Regulations	5-7%	5-8%
(5) Public Sector Services	5-7%	5-8%
(6) Tax Morale 2)	22-25%	-
Overall influence	76-94%	70-90%
1) Average values of empirical results of 28 studies.		
2) Average values of „only“ 15 studies		
Source: Schneider (2004)		

3 The Size of the Shadow Economies for 145 Countries

3.1 Econometric Results

In tables 3.1 to 3.3 the econometric estimations using the DYMIMIC approach (latent estimation approach) are presented for the 96 developing countries, the 28 (25) transition and 3 communist countries and the 21 industrialized (highly developed) OECD-countries.¹³⁾ This grouping was necessary because the available data situation is different for these countries. For the 96 developing countries and the 28 transition and communist countries the estimation

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

¹³⁾ The classification which country is a developing country follows the one done by the World Bank (2002) using a benchmark a per capita income of 9,265 USD or less. The others with a higher income are either transition or industrialized countries (here 21 OECD countries). The grouping of the transition countries is done following the grouping in of the OECD country studies (Paris, various years).

was done for three different points of time 1999/2000, 2001/02 and 2002/03 and for the 21 OECD countries I have six data points of time 1990/91, 1994/95, 1997/98, 1999/2000, 2001/02 and 2002/03. For the developing and transition countries I use as cause variables the following ones: share of direct and indirect taxation (in % of GDP) as the two tax burden variables; burden of state regulation (share of public administrative employment in % of total employment), unemployment quota and GDP per capita as two cause variables for the status of the “official” economy. As indicator variables I use the employment quota (in % of the population between 18 and 64), annual rate of GDP, and annual rate of local currency per capita.¹⁴⁾ For the OECD countries I use as additional cause variables the burden of social security payments, the tax morale, quality of state institutions and an index of the regulation of the labor market.

The estimation results for the 96 developing countries in Middle and South America, Africa, Asia and South West Pacific Islands are shown in table 3.1. All estimated coefficients of the cause variables are statistically significant and have the theoretically expected signs. The two tax burden variables together have the quantitative most important influence followed by the burden of state regulation and the “official” employment situation (unemployment quota) on the size of the shadow economy – a result which is in line with the theoretical argumentation of section 2. The estimated coefficient of the burden of state regulation has the quantitative largest impact on the size of the shadow economy as single independent variable, showing that state regulation is the most important factor for the shadow economy in the developing countries. Also the estimated coefficients of the indicator variables are statistically significant and have the expected signs.¹⁵⁾

In table 3.2 the estimation results are presented for the 25 transition and 3 communist countries in Central and East Europe and of former Soviet Union Countries¹⁶⁾. Again all estimated coefficients of the cause variables are statistically significant and similar as the case of the developing countries the two tax burden variables have together the quantitative largest impact on the size of the shadow economy. Then follows an annual rate of GDP per capita followed by the unemployment quota and burden of state regulation. The three indicator

¹⁴⁾ Here I have the problem, that in some developing and transition countries the US-\$ (or Euro) is also a widely used currency, which is not considered here, because I got no reliable figures of the amount of US-\$ (Euro) in these developing and transition countries.

¹⁵⁾ The estimation results are in general robust, if other indicator variables are normalized; e.g. if the variable currency per capita is normalized the share of direct taxation becomes insignificant as well as the variable GDP per capita.

¹⁶⁾ How useful it is to conclude the three communist countries in this estimation, is an open question, as these countries have only a somewhat limited market system. Hence they may not fit in this sample, which may be a point of criticism.

variables are also statistically significant and the estimated coefficients have the theoretically expected signs.

Finally, in table 3.3 the results for 21 highly developed OECD countries are shown. For these countries the availability of data is somewhat better: Not only have I more data points but also I have three additional cause variables, tax morale (an index), quality of state institutions and now, as separate variable, the burden of social security payments (in % of GDP). The additional indicator variable is the average working time (per week).¹⁷⁾ The estimated coefficients of all eight cause variables are statistically significant and have the theoretically expected signs. The tax and social security burden variables are quantitatively the most important ones followed by the tax moral variable which has the single biggest influence; hence the tax payers attitude against the state institutions/government is quite important to determine whether one is engaged in shadow economy activities or not. Also the development of the official economy measured in unemployment and GDP per capita has a quantitative important influence on the shadow economy. Turning to the four indicator variables they all have a statistically significant influence and the estimated coefficients have the theoretically expected signs. The quantitatively most important are the employment quota and change of currency per capita.¹⁸⁾

Summarizing, the econometric results demonstrate that for all three groups of countries the theoretical considerations in section 2 can be confirmed: The tax and social security payment burden are the driving forces of the shadow economy closely followed by the status of the official economy for the developed and transition countries and by the tax moral variable for the highly developed OECD countries. For the developing countries the burden of state regulation is the single most important factor.

¹⁷⁾ Using this indicator variable one has the problem that, of course, this variable is influenced by state regulation, so that this variable is not really exogenous; hence the estimation may be biased.

¹⁸⁾ The variable currency per capita or annual change of currency per capita is heavily influenced by banking innovations; hence this variable is pretty unstable in the estimations with respect to the length of the estimation period. Similar problems are already mentioned by Giles (1999a) and Giles and Tedds (2002).

Table 3.1: DYMIMIC Estimations of the size of the shadow economy of 96 developing countries in Middle and South America, Africa, Asia and South West Pacific Islands over 1999/00, 2001/02 and 2002/03

Cause Variables	Estimated Coefficients
Share of direct taxation (in % of GDP)	$\lambda_1 = 0.16^{(*)}$ (1.77)
Share of indirect taxation and custom duties (in % of GDP)	$\lambda_2 = 0.246^{**}$ (3.34)
Burden of state regulation (share of public administrative employment) in % of total employment	$\lambda_3 = 0.306^{**}$ (3.01)
Unemployment quota	$\lambda_4 = 0.296^{**}$ (3.96)
GDP per capita	$\lambda_5 = -0.151^*$ (2.56)
Lagged endogenous variable	$\lambda_6 = 0.341^*$ (2.56)
Indicator Variables	
Employment quota (in % of population 18-64)	$\lambda_7 = -0.651^{**}$ (-3.45)
Annual rate of GDP (standardized)	$\lambda_8 = -1$
Change of currency per capita	$\lambda_9 = 0.412^{(**)}$ (4.99)
Test-statistics	RMSE ¹⁾ = 0.0004 ^(*) (p-value = 0.952) Chi-square ²⁾ = 7.53 (p-value = 0.904) TMNCV ³⁾ = 0.042 AGFI ⁴⁾ = 0.774 N = 288 D.F. ⁵⁾ = 34
Notes: t-statistics are given in parentheses (*); *, ** means the t-statistics is statistically significant at the 90%, 95%, or 99% confidence level. 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). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both is given for a all three equations in tables 3.1-3.3 using a test of multi normal distributions. 3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis. 4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit. 5) 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: DYMIMIC Estimation of the Shadow Economy of 25 Central and East European and Former Soviet Union Countries and 3 Communist Countries, Years 1999/00, 2001/02 and 2002/03

Cause Variables	Estimated Coefficients
Share of direct taxation + share of social security payments (in % of GDP)	$\lambda_1 = 0.461^{**}$ (3.71)
Share of indirect taxation + custom duties (in % of GDP)	$\lambda_2 = 0.361^{**}$ (3.31)
Burden of state regulation (share of public administrative employment in % of total employment)	$\lambda_3 = 0.131^*$ (2.22)
Unemployment quota	$\lambda_4 = 0.391^{**}$ (3.91)
GDP per capita	$\lambda_5 = -0.221^{**}$ (-3.77)
Lagged endogenous variable	$\lambda_6 = 0.284^*$ (2.66)
Indicator Variables	
Employment quota (as % of population 18-64)	$\lambda_7 = -0.729^{**}$ (-5.49)
Annual rate of GDP	$\lambda_8 = -1.00$ (Residuum)
Change of currency per capita	$\lambda_9 = 0.432^{**}$ (3.88)
Test-statistics	RMSE ¹⁾ = 0.0003 ^(*) (p-value = 0.914) Chi-square ²⁾ = 403.41 (p-value = 0.762) TMCV ³⁾ = 0.091 AGFI ⁴⁾ = 0.661 N = 84 D.F. ⁵⁾ = 33

Notes:

t-statistics are given in parentheses (*); *, ** means the t-statistics is statistically significant at the 90%, 95%, or 99% confidence level.

