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Estimating the Size of the Shadow Economy: Methods and Problems; and the Latest Results for the Baltic Countries

1. Introduction

All over the world, empirical research about the size and development of the shadow economy has strongly increased. However, most empirical results are heavily disputed by many economists around the world.

Hence, the first goal of this lecture is to review the various methods estimating the size of the shadow economy and to discuss their strengths and weaknesses; the second one is to present some results for the Baltic countries.

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2. Defining the Shadow Economy

Table 2.1: A taxonomy of types of underground economic activities

<i>Type of activity</i>	<i>Monetary transactions</i>		<i>Non-monetary transactions</i>	
<i>Illegal Activities</i>	Trade with stolen goods; drug dealing and manufacturing; prostitution; gambling; fraud; etc.		Barter of drugs, stolen goods, smuggling etc. Produce drugs for own use. Theft for own use.	
	Tax Evasion	Tax Avoidance	Tax Evasion	Tax Avoidance
<i>Legal Activities</i>	Unreported income from self-employment; wages, salaries and assets from unreported work	Employee discounts, fringe benefits	Barter of legal services and goods	All do-it-yourself work; neighbor help; and voluntary work

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

2. Defining the Shadow Economy

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 and/or indirect taxes,**
- (2) to avoid payment of social security contributions,**
- (3) to avoid certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and**
- (4) to avoid complying with certain administrative procedures.**

2. Defining the Underground and Informal Household Economy

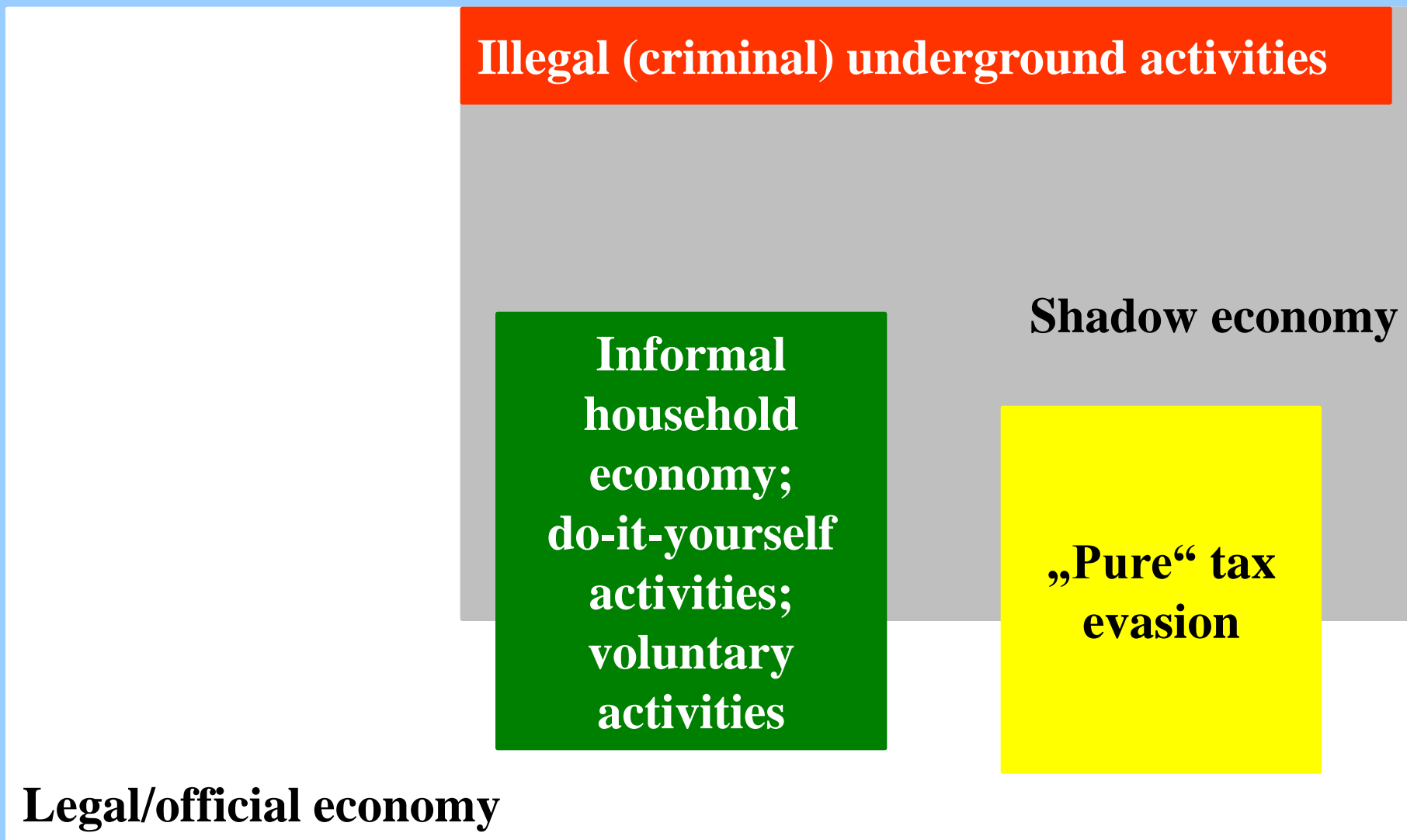
(1) *Underground (classical crime) activities are all illegal actions that fit the characteristics of classical crime activities like burglary, robbery, drug dealing, etc.*

(2) *Informal household economy consists of household enterprises that are not registered officially under various specific forms of national legislation.*

To a large extent these two sectors are not included in the shadow economy activities.

