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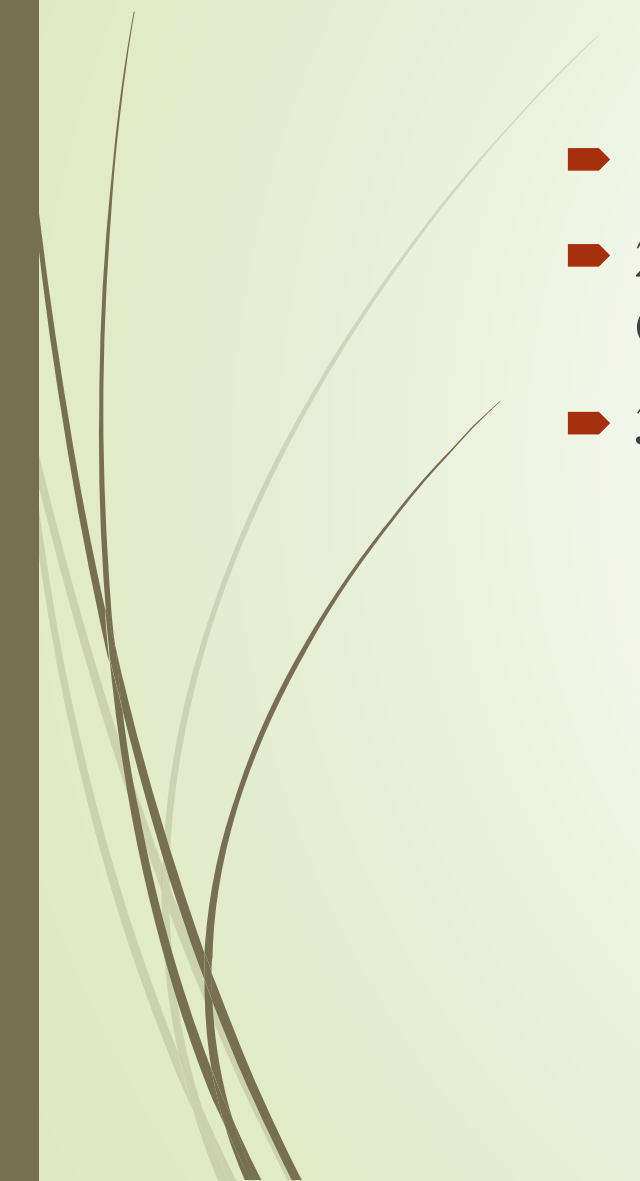
The theoretical remarks about the shadow economy



Measuring the shadow economy – Estimation Methods




Outline

- **1. Introduction: Defining the Shadow Economy**
 - **2. The Size of the Shadow Economies: Econometric Estimates for 21 OECD countries – An example**
 - **3. Methods to Estimate the Size of the Shadow Economy:**
 - 1. Direct Approaches**
 - 2. Indirect Approaches**
 - 3. The Model/Latent Estimation Approaches**
 - 4. Problems and Open Questions**
- 



Goal of this lecture:

- (i)** Discussing the definition of the shadow economy and its taxonomy
 - (ii)** Discussing the main approaches of measuring the size of shadow activities
 - (iii)** Comparing advantages and disadvantages of discussed approaches
- 



Introduction - Measuring the shadow economy

Empirical research about the size and development of the shadow economy all over the world has grown rapidly.

Nowadays, there are so many studies,¹ which use different methods in order to estimate the size and development of the shadow economy, that it is quite difficult to judge the reliability of various methods.

Estimating the size of a shadow economy is a difficult and challenging task.



