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DO DIFFERENT ESTIMATION METHODS LEAD TO IMPLAUSIBLE DIFFERENCES IN THE SIZE OF THE SHADOW ECONOMIES? A PRELIMINARY ANSWER

CONTENT

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1. INTRODUCTION

(1) All over the world the estimation of the size and development of shadow economies (se) is a hot and controversial scientific topic, especially as the sizes of the se vary considerably when different methods are used.

(2) Hence, the goal of this lecture is *threefold*:

(i) to present the most often used methods of four micro- and three macro-approaches as well as some results,

(ii) to compare the micro-based se results with macro ones, as we see from them the, by far, biggest differences in the size of various countries' shadow economies, and

(iii) to draw preliminary conclusions about the plausibility and reliability of the macro and micro estimation methods.

2. MICRO AND MACRO APPROACHES
2.1 OVERVIEW

The following seven most frequently used methods of measuring the shadow economy are briefly presented and critically evaluated:

(1) Micro approach (survey technique);

(2) Micro approach: The use of surveys and the knowledge of company managers;

(3) Micro approach: estimation of the consumption-income-gap of households;

(4) Micro and/or macro: The system of National Accounts Statistics – Discrepancy method;

(5) Macro approach: The currency demand approach

(6) Macro approach: MIMIC method (macro and adjusted); and

(7) Macro approach: Currency demand and MIMIC models: A structured hybrid method. ***Not discussed***

2. MICRO AND MACRO APPROACHES
2.2 DEFINITIONS

Goal of national account institutions: Reaching "exhaustive estimates"; hence, hidden and illegal activities should be included (Van de Ven, 2017): .

(1) Hidden but legal activities (System of National Accounts - SNA):

SNA 2008, § 6.40: Certain activities may clearly fall in the production boundary of the SNA and also are quite legal, but deliberately concealed from public authorities for the following kinds of reasons:

(i) To avoid the payment of income, value added taxes or other payments to public institutions;

(ii) to avoid the payment of social security contributions;

(iii) to avoid having to meet certain legal standards such as minimum wages, maximum hours, safety or health standards, etc.; and

(iv) to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms.

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2. MICRO AND MACRO APPROACHES
2.2 DEFINITIONS (CONT.)

(2) Illegal activities:

SNA 2008, § 6.43: There are two kinds of illegal production:

(i) The production of goods or services whose sale, distribution or possession is forbidden by law;

(ii) Production activities that are usually legal but become illegal when carried our by unauthorized producers; for example, unlicensed medical practitioners.

SNA 2008, § 6.45: Both kinds of illegal production are included within the production boundary of the SNA provided they are genuine production processes whose outputs consist of goods or services for which there is an effective market demand (Van de Ven, 2017).

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2. MICRO AND MACRO APPROACHES
2.3 THEORIZING ABOUT THE SHADOW ECONOMY

What are the main causes determining the size of the shadow economy and of tax evasion?

(i) Tax and social security contribution burdens;

(ii) intensity of regulations; (iii) public Sector Services;

(iv) tax morale; (v) unemployment;

(vi) self-employment; (vii) size of the agricultural sector;

(viii) official income; (ix) quality of public institutions; and

(x) federal (and/or direct democratic) system.

What are the main indicators, in which shadow economy activities are reflected?

(i) Official GDP; (ii) cash; and (iii) (official) employment.

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2. MICRO AND MACRO APPROACHES
2.4 PROBLEM OF "DOUBLE COUNTING"

All ten causal factors, but especially

(i) tax burden, (ii) regulation,

(iii) unemployment, (iv) self-employment, and

(v) the size of the agricultural sector

***are also major driving forces for* smuggling, do-it-yourself and household activities and neighbors help.**

In the Macro- (MIMIC and Currency Demand) Estimations these activities are (at least) partly included; hence, these estimates are higher than the „true" shadow economy estimates.

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3. ESTIMATION METHODS

THREE ESTIMATION PROCEDURES

(1) **Direct procedures** monthly use the micro level and aiming at determine the size of the shadow economy. Quite often this method is done by surveys or by "calculating" discrepancies in National Accounts.

(2) **Indirect procedures** make use of macroeconomic indicators proxying the development of the shadow economy over time; e.g. the currency demand approach.

(3) **Statistical models** use statistical tools to estimate the shadow economy as an "unobserved" or "latent" variable; e.g. the MIMIC (Multiple Indicator, Multiple Causes) Method.

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3. ESTIMATION METHODS

3.1 MICRO-APPROACHES (1)

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

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

Advantage of methods (A) and (B): Detailed knowledge about the shadow economy on an individual basis.

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3. ESTIMATION METHODS

3.1 MICRO APPROACHES – METHOD(2): USE OF SURVEYS OF COMPANY MANAGERS

(2) Surveys of company managers and miss reported business income developed by Putnins and Sauka (2015):

(i) They combine miss-reported business income and miss-reported wages.

(ii) Their method produces detailed information on the structure of the shadow economy, especially in the firm sector.

(iii) It is based on the facts that company managers know how much business income and wages go unreported due to their unique position in dealing both of these types of income.

(iv) Their method combines estimates of miss reported business incomes, unregistered or hidden employees, and unreported wages in order to calculate a total estimate of the size of the shadow economy.

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3. ESTIMATION METHODS

3.1 MICRO APPROACHES METHOD (3) MODIF. CONSUMP-TION-INCOME GAP METHOD

(3) Modified household data for the estimation of a shadow economy: Consumption – Income Gap - method:

(i) The size of the shadow economy estimated by Lichard, Hanousek and Filer (2014) is based on microeconomic data without making the unrealistic assumptions, which leads to under-estimating the size of the shadow economy by excluding underreporting among those who unjustifiably assumed to fully report their income.

(ii) The logical explanation is that employees being paid under the table or having a secondary, (undeclared) source of income while not being officially classified as "self-employed" constitute a major source of unreported income, which is included in their approach.