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). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both is given for a all three equations in tables 3.1.1-3.1.3 using a test of multi normal distributions.

3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis.

4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.

5) 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: DYMIMIC Estimation of the Shadow Economy of 21 highly developed OECD Countries, years 1990/91, 1994/95, 1997/98, 1999/2000, 2001/02 and 2002/03

Cause Variables	Estimated Coefficients
Share of direct taxation (in % of GDP)	$\lambda_1 = 0.410^*$ (3.41)
Share of indirect taxation (in % of GDP)	$\lambda_2 = 0.213(^*)$ (1.92)
Share of social security contribution (in % of GDP)	$\lambda_3 = 0.523^{**}$ (4.59)
Burden of state regulation (index of labour market regulation)	$\lambda_4 = 0.203(^*)$ (1.84)
Quality of state institutions (index)	$\lambda_5 = 0.346^{**}$ (2.76)
Tax morale	$\lambda_6 = 0.614^{**}$ (4.06)
Unemployment quota	$\lambda_7 = 0.399^{**}$ (3.41)
GDP per capita	$\lambda_8 = -0.134^{**}$ (-3.64)
Lagged endogenous variable	$\lambda_9 = -0.174^{(*)}$ (-1.78)
Indicator Variables	Estimated Coefficients
Employment quota (in % of population 18-64)	$\lambda_{10} = -0.713^{**}$ (-3.49)
Average working time (per week)	$\lambda_{11} = -1.00$ (Residuum)
Annual rate of GDP (adjusted for the mean of all 22 OECD countries)	$\lambda_{12} = -0.345^{**}$ (-3.513)
Change of currency per capita	$\lambda_{13} = 0.384^{**}$ (4.71)
Test-statistics	$RMSE^1 = 0.0002^*$ (p-value = 0.981) $Chi-square^2 = 6.54$ (p-value = 0.921) $TMCV^3 = 0.038$ $AGFI^4 = 0.814$ $N = 126$ $D.F.^5 = 61$

Notes:

t-statistics are given in parentheses (*); *, ** means the t-statistics is statistically significant at the 90%, 95%, or 99% confidence level.

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). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both is given for all three equations in tables 3.1.1-3.1.3 using a test of multi normal distributions.
- 3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis.
- 4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.
- 5) 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.

In order to calculate the size and development of the shadow economies of 145 countries, I have to overcome the disadvantage of the DYMIMIC approach, which is; that one gets only relative 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 DYMIMIC estimation results I use the already available estimations from the currency demand approach in combination with the DYMIMIC approach for Australia, Austria, Germany, Hungary, Italy, India, Peru, Russia and the United States (from studies of Chatterjee, Chaudhury and Schneider (2006), Del'Anno and Schneider (2004), Bajada and Schneider (2003), Alexeev and Pyle (2003), Schneider and Enste (2002) and Lacko (2000)). With the help of the absolute values of the shadow economy (in % of GDP) for these countries the absolute values of the shadow economy for all other countries could be calculated. The results are shown in the next section.

3.2 The Size of the Shadow Economies for 145 Countries for 1999/2000, 2001/2002 and 2002/2003

When showing the size of the shadow economies over the three periods of time (1999/2000, 2001/2002 and 2002/2003) for the 145 countries which are quite different in location and developing stage, one should be aware that such country comparison give only a rough picture of the ranking of the size of the shadow economy over the countries and over time, because the DYMIMIC and the currency demand methods have shortcomings which are discussed in appendix (chapter 5) see also Thomas (1992, 1999), Tanzi (1999), Pedersen (2003) and Ahumada, Alveredo, Cavanese A and P. Cavanese (2004), Janisch and Brümmerhoff (2005), and Schneider (2005)). Due to these shortcomings a detailed discussion of the (relative) ranking of the size of the shadow economies is not done.

3.2.1 Developing Countries ¹⁹

The results of the shadow economies for developing countries are divided by continent into Africa, Asia, and Central and South America, and are shown in Tables 3.2.1-3.2.3. The results for thirty-seven African countries are shown in Table 3.2.1. If we first consider the development of the shadow economies in these thirty-seven African countries from 1999-2000, we realize that shadow economy in these African nations has increased. On average, the size of these thirty-seven African shadow economies was 41.3% of official GDP in 1999/2000, and increased to 43.2% in 2002/2003. This is an average increase of 0.9 percentage points over four years. Turning to the latest results for 2002/2003, Zimbabwe, Tanzania, and Nigeria (with 63.2, 60.2 and 59.4% respectively) have by far the largest shadow economies, and the country in the median position is Mozambique with 42.4%. South Africa has the lowest shadow economy, with 29.5%, followed by Lesotho with 33.3%, and Namibia with 33.4%.

The large shadow economy in Africa (and in other developing countries) is less an issue of tax burdens than 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.

Table 3.2.1: The Size of the Shadow Economy in Thirty-Seven African Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Algeria	34,1	35,0	35,6
2	Angola	43,2	44,1	45,2
3	Benin	47,3	48,2	49,1
4	Botswana	33,4	33,9	34,6
5	Burkina Faso	41,4	42,6	43,3
6	Burundi	36,9	37,6	38,7
7	Cameroon	32,8	33,7	34,9
8	Central African Republic	44,3	45,4	46,1
9	Chad	46,2	47,1	48,0
10	Congo, Dem. Rep.	48,0	48,8	49,7
11	Congo, Rep.	48,2	49,1	50,1
12	Cote d'Ivoire	43,2	44,3	45,2
13	Egypt, Arab Rep.	35,1	36,0	36,9

¹⁹⁾ For an extensive and excellent literature survey of the research about the shadow economy in developing countries see Gerxhani (2003), who stresses thorough out her paper that the destination 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 also the former results and literature are not discussed here. Compare Schneider and Enste (2000)

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
14	Ethiopia	40,3	41,4	42,1
15	Ghana	41,9	42,7	43,6
16	Guinea	39,6	40,8	41,3
17	Kenya	34,3	35,1	36,0
18	Lesotho	31,3	32,4	33,3
19	Madagascar	39,6	40,4	41,6
20	Malawi	40,3	41,2	42,1
21	Mali	42,3	43,9	44,7
22	Mauritania	36,1	37,2	38,0
23	Morocco	36,4	37,1	37,9
24	Mozambique	40,3	41,3	42,4
25	Namibia	31,4	32,6	33,4
26	Niger	41,9	42,6	43,8
27	Nigeria	57,9	58,6	59,4
28	Rwanda	40,3	41,4	42,2
29	Senegal	45,1	46,8	47,5
30	Sierra Leone	41,7	42,8	43,9
31	South Africa	28,4	29,1	29,5
32	Tanzania	58,3	59,4	60,2
33	Togo	35,1	39,2	40,4
34	Tunisia	38,4	39,1	39,9
35	Uganda	43,1	44,6	45,4
36	Zambia	48,9	49,7	50,8
37	Zimbabwe	59,4	61,0	63,2
Unweighted Average		41,3	42,3	43,2