Definition

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

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

Table 1: A taxonomy of types of underground economic activities

Type of activity	Monetary transactions		Non-monetary transactions	
Illegal Activities	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
Legal Activities	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

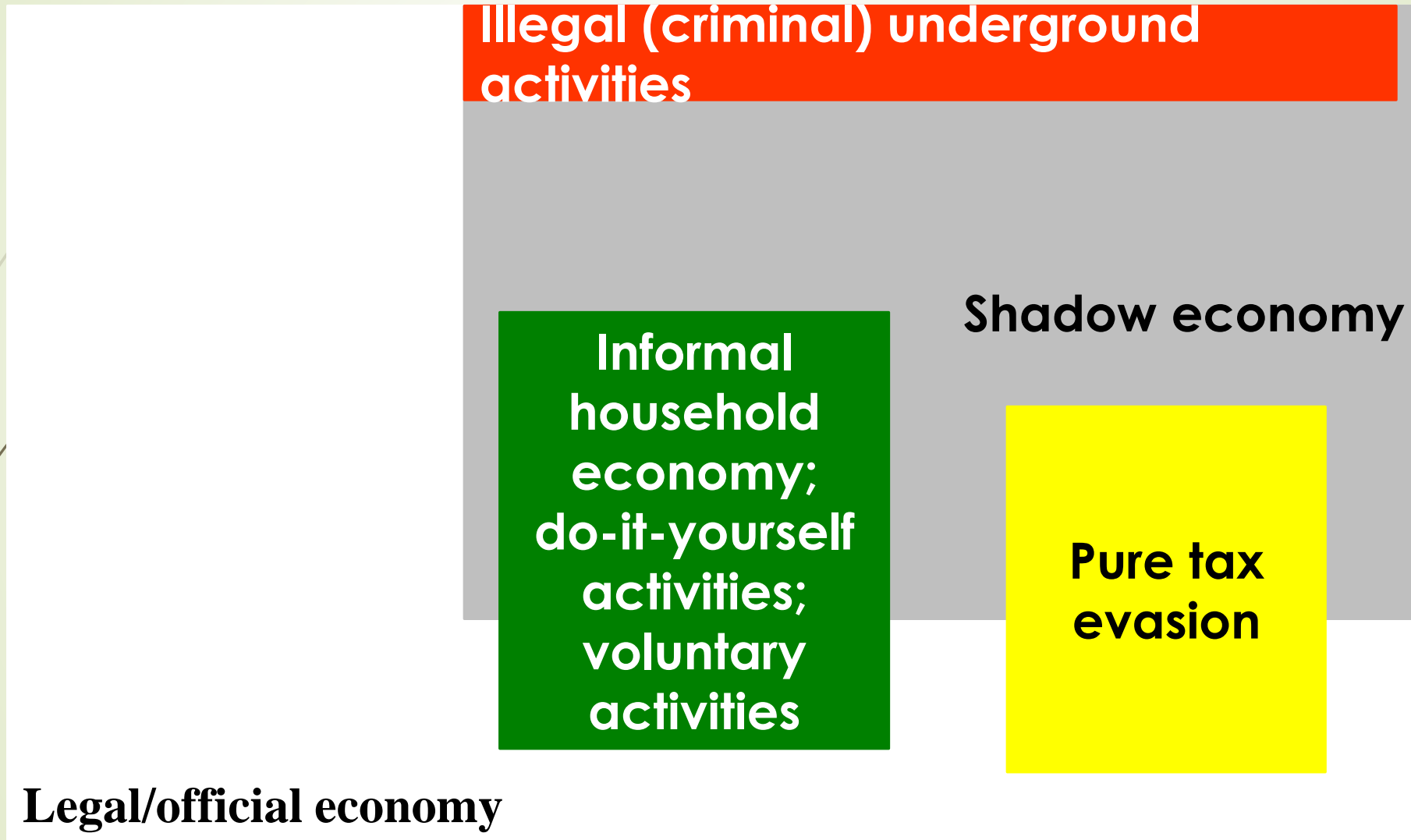


The Definition of the Underground and Informal Household Economy

- (1.2) *Underground (classical crime)* activities are all *illegal actions* that fit the characteristics of classical crime activities like burglary, robbery, drug dealing, etc.
- (1.3) *Informal household economy* consists of household enterprises that are not registered officially under various specific forms of national legislation.
- (1.4) To a large extent these two sectors ((1.2) classical crime and (1.3) household production) are not included in the shadow economy activities.