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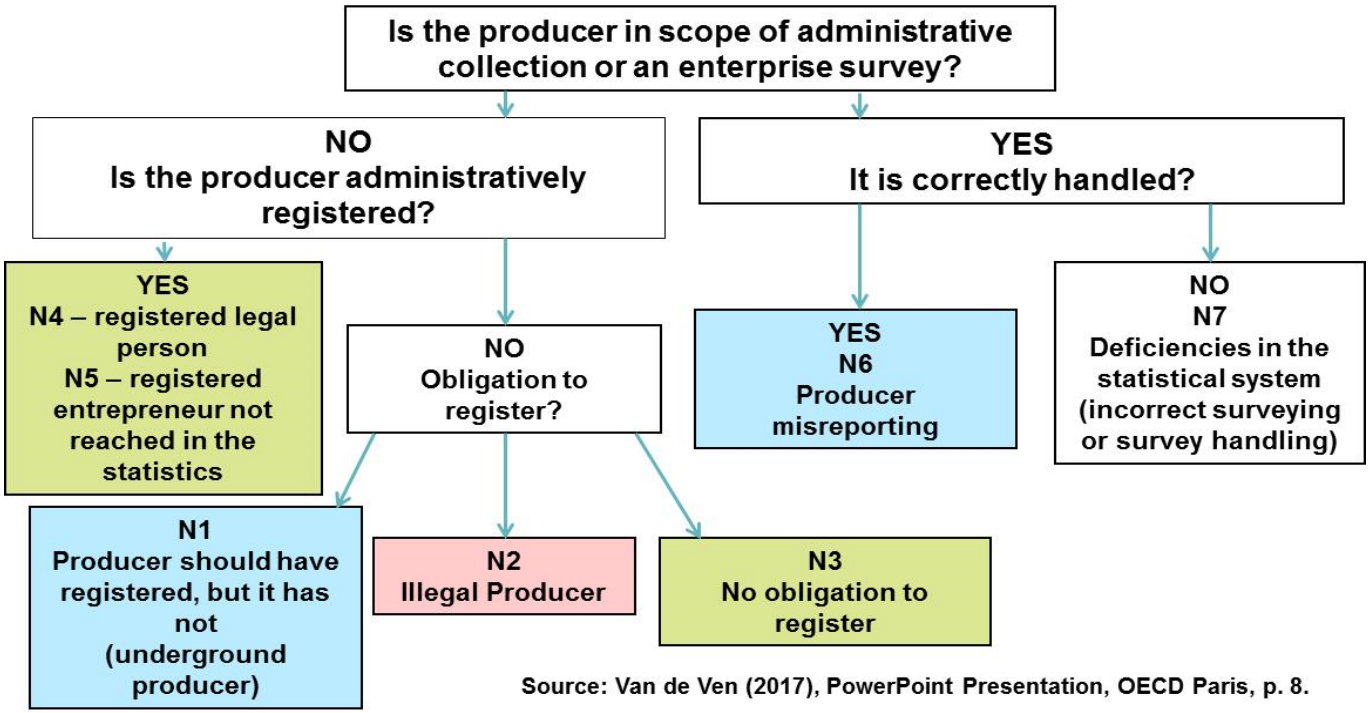
3 ESTIMATION METHODS
3.1 MICRO APPROACHES – METHOD (4) NATIONAL ACCOUNTS OR DISCREPANCY APPROACH

■ **Figure 3.1: Classification of NOE (Non-Observed Economy)**



Source: Van de Ven (2017), PowerPoint Presentation, OECD Paris, p. 8.

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3. ESTIMATION METHODS

3.1 DIRECT APPROACHES – METHOD (4) NATIONAL ACCOUNTS OR DISCREPANCY APPROACH

Concept of the NOE (= Non-Observed Economy):

(1) Seven non-observed economy (NOE) categories:

- **Economic underground: N1 - non-registered producers; N6 - misreporting from firms and individuals**
- **Informal (and own account production): N3 -no obligation to register, N4 - registered legal persons and N5 - registered entrepreneur not reached in the statistics.**
- **Statistical underground: N7 - Deficiencies in the statistical system; e.g. miss-reporting, omissions, false declarations.**
- **Illegal: N2 - Illegal producers or producing criminal goods + services**

Source: Van de Ven (2017)

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3. ESTIMATION METHODS

3.1 DIRECT APPROACHES – METHOD (4): RESULTS

Table 3.1: NOE adjustments by informality type; (share of adjustment type within total NOE); years:2011–2012

	Underground N1 + N6	Illegal N2	Informal sector N3 + N4 + N5	Statistical deficiencies N7	Total NOE
Austria	2.4 (31.7%)	0.2 (2.1%)	1.5 (19.4%)	3.5 (46.8%)	7.5 (100%)
Belgium	3.8 (83.8%)	--	--	0.7 (16.2%)	4.6 (100%)
Canada	1.9 (88.2%)	0.2 (8.2%)	--	0.1 (3.6%)	2.2 (100%)
Czech Rep.	6.3 (77.6%)	0.4 (4.5%)	1.3 (15.6%)	0.2 (2.3%)	8.1 (100%)
France	3.7 (54.7%)	--	2.9 (42.7%)	0.2 (2.7%)	6.7 (100%)
Hungary	3.1 (27.9%)	0.8 (7.5%)	3.1 (28.6%)	3.9 (36%)	10.9 (100%)
Israel	2.2 (32.6%)	--	1.4 (21.8%)	3 (45.6%)	6.6 (100%)
Italy	16.2 (92.8%)	--	--	1.2 (7.2%)	17.5 (100%)
Mexico	5.5 (34.7%)		10.4 (65.3%)	--	15.9 (100%)
Netherlands	0.8 (36.6%)	0.5 (20.1%)	0.5 (20%)	0.5 (23.2%)	2.3 (100%)
Norway	0.5 (51.5%)	0 (0.3%)	0.5 (43.8%)	0 (4.4%)	1 (100%)
Poland	12.7 (82.6%)	0.9 (6%)	0 (0%)	1.8 (11.4%)	15.4 (100%)
Slovak Rep.	12.1 (77.3%)	0.5 (3%)	2.9 (18.7%)	0.2 (1%)	15.6 (100%)
Slovenia	3.9 (38.2%)	0.3 (3.2%)	2.8 (27.7%)	3.1 (30.9%)	10.2 (100%)
Sweden	3 (100%)	--	--	--	3 (100%)
U.K.	1.5 (65.6%)	--	0.5 (22.9%)	0.3 (11.4%)	2.3 (100%)

Source: Van de Ven (2017), PowerPoint Presentation, OECD Paris, p. 15.

