

The Influence of Public Institutions on the Shadow Economy: An Empirical Investigation for OECD Countries

FRIEDRICH SCHNEIDER*
University of Linz

The size and development of the shadow economy of 21 OECD countries is estimated, using the MIMIC estimation procedure. The analysis finds that an increased burden of taxation and social security payments, combined with intensive labor market regulation, quality of state institutions, and tax morale, are the driving forces for the shadow economy. The public institution of federalism has no statistically significant effect on the shadow economy. Finally, on the one side, incentive-oriented policy means are suggested so that any “black” value added can be transformed into official value added, and on the other side, it is important to have public institutions which work efficiently and act as a constraint for selfish politicians.

1. INTRODUCTION

Intensive discussion about the major factors influencing the shadow economy has been taking place over the last 25 years and has been far from conclusive. On the one hand, it has been argued that the size and development of the shadow economy is at least partially responsible for such problems as increasing unemployment in the official sector, growing public debt and national pension deficits. On the other hand, it has been claimed that working in the shadow economy is the individual's opportunity to escape from unjust and burdensome restraints imposed by the government. Thus, migration into shadow employment can be seen as a reaction to excessive constraints created by public institutions and bureaucracy (Schneider and Badekow, 2006; Schneider, 2009). Furthermore, as argued by sociologists and economists, the shadow economy generates a considerable share of additional social welfare in many countries.

* Prof. Dr. Dr.h.c.mult. Friedrich Schneider, Department of Economics, Johannes Kepler University Linz, Altenbergerstraße 69, A-4040 Linz-Auhof, Austria, E-mail: friedrich.schneider@jku.at.

This study has two major goals: The first is to estimate the development and the size of the shadow economy of OECD countries, using the MIMIC estimation procedure. The second is to investigate which public institutions influence the shadow economy besides the claimed ones such as tax burden and labor market regulation. Section 2 contains some theoretical considerations about the definition of the shadow economy and the major causes influencing it. Section 3 presents an econometric estimation of the shadow economy in OECD countries and discusses the impact of public institutions on the shadow economy. Finally, section 4 provides some policy measures and conclusions.

2. SOME THEORETICAL CONSIDERATIONS ABOUT THE SHADOW ECONOMY

2.1. DEFINING THE SHADOW ECONOMY

Most authors trying to measure the shadow economy still face the difficulty of how to define it.¹ One commonly used working definition is: all currently unregistered economic activities that contribute to the officially calculated (or observed) Gross National Product.² Smith (1994:18) defines it as "market-based production of goods and services, whether legal or illegal, that escapes detection in the official estimates of GDP." Or to put it in another way, one of the broadest definitions of it includes..."those economic activities and the income derived from them that circumvent or otherwise avoid government regulation, taxation or observation."³ 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.

¹ My paper focuses on the size and development of the shadow economy for countries taken as one unit and does not show any disaggregated values for specific regions. Lately some initial studies have been undertaken to measure the size of the shadow economy as well as the "grey" or "shadow" labor force for urban regions or states (e.g. California). Compare e.g. Marcelli et al. (1999), Marcelli (2004), Chen (2004), Williams and Windebank (1998, 2001a,b), Flaming et al. (2005) and Alderslade et al. (2006), and Brueck et al. (2006).

² 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 Buehn et al. (2009) and Karmann (1986, 1990).

³ This definition is taken from Dell'Anno (2003), Dell'Anno and Schneider (2004), and Feige (1989); see also Thomas (1999), and Fleming et al. (2000).

Table 2.1. A Taxonomy of Types of Underground Economic Activities¹

<i>Type of Activity</i>	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 grow 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 (1997:5) with additional remarks.

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 definition of the shadow economy is used.⁴

The shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for the following reasons:

1. to avoid payment of income, value-added, or other taxes,
2. to avoid payment of social security contributions,
3. to avoid having to meet certain legal 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.

In the following I will use this definition for the 21 OECD countries, as it is broad enough to capture a great number, and the most important, of the shadow economy activities in these OECD countries. Hence, I will not deal with typical underground economic activities, which are all illegal actions that fit the characteristics of classical crimes such as burglary, robbery, drug dealing, etc.

⁴ Compare also the excellent discussions of the definition of the shadow economy in Pedersen (2003:13-19) and Kazemier (2005a) who uses a similar one.

I also exclude the informal household economy, which consists of all household services and production, as well as excluding tax evasion or tax compliance where a great deal of research has already been undertaken.⁵

2.2. MEASURING THE SHADOW ECONOMY

The definition of the shadow economy plays an important role in assessing its size. By having a clear definition, one can avoid a number of ambiguities and controversies. In general, there are two types of underground economic activity: illicit employment and the production of goods and services consumed within the household.⁶ The following analysis focuses on the former type and excludes illegal activities such as drug production, crime and human trafficking. The latter type includes the production of goods and services consumed within the household or childcare, and is also not part of this analysis. Thus, the analysis focuses only on economic activities that would normally be included in national accounts, but which due to tax or regulatory burdens remain underground.⁷ Although such legal activities contribute to the country's value creation, they are not captured in national accounts because they are produced in illicit ways (e.g. by people without proper qualification or without a master craftsman's certificate). From the economic and social perspective, soft forms of illicit employment, such as moonlighting (e.g. construction work in private homes) and its contribution to value creation can be assessed rather positively.

Although the issue of the shadow economy has been under investigation for some time, the discussion regarding the "appropriate" methodology to assess its scope has not yet come to an end.⁸ There are three methods of assessment:

1. Direct procedures that are carried out at the micro level and aim at determining the size of the shadow economy at one particular point in time. An example of this method is surveys.

⁵ Compare, e.g., the survey of Andreoni et al. (1998) and the paper by Kirchler et al. (2002).

⁶ For a broad discussion of the definition issue, see, for example, Thomas (1992); Schneider, Volkert and Caspar (2002), Schneider and Enste (2002, 2006) and Kazemier (2005a,b).

⁷ Using this definition at least partly avoids the problem of having classical crime activities included, because in neither the MIMIC procedure, nor in the currency demand approach are these activities captured (because e.g. drug dealing is independent of a tax burden increase, especially as the included causal variables are not linked (or causal) to the classical crime activities). See e.g. Thomas (1992), Kazemier (2005a,b) and Schneider (2005).

⁸ For the strengths and weaknesses of the various methods, compare Bhattacharyya (1999); Breusch (2005a,b); Dell'Anno and Schneider (2009); Dixon (1999); Feige (1989); Giles (1999a,b,c); Schneider (1986, 2001, 2003, 2005, 2006); Schneider and Enste (2000a,b, 2002, 2006); Tanzi (1999); Thomas (1992; 1999). See also the discussion in the appendix of this paper.

2. Indirect procedures that make use of macroeconomic indicators proxying the development of the shadow economy over time.
3. Statistical models that use statistical tools to estimate the shadow economy as an “unobserved” variable.

The estimation of the shadow economy of highly developed OECD countries (with a stronghold in Austria and Germany) is firstly based on a combination of the MIMIC procedure and the currency demand method.⁹ The first assumes that the shadow economy remains an unobserved phenomenon (latent variable) which can be estimated using quantitatively measurable causes of illicit employment, e.g. tax burden and regulation intensity, and indicators reflecting illicit activities, e.g. currency demand and official work time. A disadvantage of the MIMIC procedure is the fact that it produces only relative estimates of the size and the development of the shadow economy. Thus, the currency demand method¹⁰ is used to calibrate the relative estimates into absolute ones by using two or three absolute values for the absolute size of the shadow economy.

2.3. THE MAIN CAUSES OF DETERMINING THE SHADOW ECONOMY

2.3.1. Tax and Social Security Contribution Burdens

The first and most important (institutional) factor is the overall tax and social security contribution burden,¹¹ which is among the main causes for the existence of the shadow economy. Since taxes affect labor-leisure choices, and also stimulate labor supply in the shadow economy, the distortion of the overall tax burden is a major concern for economists. The bigger the difference between the

⁹ These methods are presented in detail in Schneider (1994a,b,c, 2005) and Schneider and Enste (2000b, 2002, 2006). These studies further discuss advantages and disadvantages of both the MIMIC and the money demand methods and other estimation methods for assessing the size of illicit employment; see also appendix 1 in this paper for a detailed discussion.