2. Defining the Shadow Economy

Figure 2.1: Legal, Shadow, Illegal and Informal Economy and Tax Evasion



3. Methods to Estimate the Size of the Shadow Economy

There are three major approaches to measure the shadow economy:

- (1) direct ones,**
- (2) indirect ones, and the**
- (3) model or latent variable (MIMIC = multiple indicators multiple causes) one.**

3. Methods to Estimate the Size of the Shadow Economy

3.1 Direct Approaches

(1) These are microeconomic approaches that employ either well designed surveys or samples based on voluntary replies or tax auditing and other compliance methods.

(2) Estimates of the shadow economy can also be based on the discrepancy between income declared for tax purposes and the actual detected one by audits.

Advantage of (1) and (2): Detailed knowledge about the shadow economy on an individual basis.

3. Methods to Estimate the Size of the Shadow Economy

3.1 Direct Approaches

Disadvantages of (1) and (2):

(i) Survey methods are likely to underestimate the shadow economy because in surveys people are likely to under-declare what they are hiding from authorities.

In order to minimize this behavior structured interviews are undertaken (usually face to face).

(ii) A further disadvantage of these two direct methods (surveys and tax auditing) is the point estimate character.

3. Methods to Estimate the Size of the Shadow Economy

3.2 Indirect Approaches

These approaches, which are also called “indicator” approaches, are mostly macroeconomic ones and use various (mostly economic) indicators that contain information about the development of the shadow economy (over time).

Five indicator approaches:

- 3.2.1 The Discrepancy between National Expenditure and Income Statistics;**
- 3.2.2 The Discrepancy between the Official and Actual Labor Force;**
- 3.2.3 The Transactions Approach;**
- 3.2.4 The Currency Demand Approach; and**
- 3.2.5 The Physical Input (Electricity Consumption) Method.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.1 The Discrepancy between National Expenditure and Income Statistics

- (1) This approach is based on discrepancies between income and expenditure statistics.**
- (2) In national accounting the income measure of GNP should be equal to the expenditure measure of GNP.**
- (3) If an independent estimate of the expenditure side of the national accounts is available, the gap between the expenditure measure and the income measure is an indicator of the size of the shadow economy.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.1 The Discrepancy between National Expenditure and Income Statistics

- (4) If all the components of the expenditure side were measured without error, then this approach would indeed yield a good estimate of the scale of the shadow economy.**
- (5) However, unfortunately, this is not the case and the discrepancy, therefore, reflects all omissions and errors everywhere in the national accounts statistics as well as the shadow economy activity.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.2 The Discrepancy between the Official and Actual Labor Force

- (1) If total labor force participation is assumed to be constant, a decreasing official rate of participation can be an indicator of an increase in the activities in the shadow economy, ceteris paribus.**
- (2) One weakness of this method is that differences in the rate of participation also have other causes.**
- (3) Moreover, people can work in the shadow economy and have a job in the „official’ economy.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.3 *The Transactions Approach*

(1) This approach has been developed by Edgar Feige. He assumes, that over time there is a constant relation between the volume of total transactions and total GNP.

(2) Feige's approach starts from Fisher's quantity equation:

$$\mathbf{M} * \mathbf{V} = \mathbf{p} * \mathbf{T},$$

with \mathbf{M} = money \mathbf{p} = prices

\mathbf{V} = velocity \mathbf{T} = total transactions

(3) Assumptions are necessary about the velocity of money and about the relationships between the value of total transactions ($\mathbf{p} * \mathbf{T}$) and total (=official + unofficial) nominal GNP.

3. Methods to Estimate the Size of the Shadow Economy

3.2.3 The Transactions Approach

- (4) 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.**

- (5) To derive figures for the shadow economy, Feige has to assume a base year, in which there is no shadow economy, and therefore the ratio of $p \cdot T$ to total nominal (official = total) GNP was „normal“ and would have been constant over time, if there had been no shadow economy.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.3 The Transactions Approach

(6) Weaknesses:

- (i) the assumption of a base year with no shadow economy;**
- (ii) the assumption of a „normal“ ratio of transactions constant over time;**
- (iii) to obtain reliable estimates, precise figures of the total volume of transactions should be available;**
- (iv) This is 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 paper on which they are printed; and**

3. Methods to Estimate the Size of the Shadow Economy

3.2.3 The Transactions Approach

(6) Weaknesses (cont.):

(v) in an “ideal” situation 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 totally legal and have nothing to do with the shadow economy.