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3. ESTIMATION METHODS

3.2 MACRO APPROACH (5):THE CURRENCY DEMAND METHOD

Basic idea:

(1) Se activities are mostly paid in cash (up to now, will change!).

(2) Specify a currency demand function and include the causal factors responsible for the size of the se; estimate it over time.

(3) Make a simulation to calculate how much cash would be used without a shadow economy by setting the causal factors for se activities to a minimum value (or to zero) in the estimated function.

(4) Subtract from (2) (3) to get the amount cash used for se activities.

(5) Multiply (4), the amount of se used cash with the velocity of money and you get a value added figure of se.

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3. ESTIMATION METHODS

3.3 INDIRECT MACRO METHOD(6): THE MULTIPLE INDICATORS MULTIPLE CAUSES (MIMIC) APPROACH

- 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×1) vector of causes in the structural model
Y: (p×1) vector of indicators in the measurement model
Γ: (1×q) coefficient matrix of the causes in the structural equation
Λ_y: (p×1) coefficient matrix in the measurement model
ζ, ε : error term in the structural model and ε is a (p×1) vector of measurement error in y

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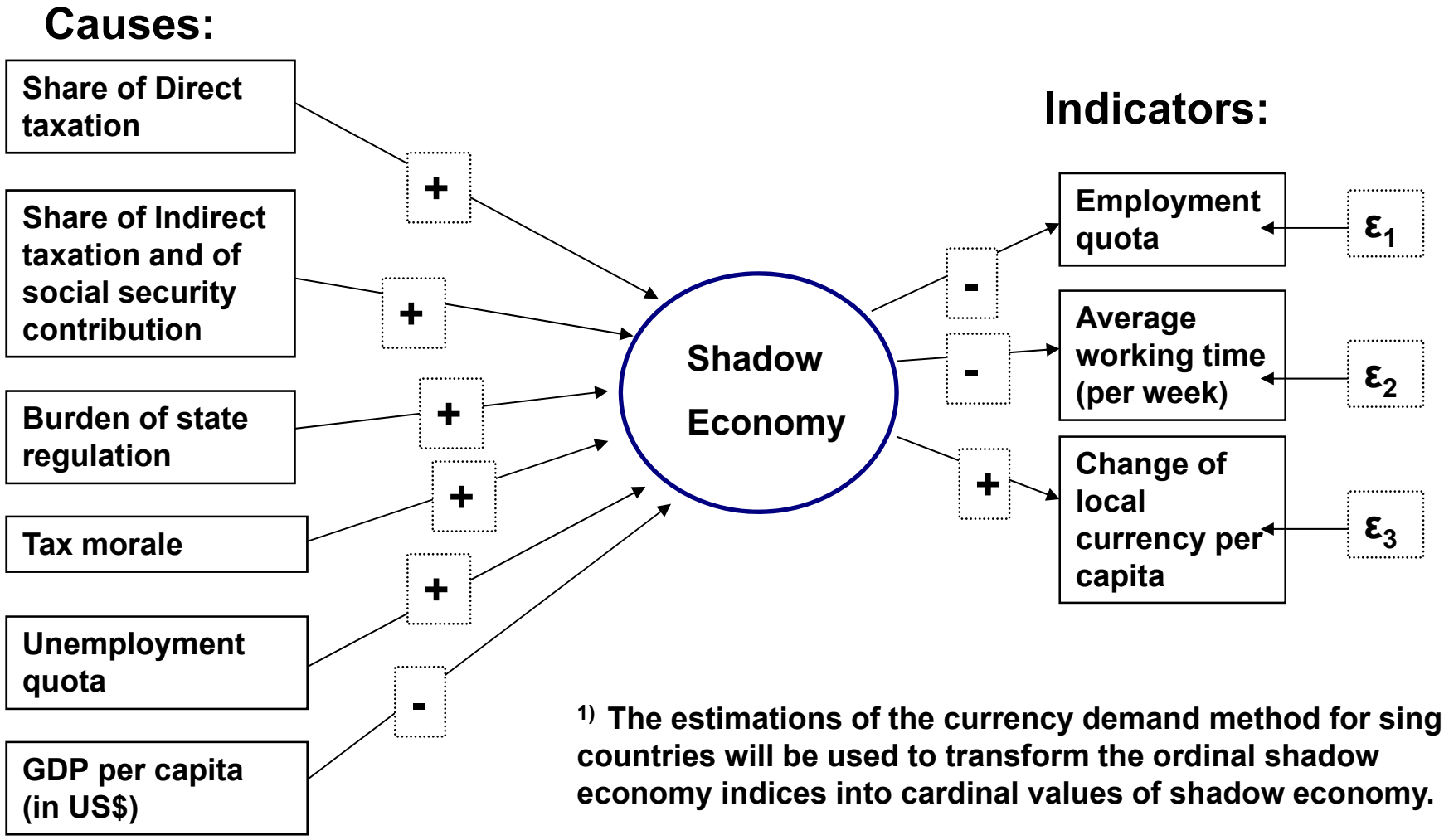
3. ESTIMATION METHODS

Figure 3.2: Path diagram of the MIMIC model[1)]



[1)] The estimations of the currency demand method for single countries will be used to transform the ordinal shadow economy indices into cardinal values of shadow economy.