In Table 3.2.2, the results for twenty-eight Asian countries are shown; it is somewhat difficult to treat all Asian countries equally because some, such as Israel, Singapore, and Hong Kong, are highly developed, while others such as Thailand and Nepal, are still developing. The average shadow economy in the region increased from 28.9% in 1999/2000, to 30.8% of official GDP in 2002/2003, which is an increase of 1.9 percentage points over four years. Looking at individual countries²⁰⁾ for the year 2002/2003, with 54.1% Thailand has by far the largest shadow economy, followed by Cambodia with 52.4%, and Sri Lanka with 47.2% of official GDP. The median country is the Republic of Korea with 28.2% of official GDP, surrounded by Yemen with 29.1% and United Arab Emirates with 27.8%. Singapore, Hong Kong, and Saudi Arabia have the lowest shadow economies with 13.7%, 17.2%, and 19.7% of official GDP, respectively.

It is clear that the average size of the Asian shadow economies is considerably smaller than the shadow economies of African and Latin American states—this is partly due to the fact that there are a greater number of developed countries, which have smaller shadow economies located in Asia. It should be noted, however, that average increase of the shadow economies in the region is slightly more rapid than in Africa. This is not surprising given that

²⁰⁾ The case of India has been extensively investigated by Chatterjee, Chaudhury and Schneider (2006).

size of the average African shadow economy is already more than eleven percentage points higher than its Asian counterpart. There is simply more room for growth in Asia.

Table 3.2.2: The Size of the Shadow Economy in Twenty-Eight Asian Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Bangladesh	35,6	36,5	37,7
2	Bhutan	29,4	30,5	31,7
3	Cambodia	50,1	51,3	52,4
4	Hong Kong, China	16,6	17,1	17,2
5	India	23,1	24,2	25,6
6	Indonesia	19,4	21,8	22,9
7	Iran, Islamic Rep.	18,9	19,4	19,9
8	Israel	21,9	22,8	23,9
9	Jordan	19,4	20,5	21,6
10	Korea, Rep.	27,5	28,1	28,8
11	Kuwait	20,1	20,7	21,6
12	Lebanon	34,1	35,6	36,2
13	Malaysia	31,1	31,6	32,2
14	Mongolia	18,4	19,6	20,4
15	Nepal	38,4	39,7	40,8
16	Oman	18,9	19,4	19,8
17	Pakistan	36,8	37,9	38,7
18	Papua New Guinea	36,1	37,3	38,6
19	Philippines	43,4	44,5	45,6
20	Saudi Arabia	18,4	19,1	19,7
21	Singapore	13,1	13,4	13,7
22	Sri Lanka	44,6	45,9	47,2
23	Syrian Arab Republic	19,3	20,4	21,6
24	Taiwan, China	25,4	26,6	27,7
25	Thailand	52,6	53,4	54,1
26	Turkey	32,1	33,2	34,3
27	United Arab Emirates	26,4	27,1	27,8
28	Yemen, Rep.	27,4	28,4	29,1
Unweighted Average		28,5	29,5	30,4

In Table 3.2.3, the sizes of shadow for twenty-one Central and South American countries are shown. Averaging the figures in all twenty-one Central and South American countries, the shadow economy increased from 41.1% in the year 1999/2000 to 43.4% of official GDP in 2002/2003; an increase of 2.3 percentage points over these four years. If I now turn to the size of the shadow economy for single countries for 2002/2003, Bolivia has the largest shadow economy with 68.3%, followed by Panama with 65.3%. and Peru with 60.9% of official GDP. The median country is Brazil with 42.3% and at the lower end are Chile with 20.9%, Costa Rica with 27.8%, and Argentina with 28.9% of official GDP.

The sizes of the shadow economies of African and Central and South American countries are generally similar. This is partly due to the factors mentioned earlier; for the majority of citizens in many of these countries, the only way to ensure a decent standard of

living is to turn to the black market. As income inequality is much more pronounced in most Central and South American countries, compared to Africa, the rate of increase of in shadow economy activity in Central and South America is higher.

Table 3.2.3: The Size of the Shadow Economy in Twenty-One Central and South American Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Argentina	25,4	27,1	28,9
2	Bolivia	67,1	68,1	68,3
3	Brazil	39,8	40,9	42,3
4	Chile	19,8	20,3	20,9
5	Colombia	39,1	41,3	43,4
6	Costa Rica	26,2	27,0	27,8
7	Dominican Republic	32,1	33,4	34,1
8	Ecuador	34,4	35,1	36,7
9	El Salvador	46,3	47,1	48,3
10	Guatemala	51,5	51,9	52,4
11	Haiti	55,4	57,1	58,6
12	Honduras	49,6	50,8	51,6
13	Jamaica	36,4	37,8	38,9
14	Mexico	30,1	31,8	33,2
15	Nicaragua	45,2	46,9	48,2
16	Panama	64,1	65,1	65,3
17	Paraguay	27,4	29,2	31,4
18	Peru	59,9	60,3	60,9
19	Puerto Rico	28,4	29,4	30,7
20	Uruguay	51,1	51,4	51,9
21	Venezuela, RB	33,6	35,1	36,7
Unweighted Average		41,1	42,2	43,4

3.2.2 Transition Countries

The measurement of the size and development of the shadow economy in the transition countries has been undertaken since the late 80s starting with the work of Kaufmann and Kaliberda (1996), Johnson et.al. (1997) and Lacko (2000). They all are using the physical input (electricity) method (see Appendix 7.1.2.5) 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 content a historical phenomenon and partly determined by institutional factors.

In table 3.2.4 the size and development of the shadow economy of 25 East and Central European and Former Soviet Union countries are presented. Turning again first to the development of the size of the shadow economy over time, the average size of the shadow economy of these 25 East

and Central European countries was 38.1% of official GDP in 1999/2000 and increased to 40.1% in 2002/2003 which is an increase of 2 percentage points over these four years. The highest shadow economies have Georgia, Azerbaijan and the Ukraine with 68.0%, 61.3% and 54.7%. The median country is Bulgaria, surrounded by Serbia and Montenegro of 39.1% and Romania of 37.4%. At the lower end are the Czech Republic with 20.1%, the Slovak Republic with 20.2% and Hungary with 26.2% of official GDP.

Table 3.2.4: The Size of the Shadow Economy in 25 East and Central European and Former Soviet Union Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Albania	33,4	34,6	35,3
2	Armenia	46,3	47,8	49,1
3	Azerbaijan	60,6	61,1	61,3
4	Belarus	48,1	49,3	50,4
5	Bosnia and Herzegovina	34,1	35,4	36,7
6	Bulgaria	36,9	37,1	38,3
7	Croatia	33,4	34,2	35,4
8	Czech Republic	19,1	19,6	20,1
9	Estonia	38,4	39,2	40,1
10	Georgia	67,3	67,6	68,0
11	Hungary	25,1	25,7	26,2
12	Kazakhstan	43,2	44,1	45,2
13	Kyrgyz Republic	39,8	40,3	41,2
14	Latvia	39,9	40,7	41,3
15	Lithuania	30,3	31,4	32,6
16	Macedonia, FYR	34,1	35,1	36,3
17	Moldova	45,1	47,3	49,4
18	Poland	27,6	28,2	28,9
19	Romania	34,4	36,1	37,4
20	Russian Federation	46,1	47,5	48,7
21	Serbia and Montenegro	36,4	37,3	39,1
22	Slovak Republic	18,9	19,3	20,2
23	Slovenia	27,1	28,3	29,4
24	Ukraine	52,2	53,6	54,7
25	Uzbekistan	34,1	35,7	37,2
Unweighted Average		38,1	39,1	40,1

3.2.3 Highly developed OECD-Countries

The size and development of 21 highly developed OECD countries is shown in table 3.2.5.