In general, although this approach is theoretically very attractive, the empirical requirements necessary to obtain reliable estimates are so difficult to fulfill that in most cases its application leads to quite high results.

3. Methods to Estimate the Size of the Shadow Economy

3.2.4 *The Currency Demand Approach*

The basic regression equation for the currency demand from Tanzi (1983) is:

$$\ln (C / M2)_t = b_0 + b_1 \ln (1 + TW)_t + b_2 \ln (WS / Y)_t + b_3 \ln R_t + b_4 \ln (Y / N)_t + u_t$$

with $b_1 > 0$, $b_2 > 0$, $b_3 < 0$, $b_4 > 0$, where

ln denotes natural logarithms,

C / M2 is the ratio of cash holdings to deposit accounts,

TW is an average tax rate (to proxy changes of the shadow economy),

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

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

Y / N is the per capita income.

3. Methods to Estimate the Size of the Shadow Economy

3.2.4 The Currency Demand Approach

The objections against the *currency demand approach*

- (1) Not all transactions in the shadow economy are paid in cash. The size of the total shadow economy (including barter) may thus be larger.**
- (2) Many studies consider only one factor, the tax burden, as a cause of the shadow economy. If other factors also have an impact on the shadow economy it will be higher.**
- (3) Blades and Feige, criticize Tanzi's studies on the grounds that the US dollar is used as an international currency, which has to be controlled.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.4 The Currency Demand Approach

The objections against the *currency demand approach* (cont.)

- (4) As discussed by Garcia, Park, and Feige, increases in currency demand deposits are largely due to a slowdown in demand deposits rather than to an increase in currency caused by the shadow economy.**

- (5) Another weak point is the assumption of the same velocity of money in both types of economies.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.4 The Currency Demand Approach

The objections against the *currency demand approach* (cont.)

- (6) Ahumada, Canavese and Canavese (2004) show, that the assumption of equal income velocity of money in both economies is only correct, if the income elasticity is 1; if this is not the case, the calculation has to be corrected.**

- (7) Finally, the assumption of no shadow economy in a base year is open to criticism.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.5 The Physical Input (Electricity Consumption) Method

The Kaufmann - Kaliberda Method:

- (1) To measure overall (official and unofficial) economic activity the authors assume that electric power consumption is regarded as the single best physical indicator of overall economic activity.**
- (2) Overall (official and unofficial) economic activities and electricity consumption have been empirically observed move in lockstep with an electricity/GDP elasticity usually close to one.**
- (3) By having a proxy measurement for the overall economy and subtracting it from estimates of official GDP, Kaufmann and Kaliberda derive an estimate of unofficial GDP.**

3. Methods to Estimate the Size of the Shadow Economy

3.2.5 The Physical Input (Electricity Consumption) Method

The Kaufmann-Kaliberda-Method is open to criticism:

- (i) Not all shadow economy activities require a considerable amount of electricity (e.g. personal services), and other energy sources (gas, oil, coal, etc.) can be used, so that only a part of the shadow economy is captured.**
- (ii) Over time, there has been considerable technical progress and price variation. Both the production and use of electricity are more efficient than in the past, and that will apply in both official and unofficial uses.**
- (iii) There may be considerable differences or changes in the elasticity of electricity/GDP across countries and over time.**

3. Methods to Estimate the Size of the Shadow Economy

3.3 Multiple Indicators, Multiple Causes (MIMIC) Approach

MIMIC Estimation Procedure:

- Modeling the shadow economy as an unobservable (latent) variable
- Description of the relationships between the latent variable and its causes in a structural model: $\eta = \Gamma x + \zeta$
- Link between the latent variable and its indicators is represented in the measurement model: $y = \Lambda_y \eta + \varepsilon$
- η : latent variable (shadow economy)
- X : ($q \times 1$) vector of causes in the structural model
- Y : ($p \times 1$) vector of indicators in the measurement model
- Γ : ($1 \times q$) coefficient matrix of the causes in the structural equation
- Λ_y : ($p \times 1$) coefficient matrix in the measurement model
- ζ : error term in the structural model and ε is a ($p \times 1$) vector of measurement error in y

3. Methods to Estimate the Size of the Shadow Economy

3.3 Multiple Indicators, Multiple Causes (MIMIC) Approach

MIMIC Estimation Procedure (cont.):

► Specification of structural equation:

$$[\text{shadow economy}] = [\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7, \gamma_8] \times \begin{array}{|l} \text{[Share of direct taxation]} \\ \text{[Share of indirect taxation]} \\ \text{[Share of social security burden]} \\ \text{[Burden of state regulation]} \\ \text{[Quality of state institutions]} \\ \text{[Tax morale]} \\ \text{[Unemployment quota]} \\ \text{[GDP per capita]} \end{array} + [\zeta]$$