Defining the Shadow Economy

Figure 1: Legal, shadow, illegal and informal economy and tax evasion



The Size of the Shadow Economies: Econometric Estimates for 21 OECD countries – An example

Table 2.1: DYMIMIC
Estimation of the
Shadow Economy of 21
highly developed OECD
Countries, years
1990/91 to 2004/05–
PART 1

Cause Variables	Estimated Coefficients
Share of direct taxation (in % of GDP)	$\lambda_1 = 0.384^{**}$ (3.06)
Share of indirect taxation (in % of GDP)	$\lambda_2 = 0.196^{(*)}$ (1.84)
Share of social security contribution (in % of GDP)	$\lambda_3 = 0.506^{**}$ (3.86)
Burden of state regulation (index of labour market regulation, Heritage Foundation, score 1 least regular, score 5 most regular)	$\lambda_4 = 0.213^{(*)}$ (1.96)
Quality of state institutions (rule of law, World Bank, score -3 worst and +3 best case)	$\lambda_5 = -0.307^{**}$ (-2.61)
Tax morale (WUS and EUS, Index, Scale tax cheating always justified =1, never justified =10)	$\lambda_6 = -0.582^{**}$ (-3.66)
Unemployment quota (%)	$\lambda_7 = 0.324^{**}$ (2.61)
GDP per capita (in US-\$)	$\lambda_8 = -0.106^{**}$ (-3.04)
Lagged endogenous variable	$\lambda_9 = -0.165^{(*)}$ (-1.66)

Table 2.1: DYMIMIC Estimation of the Shadow Economy of 21 highly developed OECD Countries, years 1990/91 to 2004/05 – PART 2

Indicator Variables	Estimated Coefficients
Employment quota (in % of population 18-64)	$\lambda_{10} = -0.626^{**}$ (-2.72)
Average working time (per week)	$\lambda_{11} = -1.00$ (Residuum)
Annual rate of GDP (adjusted for the mean of all 22 OECD countries)	$\lambda_{12} = -0.274^{**}$ (-3.03)
Change of local currency per capita	$\lambda_{13} = 0.312^{**}$ (3.74)
Test-statistics	$RMSE^1 = 0.0016^*$ (p-value = 0.903) $Chi\text{-square}^2 = 26.43$ (p-value = 0.906) $TMCV^3 = 0.049$ $AGFI^4 = 0.763$ $N = 168$ $D.F.^5 = 67$

Notes:

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

1)Steigers Root Mean Square Error of Approximation (RMSEA) for test of close fit; $RMSEA < 0.05$; the RMSEA- value varies between 0.0 and 1.0.

2)If the structural equation model is asymptotically correct, then the matrix S (sample covariance matrix) will be equal to $\Sigma(\theta)$ (model implied covariance matrix). This test has a statistical validity with a large sample ($N \geq 100$) and multinomial distributions; both is given for a all three equations in tables 3.1.1-3.1.3 using a test of multi normal distributions.