¹⁰ This indirect approach is based on the assumption that cash is used to make transactions within the shadow economy. By using this method one econometrically estimates a currency demand function including independent variables such as tax burden, regulation, etc. which “drive” the shadow economy. This equation is used to make simulations of the amount of money that would be necessary to generate the official GDP. This amount is then compared with the actual money demand and the difference is treated as an indicator for the development of the shadow economy. Based on this the calculated difference is multiplied by the velocity of money and one gets a value-added figure for the shadow economy. See footnote 8 for criticism of this method.

¹¹ See Thomas (1992); Lippert and Walker (1997); Schneider (1994a,b, 1997, 1998a,b, 2000a,b, 2003, 2005); Johnson et al. (1998a,b); Tanzi (1999); Giles (1999a); Mummert and Schneider (2001); Giles and Tedds (2002) and Dell’Anno (2003), just to quote a few more recent ones.

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 level and increase of 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.¹² 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 on the part 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 on the influence of the tax burden on the shadow economy are provided in the studies of Schneider (1994b, 2000b, 2004, 2005) and Johnson, Kaufmann and Zoido-Lobato (1998a,b); they all found statistically significant evidence for the influence of taxation on the shadow economy. For Austria, the driving force for shadow economy activities is the direct tax burden (including social security payments); it has the biggest influence, followed by the intensity of regulation and complexity of the tax system. A similar result has been found by Schneider (1986) for the Scandinavian countries (Denmark, Norway and Sweden). In all three countries various tax variables: average direct tax rate, average total tax rate (indirect and direct tax rate) and marginal tax rates have the expected positive effect (on currency demand) and are highly statistically significant. These findings are supported by the studies of Kirchgaessner (1984) for Germany and by Klovland (1984) for Norway and Sweden.

2.3.2. *Intensity of Regulations*

The public institution of state (especially labor market) regulation is another important factor which reduces the freedom (of choice) for individuals engaged in the official economy.¹³ One can think of labor market regulations, trade barriers, and labor restrictions for foreigners. Johnson, Kaufmann, and Zoido-Lobato (1998b) find significant overall empirical evidence of the

¹² See Schneider (1994b, 1998b) for a similar result on 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, for a considerable number of taxpayers the actual tax and regulation burden remained unchanged.

¹³ See e.g. Loayza, Oviedo and Servén (2005a,b).

influence of (labor) regulations on the shadow economy; and the impact is clearly described and theoretically derived in other studies, e.g. for Germany (Deregulation Commission, 1991). Regulations lead to a substantial increase in labor costs in the official economy. But since most of these costs can be shifted to the employees, these costs provide another incentive to work in the shadow economy, where they can be avoided. 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. 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 drives firms into the shadow economy. Friedman, Johnson, Kaufmann and Zoido-Lobaton (2000) reach a similar conclusion. In their study every available measure of regulation is significantly correlated with the share of the unofficial economy and the estimated sign of the relationship is unambiguous: more regulation is correlated with a larger shadow economy.

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

2.3.3. Public Sector Services

An increase of the shadow economy can lead to reduced state revenues which can in turn reduce the quality and quantity of publicly provided goods and services. Ultimately, this can lead to an increase in 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 administration, with the consequence of even stronger incentives to participate in the shadow economy. Johnson, Kaufmann, and Zoido-Lobaton (1998a,b) present a simple model of this relationship. Their findings show that smaller shadow economies appear in countries with higher tax revenues if achieved by lower tax rates, fewer laws and regulations and less bribery facing enterprises. Countries with a better rule of law, which is financed by tax revenues, also have smaller shadow economies. Transition countries have higher levels of regulation leading to a significantly higher incidence of bribery, higher effective taxes on official activities and a large discretionary framework of regulations and consequently a larger shadow economy. Their overall conclusion is that

"wealthier countries of the OECD, as well as some in Eastern Europe, find themselves in the 'good equilibrium' of relatively low tax and regulatory burden, sizeable revenue mobilization, good rule of law and corruption control, and a (relatively) small unofficial economy. By contrast, a number of countries in Latin America 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 et al., 1998a:1).

2.3.4. *Other Public Institutions*

Recently, various authors¹⁴ have come to consider the quality of public institutions as another key factor in the development of the informal sector. They argue that an efficient and discretionary application of tax systems and regulations by government may play a crucial role in the decision to operate unofficially, even more important than the actual burden of taxes and regulations. In particular, corruption of bureaucracy and government officials seems to be associated with larger unofficial (shadow) activities, while a good rule of law, by securing property rights and contract enforceability, increases the benefits of being formal. Hence, it is important to analyze theoretically and empirically the effect of public institutions such as the federal political system on the shadow economy. If one considers the development of the informal sector as one consequence of the failure of public institutions in promoting an efficient market economy, especially as entrepreneurs go underground when there is an inefficient and non-market supporting public goods provision, then I can access this effect of public institutions on the individual's incentive to operate unofficially. Under a federal system, the competition among jurisdictions and the mobility of individuals can act as an important constraint on politicians' "choices," so that they have to adopt a policy which is closer to a majority of voters' preferences. Under a federalist structure, efficient policies characterized by a certain level of taxation, and mostly spent on productive public services, will lower the size of the shadow economy. In fact, production in the formal sector benefits from a higher provision of productive public services and is negatively affected by taxation, while the shadow economy reacts in the opposite way. As in a federalist system, when fiscal policy is closer to a majority of voters' preferences, the size of the informal sector should go down. This leads to the hypothesis that the size of the shadow economy should be lower in a federal than in a non-federal system, *ceteris paribus*.

¹⁴ E.g. Johnson et al. (1998a,b), Friedman et al. (2000), Dreher and Schneider (2010), Dreher, Kotsogiannis and McCorriston (2009).

2.3.5. Summary of the Main Causes of the Shadow Economy

In table 2.2 an overview of a number of empirical studies summarizes the various factors influencing the shadow economy. In all of the selected studies, several of the just-mentioned causes were used, as well as a roughly similar definition of the shadow economy. The calculation of the percentages was done using the beta-coefficients. In table 2.2 two columns are presented, showing the various factors influencing the shadow economy with and without the independent variable, "tax morale." This table clearly demonstrates that an increase in tax and social security contribution burdens is by far the most important single contributor to an increase in the shadow economy. This factor explains some 35-38% or 45-52% of the variance in the shadow economy, with and without including the variable "tax morale." The variable tax morale accounts for some 22-25% of the variance in the shadow economy,¹⁵ with a third factor, "quality of state institutions," accounting for 10-12%, and a fourth, "intensity of state regulation" (mostly for the labor market) for 7-9%. In general this table shows that the independent variables tax and social security burden, followed by variables tax morale and quality of state institutions are the three major driving forces of the shadow economy.

Table 2.2. Main Causes of the Increase in the Shadow Economy

Factors influencing the shadow economy	Influence on the shadow economy (in %)	
	(a)	(b)
(1) Increase of Tax and Social Security Contribution Burdens	35-38	45-52
(2) Quality of State Institutions	10-12	12-17
(3) Transfers	5-7	7-9
(4) Specific Labor Market Regulations	7-9	7-9
(5) Public Sector Services	5-7	7-9
(6) Tax Morale	22-25	-
Influence of all Factors	84-98	78-96
(a) Average values of 12 studies. (b) Average values of empirical results of 22 studies.		
Source: Schneider (2003, 2005, 2009)		

¹⁵ The importance of this variable with respect to theory and empirical relevance is also shown in Feld and Frey (2002, 2007), Frey (1997), and Torgler and Schneider (2005).