Table 3.2.5: The Size of the Shadow Economy in 21 OECD Countries

	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Australia	14,3	14,1	13,5
2	Austria	9,8	10,6	10,9
3	Belgium	22,2	22,0	21,0
4	Canada	16,0	15,8	15,2
5	Denmark	18,0	17,9	17,3
6	Finland	18,1	18,0	17,4
7	France	15,2	15,0	14,5
8	Germany	16,0	16,3	16,8
9	Greece	28,7	28,5	28,2
10	Ireland	15,9	15,7	15,3
11	Italy	27,1	27,0	25,7
12	Japan	11,2	11,1	10,8
13	Netherlands	13,1	13,0	12,6
14	New Zealand	12,8	12,6	12,3
15	Norway	19,1	19,0	18,4
16	Portugal	22,7	22,5	21,9
17	Spain	22,7	22,5	22,0
18	Sweden	19,2	19,1	18,3
19	Switzerland	8,6	9,4	9,4
20	United Kingdom	12,7	12,5	12,2
21	United States	8,7	8,7	8,4
Unweighted Average		16,8	16,7	16,3

If we first consider again the development of the size and development of the shadow economies of these 21 OECD countries, we realize for the first time that the size of the shadow economy of these 21 OECD countries has decreased over the period 1999/2000 to 2002/2003. The average size of the shadow economy in 1999/2000 of these 21 OECD countries was 16.8% of official GDP, it decreased to 16.3% in 2002/2003, a decrease of 0.5 percentage points. If we consider single countries, Greece, Italy and Spain has by far the largest size of the shadow economy in 2002/2003 with 28.2%, 25.7% and 22.0% of official GDP. The median country is Ireland with 15.3%, surrounded by Germany with 16.8% and Canada with 15.2% of official GDP. At the lower end are the United States, Switzerland and Japan with a shadow economy of 8.4%, 9.4% and 10.8% of official GDP.

3.2.4 South West Pacific Islands

The size and development of the shadow economies of 10 South West Pacific islands is presented in table 3.2.6.

Table 3.2.6.: The Size of the Shadow Economy in 10 South West Pacific Islands

		Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Fiji	33,6	34,3	35,1
2	Kiribati	34,1	35,0	35,3
3	Maldives	30,3	31,4	32,0
4	Marshall Islands	28,1	29,0	29,6
5	Micronesia, Fed. Sts.	31,3	32,1	33,2
6	Palau	28,4	29,2	30,0
7	Samoa	31,4	32,6	33,5
8	Solomon Islands	33,4	34,5	35,3
9	Tonga	35,1	36,3	37,4
10	Vanuatu	30,9	31,7	32,5
Unweighted Average		31,7	32,6	33,4

If we again consider first the development over time the average size of the shadow economy of these 10 South West Pacific islands countries, increased from 31.7% in the year 1999/2000 to 33.4% in the year 2002/2003, which means an increase of 1.7 percentage points over these four years. The largest size of the shadow economy (the latest estimation period 2002/2003) has Tonga with 37.4%, followed by Solomon Islands with 35.3% and Kiribati with 35.3%. In the middle field is Micronesia and Samoa with a shadow economy of 33.2% and 33.5% of official GDP. The lowest shadow economy have the Marshall Islands and Palau with a shadow economy of 29.6% and 30.0%.

3.2.5 Communist Countries

In this last section the size and development of the shadow economy of 3 communist countries (China, Laos and Vietnam) is presented. The results are shown in table 3.2.7.

Table 3.2.7: The Size of the Shadow Economy in 3 Communist Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	China	13,1	14,4	15,6
2	Lao PDR	30,6	31,9	33,4
3	Vietnam	15,6	16,9	17,9
Unweighted Average		19,8	21,1	22,3

If we again first consider the average development of the size of the shadow economy of these three Communist countries over time, the average size of the shadow economy in 1999/2000 was 19.8% and increased to 22.3% in 2002/2003. This is an increase of 2.5 percentage points. Laos has the largest shadow economy with 33.4% and China the lowest with 15.6%. It should be aware that the shadow economy in these countries, and especially in China, which is partly a market economy and still a planning socialist economy, is difficult to interpret. It should be more seen as a parallel economy, where especially farmers produce additional products to earn some extra money. It is an open question whether the meaning of these shadow economies can be compared to the size of the other ones. That is one reason, why they are shown in this paper in an extra section.

4 Summary and Conclusions

There have been many obstacles to overcome to measure the size of the shadow economy and to analyze its consequences on the official economy, but as this paper shows some progress has been made. I provided estimates of the size of the shadow economies for 145 countries for three periods of time (1999/2000, 2001/2002 and 2002/2003) using the DYMIMIC and the currency demand approach. Coming back to the question in the headline of this paper, some (new) knowledge/insights can be with respect to the size and development of the shadow economy of developing, transition, highly developed OECD, Pacific Islands and Communist countries,²¹⁾ 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; the summarized results are shown in table 4.1.

²¹⁾ In the appendix some critical discussion of these two methods is given, they have well known weaknesses, compare also Pedersen (2003).

Table 4.1: Average Size of the Shadow Economy for Developing, Transition and OECD-Countries in % of official GDP

Countries/Year	Average Size of the Shadow Economy – Value added in % of official GDP using DYMIMIC and Currency Demand method (<i>Number of Countries</i>)		
	1999/2000	2000/2001	2002/2003
Mostly developing countries:			
Africa	41.3 (37)	42.3 (37)	43.2 (37)
Central and South America	41.1 (21)	42.1 (21)	43.4 (21)
Asia	28.5 (28)	29.5 (28)	30.4 (28)
Transition countries	38.1 (25)	39.1 (25)	40.1 (25)
Highly developed OECD Countries	16.8 (21)	16.7 (21)	16.3 (21)
South Pacific Islands	31.7 (10)	32.6 (10)	33.4 (10)
Communist Countries	19.8 (3)	21.1 (3)	22.3 (3)
Unweighted Average over 145 Countries	33.6	34.5	35.2

Source: Own calculations.

The second conclusion is, 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 most important, of which we can count are government actions, most notable taxation and regulation. With these two insights/conclusions goes a third, no less important one: a government aiming to decrease shadow economic activity has to first and foremost analyze the complex relationships between the official and shadow economy – and even more important – among consequences of its own policy decisions.

Considering a public choice perspective a fourth conclusion is, that a government may not have a great interest to reduce the shadow economy due to the facts, that

(i) tax losses may be moderate, as at least 2/3 of the the income earned in the shadow economy is immediately spend in the official economy,

- (ii) income earned in the shadow economy increases the standard of living at least of 1/3 of the working population, and
- (iii) people who work in the shadow economy have less time for other things like to go on demonstrations, etc.

Considering these three facts, 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 lead to a reduction of the shadow economy.

5 Appendix: Methods to Estimate the Size of the Shadow Economy

As has already been mentioned in chapters 2 and 3 estimating the size and development of a shadow economy is a difficult and challenging task. In this appendix I give a short but comprehensive overview on the various procedures to estimate the size of a shadow economy. Three different types of methods are most widely used, and each is briefly discussed as well as critically evaluated.