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

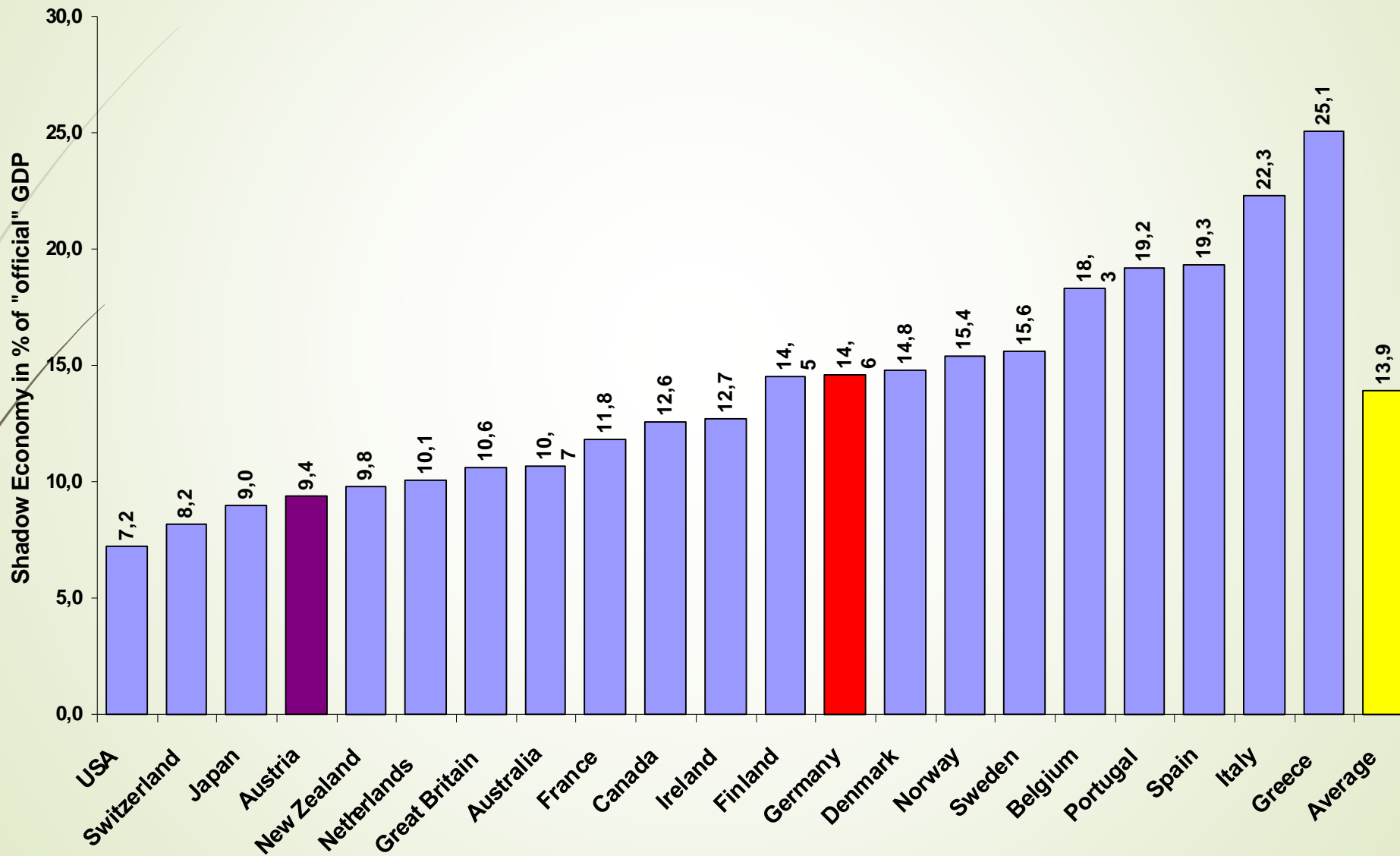
4) Test of Adjusted Goodness of Fit Index (AGFI), varying between 0 and 1; 1 = perfect fit.

5)The degrees of freedom are determined by $0.5(p + q)(p + q + 1) - t$; with p = number of indicators; q = number of causes; t = the number for free parameters.