Table 3.1: MIMIC Estimation of the Shadow Economy of 21 Highly Developed OECD Countries
1990/91, 1994/95, 1997/98, 1999/2000, 2001/02, 2002/03, 2003/04 and 2004/05

Cause Variables	Estimated Coefficients
Share of direct taxation (in % of GDP)	$\lambda_1 = 0.364^{**}$ (2.99)
Share of indirect taxation (in % of GDP)	$\lambda_2 = 0.182^{(*)}$ (1.76)
Share of social security contribution (in % of GDP)	$\lambda_3 = 0.512^{**}$ (3.41)
Burden of state regulation (index of labor market regulation, Heritage Foundation, score 1 least regular, score 5 most regular)	$\lambda_4 = 0.224^*$ (2.02)
Quality of state institutions (rule of law, World Bank, score -3 worst and +3 best case)	$\lambda_5 = -0.316^*$ (-2.71)
Index of Federalism =1 if a country has a federal structure, and =0 otherwise	$\lambda_6 = -0.104$ (-1.49)
Tax morale (WVS and EVS, Index, Scale tax cheating always justified =1, never justified =10)	$\lambda_7 = -0.601^{**}$ (-3.49)
Unemployment quota (%)	$\lambda_8 = 0.302^*$ (2.42)
GDP per capita (in US-\$)	$\lambda_9 = -0.042^*$ (-2.47)
Indicator Variables	Estimated Coefficients
Employment quota (in % of population 18-64)	$\lambda_{10} = -0.603^{**}$ (-2.42)
Annual rate of GDP (adjusted for the mean of all 21 OECD countries)	$\lambda_{11} = 1.00$
Change of local currency Per capita	$\lambda_{12} = 0.331^{**}$ (3.74)
Test-statistics	RMSE ¹⁾ = 0.0016* (p-value = 0.93) Chi-square ²⁾ = 46.45 (p-value = 0.96) TMCV ³⁾ = 0.050 AGFI ⁴⁾ = 0.794 N = 168 D.F. ⁵⁾ = 59
<p><i>Notes:</i> t-statistics are given in parentheses (*); **, ** denotes significance at the 90%, 95%, or 99% confidence level.</p> <p>1) Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; RMSEA < 0.05; the RMSEA-value varies between 0.0 and 1.0.</p> <p>2) If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both are given for the equation in table 3.1 using a test of multi-normal distributions.</p> <p>3) Test of Multivariate Normality for Continuous Variables (TMNCV); p-values of skewness and kurtosis.</p> <p>4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.</p> <p>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 = number of free parameters.</p>	

3. ESTIMATION AND SIZE OF THE SHADOW ECONOMIES IN OECD COUNTRIES

3.1. ECONOMETRIC ESTIMATION

Using the theoretical considerations from section 2, I develop the following eight hypotheses, which will be empirically tested below:

1. An increase in direct and indirect taxation increases the shadow economy, *ceteris paribus*.
2. An increase in social security contribution increases the shadow economy, *ceteris paribus*.
3. The more the country is regulated, the greater the incentive is to work in the shadow economy, *ceteris paribus*.
4. The lower the quality of state institutions, the higher the incentive to work in the shadow economy, *ceteris paribus*.
5. The size of the shadow economy is lower in a federal system than in non-federal ones, *ceteris paribus*.
6. The lower the tax morale, the higher the incentive to work in the shadow economy, *ceteris paribus*.
7. The higher the unemployment, the more people engage in shadow economy activities, *ceteris paribus*.
8. The lower the GDP per capita in a country, the higher is the incentive to work in the shadow economy, *ceteris paribus*.

In table 3.1 an econometric estimation using the MIMIC approach is presented for 21 OECD countries. For these countries I have eight data points for 1990/91, 1994/95, 1997/98, 1999/2000, 2001/02, 2002/03, 2003/04 and 2004/05. In addition to the usual cause variables such as direct and indirect taxation, social security contribution, and regulation, I have four additional cause variables – the burden of social security payments (in % of official GDP), tax morale (an index), quality of state institutions and the specific public institution, and the federal structure of a country. I use employment quota, annual rate of GDP, and change of currency per capita as indicator variables. The estimated coefficients of eight out of nine cause variables are statistically significant and have the theoretically expected signs, but the variable index of federalism is not statistically significant. The tax and social security burden variables are quantitatively the most important ones, followed by the tax

morale variable, which has the single biggest influence. Also the variable “quality of state institutions” is statistically significant and 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 quantitatively important influence on the shadow economy. Turning to the indicator variables, they all have a statistically significant influence and the estimated coefficients have the theoretically expected signs. The quantitatively most important independent variables are the employment quota and change of currency per capita.¹⁶ Summarizing, the econometric results demonstrate that in these OECD countries social security contributions and the share of direct taxation have the biggest influence, followed by tax morale and the quality of state institutions.

3.2. SIZE AND DEVELOPMENT OF THE SHADOW ECONOMY IN 21 OECD COUNTRIES

In order to calculate the size and development of the shadow economies of the 21 OECD countries, I have to overcome the disadvantage of the MIMIC approach, which is that one gets only relatively estimated sizes for the shadow economy and one has to use another approach to get absolute figures. Hence, for the calculation of the absolute size of the shadow economies from these MIMIC estimation results, I use the already available estimations from the currency demand approach for Austria, Germany, Italy and the United States (from studies of Dell’Anno and Schneider (2004), Bajada and Schneider (2005, 2009), and Schneider and Enste (2002)). As I already have values of the shadow economy (in % of GDP) for various years for the above-mentioned countries, I can use them in a benchmark procedure to transform the index of the shadow economy from the MIMIC estimations into cardinal values.¹⁷

¹⁶ The variable currency per capita or annual change of currency per capita is heavily influenced by banking innovations; hence this variable is pretty unstable with respect to the length of the estimation period. Similar problems have already been mentioned by Giles (1999a) and Giles and Tedds (2002).

¹⁷ This procedure is described in great detail in two papers by Dell’Anno and Schneider (2003, 2009); compare also the appendix, where the procedure is briefly described and the advantages and disadvantages are shown.

Table 3.2. The Size of the Shadow Economy in 21 OECD Countries Between 1989/90 and 2007

Estimated using money demand and MIMIC methods (in % of official GDP)

OECD countries	Shadow Economy									
	Average 1989/90	Average 1994/95	Average 1997/98	Average 1999/00	Average 2001/02	2003	2004	2005	2006	2007
1. Australia	10.1	13.5	14.0	14.3	14.1	13.7	13.2	12.6	11.4	10.7
2. Belgium	19.3	21.5	22.5	22.2	22.0	21.4	20.7	20.1	19.2	18.3
3. Canada	12.8	14.8	16.2	16.0	15.8	15.3	15.1	14.3	13.2	12.6
4. Denmark	10.8	17.8	18.3	18.0	17.9	17.4	17.1	16.5	15.4	14.8
5. Germany	11.8	13.5	14.9	16.0	16.3	17.1	16.1	15.4	14.9	14.6
6. Finland	13.4	18.2	18.9	18.1	18.0	17.6	17.2	16.6	15.3	14.5
7. France	9.0	14.5	14.9	15.2	15.0	14.7	14.3	13.8	12.4	11.8
8. Greece	22.6	28.6	29.0	28.7	28.5	28.2	28.1	27.6	26.2	25.1
9. Great Britain	9.6	12.5	13.0	12.7	12.5	12.2	12.3	12.0	11.1	10.6
10. Ireland	11.0	15.4	16.2	15.9	15.7	15.4	15.2	14.8	13.4	12.7
11. Italy	22.8	26.0	27.3	27.1	27.0	26.1	25.2	24.4	23.2	22.3
12. Japan	8.8	10.6	11.1	11.2	11.1	11.0	10.7	10.3	9.4	9.0
13. Netherlands	11.9	13.7	13.5	13.1	13.0	12.7	12.5	12.0	10.9	10.1
14. New Zealand	9.2	11.3	11.9	12.8	12.6	12.3	12.2	11.7	10.4	9.8
15. Norway	14.8	18.2	19.6	19.1	19.0	18.6	18.2	17.6	16.1	15.4
16. Austria	6.9	8.6	9.0	9.8	10.6	10.8	11.0	10.3	9.7	9.4
17. Portugal	15.9	22.1	23.1	22.7	22.5	22.2	21.7	21.2	20.1	19.2
18. Sweden	15.8	19.5	19.9	19.2	19.1	18.6	18.1	17.5	16.2	15.6
19. Switzerland	6.7	7.8	8.1	8.6	9.4	9.5	9.4	9.0	8.5	8.2
20. Spain	16.1	22.4	23.1	22.7	22.5	22.2	21.9	21.3	20.2	19.3
21. USA	6.7	8.8	8.9	8.7	8.7	8.5	8.4	8.2	7.5	7.2
Unweighted average for 21 OECD countries	12.7	16.2	16.8	16.8	16.7	16.5	16.1	15.6	14.5	13.9

Source: Own calculations.