5.1 Direct Approaches

5.1.1 Survey Method

These are micro approaches that employ either well designed surveys and samples based on voluntary replies or tax auditing and other compliance methods. Sample surveys designed to estimate the shadow economy are widely used in a number of countries²²⁾. The main disadvantage of this method is that it presents the flaws of all surveys. For example, the average precision and results depend greatly on the respondent's willingness to cooperate, it is difficult to asses the amount of undeclared work from a direct questionnaire, most interviewers hesitate to confess a fraudulent behavior, and responses are of uncertain reliability, which makes it difficult to calculate a real estimate (in monetary terms) of the

²²⁾The direct method of voluntary sample surveys has been extensively used for Norway by Isachsen, Klovland and Strom (1982), and Isachsen and Strom (1985). For Denmark this method is used by Mogensen et. al. (1995) in which they report „estimates“ of the shadow economy of 2.7 percent of GDP for 1989, of 4.2 percent of GDP for 1991, of 3.0 percent of GDP for 1993 and of 3.1 percent of GDP for 1994. In Pedersen (2003) estimates of

extend of undeclared work. The main advantage of this method lies in the detailed information about the structure of the shadow economy, but the results from these kinds of surveys are very sensitive to the way the questionnaire is formulated²³⁾.

In order to demonstrate the difficulties to calculate a macro estimation for a whole country from survey results of shadow economy activities (from single individuals) the following example is used. In Austria the author undertook a representative questioning of the Austrian population in order to estimate the size of the shadow economy in the construction and craftsman sector (including repairing) in November /December 2002 considering three groups.

1. A representative sample of the Austrian population between 16 and 65 years old.
2. 55 self declared shadow economy workers in the construction and craftsmen sector, and
3. 320 managers (owners) of construction and craftsmen firms.

The following results were gained: (1) Among the Austrian population (potential labour force) are 918.000 Austrians who supplied shadow economy activities in the construction and craftsmen sector. They average hourly earning in the shadow economy varies between €15,30 and €15,60, and the average yearly income from shadow economy activities varies between € 1.117,- and €1.142,-. This means that 73 hours per year were worked in the shadow economy.

(2) Among the 55 self-declared shadow economy workers I got a wage rate of € 11,50 per hour and an earning per year in the shadow economy was € 2.480,- using the fact, that these group worked 245 hours per year in the shadow economy.

(3) Managers (owners) of construction and craftsmanship firms report a wage rate of shadow economy workers of € 17,- per hour and an average earning per year from € 4.590,-, assuming that 270 hours per year were used for shadow economy activities by their employees/workers.

The questioned managers also state: 21% that more then 50% of their employees work in the shadow economy, 41% that less then 50%, and 34% that no-one in the firm works in the shadow economy. To summarize 62 % of the managers acknowledge that a large percentage of their employees work in the shadow economy. Further results are, that 7% of the managers think, that their employees work between 0 and 2 hours per week in the shadow economy; 29 % assume that they work between 6 and 10 hours, 28% between 3 and 5 hours and 14% think that their employees work more then 10 hours per week in the shadow economy; 22% of all

the Danish shadow economy contain the years 1995 with 3.1% up to 2001 with 3.8%.

²³⁾The advantages and disadvantages of this method are extensively dealt by Pedersen (2003) and Mogensen et. al (1995) in their excellent and very carefully done investigations. Compare also the careful and detailed studies by Kazemier (2005a,b), who extensively discusses the pros .and costs of this method.

managers have no knowledge of this fact. In principle 39% of managers are not in favour (do not support), that their workers moonlight and 61 % are in favour (do support) - an amazing high percentage.

Finally in the table 5.1 the aggregate values of the size of the shadow economy in the construction and craftsmen sector of the year 2002 based on questionnaire findings are presented. Table 5.1 clearly demonstrates, that the size of the shadow economy in the construction an craftsmen sector varies considerably from a total value of 2.6 billion Euros up to 4.2 billion Euros. These differences origin from different hourly wages rates, ranging from 11,50 € to 17 € and from the different amount of hours worked per year in the shadow economy ranging from 245 h to 270 h. Hence the survey method “covers” between 31,2% and 50,9 % of the value obtained by a macro approach (mimic method). These results leave still open a considerable leeway, but the rather large differences may be explained due to the following facts:

1. Tabel 5.1 contains earnings and not the value added of the shadow economy.
2. Shadow economy demanders are overwhelmingly households, the whole area of the shadow economy activities between firms (which are especially a problem in the construction and craftsmen sectors) are not considered.
3. All foreign shadow economy activities achieved by foreigners (illegal immigrants) is not considered.
4. The amount earned in the shadow economy, hourly wage rate and hours worked per year vary considerably.

Table 5.1: Size of the supplied shadow economy in the construction and craftsmen sector, Austria 2002, based on the questionnaire findings

Variable/Indicator	Worked hours and earning in the shadow economy			
	results from declared moonlighters (1)	results from managers of construction and craftsmen firms (2)	results from declared moonlighters (3)	results from managers of construction and craftsmen firms (4)
∅ hourly shadow economy wage rate	11.5 €	17 €	11.5 €	17 €
∅ average yearly earning	2,814 €	4,165 €	3,105 €	4,590 €
∅ amount of hours worked in the shadow economy per year per worker	245 h	245 h	270 h	270 h
∅ aggregated yearly amount of million hours worked in the shadow economy 1)	225.1 Mio. h	225.1 Mio. h	248.1 Mio. h	248.1 Mio. h
Total earnings of the shadow economy in the year 2002	2,588.65 Mio. €	3,826.7 Mio. €	2,853.15 Mio. €	4,217.7 Mio. €
Total shadow economy earnings in % of the value added of the shadow economy in the construction and craftsmanship sector (including repairing); absolute value 8,284 billion € in 2002	31,2%	46,1%	34,4%	50,9%

1) Basis of the calculation 918,864 shadow economy workers in the construction and craftsmen sector. Source: Own calculations.

5.1.2 Tax Auditing Method

Estimates of the shadow economy can also be based on the discrepancy between income declared for tax purposes and that measured by selective checks. Fiscal auditing programs have been particularly effective in this regard. Since these programs are designed to measure the amount of undeclared taxable income, they may also be used to calculate the shadow

economy.²⁴⁾ However, a number of difficulties beset this approach. First, using tax compliance data are equivalent to using a (possibly biased) sample of the population. In general, the selection of tax payers for tax audit is not random but based on properties of submitted (tax) returns that indicate a certain likelihood of (tax) fraud. Consequently, such a sample is not a random one of the whole population, and estimates of the shadow based upon a biased sample may not be accurate. Second estimates based on tax audits reflect only that portion of shadow economy income that the authorities succeed in discovering, and this is likely to be only a fraction of hidden income.

A further disadvantage of these two direct methods (surveys and tax auditing) is that they lead only to point estimates. Moreover, it is unlikely that they capture all „shadow“ activities, so they can be seen as providing lower bound estimates. They are unable to provide estimates of the development and growth of the shadow economy over a longer period of time. As already argued, they have, however at least one considerable advantage – they can provide detailed information about shadow economy activities and the structure and composition of those who work in the shadow economy.

5.2 Indirect Approaches

These approaches, which are also called „indicator“ approaches, are mostly macroeconomic ones and use various economic and other indicators that contain information about the development of the shadow economy (over time). Currently there are five indicators that leave some „traces“ of the shadow economy.