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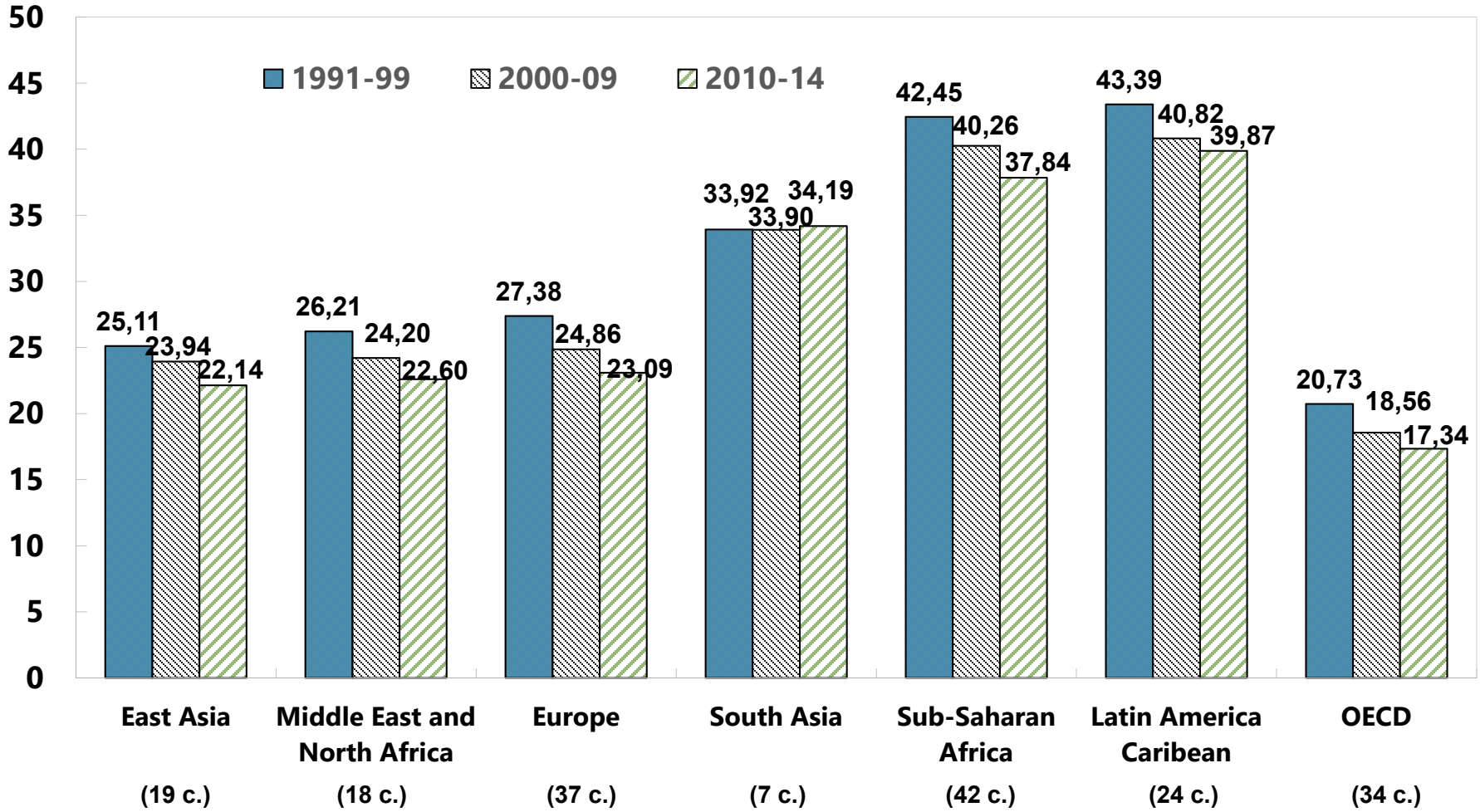
3. EMPIRICAL RESULTS OF REGIONAL SE FIG.

Fig. 3.3: Worldwide shadow economies by region (average, % of GDP); MIMIC-Method



Source: Own calculations.

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3. ESTIMATION METHODS: THE PROBLEM OF "DOUBLE COUNTING"

Table 3.2: Decomposition of the shadow economy activities in Estonia and Germany

Kinds of shadow economy activities (rough estimates!)	Estonia		Germany	
	Size in % of official GDP average 2009-2015	Proportion of total shadow economy	Size in % of official GDP average 2009-2015	Proportion of total shadow economy
(1) Total (macro) shadow economy (estimated by the MIMIC and calibrated by the currency demand procedures)	28.0	100%	16.2	100%
(2) Legally bought material for shadow economy and DIY-activities	6.0	21%	3.1	19.1%
(3) Illegal activities (smuggling etc.)	2.0	7%	1.2	7.4%
(4) Do-it-yourself activities and neighbors help[1)]	2.0	7%	1.5	9.2%
(5) Sum (2) and (4)	10.0	35%	5.8	35.7%
(6) "Corrected" or "adjusted" shadow economy, but legal activities (position (1) minus position (5))	18.0	65%	10.4	64.2%

[1)] Without legally bought material which is included in (2)

Source: Own calculations, Linz, September 2016.