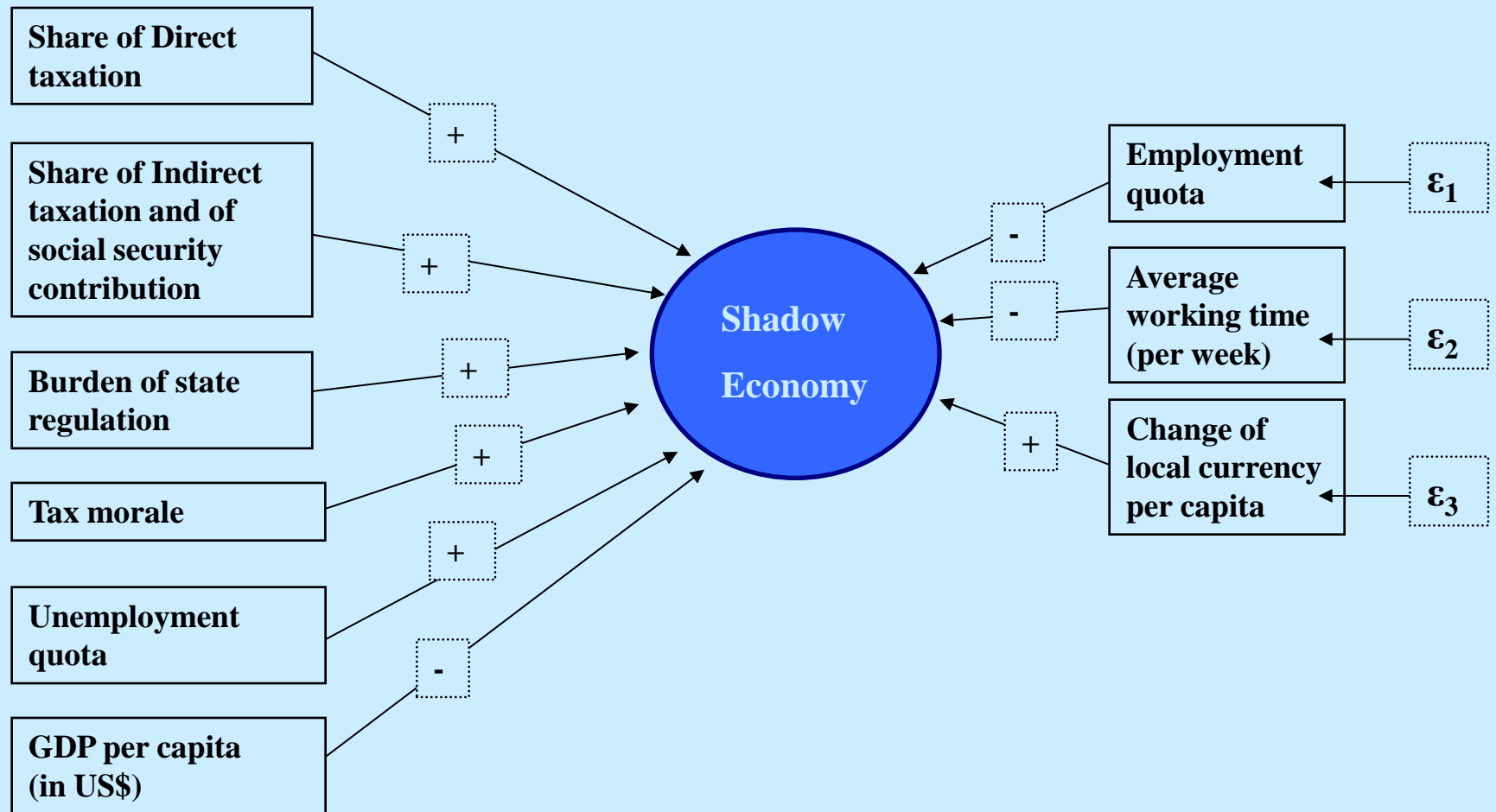
► Specification of measurement equation:

$$\begin{array}{|l} \text{Employment Quota} \\ \text{Change of local currency} \\ \text{Average working time} \end{array} = \begin{array}{|l} \lambda_1 \\ \lambda_2 \\ \lambda_3 \end{array} \times \left(\text{Shadow Economy} \right) + \begin{array}{|l} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \end{array}$$

3. Methods to Estimate the Size of the Shadow Economy

3.3 Multiple Indicators, Multiple Causes (MIMIC) Approach

Figure 3.1: MIMIC Estimation Procedure



- (1) **Time Period:** various years
- (2) The currency demand method will be used to transform the ordinal index into cardinal index of shadow economy.