5.2.1 The Discrepancy between National Expenditure and Income Statistics

This approach is based on discrepancies between income and expenditure statistics. In national accounting the income measure of GNP should be equal to the expenditure measure of GNP. Thus, if an independent estimate of the expenditure side of the national accounts is available, the gap between the expenditure measure and the income measure can be used as an indicator of the extent of the black economy.²⁵⁾ Since national accounts statisticians are

²⁴⁾In the United States, IRS (1979, 1983), Simon and Witte (1982), Witte (1987), Clotefelter (1983), and Feige (1986). For a more detailed discussion, see Dallago (1990) and Thomas (1992).

²⁵⁾ See, e.g., Franz (1983) for Austria; MacAfee (1980) O'Higgins (1989) and Smith (1985), for Great Britain; Petersen (1982) and Del Boca (1981) for Germany; Park (1979) for the United States. For a critical survey, see Thomas (1992).

anxious to minimize this discrepancy, the initial discrepancy or first estimate, rather than the published discrepancy should be employed as an estimate of the shadow economy. If all the components of the expenditure site are measured without error, then this approach would indeed yield a good estimate of the scale of the shadow economy. Unfortunately, however, this is not the case. Instead, the discrepancy reflects all omissions and errors everywhere in the national accounts statistics as well as the shadow economy activity. These estimates may therefore be very crude and of questionable reliability.²⁶⁾

5.2.2 The Discrepancy between the Official and Actual Labor Force

A decline in participation of the labor force in the official economy can be seen as an indication of increased activity in the shadow economy. If total labor force participation is assumed to be constant, then a decreasing official rate of participation can be seen as an indicator of an increase in the activities in the shadow economy, *ceteris paribus*.²⁷⁾ One weakness of this method is that differences in the rate of participation may also have other causes. Also, people can work in the shadow economy and have a job in the „official’ economy. Therefore such estimates may be viewed as weak indicators of the size and development of the shadow economy.

5.2.3 The Transactions Approach

This approach has been most fully developed by Feige.²⁸⁾ It is based upon the assumption, that there is a constant relation over time between the volume of transaction and official GNP, as summarized by the well-known Fisherian quantity equation, or $M \cdot V = p \cdot T$ (with M = money, V = velocity, p = prices, and T = total transactions). Assumptions also have to be made about the velocity of money and about the relationships between the value of total transactions ($p \cdot T$) and total (=official + unofficial) nominal GNP. Relating total nominal GNP to total transactions, the GNP of the shadow economy can be calculated by subtracting the official GNP from total nominal GNP. However, to derive figures for the shadow economy, one must also assume a base year in which there is no shadow economy and

²⁶⁾ A related approach is pursued by Pissarides and Weber (1988), who use micro data from household budget surveys to estimate the extend of income understatement by self-employed.

²⁷⁾ Such studies have been made for Italy, see e.g., Contini (1981) and Del Boca (1981); for the United States, see O’Neill (1983), for a critical survey, see again Thomas (1992).

²⁸⁾ For an extended description of this approach, see Feige (1996); for a further application for the Netherlands, Boeschoten and Fase (1984), and for Germany, Langfeldt (1984).

therefore the ratio of p^*T to total nominal (official = total) GNP was „normal“ and would have been constant over time, if there had been no shadow economy.

This method, too, has several weaknesses, such as the required assumptions of a base year with no shadow economy, and of a „normal“ ratio of transactions to nominal GNP. Moreover, to obtain reliable shadow economy estimates, precise figures of the total volume of transactions should be available, and this availability might be especially difficult to achieve for cash transactions, because they depend, among other factors, on the durability of bank notes in terms of the quality of the papers on which they are printed.²⁹⁾ Also, the assumption is made that all variations in the ratio between the total value of transaction and the officially measured GNP are due to the shadow economy. This means that a considerable amount of data is required in order to eliminate financial transactions from “pure” cross payments, which are legal and have nothing to do with the shadow economy. In general, although this approach is theoretically attractive, the empirical requirements necessary to obtain reliable estimates are so difficult to fulfill, that its application may lead to doubtful results.

5.2.4 The Currency Demand Approach

The currency demand 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

²⁹⁾For a detailed criticism of the transaction approach see Boeschoten and Fase (1984), Frey and Pommerehne (1984), Kirchgassner (1984), Tanzi (1982a,b, 1986), Dallago (1990), Thomas (1986, 1992, 1999), Giles (1999a), Pederson (2003), and Janisch and Brümmerhoff (2005)

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.³⁰⁾

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 its 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 income 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,³¹⁾ but has nevertheless been criticized on various grounds.³²⁾ The most commonly raised objections to this method are several:

³⁰⁾ 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.

³¹⁾ See Karmann (1986 and 1990), Schneider (1997, 1998a), Johnson, Kaufmann and Zoido-Lobaton (1998a), and Williams and Windebank (1995).

³²⁾ See Thomas (1992, 1999), Feige (1986), Pozo (1996), Pedersen (2003) and Ahumada, Alvareda, Canavese A. and P. Canavese (2004).

- (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 percent 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.
- (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 is 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.³³⁾
- (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 for) the presence of US dollars, which are used as an international currency and held in cash abroad.³⁴⁾ Moreover, Frey and Pommerehne (1984) and Thomas (1986, 1992, 1999) claim that Tanzi's parameter estimates are not very stable.³⁵⁾
- (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

³³⁾One (weak) justification for the only use of 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 percent to the size of the shadow economy. See also Zilberfarb (1986).

³⁴⁾ 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 major driving force for the growth of the shadow economy and classical crime activities due largely to reduced transactions costs.

³⁵⁾ 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]).

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 an „equal“ money velocity in both sectors.

- (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 for most countries not the case, 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.

5.2.5 The Physical Input (Electricity Consumption) Method

(1) The Kaufmann – Kaliberda Method³⁶⁾

To measure overall (official and unofficial) economic activity in an economy, Kaufmann and Kaliberda (1996) assume that electric-power consumption is regarded as the single best physical indicator of overall (or official plus unofficial) economic activity. Now, overall economic activity and electricity consumption have been empirically observed throughout the world to move in lockstep with an electricity to GDP elasticity usually close to one. This means, that the growth of total electricity consumption is an indicator for growth of overall (official and unofficial) GDP. By having this proxy measurement for the overall economy and then subtracting from this overall measure the estimates of official GDP, Kaufmann and Kaliberda (1996) derive an estimate of unofficial GDP. This method is very simple and appealing. However, it can also be criticized on various grounds:

- (i) Not all shadow economy activities require a considerable amount of electricity (e.g. personal services), and other energy sources can be used (gas, oil, coal, etc.). Only a part of the shadow economy will be captured.
- (ii) Over time, there has been considerable technical progress, so that both the production and use of electricity are more efficient than in the past, and this will apply in both official and unofficial uses.

³⁶⁾This method was used earlier by Lizzeri (1979), Del Boca and Forte (1982), and then was used much later by Portes (1996), Kaufmann and Kaliberda (1996), Johnson, Kaufmann and Shleifer (1997). For a critique see Lackó (1998).

- (iii) There may be considerable differences or changes in the elasticity of electricity/GDP across countries and over time.³⁷⁾

(2) The Lackó Method

Lackó (1996, 1998, 1999, 2000) assumes that a certain part of the shadow economy is associated with the household consumption of electricity. This part comprises the so-called household production, do-it-yourself activities, and other non registered production and services. Lackó further assumes that in countries where the portion of the shadow economy associated with the household electricity consumption is high, the rest of the hidden economy (or the part Lackó cannot measure) will also be high. Lackó (1996, pp.19 ff.) assumes that in each country a part of the household consumption of electricity is used in the shadow economy.