Table 2.2: The Size of the Shadow Economy of 21 OECD Countries over time

	1989/90	1990/93	1994/95	1997/98	1999/2000	2001/2002	2002/2003	2004	2005	2006	2007 1)
Australia	10.1	13.0	13.5	14.0	14,3	14,1	13,5	13,2	12,6	11,4	11,7
Austria	6.9	7.1	8.6	9.0	9,8	10,6	10,9	11,0	10,3	9,7	9,4
Belgium	19.3	20.8	21.5	22.5	22,2	22	21,0	20,7	20,1	19,2	18,3
Canada	12.8	13.5	14.8	16.2	16	15,8	15,2	15,1	14,3	13,2	12,6
Denmark	10.8	15.0	17.8	18.3	18	17,9	17,3	17,1	16,5	15,4	14,8
Finland	13.4	16.1	18.2	18.9	18,1	18	17,4	17,2	16,6	15,3	14,5
France	9.0	13.8	14.5	14.9	15,2	15	14,5	14,3	13,8	12,4	11,8
Germany	11.8	12.5	13.5	14.9	16	16,3	16,8	16,2	15,6	15,0	14,7
Great Britain	9.6	11.2	12.5	13.0	12,7	12,5	12,2	12,3	12,0	11,1	10,6
Greece	22.6	24.9	28.6	29.0	28,7	28,5	28,2	28,1	27,6	26,2	25,1
Ireland	11.0	14.2	15.4	16.2	15,9	15,7	15,3	15,2	14,8	13,4	12,7
Italy	22.8	24.0	26.0	27.3	27,1	27	25,7	25,2	24,4	23,2	22,3
Japan	8.8	9.5	10.6	11.1	11,2	11,1	10,8	10,7	10,3	9,4	9,0
Netherlands	11.9	12.7	13.7	13.5	13,1	13	12,6	12,5	12,0	10,9	10,1
New Zealand	9.2	9.0	11.3	11.9	12,8	12,6	12,3	12,2	11,7	10,4	9,8
Norway	14.8	16.7	18.2	19.6	19,1	19	18,4	18,2	17,6	16,1	15,4
Portugal	15.9	17.2	22.1	23.1	22,7	22,5	21,9	21,7	21,2	20,1	19,2
Spain	16.1	17.3	22.4	23.1	22,7	22,5	22,0	21,9	21,3	20,2	19,3
Sweden	15.8	17.0	19.5	19.9	19,2	19,1	18,3	18,1	17,5	16,2	15,6
Switzerland	6.7	6.9	7.8	8.1	8,6	9,4	9,4	9,4	9,0	8,5	8,2
USA	6.7	8.2	8.8	8.9	8,7	8,7	8,4	8,4	8,2	7,5	7,2
Average	13.2	14.3	15.7	16.7	16,8	U 16,7	16,3	16,1	15,6	14,5	13,9

Figure 2.1: Size of the Shadow Economy in 21 OECD COUNTRIES, in % of GDP, 2007





3) Methods to Estimate the Size of the Shadow Economy

- 1. Direct Approaches**
- 2. Indirect Approaches**
- 3. The Model/Latent Estimation Approaches**



3) Methods to Estimate the Size of the Shadow Economy

1. Direct Approaches

- 1. Survey-method**
- 2. Tax-auditing-method**
- 3. Empirical results of Questionnaires for Germany**
- 4. Empirical results of Questionnaires for Austria**

These micro approaches employ either well designed surveys and samples based on voluntary replies or tax auditing and other compliance methods.

3.1.3: Empirical Results of Questionnaires for Germany

Table 3.1.1: Do you regularly work in the shadow economy? (yes or no)? Germany, 2007

(1) Do you work regularly in the shadow economy?	Values in percent
No	77,3
Yes	20,7 (25% male, 16% female)
No answer	2
(2) Do you regularly demand shadow economy activities?	Values in percent
No	69,2
Yes	30,8 (35.4% male, 26.5% female)
Representative questionnaire, Germany, January 2007	
Source: IDW Koeln, Germany	

3.1.3: Empirical Results of Questionnaires for Germany

Table 3.1.2: Reasons, why shadow economy activities are demanded, Germany, 2007

Reasons why shadow economy activities are demanded	Values in percent
(1) One saves money – or they are much cheaper than the official ones	90%
(2) The tax and social security burden is much too high	73%
(3) Due to the high labour costs in the official economy one would not demand these activities (extreme assumption: no shadow economy – 22% demand in the official economy; 30% do-it-themselves; and 48% no demand at all!)	68%
(4) The firms offer them themselves	52%
(5) It's so easy to get quick and reliable workers	31%

Representative questionnaire, Germany, January 2007, Source: IDW Koeln

Table 3.1.3: A comparison of the Size of the German Shadow Economy using the survey and the DYMIMIC-method, year 2006

Various kinds of shadow economy activities/values	Shadow Economy in % of official GDP	Shadow Economy in bill. Euro	Fictive jobs (full time equivalent) millions	% share of the overall shadow economy
Shadow economy activities from labour (hours worked, <i>survey results</i>)	5.0 – 6.0	117 – 140	2.1 – 2.4	33 – 40
+ Material (used)	3.0 – 4.0	70 – 90	1.2 – 1.5	20 – 25
+ Illegal activities (goods and services)	4.0 – 5.0	90 – 117	1.5 – 2.1	25 – 33
+ already in the official GDP included illegal activities	1.0 – 2.0	23 – 45	0.4 – 0.8	7 - 13
Sum (1) to (4)	13.0 – 17.0	300 – 392	5.2 – 6.8	85 – 111
Overall (total) shadow economy (estimated by the DYMIMIC and calibrated by the currency demand procedure)	15.0	340	6.0	100

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



3.1.4. Some remarks when comparing the values from the survey method with the total value added in the shadow economy sector achieved by the DYMIMIC method.