Table 3.2 presents the findings for 21 OECD countries through 2007. Table 3.2 clearly shows that in all of the 21 OECD countries the shadow economy was strongly increasing over the period 1989/90 to 1999/2000, from 12.7% (average over all 21 countries) in 1989/90 to 16.8% in 1999/2000 – an increase of 4.1 percentage points. The reasons for this increase are the rise in the tax and social security burden, as well as in regulation and other specific factors which are different from country to country, such as growth, development of unemployment, and reforms of taxation and the provision of goods and services. The findings also clearly reveal that since the end of the 90's, the size of the shadow economy in most OECD countries has begun to decrease. The unweighted average for all countries in 1999/2000 was 16.8% and dropped to 13.9% in 2007. This means that since 1997/98 - the year in which the shadow economy was the biggest in most OECD countries, it has continuously shrunk. Only in Germany, Austria and Switzerland has the growing trend lasted longer, and was reversed only two or three years ago. The reduction of the share of the shadow economy in the GDP between 1997/98 and 2007 is most pronounced in Italy (-5.0%) and in Sweden (-4.0%). This decline over the last ten years can

be explained by the general tendency to reduce the tax and/or social security burden, to deregulate the economy, and again to country-specific measures, (like the introduction of mini-jobs in Germany, or the Belgian voucher system, or the Luxembourg model: a reduced value-added tax, for example, in the construction sector in Luxembourg and in France).

The German shadow economy lies in the middle of the ranking, whereas Austria and Switzerland are located in the lower bound. With 20% to 26%, South European countries exhibit the biggest shadow economies measured as a share of the official GDP. They are followed by the Scandinavian countries, whose shadow economies' shares in GDP range between 15 and 16%. One reason for the differences in the size of the shadow economy between these OECD countries includes, among others, that, for example, there are fewer regulations in OECD-member USA as compared to OECD-member Germany, where everything that is not explicitly allowed is forbidden. The individual's freedom is limited in many areas by far-reaching state interventions. Another reason is the large differences in the direct and indirect tax burden, with the lowest being in the U.S. and Switzerland in this sample.

Finally the question "how robust are these estimates and calculations of the rise and development of the shadow economy for these 21 OECD countries" has to be tackled. In Schneider, Buehn and Montenegro (2010) and Feld and Schneider (2010), the two questions of stability of the MIMIC estimations and the one of the calibration are extensively discussed tackling the question of stability and/or robustness. Schneider, Buehn and Montenegro clearly demonstrate that when using different MIMIC specifications and different time periods for highly developed OECD countries, the estimation results (estimated coefficients) are quite robust. Much more complicated is a similar statement about the various calibration methods (see Dell'Anno and Schneider (2009)) which can be used to calibrate the relative estimated values of the shadow economy into absolute ones. Here two factors are crucial: (1) the choice of the starting values (mostly ones from the currency demand method) and (2) the concrete calibration procedure/calculation. As we have no standardized and internationally accepted values to use, some variation in the estimated size and development of the shadow economy occurs when using different starting values and calibration methods.

4. SUMMARY AND POLICY CONCLUSIONS

4.1. POLICY MEASURES

The rigidity of the European and particularly German labor market and the high tax and social system contributions burden are certainly two of the important causes of the relatively large shadow economy in most European OECD countries compared to the US. Thus, in order to reduce the scope and size of illicit employment and/or the shadow economy, one has to tackle these issues with appropriate reforms. If the necessary measures are not taken, the incentive to move from the underground economy to the official sector will further decrease. Stricter laws will not solve the problem, because German and Austrian citizens do not perceive illicit employment as law infringement and, as a result, 2/3 of them would not report illicit economic activities to the authorities.

From an economic and social policy perspective, the question of what the state authorities could do in order to reduce the size of the shadow economy is repeatedly raised; in other words, whether it is possible to transfer the millions of working hours and/or the tens of thousands of jobs from the shadow into the official economy. It is doubtful that this can be achieved only through legislative measures, i.e. more severe penalties,¹⁸ because 2/3 of the value added in the Austrian and German shadow economies is “created” by the self-employed and those who are also employees in the official economy, the so-called part-time shadow economy worker. In other words, illicit employment is a common phenomenon across the entire country. Furthermore, German and Austrian citizens do not perceive illicit employment as law infringement; 2/3 of the society in both countries sees it as only a minor violation of law.

In order to curb illicit employment, policy-makers should concentrate on its major causes. Some steps in the right direction have already been made in recent years. However, attempts to reduce non-wage labor costs were only moderately successful. At the same time, enforcement demands social consensus, which also requires that other taxes, e.g. an energy tax, will be increased. Also, it is worth considering reimbursing VAT on labor-intensive services (the so-called Luxembourg model) in order to strengthen the supply of those services in the official economy. Some European neighbor countries have retained an option to levy a reduced VAT rate on labor-intensive services. Such measures lead obviously to a decrease in tax revenues, but if they succeed in transferring some part of services produced into the official economy (25-33%), the tax losses will be mostly offset. This policy measure could be introduced in

¹⁸ See Feld and Larsen (2005, 2010) and Feld and Frey (2002, 2007).

such sectors as old building reconstruction, and catering and tourism, i.e. sectors that are particularly harmed by high labor costs.

It is obvious that the shadow economy represents a challenge for both economic and social policy. As already mentioned, in order to succeed in transferring illicit employment into the official sector, it is necessary to concentrate on the major causes. The most important ones include the growing burden of taxation and social security contributions related to labor in the official sector. Stricter penalties address only the results of the shadow economy, are expensive, and do not necessarily eliminate the core problem (e.g. high taxation and regulation). In the middle- and long-run, the size of the shadow economy can be efficiently reduced only through such measures as lowering non-wage labor costs, introducing a flat-rate tax, and extracting social security contributions for side jobs (in Germany called mini-jobs) and the increase of the tax-free amount of such jobs.

Finally, before implementing these policy measures, it is necessary to answer the question of whether the decreasing size of the shadow economy is a blessing or a curse for the OECD countries. Assuming that 2/3 of all activities in the shadow economy complement those in the official sector, i.e. those goods and services would not be produced in the official economy without input from the shadow economy, the development of the shadow economy can lead to more value added “creation.” Hence, a decline in shadow economy production will increase social welfare only if almost all of it is transferred into the official economy. If this is not the case, the overall (official and unofficial production) value added will decrease. It is therefore necessary to introduce economic and fiscal measures that strongly increase the incentive to move production from the unofficial sector into the official economy. Only then will the decline of the shadow economy be a blessing for the entire economy.

4.2. CONCLUSIONS

Finally, I want to draw three conclusions in this paper.

The first conclusion is that shadow economies are a complex phenomenon present to an important extent in all type of economies. People engage in shadow economic activity for a variety of reasons, among the most important of which I count, are government actions, most notably, taxation and regulation. With this insight/conclusion goes a second, no less important one: a government aiming to decrease shadow economic activities has to first and foremost analyze the complex relationships between the official and shadow economy – and even more important – as well as the consequences of its own policy decisions.