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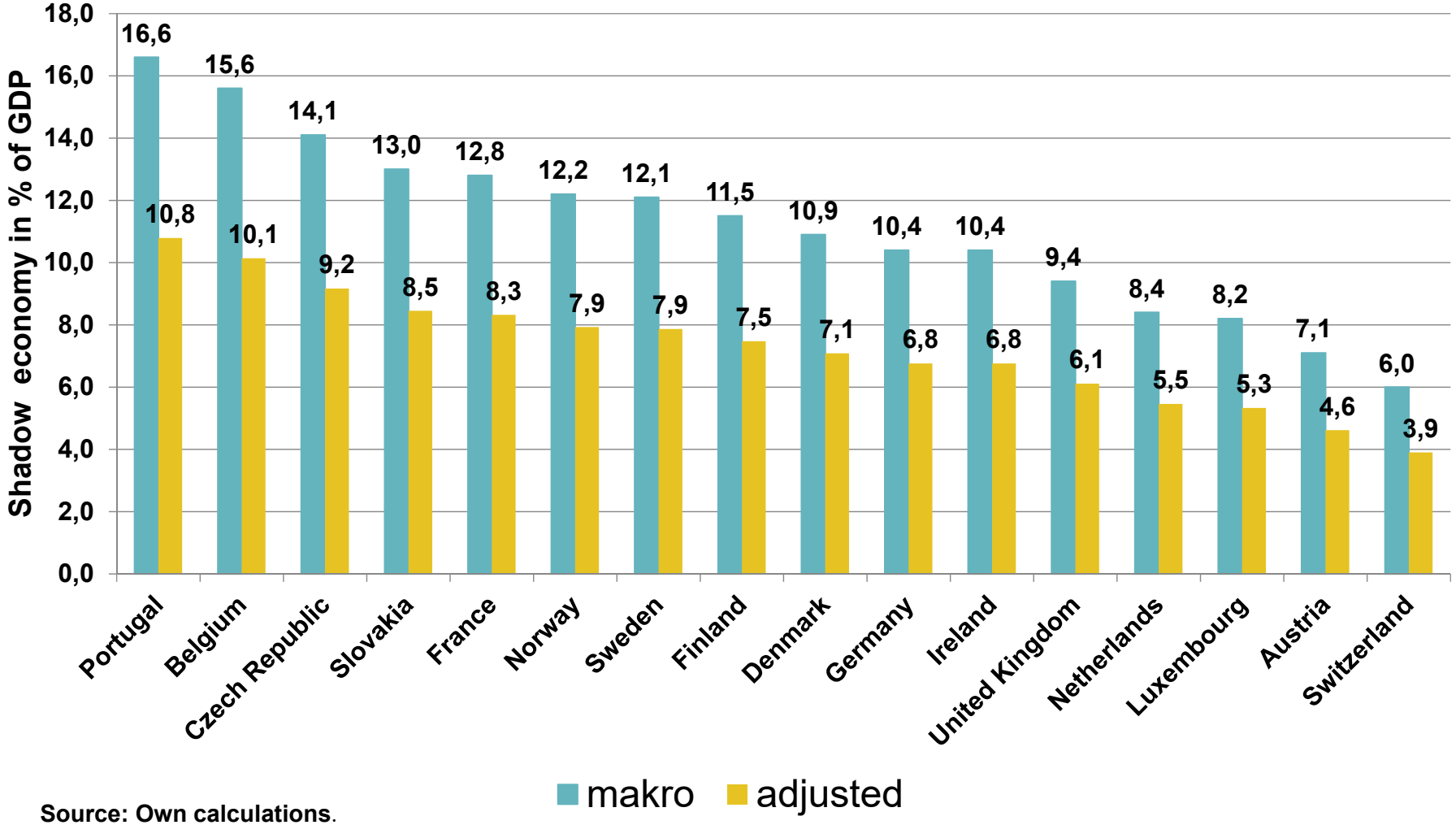
3. EST. METHODS: THE PROBLEM OF "DOUBLE COUNTING" -RESULTS

Figure 3.4: Size of the Shadow Economy of 16 European Countries average of the years 2017- 2020 – macro and adjusted



Source: Own calculations.

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3. EMPIRICAL RESULTS OF THE SHADOW ECONOMY OF SIX BALKAN COUNTRIES

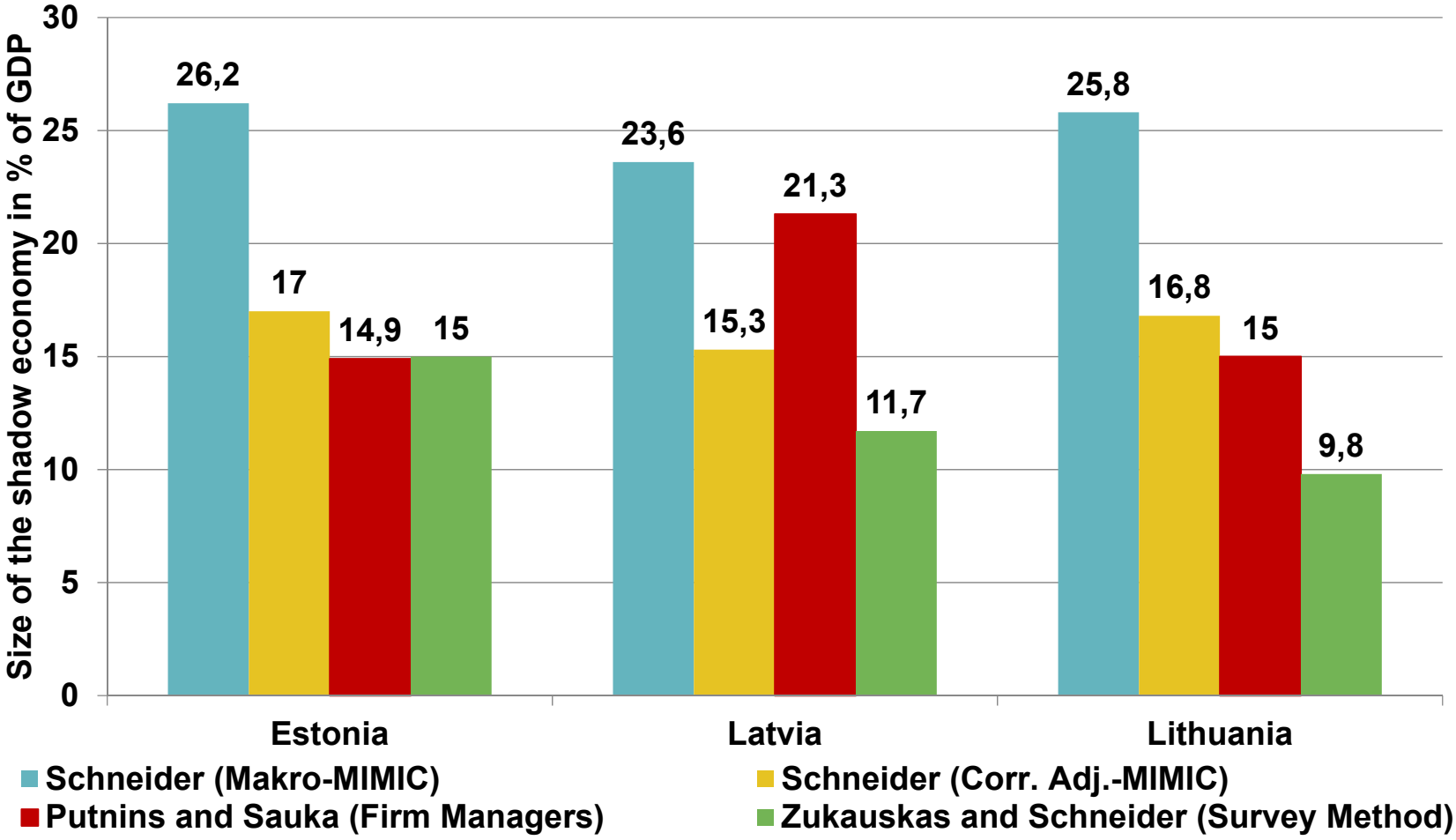
TABLE 3.5: SIZE AND DEVOPMENT OF SHADOW ECONOMIES (IN % OF GDP) OF SIX BALCAN COUNTRIES OVER 2013 TO 2023.