The rather large difference can be “explained” with the following facts:

- 1. Table 3.3 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 earned in the shadow economy, hourly wage rate and hours worked per year vary considerably.**

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).

1. **The Discrepancy between National Expenditure and Income Statistics**
 2. **The Discrepancy between the Official and Actual Labor Force**
 3. **The Transactions Approach**
 4. **The Currency Demand Approach**
 5. **The Physical Input (Electricity Consumption) Method**
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2. **The Model/Latent Estimation Approach**

3.2.4. The Currency Demand Approach

The basic regression equation for the currency demand, proposed by Tanzi (1983), is the following:

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

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 current and deposit accounts,

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

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

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

Y / N is the per capita income.



The most commonly raised objections (criticism) against the current demand approach are:

- (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) Most studies consider only one particular factor, the tax burden, as a cause of the shadow economy. If other factors also have an impact on the extent of the hidden economy, the shadow economy may 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.**



The most commonly raised objections (criticism) against the current demand approach are:

- (4) Another weak point is the assumption of the same velocity of money in both types of economies.**
- (5) Ahumada, Alvaredo, Canavese A. and P. Canavese (2004) show, that the currency approach together with the assumption of equal income velocity of money in both, the reported and the hidden transaction is only correct, if the income elasticity is 1. As this is for most countries not the case, the calculation has to be corrected.**
- (6) Finally, the assumption of no shadow economy in a base year is open to criticism.**

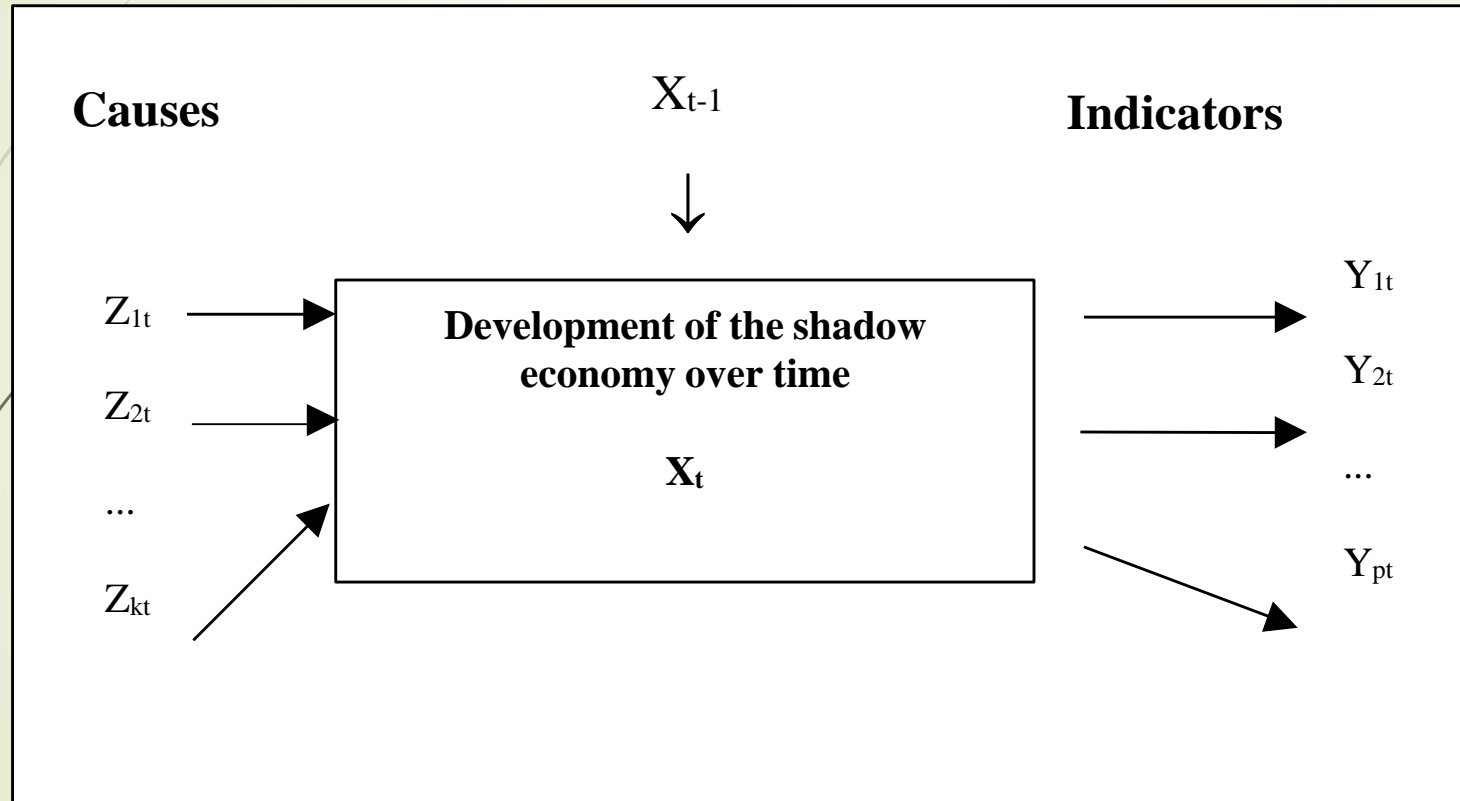
3.3. The Model (Latent) Estimation (DYMIMIC) approach