Considering a public choice perspective, a final and third conclusion for highly developed countries is that a government may not have a great interest in reducing the shadow economy due to the fact that:

- (i) tax losses may be moderate, as at least 2/3 of the income earned in the shadow economy is immediately spent in the official economy,
- (ii) income earned in the shadow economy increases the standard of living of 1/3 of the working population, and,
- (iii) between 40 and 50% of shadow economy activities have a complementary character, which means that additional value added is created, and this increases the overall (official and unofficial) GDP.
- (iv) people who work in the shadow economy have less time for other things like going to demonstrations, etc.

Evaluating these three conclusions, it is obvious that there are two big challenges for every government: The first is to undertake efficient incentive-oriented policy measures in order to make work in the shadow economy less attractive, and hence to make work more attractive in the official economy. The second is to have public institutions, which work efficiently and act as a constraint for selfish politicians.

5. APPENDIX: THE MIMIC ESTIMATION PROCEDURE, ITS ADVANTAGES AND DISADVANTAGES¹⁹

5.1. MIMIC MODEL

How does the MIMIC procedure work? Using the standard LISREL notation of Joreskog and Sorbom (1993), equation 1 is a measurement equation where η_t (unobserved or latent) variable determines $y' = (y_1, y_2, \dots, y_d)'$ column vector of indicators subject to a random error term ε_t . η_t is unobserved or latent and is a scalar. Following Dell'Anno and Solomon (2007), Λ is a $(d \times 1)$ column vector of parameters that relates y_t to η_t :

$$y_t = \lambda \eta_t + \varepsilon_t. \quad (1)$$

¹⁹ This appendix closely follows Dell'Anno and Schneider (2009:7-14).

Equation 2 is a structural equation which shows that the unobserved variable η_t is determined by x_t set of exogenous causes (x_1, x_2, \dots, x_c) and ζ_t a structural disturbance error term. γ is a $(1 \times c)$ vector of structural parameters:

$$\eta_t = \gamma x_t + \zeta_t. \quad (2)$$

Without loss of generality, all variables are taken to have zero means. In equations (1) and (2) it is assumed that: the elements of ζ_t and ε_t are normal, independent and identically distributed;²⁰ the variance of the structural disturbance term ζ_t is Ψ and the covariance matrix of the measurement errors is a diagonal covariance matrix²¹ Θ_ε . Substituting equation 1 and 2 yields a reduced form equation which expresses a relationship between the observed variables x_t and y_t . This is shown in equation 3:

$$y_t = \Pi' x_t + z_t, \quad (3)$$

where $\Pi = \lambda\gamma'$ is a $c \times d$ reduced form coefficients matrix and has rank 1 expressed in terms of c and d elements of λ and γ ; $z_t = \lambda\zeta_t + \varepsilon_t$ is a reduced form disturbance vector; z has a $d \times d$ reduced form covariance matrix (ω) given by:

$$\omega = \lambda\varphi\lambda' + \Theta_\varepsilon \quad (4)$$

where $\varphi = \text{var}(\lambda)$ and Θ_ε = the reduced-form covariance matrix of the measurement errors.

²⁰ The assumption of independence between structural disturbance ζ_t , and the measurement errors ε_t could be considered too restrictive when mainly using an economic dataset and, consequently, is used to question the validity of this approach. Hayduk (1987:193) explains it "...is purely a matter of arbitrary convention" for SEM analysis. Dell'Anno (2003) uses the context model to present a re-parameterization of the MIMIC able to test the assumption on independence between structural disturbance ζ_t , and measurement errors ε_t .

²¹ In the standard MIMIC model the measurement errors are assumed to be independent of each other, but this restriction could be relaxed (Stapleton, 1978:53).

For the MIMIC nomenclature, the equations system with the relationships between the latent variable η_t (shadow economy) and the causes x_t is called the “structural model” (eq. 2); the links among indicators y_t and the underground economy is called the “measurement model” (eq. 3).

5.2. APPLICATION OF THE MIMIC PROCEDURE

In a first step, the researcher has to translate his/her theory into a structural model. In a second step it is necessary to fix one coefficient to the value 1 in order to give the latent variable an interpretable scale. If the researcher has set up his/her model and fixed the one coefficient to 1, in a third step the estimation method has to be chosen. The Maximum Likelihood Estimation (MLE procedure) is the most widely used in a MIMIC model. It assumes multivariate normal data and a reasonable sample size.²² If the data are continuous but not normally distributed, an alternative method is an asymptotically distributed free estimation procedure, which in LISREL is known as WLS (weighted least squares).

All goodness-of-fit measures are a function of sample size and degrees of freedom. Most of these take into account not only the fit of the model but also the model complexity. On the one side, if I have a very large sample, the statistical test will almost certainly be significant with respect to the degrees of freedom. On the other side, if I have small samples the model is very likely to be accepted even if the fit is poor. This is particularly important in the analysis of the shadow economy, since usually both the data availability is poor and the model complexity is high. When the model fit is not adequate, it has become common practice to modify the model, by deleting non-significant parameters in order to improve the fit and select the most suitable model specification.

5.3. ADVANTAGES AND DISADVANTAGES OF THE MIMIC ESTIMATES OF THE SHADOW ECONOMY

5.3.1. Advantages

It is widely accepted by most scholars who estimate the size and development of the shadow economy that such an empirical exercise is a “minefield”

²² There are several rules of thumb about the sample size in the literature (Garson, 2005): the sample size should contain at least 50 observations or have more than 8 times the observations than the number of independent variables in the model. Another one, based on Stevens (1996), is to have at least 15 observations per measured variable or indicator. Bentler and Chou (1987) recommend at least 5 observations per parameter estimate (including error terms as well as path coefficients). If possible, the researcher should go beyond these minimum sample size recommendations, particularly when the data are not normally distributed or are incomplete.

regardless of which method is used. In evaluating estimations of the shadow economy, we should keep in mind that Schneider (1997) and Schneider and Enste (2000a) have already warned that there is no best or commonly accepted method. Each approach has its strengths and weaknesses and can provide specific insights and results. Although from the first use the MIMIC approach has been “accompanied” by strong criticisms,²³ in the last 10 years it is increasingly used for estimation of the shadow economy.²⁴

The MIMIC approach offers several advantages in comparison with other statistical methods to estimate the shadow economy. According to Giles and Tedds (2002), MIMIC provides a wider approach than most other competing methods, since it allows one to take multiple indicator variables and multiple causal variables into consideration at the same time. Moreover, it is quite flexible, allowing one to vary the choice of causal and indicator variables according to the particular features of the economy under study, the period in question, and the availability of data. Again, following Giles and Tedds (2002), the MIMIC model leads to a formal estimation and to testing procedures, such as those based on the MLE method. These procedures are well known and are generally “optimal,” if the sample is sufficiently large.

A further advantage of the MIMIC approach has been stressed by Schneider and Enste (2000a), who emphasize that the MIMIC approach leads to some progress in using estimation techniques for the underground economy, because this methodology allows a wide flexibility in its application, therefore it is potentially superior over all other estimation methods. Compared with other methods, Cassar (2001) argues that MIMIC does not need restrictive assumptions to operate (with the exception of the calibrating process). Also, Thomas (1992) argues that the only real constraint of this approach is not in its conceptual structure, but the choice of variables.

5.3.2. *Disadvantages*

Besides advantages there are, of course, disadvantages. Six of these are shown in the following.

(1) When estimating the shadow economy using the MIMIC model approach, the most common objection concerns the meaning of the latent variable (Helberger and Knepel (1988); Giles and Tedds (2002); Smith (2002); Hill (2002); Dell’Anno (2003)), because the MIMIC approach is largely a confirmatory rather than exploratory technique. This means a researcher is more likely to determine

²³ Compare e.g. the criticism by Helberger and Knepel (1988) with respect to the pioneering work of Frey and Weck-Hannemann (1984).