SOURCE: OWN CALCULATIONS

Country / Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	Average 2013-23	Rank (1 highest SE
Austria	7.5	7.8	8.2	7.8	7.1	6.7	6.1	7.2	6.9	6.6	7.7	*7.8*	--
Albania	30.8	30.1	30.5	30.0	27.6	28.3	28.7	29.3	29.0	28.1	27.3	*29.1*	*(4)*
B&H	40.7	40.1	39.1	39.4	40.9	42.4	43.3	45.8	44.5	44.1	43.7	*42.2*	*(1)*
Croatia	32.0	32.1	32.9	30.9	30.3	30.5	30.8	31.9	31.1	30.6	29.7	*31.2*	*(3)*
N.Maze-donia	32.3	32.5	32.8	32.6	32.2	31.7	32.8	33.3	33.1	32.2	31.6	*32.5*	*(2)*
Serbia	27.8	26.9	25.0	24.6	23.2	22.3	22.7	22.9	23.1	23.0	23.2	*24.1*	*(5)*
Slovenia	20.9	20.6	20.8	20.3	20.4	20.3	21.3	21.8	21.6	21.2	20.7	*20.9*	*(6)*

4. COMPARISON OF THE SE SIZE OF DIFFERENT EST. METHODS

Figure 4.1: A comparison of the size of the shadow economy (in % of GDP) of the Baltic countries in *2015* applying three different estimation methods.



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4. COMPARISON OF THE SE SIZE OF DIFFERENT EST. METHODS

Table 4.1: A comparison of nine alternative estimates of the shadow economy as percent of GDP* for Czech and Slovak Republic; source: Lichard et al (2021, p.23

Estimation method	Source	Year	Czech Rep.	Slovak Rep.
Currency Demand Deposit Ratio (panel GMM difference) (1)	*Alm and Amebaye (2013)*	*2006*	*23.2%*	*25.1%*
Consumption-Income Gap-Method (switching reg.) (2)	*Lichard et al. (2014)*	*2008*	*17.6%*	*22.9%*
Deterministic Dynamic General Equilibrium Model (3)	*Elgin and Oztunali (2012)*	*2008*	*16.8%*	*16.6%*
MIMIC (4)	Buehn and Schneider (2013)	2008	15.2%	16.0%
Statistical Office: Discrepancy Method (5)	Calculated from Quintano and Mazzocchi (2010)	2008	5.4%	13.6%
Currency Deposit Ratio (6)	Embaye (2007)	2000-2005	8.0%	12.6%
Structural Model (calibrated to M1) (7)	Ruge (2010)	2001	8.2%	8.1%
Consumption Income Method using Food Engel Curves (self-employed excl.) (8)	Lichard (2012)	2008	4.0%	6.8%
Structural Model (calibrated to M2) (9)	Ruge (2010)	2001	3.3%	3.3%

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4. COMPARISON OF THE SE SIZE OF DIFFERENT EST. METHODS

Table 4.2: Comparison of the MIMIC (macro and adjusted) with National Accounts Method; 16 OECD countries, years 2011/2012 (av.)

Nr.	Country	NOE[1)] (1)	MIMIC		Difference (MIMIC-NOE)	
		% of GDP	Macro (2)	Adj. (3)	(2)-(1)	(3)-(1)
1	*Slovenia*	*10.2*	*23.9*	*15.5*	*13.7*	*5.3*
2	*Norway*	*1*	*14.5*	*9.4*	*13.5*	*8.4*
3	*Israel*	*6.6*	*19.7*	*12.8*	*13.1*	*6.2*
4	*Belgium*	*4.6*	*17*	*11*	*12.4*	*6.4*
5	Mexico	15.9	27.9	18.1	12	2.2
6	Hungary	10.9	22.6	14.7	11.7	3.8
7	Sweden	3	14.5	9.4	11.5	6.4
8	Canada	2.2	11.7	7.6	9.5	5.4
9	Poland	15.4	24.7	16	9.3	0.6
10	Czech Rep.	8.1	16.2	10.5	8.1	2.4
11	UK	2.3	10.3	6.7	8	4.4
12	Netherlands	2.3	9.6	6.2	7.3	3.9
13	France	6.7	10.9	7.1	4.2	0.4
14	*Italy*	*17.5*	*21.4*	*13.9*	*3.9*	*-3.6*
15	*Slovak Rep.*	*15.6*	*15.7*	*10.2*	*0.1*	*-5.4*
16	*Austria*	*7.5*	*7.6*	*4.9*	*0.1*	*-2.6*

1) NOE calculated by National Account Stat. using the discrepancy method.
Source: Non observed economy OECD (2014): Papers; MIMIC: own calculations.

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5. HOW WELL DO WE ESTIMATE THE SHADOW ECONOMIES? – A RÉSUMÉ

5.1 Surveys

(1) Quite often only households are considered;

(2) non-responses and/or incorrect responses;

(3) results of the financial volume of „black“ hours worked and *not* value added figures; and

(4) new methods are promising.

5.2 Discrepancy Method

(1) Combination of meso-estimates/assumptions;

(2) calculation method often not clear; and

(3) Documentation and procedures often not public.

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5. HOW WELL DO WE ESTIMATE THE SHADOW ECONOMIES? – A RÉSUMÉ

5.3 Monetary and/or Electricity Methods

(1) Some estimates are very high, are "only" macro-estimates and a double counting problem occurs.

(2) Not all transactions in the shadow economy are paid in cash -> lower bound estimate!

(3) Some currencies ($ or €) are used as international currencies, but only domestic ones are relevant.

(4) The assumption of a minimum starting value of x-percent is open to criticism.

(5) Breakdown by sector or industry not possible!

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5. HOW WELL DO WE ESTIMATE THE SHADOW ECONOMIES? – A RÉSUMÉ

5.4 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.