3. Methods to Estimate the Size of the Shadow Economy

3.3 Multiple Indicators, Multiple Causes (MIMIC) Approach

The objections against the MIMIC approach

- (1) instability in the estimated coefficients with respect to sample size changes and alternative specifications;**
- (2) the reliability and selection of „causes“ and „indicators“ in explaining the variability of the shadow economy; also little theoretical justification for the selection;**
- (3) MIMIC estimations “produce” only relative values of the SE. Hence, one has to use another method to calibrate these values into absolute ones; the calibration procedures are open to criticism, too.**

3. Methods to Estimate the Size of the Shadow Economy

3.3 Multiple Indicators, Multiple Causes (MIMIC) Approach

The objections against the MIMIC approach (cont.)

- (4) Another critique concerns the meaning of the latent variable. As the latent variable and its unit of measurement are not observed, the MIMIC procedure just provides a set of estimated coefficients from which one can calculate an index that shows the dynamics of the unobservable variable;**
- (5) The application of the calibration or benchmarking procedure requires experimentation, and a comparison of the calibrated values in a wide academic debate.**

4. Results of the Size of the German Shadow Economy Using the Various Estimation Methods

Table 4.1: The Size of the Shadow Economy in Germany According to Different Methods (in percentage of official GDP)

Method/Source	Shadow economy (in percentage of official GDP) in:							
	1970	1975	1980	1985	1990	1995	2000	2005
Survey Approach (IfD Allensbach, 1975 (1 st row); Feld and Larsen, 2005 (2 nd and 3 rd row))	-	3.6 ¹⁾	-	-	-	-	-	-
	-	-	-	-	-	-	4.1 ²⁾	3.1 ²⁾
	-	-	-	-	-	-	1.3 ³⁾	1.0 ³⁾
Discrepancy between expenditure and income (Lippert and Walker, 1997)	11.0	10.2	13.4	-	-	-	-	-
Discrepancy between official and actual employment (Langfeldt, 1983)	23.0	38.5	34.0	-	-	-	-	-

1) 1974.

2) 2001 and 2004; calculated using wages in the official economy.

3) 2001 and 2004; calculated using actual “black” hourly wages paid.

4. Results of the Size of the German Shadow Economy Using the Various Estimation Methods

Table 4.1: The Size of the Shadow Economy in Germany According to Different Methods (in percentage of official GDP) (cont.)

Method/Source	Shadow economy (in percentage of official GDP) in:							
	1970	1975	1980	1985	1990	1995	2000	2005
Physical input method (Feld and Larsen, 2005)	-	-	-	14.5	14.6	-	-	-
Transactions approach	17.2	22.3	29.3	31.4	-	-	-	-
Currency demand approach (Kirchgässner, 1983 (1 st row); Langfeldt, 1983, 1984 (2 nd row); Schneider and Enste, 2000 (3 rd row))	3.1	6.0	10.3	-	-	-	-	-
	12.1	11.8	12.6	-	-	-	-	-
	4.5	7.8	9.2	11.3	11.8	12.5	14.7	-
Latent (MIMIC) approach (Frey and Weck, 1983 (1 st row); Pickardt and Sarda, 2006 (2 nd row); Schneider, 2005, 2007 (3 rd row))	5.8	6.1	8.2	-	-	-	-	-
	-	-	9.4	10.1	11.4	15.1	16.3	-
	4.2	5.8	10.8	11.2	12.2	13.9	16.0	15.4

5. Size of the Shadow Economies of the Baltic States

Table 5.1: MIMIC-Estimation of 39 OECD countries; estimation Period: 1998/99-2010

Specification	1	2	3	4	5
<i>Causes</i>					
Personal income tax	0.27*** (3.27)	0.33*** (3.99)	0.37*** (4.30)	0.40*** (4.80)	0.39*** (4.74)
Payroll taxes	-0.08 (0.98)	-0.11 (1.35)	-	-	-
Indirect taxes	0.24*** (2.75)	0.22*** (2.66)	0.31*** (3.85)	0.21*** (2.67)	0.24*** (2.97)
Tax morale	-0.31*** (3.29)	-0.22*** (2.40)	-0.26*** (2.84)	-0.22*** (2.51)	-0.21*** (2.38)
Unemployment rate	0.63*** (5.92)	0.65*** (6.30)	0.63*** (5.96)	0.55*** (5.56)	0.53*** (5.47)
Business freedom	-0.29*** (3.35)	-0.26*** (3.11)	-0.29*** (3.36)	-0.35*** (4.06)	-0.35*** (4.20)
Self-employment rate	0.29*** (2.68)	0.30*** (2.88)	0.34*** (3.17)	0.33*** (3.18)	0.27*** (2.57)
Rule of Law	-0.14* (1.81)	-0.14* (1.83)	-0.10 (1.31)	-0.08 (1.03)	-
GDP growth	-	0.30*** (3.62)	0.31*** (3.70)	0.27*** (3.35)	0.29*** (3.52)
Education	-	-	-	-0.31*** (3.51)	-0.26*** (2.83)
Corruption	-	-	-	-	0.14 (1.56)