²⁴ Compare the studies quoted in section 4.

whether a certain model is valid, rather than to “find” a suitable model. Therefore, it is possible that the theoretical construct “shadow economy” could include other potential definitions (i.e. traditional crime activities, do-it-yourself, etc.). This criticism which is probably the most common in the literature, remains difficult to overcome as it goes back to the theoretical assumptions behind the choice of variables and the empirical limitations on the availability of data.

(2) Another objection is expressed by Helberger and Knepel (1988). They argue that the MIMIC estimations lead to unstable estimated coefficients with respect to changes the sample size and with respect to alternative model specifications. As Dell’Anno (2003) shows, instability disappears asymptotically as the sample size grows large and if data is stationary and normally distributed.

Dell’Anno (2003) points out additional objections: (i) to calculate the confidence intervals associated with estimates of the latent variable, (ii) to test the hypothesis of independence between structural and measurement errors, (iii) to identify exhaustively the properties of the residuals, and (iv) to apply the SEM approach to small sample sizes and time series analysis. I believe that these cited weaknesses are the main limitations of this approach.

(3) A further criticism is pointed out by Dell’Anno (2003). When using the MIMIC approach he finds that there is a frequent possibility of encountering an indefinite covariance matrix in the estimation procedure. According to Bollen and Long (1993) this problem arises when the data contains too little information, like small sample size, too few indicator variables, small factor loadings, missing values, etc.

(4) Another criticism about the reliability of the MIMIC estimates of the shadow economy is related to the benchmark method (Breusch, 2005a,b). This criticism has its origin in the complications that researchers face when wanting to convert the index of the shadow economy (estimated by the MIMIC model) into cardinal values. This is not an easy task, as the latent variable and its unit measure are not observed. The model provides only a set of estimated coefficients from which one can calculate an index which shows the dynamics of the unobserved factor.

Such a calibration – regardless of which methodology is used – requires experimentation, and a comparison of the calibrated values in a wide academic debate. At this stage of research on the MIMIC approach though, it is not clear which benchmark method is the best or most reliable one. Which way to proceed here is still problematic and unexplored, hence every suggestion about this aspect of the technique is welcome.²⁵

²⁵ In Dell’Anno and Schneider (2009:11-12) four different benchmarking strategies are discussed.

(5) The last criticism about MIMIC estimates refers to the methodological side and, in accord with the aims of this paper, may be the most relevant. Breusch (2005b) argues that the statistical properties/nature of the MIMIC approach are unsuitable for economic questions/problems because this approach was designed for psychometric applications and “*measuring intelligence seems far removed from estimating the underground economy.*” Dealing with this critique, the main problem of the MIMIC approach lies in the strong difference between economic and psychological variables. Although we agree that it is (still) problematic to apply this methodology to an economic dataset, and to specify a macroeconomic model through the MIMIC framework, it doesn’t mean we should abandon this approach. On the contrary, following an interdisciplinary approach to economics, the marked criticism should be considered as incentives for further (economic) research in this field rather than to suggest not to use this method because of difficulties in the implementation of the MIMIC method.

REFERENCES

- Alderslade, Jamie, John Talmage, and Yusef Freeman. 2006. “Measuring the Informal Economy: One Neighborhood at a Time,” Discussion Paper, Brookings Institution Metropolitan Policy Program, Washington D.C., September 2006.
- Andreoni, James, Brian Erard, and Jonathan Feinstein. 1998. “Tax Compliance,” 36 *Journal of Economic Literature* 818-860.
- Bajada, Christopher, and Friedrich Schneider. 2005. “The Shadow Economies of the Asia-Pacific,” 10(3) *Pacific Economic Review* 379-401.
- _____. and _____. 2009. “Unemployment and the Shadow Economy in the OECD,” 60(5) *Revue Economique* 1033-1068.
- Bartlett, Bruce. 1998. “Corruption, the Underground Economy, and Taxation,” Washington D.C: National Center for Policy Analysis, *unpublished manuscript*.
- Bentler, P.M., and C.P. Chou. 1987. “Practical Issues in Structural Modelling,” 16(1) *Sociological Methods and Research* 78-117.
- Bhattacharyya, Dilip K. 1999. “On the Economic Rationale of Estimating the Hidden Economy,” 109(456) *Economic Journal* 348-359.
- Bollen, K.A., and J.S. Long. 1993. *Testing Structural Equation Models*. Beverly Hills, CA: Sage.
- Brehm, J.W. 1966. *A Theory of Psychological Reactance*. New York: Academic Press.
- _____. 1972. *Responses to Loss of Freedom. A Theory of Psychological Reactance*. Morristown: General Learning Press.
- Breusch, T. 2005a. “The Canadian Underground Economy: An Examination of Giles and Tedds,” 53(2) *Canadian Tax Journal* 367-391.
- _____. 2005b. “Estimating the Underground Economy Using MIMIC Models,” Working Paper, Canberra, Australia, <http://econwpa.wustl.edu/eps/em/papers/0507/0507003.pdf>.

- Brueck, Tilman, John B. Haisten-DeNew, and Klaus F. Zimmermann. 2006. "Creating Low-Skilled Jobs by Subsidizing Market Contracted Household Work," 38(4) *Applied Economics* 899-911.
- Buehn, Andreas, Alexander Karmann, and Friedrich Schneider. 2009. "Shadow Economy and Do-It-Yourself Activities: The German Case," 165(4) *Journal of Institutional and Theoretical Economics* 701-722.
- Cappiello, M.A. 1986. "Proposita di bibliografia ragionata sull'economia sommersa nell'industria (Italia 1970-82)", pp. 307-345, in A. Bagnasco, ed. *L'altra metà dell'economia. La ricerca internazionale sull'economia informale*. Naples: Liguori.
- Cassar, A. 2001. "An Index of the Underground Economy in Malta," 23 *Bank of Valletta Review* 44-62.
- Chen, Martha. 2004. "Rethinking the Informal Economy: Linkages with the Formal Economy and the Formal Regulatory Environment," paper presented at the EGDI-WIDR Conference "Unleashing Human Potential: Linking the Informal and Formal Sectors," Helsinki, Finland.
- Chickering, Lawrence A., and Muhamed Salahdine, eds. 1991. *The Silent Revolution – The Informal Sector in Five Asian and Near Eastern Countries*. San Francisco: An International Center for Economic Growth Publication (ICS Press).
- Dallago, Bruno. 1990. *The Irregular Economy: The 'Underground Economy' and the 'Black Labour Market'*. London: Dartmouth Publishing Company.
- Dell'Anno R. 2003. "Estimating the Shadow Economy in Italy: a Structural Equation Approach," Working Paper 2003-7, Dept. of Economics, University of Aarhus, DK.
- _____ and Friedrich Schneider. 2005. "The Shadow Economy of Italy and other OECD Countries: What Do We Know?" 2005 *Journal of Public Finance and Public Choice* 223-245.
- _____ and _____. 2009. "A Complex Approach to Estimate Shadow Economy: The Structural Equation Modelling," in M. Fagnini and T. Looks, eds. *Coping with the Complexity of Economics*. Berlin: Springer Publishing Company, 110-130.
- _____ and H.O. Solomon. 2007. "Shadow Economy and Unemployment Rate in USA: Is There a Structural Relationship? An Empirical Analysis," 35(2) *Applied Economics* 220-236.
- Deregulierungskommission (Deregulation Commission). 1991. *Marktöffnung und Wettbewerb*. Stuttgart: Publishing Company C.E. Poeschel.
- Dreher, A., and F. Schneider. 2010. "Corruption and the Shadow Economy: An Empirical Analysis," 144(2) *Public Choice* 215-238.
- _____, C. Kotsogiannis, and S. McCorriston. 2009. "How Do Institutions Affect Corruption and the Shadow Economy?" 16(4) *Int'l Tax and Public Finance* 773-796.
- Dixon, Huw. 1999. "Controversy: On the Hidden Economy. Editorial Introduction," 109(456) *Economic Journal* 335-337.
- Feige, Edgar L., ed. 1989. *The Underground Economies. Tax Evasion and Information Distortion*. Cambridge, New York, Melbourne: Cambridge University.
- _____. 1994. "The Underground Economy and the Currency Enigma," 49 *Supplement to Public Finance/ Finances Publiques* 119-136.