(5) High macro values of the shadow economy and again a double counting problem

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5. HOW WELL DO WE ESTIMATE THE SHADOW ECONOMIES? – A RÉSUMÉ

5.5 Open Research Questions and Recommendations

(1) No ideal or dominating method – all have serious problems and weaknesses. If possible use several methods.

(2) We can explain a large part of the differences between macro and micro estimates ; the main reason is that the macro est. capture partly legal and illegal activities!!

(3) An internationally accepted definition of the shadow economy is still missing.

(4) The link between theoretical and empirical work is still unsatisfactory. One Example: 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".

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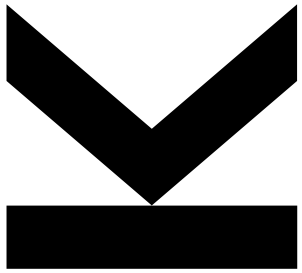
THANK YOU VERY MUCH FOR YOUR ATTENTION!



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APPENDIX A1:
THE OBJECTIONS AGAINST THE MIMIC APPROACH:

(1) **Instability** in the estimated coefficients with respect to sample size changes and alternative specifications;

(2) **The selection** of „causes“ and „indicators“ in explaining the shadow economy has **little theoretical justification**.

(3) **MIMIC estimations** “produce” only relative values of the SE. Hence, one has to use another method to calibrate these values into absolute ones; and **the calibration procedures are open to criticism, too.**

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APPENDIX TABLE A1: COMPARISON OF THE SE SIZE OF DIFFERENT EST. METHODS

Table A1: Comparison between National Accounts Statistics and MIMIC Results of 8 Sub-Saharan African countries over 2010-2014

Country	Methods (averages over 2010-2014)			Differences	
	(1) National Accounts Statistics[1)]	(2) MIMIC	(3) MIMIC Adjusted	(2)-(1)	(3)-(1)
Guinea-Bissau	53.4	38	31.8	-15.4	-21.6
Mali	55	40.4	26.3	-14.6	-28.7
Togo	40.1	28	24.7	-12.1	-15.4
Guinea	48.1	37	24.1	-11.1	-24
Burkina Faso	43.1	32	26	-11.1	-17.1
Senegal	47.5	40	20.8	-7.5	-26.7
Benin	55.6	49	18.2	-6.6	-37.4
Cote d'Ivoire	34	35	22.8	1	-37.4
Correlation: 0.73 Spearman's Rank Correlation: 0.857***					

1) Discrepancy method
Source: Medina et al. (2017), p.28

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6. APPENDIX THE PROBLEM OF "DOUBLE COUNTING"

Figure A1: The development of the shadow economy (in % of GDP) of four *Scandinavian countries* over 2016 to 2018 applying the mimic and adjusted mimic method.

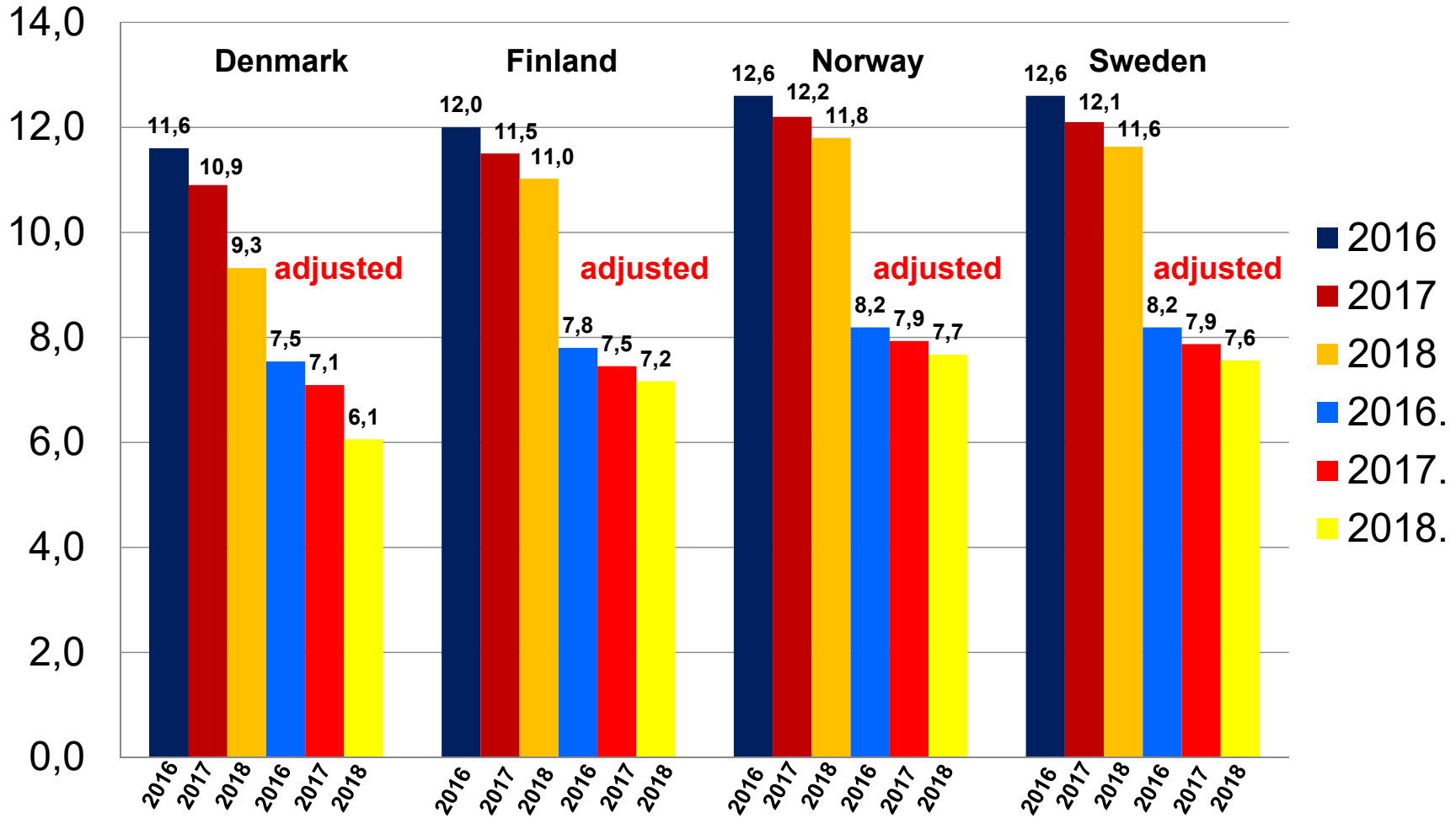

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Table A 2: A comparison of the size of the shadow economy (in % of GDP) in the Baltic countries 2009 – 2015 by Putnins and Sauka with Zukauskas and Schneider, and Schneider (Macro and adjusted).