Lackó's approach (1998, p.133) can be described by the following two equations:

$$\ln E_i = \alpha_1 \ln C_i + \alpha_2 \ln PR_i + \alpha_3 G_i + \alpha_4 Q_i + \alpha_5 H_i + u_i \quad (1)$$

with $\alpha_1 > 0, \alpha_2 < 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 > 0$

$$H_i = \beta_1 T_i + \beta_2 (S_i - T_i) + \beta_3 D_i \quad (2)$$

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

where

i : the number assigned to the country,

E_i : per capita household electricity consumption in country i in Mtoe,

C_i : per capita real consumption of households without the consumption of electricity in country i in US dollars (at purchasing power parity),

PR_i : the real price of consumption of 1 kWh of residential electricity in US dollars (at purchasing power parity),

G_i : the relative frequency of months with the need of heating in houses in country i ,

Q_i : the ratio of energy sources other than electricity energy to all energy sources in household energy consumption,

H_i : the per capita output of the hidden economy,

T_i : the ratio of the sum of paid personal income, corporate profit and taxes on goods and services to GDP,

S_i : the ratio of public social welfare expenditures to GDP, and

³⁷⁾Johnson, Kaufmann and Shleifer (1997) make an attempt to adjust for changes in the elasticity of electricity/GDP.

D_i : the sum on number of dependants over 14 years and of inactive earners, both per 100 active earners.

In a cross country study, she econometrically estimates equation (1) substituting H_i by equation (2). The econometric estimation results can then be used to establish an ordering of the countries with respect to electricity use in their respective shadow economies. For the calculation of the actual size (value added) of the shadow economy, Lackó further must know how much GDP is produced by one unit of electricity in the shadow economy of each country. Since these data are not known, she takes the result of one of the known shadow economy estimations, that were carried out for a market economy with another approach for the early 1990s, and she applies this proportion to the other countries. Lackó used the shadow economy of the United States as such a base (the shadow economy value of 10.5% of GDP taken from Morris(1993)), and then she calculates the size of the shadow economy for other countries. Lackó's method is also open to criticism:

- (i) Not all shadow economy activities require a considerable amount of electricity and other energy sources can be used.
- (ii) Shadow economy activities do not take place only in the household sector.
- (iii) It is doubtful whether the ratio of social welfare expenditures can be used as the explanatory factor for the shadow economy, especially in transition and developing countries.

It is questionable which is the most reliable base value of the shadow economy in order to calculate the size of the shadow economy for all other countries, especially, for the transition and developing countries.

5.3 The Model Approach³⁸

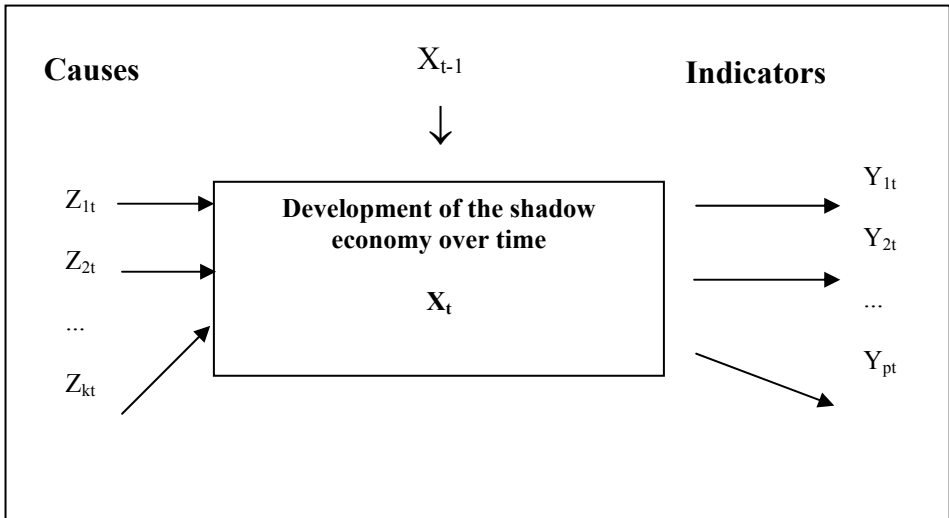
All methods described so far that are designed to estimate the size and development of the shadow economy consider just one indicator that “must” capture all effects of the shadow economy. However, it is obvious that shadow economy effects show up simultaneously in the production, labor, and money markets. An even more important critique is that the causes that

³⁸This summary is derived from a longer study by Aigner, Schneider, and Ghosh (1988, p. 303), applying this approach for the United States over 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

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 DYMIMIC (dynamic multiple-indicators multiple-causes) model consists in general of two parts, with the measurement model linking the unobserved variables to observed indicators.³⁹⁾ The structural equations model specifies causal relationships among 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.



in different countries.

³⁹⁾ One of the latest paper dealing extensively with the DYMIMIC approach, its development and its weaknesses is from Del’Anno (2003) as well as the excellent study by Giles and Tedds (2002).

There is a large body of literature⁴⁰⁾ 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 economy: it is assumed that a declining tax morality tends to increase the size of the shadow economy.⁴¹⁾

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 labor 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 labor) 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) and Bajada and Schneider (2005). They basically estimate a comprehensive

⁴⁰⁾Thomas (1992); Schneider (1994a, 1997, 2003, 2005); Pozo (1996); Johnson, Kaufmann and Zoido-Lobaton (1998a, 1998b); Giles (1997a, 1997b, 1999a, 1999b, 1999c); Giles and Tedds (2002), Giles, Tedds and Werkneh (2002), Del'Anno (2003) and Del'Anno and Schneider (2004).

⁴¹⁾ When applying this approach for European countries, Frey and Weck-Hannemann (1984) had the difficulty in obtaining reliable data for the cause series, besides the ones of 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.

(sometime dynamic) MIMIC model to get a time series index of the hidden/measured output of New Zealand, Canada, 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 DYMIMIC model treats hidden output as a latent variable, and uses several (measurable) causal variables 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) labor 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 value of hidden/measured output, so that the index for this ratio predicted by the DYMIMIC 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 DYMIMIC 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, also against the (DY)MIMIC method objections can be raised, too, which are

- (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 to obtain 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.

5.4 Summarizing the Critical Remarks

In the table 5.4 some more general weaknesses/criticisms of the different methods to estimate the shadow economy are summarized. Tabel 5.4 clearly shows, that each methods has it's strength and weaknesses and that we are far away from having an ideal or most preferred estimation method. When undertaking the difficult and challenging task to estimate the shadow economy, all methods have weaknesses and it is important to report and to consider them and to treat the size and development of shadow economy with great care.

5.4. Some critical Points of the Different Estimation Methods

1. Surveys
(1) Quite often only households or only partly firms are considered
(2) Non-responses and/or incorrect responses
2. Estimations of national account statisticians (quite often the discrepancy method):
(1) Combination of meso estimates/assumptions
(2) Often not published
(3) Documentation and procedures often not public
3. Monetary and/or electricity methods:
(1) Some estimates are very high
(2) Are the assumptions plausible?
(3) Breakdown by sector or industry possible?
4. DYMIMIC method
(1) only relative coefficients, no absolute values
(2) estimations quite often highly sensitive with respect to changes in the data.

5.5 The Size and Development of the Shadow Economies of 145 Countries over 1999/2000 to 2002/2003

Finally, the results of the size and development of the shadow economies of 145 countries are shown (and the countries are listed in alphabetical order) in table 5.4.