- Feld, Lars, and Bruno S. Frey. 2002. "Trust Breeds Trust: How Taxpayers are Treated," 3(1) *Economics of Governments* 87-89.
- _____ and _____. 2007. "Tax Compliance as the Result of a Psychological Tax Contract: The Role of Incentives and Responsive Regulation," 29(1) *Law and Policy* 102-120.
- _____ and Claus Larsen. 2005. "Black Activities in Germany in 2001 and 2004: A Comparison Based on Survey Data," *The Rockwool Foundation Research Unit, Study No. 12*, Copenhagen.
- _____ and _____. 2010. *Undeclared Work in Germany 2001 to 2007 – Impact of Deterrence, Tax Policy and Social Norms: An Analysis Based on Survey Data*. Berlin: Springer Publishing Company.
- _____ and Friedrich Schneider. 2010. "Survey on the Shadow Economy and Undeclared Earnings in the OECD Countries," 11 *German Economic Review* 109-149.
- Flaming, Daniel, Breut Hayolamak, and Pascale Joassart. 2005. "Hopeful Workers, Marginal Jobs: LA's Off-The-Books Labor Force," *Economic Roundtable*, Los Angeles, CA, 2005.
- Fleming, M.H., J. Roman, and G. Farrell. 2000. "The Shadow Economy," 53(2) *Journal of International Affairs* 64-89.
- Frey, Bruno S. 1997. *Not Just for the Money: An Economic Theory of Personal Motivation*. Cheltenham (UK): Edward Elgar.
- _____ and Werner Pommerehne. 1984. "The Hidden Economy: State and Prospect for Measurement," 30(1) *Review of Income and Wealth* 1-23.
- _____ and H. Weck-Hannemann. 1984. "The Hidden Economy as an Unobserved Variable," 26(1) *European Economic Review* 33-53.
- Frey, L. 1972. "Il lavoro a domicilio in Lombardia," Giunta Regionale Lombardia, Assessorato al Lavoro, Milan.
- _____. 1975. "Il potenziale di lavoro in Italia," Documenti ISVET, no. 50.
- _____. 1978. "Il lavoro nero nel 1977 in Italia," Tendenze della occupazione, no. 6.
- _____. 1980. "Introduzione all'analisi economica del lavoro minorile," *Economia del Lavoro*, no. 1-2, pp. 5-16.
- Friedman, E., S. Johnson, D. Kaufmann, and P. Zoido-Lobaton. 2000. "Dodging the Grabbing Hand: Determinance of Unofficial Activity in 69 Countries," 76(4) *Journal of Public Economics* 459-493.
- Garson, D.G. 2005. "Statnotes: An Online Textbook," <http://www2.chass.ncsu.edu/garson/pa765/structur.htm>.
- Giles, David E.A. 1999a. "Measuring the Hidden Economy: Implications for Econometric Modeling," 109(456) *Economic Journal* 370-380.
- _____. 1999b. "Modelling the Hidden Economy in the Tax-Gap in New Zealand," 24(4) *Empirical Economics* 621-640.
- _____. 1999c. "The Rise and Fall of the New Zealand Underground Economy: Are the Reasons Symmetric?" 6 *Applied Economic Letters* 185-189.
- _____ and Lindsay M. Tedds. 2002. "Taxes and the Canadian Underground Economy," *Canadian Tax Paper No. 106*, Canadian Tax Foundation, Toronto/Ontario.

- Halla, Martin, and Friedrich Schneider. 2005. "Taxes and Benefits: Two Distinct Options to Cheat on the State?" Discussion Paper, Institute of Economics, University of Linz, Linz (Austria).
- Hayduk, L.A. 1987. *Structural Equation Modelling with LISREL. Essentials and Advances*. London: The Johns Hopkins University Press.
- Helberger, C., and H. Knepel. 1988. "How Big is the Shadow Economy? A Re-Analysis of the Unobserved-Variable Approach of B.S. Frey and H. Weck-Hannemann," 32 *European Economic Review* 965-976.
- Hill, R. 2002. "The Underground Economy in Canada: Boom or Bust?" 50(5) *Canadian Tax Journal* 1641-1654.
- Johnson, Simon, Daniel Kaufmann, and A. Shleifer. 1997. "The Unofficial Economy in Transition," 2 *Brookings Papers on Economic Activity* 159-221.
- _____, _____ and Pablo Zoido-Lobaton. 1998a. "Regulatory Discretion and the Unofficial Economy," 88(2) *American Economic Review* 387-392.
- _____, _____ and _____. 1998b. "Corruption, Public Finances and the Unofficial Economy," World Bank, discussion paper, Washington, D.C.
- Joreskog, K.G., and D. Sorbom. 1993. *Lisrel 8: User's Reference Guide*. Chicago Scientific Software International.
- Karmann, Alexander. 1986. "Monetäre Ansätze zur Erfassung der Schattenwirtschaft: Ein Vergleich verschiedener Messansätze," 19/3 *Kredit und Kapital* 233-247.
- _____. 1990. "Schattenwirtschaft und ihre Ursachen: Eine empirische Analyse zur Schwarzwirtschaft und Selbstversorgung in der Bundesrepublik Deutschland," *Zeitschrift für Wirtschafts- und Sozialwissenschaften (ZWS)* 110/3, 1990, pp. 185-206.
- Kazemier, Brugt. 2005a. "The Underground Economy: A Survey of Methods and Estimates," Discussion Paper, Statistics Netherlands, Voorburg, Netherlands.
- _____. 2005b. "Monitoring the Underground Labour Market: What Surveys Can Do," Discussion Paper, Statistics Netherlands, Voorburg, Netherlands.
- Kirchgaessner, Gebhard. 1984. "Verfahren zur Erfassung der Schattenwirtschaft erarbeiteten Sozialprodukts," 68(3) *Allgemeines statistisches Archiv* 378-405.
- Kirchler, E., B. Maciejovsky, and F. Schneider. 2002. "Everyday Representations of Tax Avoidance, Tax Evasion and Tax Flight: Do Legal Differences Matter?" 8(3) *Economic Psychology* 1-19.
- Klovland, J.T. 1984. "Tax Evasion and the Demand for Currency in Norway and Sweden: Is There a Hidden Relationship?" 68(4) *Scandinavian Journal of Economics* 423-439.
- Lamnek, S., G. Olbrich, and W. Schäfer. 2000. "Forschungsprojekt 'Devianz im Sozialstaat,'" gefördert von der Volkswagen-Stiftung, Eichstätt.
- Lippert, Owen, and Michael Walker, eds. 1997. *The Underground Economy: Global Evidences of its Size and Impact*. Vancouver, B.C.: The Frazer Institute.
- Loayza, Norman V. 1996. "The Economics of the Informal Sector: A Simple Model and Some Empirical Evidence from Latin America," 45 *Carnegie-Rochester Conference Series on Public Policy* 129-162.
- _____, A.M. Oviedo, and L. Servén. 2005a. "The Impact of Regulation on Growth and Informality: Cross Country Evidence," World Bank, Policy Research Paper WPS3623, Washington, D.C.