5. Size of the Shadow Economies of the Baltic States

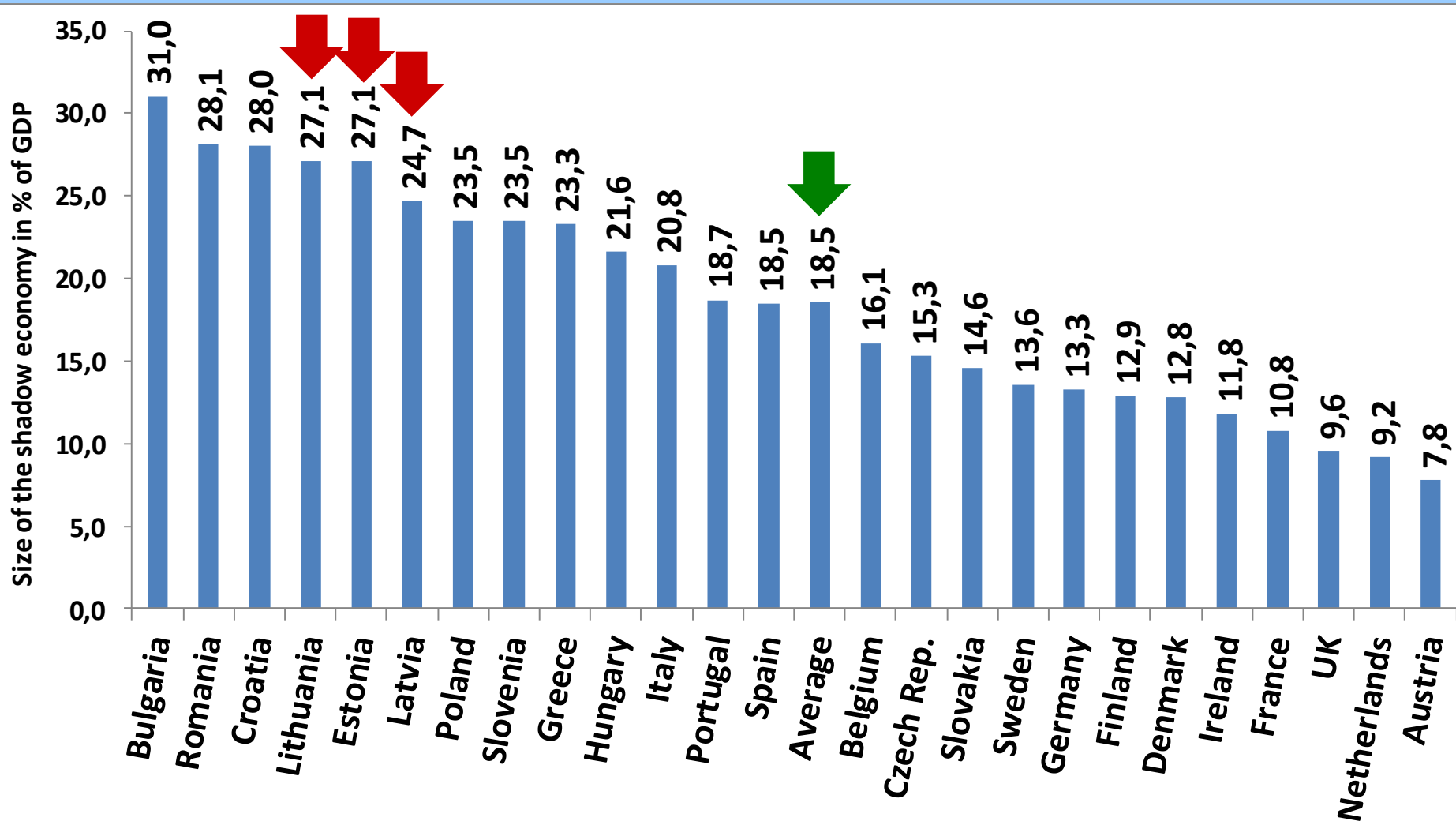
Table 5.1: MIMIC-Estimation of 39 OECD countries; estimation Period: 1998/99-2010 (cont.)

<i>Indicators</i>	1	2	3	4	5
GDP pc	-0.52	-0.52	-0.48	-0.51	-0.50
Currency in circulation per capita	0.09 (1.39)	0.07 (1.07)	0.10* (1.75)	0.10* (1.69)	0.08 (1.26)
Labour force participation rate	-0.56*** (6.42)	-0.55*** (6.58)	-0.52*** (6.36)	-0.50*** (6.48)	-0.51*** (6.46)
Observations	151	151	151	151	151
Degrees of Freedom	44	54	42	52	52
Chi-squared	88.88	89.68	24.10	32.51	34.57
RMSEA	0.08	0.06	0.00	0.00	0.00

Note: The sample includes 39 OECD countries and the estimation period is 1998 to 2010. Absolute z-statistics are reported in parentheses. *, **, *** indicate significance at the 10%, 5%, and 1% level, respectively.