Table 5.5: The Size of the Shadow Economy of 145 Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
1	Albania	33,4	34,6	35,3
2	Algeria	34,1	35,0	35,6
3	Angola	43,2	44,1	45,2
4	Argentina	25,4	27,1	28,9
5	Armenia	46,3	47,8	49,1
6	Australia	14,3	14,1	13,5
7	Austria	9,8	10,6	10,9
8	Azerbaijan	60,6	61,1	61,3
9	Bangladesh	35,6	36,5	37,7
10	Belarus	48,1	49,3	50,4
11	Belgium	22,2	22,0	21,0

Table 5.5: The Size of the Shadow Economy of 145 Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
12	Benin	47,3	48,2	49,1
13	Bhutan	29,4	30,5	31,7
14	Bolivia	67,1	68,1	68,3
15	Bosnia and Herzegovina	34,1	35,4	36,7
16	Botswana	33,4	33,9	34,6
17	Brazil	39,8	40,9	42,3
18	Bulgaria	36,9	37,1	38,3
19	Burkina Faso	41,4	42,6	43,3
20	Burundi	36,9	37,6	38,7
21	Cambodia	50,1	51,3	52,4
22	Cameroon	32,8	33,7	34,9
23	Canada	16,0	15,8	15,2
24	Central African Republic	44,3	45,4	46,1
25	Chad	46,2	47,1	48,0
26	Chile	19,8	20,3	20,9
27	China	13,1	14,4	15,6
28	Colombia	39,1	41,3	43,4
29	Congo, Dem. Rep.	48,0	48,8	49,7
30	Congo, Rep.	48,2	49,1	50,1
31	Costa Rica	26,2	27,0	27,8
32	Cote d'Ivoire	43,2	44,3	45,2
33	Croatia	33,4	34,2	35,4
34	Czech Republic	19,1	19,6	20,1
35	Denmark	18,0	17,9	17,3
36	Dominican Republic	32,1	33,4	34,1
37	Ecuador	34,4	35,1	36,7
38	Egypt, Arab Rep.	35,1	36,0	36,9
39	El Salvador	46,3	47,1	48,3
40	Estonia	38,4	39,2	40,1
41	Ethiopia	40,3	41,4	42,1
42	Fiji	33,6	34,3	35,1
43	Finland	18,1	18,0	17,4
44	France	15,2	15,0	14,5
45	Georgia	67,3	67,6	68,0
46	Germany	16,0	16,3	16,8
47	Ghana	41,9	42,7	43,6
48	Greece	28,7	28,5	28,2
49	Guatemala	51,5	51,9	52,4
50	Guinea	39,6	40,8	41,3
51	Haiti	55,4	57,1	58,6
52	Honduras	49,6	50,8	51,6
53	Hong Kong, China	16,6	17,1	17,2
54	Hungary	25,1	25,7	26,2
55	India	23,1	24,2	25,6
56	Indonesia	19,4	21,8	22,9
57	Iran, Islamic Rep.	18,9	19,4	19,9
58	Ireland	15,9	15,7	15,3
59	Israel	21,9	22,8	23,9

Table 5.5: The Size of the Shadow Economy of 145 Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
60	Italy	27,1	27,0	25,7
61	Jamaica	36,4	37,8	38,9
62	Japan	11,2	11,1	10,8
63	Jordan	19,4	20,5	21,6
64	Kazakhstan	43,2	44,1	45,2
65	Kenya	34,3	35,1	36,0
66	Kiribati	34,1	35,0	35,3
67	Korea, Rep.	27,5	28,1	28,8
68	Kuwait	20,1	20,7	21,6
69	Kyrgyz Republic	39,8	40,3	41,2
70	Lao PDR	30,6	31,9	33,4
71	Latvia	39,9	40,7	41,3
72	Lebanon	34,1	35,6	36,2
73	Lesotho	31,3	32,4	33,3
74	Lithuania	30,3	31,4	32,6
75	Macedonia, FYR	34,1	35,1	36,3
76	Madagascar	39,6	40,4	41,6
77	Malawi	40,3	41,2	42,1
78	Malaysia	31,1	31,6	32,2
79	Maldives	30,3	31,4	32,0
80	Mali	42,3	43,9	44,7
81	Marshall Islands	28,1	29,0	29,6
82	Mauritania	36,1	37,2	38,0
83	Mexico	30,1	31,8	33,2
84	Micronesia, Fed. Sts.	31,3	32,1	33,2
85	Moldova	45,1	47,3	49,4
86	Mongolia	18,4	19,6	20,4
87	Morocco	36,4	37,1	37,9
88	Mozambique	40,3	41,3	42,4
89	Namibia	31,4	32,6	33,4
90	Nepal	38,4	39,7	40,8
91	Netherlands	13,1	13,0	12,6
92	New Zealand	12,8	12,6	12,3
93	Nicaragua	45,2	46,9	48,2
94	Niger	41,9	42,6	43,8
95	Nigeria	57,9	58,6	59,4
96	Norway	19,1	19,0	18,4
97	Oman	18,9	19,4	19,8
98	Pakistan	36,8	37,9	38,7
99	Palau	28,4	29,2	30,0
100	Panama	64,1	65,1	65,3
101	Papua New Guinea	36,1	37,3	38,6
102	Paraguay	27,4	29,2	31,4
103	Peru	59,9	60,3	60,9
104	Philippines	43,4	44,5	45,6
105	Poland	27,6	28,2	28,9
106	Portugal	22,7	22,5	21,9
107	Puerto Rico	28,4	29,4	30,7

Table 5.5: The Size of the Shadow Economy of 145 Countries

No.	Country	Shadow Economy (in % of off. GDP) using the DYMIC and Currency Demand Method		
		1999/00	2001/02	2002/03
108	Romania	34,4	36,1	37,4
109	Russian Federation	46,1	47,5	48,7
110	Rwanda	40,3	41,4	42,2
111	Samoa	31,4	32,6	33,5
112	Saudi Arabia	18,4	19,1	19,7
113	Senegal	45,1	46,8	47,5
114	Serbia and Montenegro	36,4	37,3	39,1
115	Sierra Leone	41,7	42,8	43,9
116	Singapore	13,1	13,4	13,7
117	Slovak Republic	18,9	19,3	20,2
118	Slovenia	27,1	28,3	29,4
119	Solomon Islands	33,4	34,5	35,3
120	South Africa	28,4	29,1	29,5
121	Spain	22,7	22,5	22,0
122	Sri Lanka	44,6	45,9	47,2
123	Sweden	19,2	19,1	18,3
124	Switzerland	8,6	9,4	9,4
125	Syrian Arab Republic	19,3	20,4	21,6
126	Taiwan, China	25,4	26,6	27,7
127	Tanzania	58,3	59,4	60,2
128	Thailand	52,6	53,4	54,1
129	Togo	35,1	39,2	40,4
130	Tonga	35,1	36,3	37,4
131	Tunisia	38,4	39,1	39,9
132	Turkey	32,1	33,2	34,3
133	Uganda	43,1	44,6	45,4
134	Ukraine	52,2	53,6	54,7
135	United Arab Emirates	26,4	27,1	27,8
136	United Kingdom	12,7	12,5	12,2
137	United States	8,7	8,7	8,4
138	Uruguay	51,1	51,4	51,9
139	Uzbekistan	34,1	35,7	37,2
140	Vanuatu	30,9	31,7	32,5
141	Venezuela, RB	33,6	35,1	36,7
142	Vietnam	15,6	16,9	17,9
143	Yemen, Rep.	27,4	28,4	29,1
144	Zambia	48,9	49,7	50,8
145	Zimbabwe	59,4	61	63,2
Unweighted Average		33,6	34,5	35,2

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