Year	Estonia				Latvia				Lithuania			
	Putnins and Sauka	Zukauskas and Schneider	Schneider		Putnins and Sauka	Zukauskas and Schneider	Schneider		Putnins and Sauka	Zukauskas and Schneider	Schneider	
	Firm Managers	Survey	MIMIC		Firm Managers	Survey	MIMIC		Firm Managers	Survey	MIMIC	
			Macro	Corr. Adj.			Macro	Corr. Adj.			Macro	Corr. Adj.
2009	20.2%		29.6%	19.4%	36.6%		27.1%	17.6%	17.7%		29.6%	19.2 %
2010	19.4%		29.3%	19.1%	38.1%		27.3%	17.7%	18.8%		29.7%	19.3 %
2011	18.9%		28.6%	18.6%	30.2%		26.5%	17.2%	17.1%		29.0%	18.9 %
2012	19.2%		28.2%	18.3%	21.1%		26.1%	17.0%	18.2%		28.5%	18.5 %
2013	15.7%		27.6%	17.9%	23.8%		25.5%	16.6%	15.3%		28.0%	18.2 %
2014	13.2%		27.1%	17.6%	23.5%		24.7%	16.0%	12.5%		27.1%	17.6 %
2015	14.9%	15.0 %	26.2%	17.0%	21.3%	11.7 %	23.6%	15.3%	15.0%	9.8 %	25.8%	16.8 %
Average 2009 - 2015	17.4%		28.1%	18.3%	27,8%		25,8%	16.8%	16.4%		28.2%	18.4 %

Source: Putnins and Sauka, 2016, Table 1, p.12 and Schneider, Zukauskas and Schneider, own calculations, Linz, September 2016.

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6. APPENDIX: FURTHER RESULTS

Table A 3: The Size of the Shadow Economy in Germany According to Different Methods (in % of official GDP) – Part 1

Method/Source	Shadow economy (in % of official GDP) in:							
	1970	1975	*1980*	1985	1990	1995	2000	2005
Survey (IfD Allensbach, 1975) (Feld and Larsen, 2005)	-	3.6[1)]	-	-	-	-	-	-
	-	-	-	-	-	-	4.1[2)]	3.1[2)]
	-	-	-	-	-	-	1.3[3)]	1.0[3)]
Disrepancy 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 wage paid.

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6. APPENDIX: FURTHER RESULTS

Table A 3: The Size of the Shadow Economy in Germany According to Different Methods (in % of official GDP) – Part 2

Method/Source	Shadow economy (in % of official GDP) in:							
	1970	1975	*1980*	1985	1990	1995	2000	2005
Physical input method (Feld and Larsen, 2005)	-	-	*13.5*	14.5	14.6	-	-	-
Transactions approach	17.2	22.3	*29.3*	31.4	-	-	-	-
Currency demand approach (Kirchgässner 1983; Langfeldt, 1982, 1984; Schneider and Enste, 2000)	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; Pickardt and Sarda, 2006; Schneider 2005, 2007)	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
Soft modelling (Weck-Hannemann, 1983)	-	8.3	*8.3*	-	-	-	-	-

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6. APPENDIX: ESTIMATION PROCEDURE OF TAX EVASION

Table A4: The calculation of tax evasion

Kinds of shadow economy activities	Size in % of official GDP	Proportion of the overall shadow economy
(1) Total shadow economy (estimated by the MIMIC and calibrated by the currency demand procedures)	15.0	100%
(2) Legally bought material	3.0–4.0	20–26%
(3) Illegal activities (goods and services)	1.0–2.0	7–13%
(4) Do-it yourself and neighbors help without material	3.0-4.0	20-26%
(5) Already in the official GDP included illegal activities	1.0–2.0	7–13%
(6) Sum (2) to (5)	8.0–12.0	53–80%
(7) Explicit shadow economic, but legal activities (position (1) minus position (5))	3.0–7.0	20–47%
(8) Tax evasion (approx. 35% of the explicit shadow economy, driving forces: indirect taxation and self-employment)	1.4–2.5	10–16%

Source: Buehn and Schneider (2013), p. 12.

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6. APPENDIX : THE AMOUNT OF TAX EVASION IN 31 EUROPEAN COUNTRIES

Table A5: Size of tax evasion in % of GDP of 31 highly developed European countries in 2017

Country	Tax evasion	Tax Evasion Adj.
Bulgaria	3.8	2.5
Turkey	3.5	2.3
Croatia	3.4	2.2
Romania	3.4	2.2
Estonia	3.2	2.1
Lithuania	3.1	2.0
South-Cyprus	3.1	2.0
Malta	3.1	2.0
Slovenia	2.9	1.9
Hungary	2.9	1.9
Poland	2.9	1.9
Greece	2.8	1.8
Latvia	2.8	1.8
Italy	2.6	1.7
Spain	2.2	1.5

Source: Own calculations.

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6. APPENDIX : THE AMOUNT OF TAX EVASION IN 31 EUROPEAN COUNTRIES

Table A 6: Size of tax evasion in % of GDP of 31 highly developed European countries in 2017 (cont.)

Country	Tax evasion	Tax Evasion Adj.
Portugal	2.2	1.4
Belgium	2.0	1.3
Czech Republic	1.8	1.2
Slovakia	1.7	1.1
France	1.7	1.1
Norway	1.6	1.0
Sweden	1.6	1.0
Finland	1.5	1.0
Denmark	1.4	0.9
Germany	1.4	0.9
Ireland	1.4	0.9
United Kingdom	1.2	0.8
Netherlands	1.1	0.7
Luxembourg	1.1	0.7
Austria	0.9	0.6
Switzerland	0.8	0.5

Source: Own calculations.

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