5. Size of the Shadow Economies of the Baltic States

Figure 5.1: Size of the Shadow Economy of 25 European Countries in 2014 (in % of off. GDP)



5. Size of the Shadow Economies of the Baltic States

Table 5.2: Size of the shadow economies of the Baltic countries 2009-2013 in % of GDP (95% confidence intervals in parentheses)

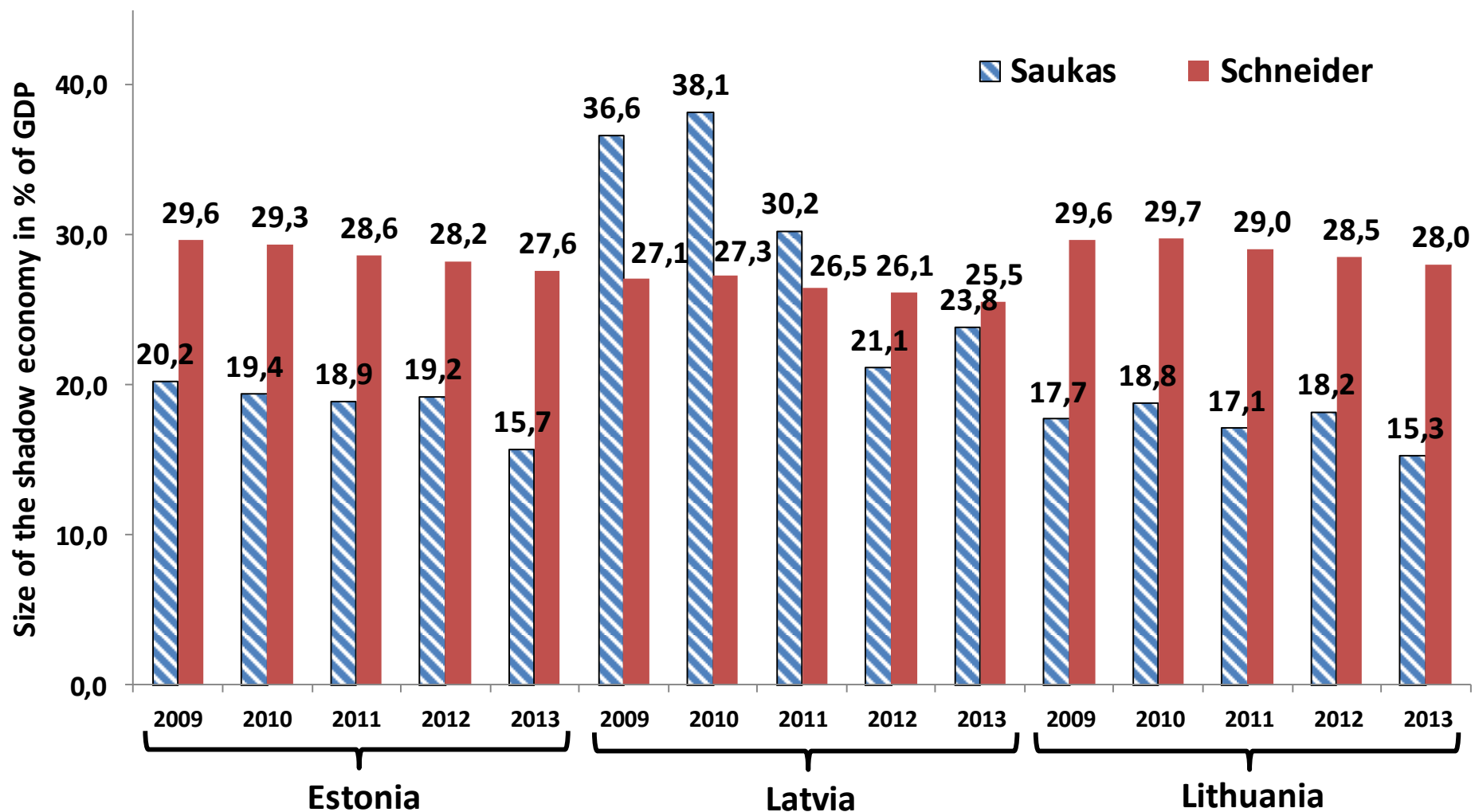
Country	2009	2010	2011	2012	2013	2013 - 2012	Estimation Method
Estonia¹⁾	20.2% (18.7, 21.7)	19.4% (18.0, 20.8)	18.9% (16.8, 20.9)	19.2% (16.6, 21.9)	15.7% (13.5, 17.9)	-3.5% (-5.9, -1.1)	Index Approach
Estonia²⁾	29.6% (28.0, 31.2)	29.3% (27.7, 30.9)	28.6% (27.0, 30.2)	28.2% (26.6, 29.8)	27.6% (26.0, 29.2)	-0,6%	MIMIC
Latvia¹⁾	36.6% (34.3, 38.9)	38.1% (35.9, 40.3)	30.2% (27.6, 32.7)	21.1% (18.5, 23.6)	23.8% (20.7, 26.9)	+2.7% (-0.1, +5.6)	Index Approach
Latvia²⁾	27.1% (24.7, 29.5)	27.3% (24.9, 29.7)	26.5% (24.1, 28.9)	26.1% (23.7, 28.5)	25.5% (23.1, 27.9)	-0,6%	MIMIC
Lithuania¹⁾	17.7% (15.8, 19.7)	18.8% (16.9, 20.6)	17.1% (15.2, 19.0)	18.2% (16.4, 20.1)	15.3% (13.6, 17.1)	-2.9% (-4.7, -1.1)	Index Approach
Lithuania²⁾	29.6% (27.7, 31.5)	29.7% (27.8-31.6)	29.0% (27.1, 30.9)	28.5% (26.6, 30.4)	28.0% (26.1, 29.9)	-0.5%	MIMIC