- _____, _____ and _____. 2005b. "Regulation and Firm Dynamics," Discussion Paper, World Bank, Washington, D.C.
- Lubell, Herald. 1991. *The Informal Sector in the 1980's and 1990's*. Paris: OECD.
- Marcelli, Enrico A. 2004. "Unauthorized Mexican Immigration, the Labour and Other Lower-Wage Informal Employment in California," 38(1) *Regional Studies* 1-13.
- _____, Manuel Pastor, Jr., and Pascale M. Joassart. 1999. "Estimating the Effects of Informal Economic Activity: Evidence from Los Angeles County," 33(3) *Journal of Economic Issues* 579-607.
- Meon, Pierre-Guillaume, Friedrich Schneider, and Lauren Weill. 2010. "Does Taking the Shadow Economy into Account Matter When Measuring Aggregate Efficiency?" Forthcoming in *Applied Economics*, 2010.
- Mummert, Annette, and Friedrich Schneider. 2001. "The German Shadow Economy: Parted in a United Germany?" 58(3) *Finanzarchiv* 260-285.
- Pedersen, Soren. 2003. "The Shadow Economy in Germany, Great Britain and Scandinavia: A Measurement Based on Questionnaire Service," Study No. 10, The Rockwool Foundation Research Unit, Copenhagen.
- Pelzmann, Linde. 1988. *Wirtschaftspsychologie. Arbeitslosenforschung, Schattenwirtschaft, Steuerpsychologie*. Wien, New York: Springer.
- Pozo, Susan (ed.). 1996. *Exploring the Underground Economy: Studies of Illegal and Unreported Activity*. Michigan: W.E. Upjohn, Institute for Employment Research.
- Schneider, Friedrich. 1986. "Estimating the Size of the Danish Shadow Economy Using the Currency Demand Approach: An Attempt," 88(4) *The Scandinavian Journal of Economics* 643-668.
- _____. 1994a. "Measuring the Size and Development of the Shadow Economy. Can the Causes be Found and the Obstacles be Overcome?" in H. Brandstatter and W. Güth, eds. *Essays on Economic Psychology*, 193-212. Berlin, Heidelberg: Springer Pub.
- _____. 1994b. "Can the Shadow Economy be Reduced Through Major Tax Reforms? An Empirical Investigation for Austria," 49 *Supplement to Public Finance/Finances Publiques* 137-152.
- _____. 1994c. "Determinanten der Steuerhinterziehung der Schwarzarbeit im internationalen Vergleich," in C. Smekal and E. Theurl, ed. *Stand und Entwicklung der Finanzpsychologie*, pp. 247-288. Baden-Baden: Nomos-Verlag.
- _____. 1997. "The Shadow Economies of Western Europe," 17(3) *Journal of the Institute of Economic Affairs* 342-48.
- _____. 1998a. "Further Empirical Results of the Size of the Shadow Economy of 17 OECD-Countries over Time," Paper to be presented at the 54. Congress of the IIPF Cordoba, Argentina and discussion paper, Department of Economics, University of Linz, Linz, Austria.
- _____. 1998b. "Stellt das Anwachsen der Schwarzarbeit eine wirtschaftspolitische Herausforderung dar? Einige Gedanken aus volkswirtschaftlicher Sicht." Linz, *Mitteilungen des Instituts für angewandte Wirtschaftsforschung (IAW)*, I/98, pp. 4-13.
- _____. 2000a. "Ist Schwarzarbeit ein Volkssport geworden? Ein internationaler Vergleich des Ausmaßes der Schwarzarbeit von 1970-97," in S. Lamnek and

- J. Luedtke, eds. *Der Sozialstaat zwischen Markt und Hedonismus*, 126-161. Opladen: Verlag Leske und Budrich.
- _____. 2000b. "The Increase of the Size of the Shadow Economy of 18 OECD-Countries: Some Preliminary Explanations," Paper presented at the Annual Public Choice Meeting, March 10-12, 2000, Charleston, S.C.
- _____. 2001. "Die Schattenwirtschaft – Tatbestand, Ursachen, Auswirkungen," in A. Rauscher, ed. *Die Arbeitswelt im Wandel, Mönchengladbacher Gespräche Bd.21*, pp. 127-143. Köln: J.P.Bachem Verlag.
- _____. 2003. "Shadow Economy," in C.K. Rowley and F. Schneider, eds. *Encyclopedia of Public Choice Vol. II*, pp. 286-296. Dordrecht: Kluwer Academic Publishers.
- _____. 2005. "Shadow Economies Around the World: What do We Really Know?" 21(3) *European Journal of Political Economy* 598-642.
- _____. 2006. "Shadow Economies and Corruption All Over the World: What Do We Really Know?" Diskussionspapier, August 2006, Universität Linz: Institut für Volkswirtschaftslehre.
- _____. 2009. "Size and Development of the Shadow Economy in Germany, Austria and Other OECD Countries: Some Preliminary Findings," 60(5) *Revue Economique* 1079-1116.
- _____, A. Buehn, and C. Montenegro. 2010. "Shadow Economies All Over the World: New Estimates for 162 Countries from 1999 to 2007," World Bank, Discussion Paper.
- _____ and Dominik Enste. 2000a. *Schattenwirtschaft und Schwarzarbeit – Umfang, Ursachen, Wirkungen und wirtschaftspolitische Empfehlungen*. München: Oldenbourg.
- _____ and Dominik Enste. 2000b. "Shadow Economies: Size, Causes and Consequences," 38 *Journal of Economic Literature* 73-110.
- _____ and Dominik Enste. 2002. *The Shadow Economy: Theoretical Approaches, Empirical Studies, and Political Implications*. Cambridge, UK: Cambridge University Press.
- _____ and Dominik Enste (ed.). 2006. *Jahrbuch Schattenwirtschaft 2006/07. Zum Spannungsfeld von Politik und Ökonomie*. Berlin: LIT Verlag.
- _____, J. Volkert, and S. Caspar. 2002. *Schattenwirtschaft und Schwarzarbeit: Beliebt bei vielen – Problem für alle: Eine Analyse der schattenwirtschaftlichen Aktivitäten in Deutschland (am Beispiel Baden-Württemberg) und mögliche politische Konsequenzen*, Baden-Baden: Nomos Verlagsgesellschaft.
- _____ and Helmut Badekow. 2006. *Ein Herz für Schwarzarbeiter: Warum die Schattenwirtschaft unseren Wohlstand steigert*. Berlin: Econ Verlag.
- Smith, P. 1994. "Assessing the Size of the Underground Economy: The Canadian Statistical Perspectives." *Canadian Economic Observer*, No. 11010, pp. 316-333.
- Smith, R.S. 2002. "The Underground Economy: Guidance for Policy Makers?" 50(5) *Canadian Tax Journal* 1655-1661.
- Spiro, P.S. 1993. "Evidence of a Post GST Increase in the Underground Economy," 41(2) *Canadian Tax Journal* 247-258.
- Stapleton, D.C. 1978. "Analyzing Political Participation Data with a MIMIC Model, 15 *Sociological Methodology* 52-74.

- Stevens, J. 1996. *Applied Multivariate Statistics for the Social Sciences*, 3rd ed. Lawrence Erlbaum Associates, Inc., USA.
- Tanzi, Vito. 1999. "Uses and Abuses of Estimates of the Underground Economy," 109(456) *Economic Journal* 338-347.
- Thomas, Jim J. 1992. *Informal Economic Activity*. New York/London/Toronto: Harvester/Weatsheaf.
- _____. 1999. "Quantifying the Black Economy: 'Measurement Without Theory' Yet Again?" 109(456) *Economic Journal* 381-389.
- Torgler, Benno. 2002. "Speaking to Theorists and Searching for Facts: Tax Moral and Tax Compliance in Experiments," 16(5) *Journal of Economic Surveys* 657-683.
- _____. and Friedrich Schneider. 2005. "Attitudes Towards Paying Taxes in Austria: An Empirical Analysis," *Empirica*, pp.206-225.
- Williams, Colin C., and Jan Windebank. 1998. *Informal Employment in the Advanced Economies: Implications for Work and Welfare*. London: Routledge.
- _____. and _____. 2001a. "Beyond Profit Motivated Exchange: Some Lessons from the Study of Paid Informal Work," 8(1) *European Urban and Regional Studies* 49-61.
- _____. and _____. 2001b. "Reconceptualizing Paid Informal Exchange: Some Lessons from English Cities," A33(1) *Environment and Planning* 121-140.