The DYMIMIC (dynamic multiple-indicators multiple-causes) model consists of two parts:

1. The **measurement model** links the unobserved variables to observed indicators.
2. The **structural equations model** specifies causal relationships among the unobserved variables.
3. In this case, there is only one unobserved variable, the size of the shadow economy.
4. Shadow Economy will be influenced by a set of indicators for the shadow economy's size, thus capturing the structural dependence of the shadow economy on variables that may be useful in predicting its movement and size in the future.

3) Methods to Estimate the Size of the Shadow Economy – The DYMIMIC approach

Figure 3.1: Development of the shadow economy over time





3.3.1. The Model Approach: Some Causes of the Shadow Economy:

- (i) The *burden of direct and indirect taxation* (including social security payments), both actual and perceived: a rising burden of taxation provides a strong incentive to work in the shadow economy.
- (ii) The *burden of regulation* as proxy for all other state activities: increases in the burden of regulation give a strong incentive to enter the shadow economy.
- (iii) The *„tax morality“* (citizens' attitudes toward the state), which describes the readiness of individuals (at least partly) to leave their official occupations and enter the shadow economy: a declining tax morality increase the size of the shadow economy.



3.3.2. Some Indicators of the shadow economy:

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

- (i) Development of *monetary indicators*: if activities in the shadow economy rise, additional monetary transactions are required.
- (ii) Development of the *labor market*: increasing participation of workers in the hidden sector results in a decrease in participation in the official economy.
- (iii) Similarly, increased activities in the hidden sector may be expected to be reflected in shorter working hours in the official economy.



The main objections against the DYMIMIC approach are:

- (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, and**
- (3) Problem that one obtains only relative values of the SE and one has to use another method to calibrate these values into absolute ones!**

3.4. Problems and Open Questions (Part 1)

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**

Estimations of national account statisticians (quite often the discrepancy method):

- (1) Combination of meso estimates/assumptions**
- (2) Often not published**
- (3) Documentation and procedures often not public**



3.4. Problems and Open Questions (Part 2)

3. Monetary and/or electricity methods:

- (1) Some estimates are very high**
- (2) Are the assumptions plausible?**
- (3) Breakdown by sector or industry possible?**

4. DYMIMIC method

- (1) Only relative coefficients, no absolute values.**
- (2) Estimations quite often highly sensitive with respect to changes in the data and specifications.**

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- ▶ **Review Article** Friedrich Schneider, Andreas Buehn **Shadow Economy: Estimation Methods, Problems, Results and Open questions** *Open Economics* 2018; 1: 1–29



Thank
you