1) Source: Putnins and Sauka (2014), Table 1, p. 12

2) Source: Schneider (2014)

5. Size of the Shadow Economies of the Baltic States

Figure 5.2: Size of the shadow economies of the Baltic countries 2009-2013 in % of GDP



1) Source: Putnins and Sauka (2014), Table 1, p. 12

2) Source: Schneider (2014)

6. Concluding Remarks: Problems

6.1 Surveys:

- (1) Quite often only households or only partly firms are considered.**
- (2) Non-responses and/or incorrect responses**
- (3) Results of the financial volume of „black“ hours worked and not of value added.**

6. Concluding Remarks: Problems

6.2 Discrepancy Method:

- (1) Combination of meso estimates/assumptions**
- (2) Calculation method often not clear**
- (3) Documentation and procedures often not public**

6. Concluding Remarks: Problems

6.3 Monetary and/or Electricity Methods:

- (1) Some estimates are very high and only macro-estimates.**
- (2) Are the assumptions about shadow economy activities plausible?**
- (3) Breakdown by sector or industry not possible!**
- (4) Great differences to convert millions of KWh into a value added figure when using the electricity method (Lackó approach).**

6. Concluding Remarks: Problems

6.4 MIMIC (Latent) Method:

- (1) Only relative coefficients, no absolute values.**
- (2) Estimations quite often highly sensitive with respect to changes in the data and specifications.**
- (3) Difficulty to differentiate between the selection of causes and indicators; little theoretical “guidance”.**
- (4) The use of the calibration procedure and starting values has great influence on the size and development of the shadow economy.**

6. Concluding Remarks: Final Statements

- (1) No ideal or dominating method – all have serious problems and weaknesses.**
- (2) If possible use several methods.**
- (3) Much more research is needed with respect to the estimation methodology and empirical results for different countries and periods.**
- (4) Experimental methods should be used to provide a micro-foundation.**

6. Concluding Remarks: Open Research Questions

- (1) A common and internationally accepted definition of the shadow economy is still missing. Such a definition or convention is needed in order to make comparisons between countries easier.**
- (2) A satisfactory validation of the empirical results should be developed so that it is easier to judge the empirical results with respect to their plausibility.**

6. Concluding Remarks: Open Research Questions

(3) The link between theory and empirical estimation of the shadow economy is still unsatisfactory.

In the best case theory provides us with derived signs of the causal and indicator variables.

However, which are the “core” causal and which are the “core” indicator variables is theoretically „open“.

**Thank you very much for your
attention!**

Appendix A 1: A Comparison between the MIMIC and Survey Method

Table A.1: A comparison of the Size of the German Shadow Economy using the survey and the MIMIC-method, year 2006

Various kinds of shadow economy activities/values	Shadow Economy in % of official GDP	Shadow Economy in bill. Euro	% share of the overall shadow economy
Shadow economy activities from labour (hours worked, <i>survey results</i>)	5.0 – 6.0	117 – 140	33 – 40
+ Material (used)	3.0 – 4.0	70 – 90	20 – 25
+ Illegal activities (goods and services)	4.0 – 5.0	90 – 117	25 – 33
+ already in the official GDP included illegal activities	1.0 – 2.0	23 – 45	7 - 13
Sum (1) to (4)	13.0 – 17.0	300 – 392	85 – 111
Overall (total) shadow economy (estimated by the MIMIC and calibrated by the currency demand procedure)	15.0	340	100

Source: Enste/Schneider (2006) and own calculations.

Appendix A 1: A Comparison between the MIMIC and Survey Method

Some remarks when comparing the values from the survey method with the total value added in the shadow economy sector achieved by the MIMIC method. The rather large difference can be “explained” with the following facts:

- (1) Table A.5 contains earnings and not the value added of the shadow economy. This means material is not considered.**
- (2) Demanders are overwhelmingly households, the whole sector of the shadow economy activities between firms (which are especially a problem in the construction and craftsmen sectors) *is not considered*.**
- (3) All foreign shadow economy activities are not considered.**
- (4) The amount of income earned in the shadow economy, the hourly wage rate and hours worked per year vary considerably.**