Saltanat Kondybayeva, PhD

Al-Farabi Kazakh National University

saltanatkondybayeva@gmail.com

The theoretical remarks about the shadow economy

Measuring the shadow economy –Estimation Methods

Outline

- *1. **Measuring the shadow economy***
- *2. Theorizing about the shadow economy*
- *3. Direct Approaches*
- *4. Indirect Approaches*

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 of

(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, 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.

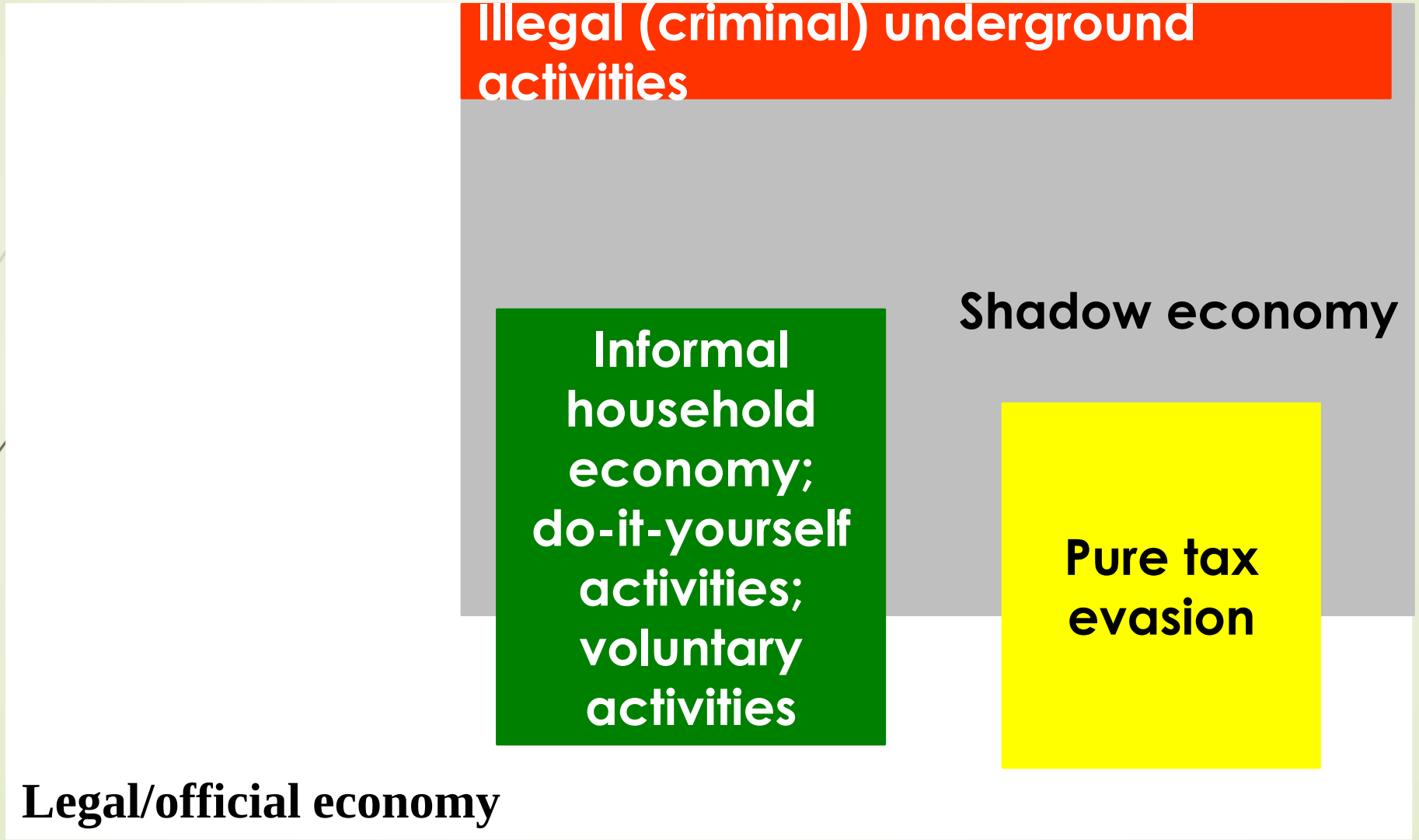
Table 1: A taxonomy of types of underground economic activities

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

Defining the Shadow Economy

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



Theorizing about the shadow economy

- A useful starting point for a theoretical discussion of the shadow economy is the famous study by Allingham and Sandmo (1972) on income tax evasion. While the shadow economy and tax evasion are not congruent, in most cases activities in the shadow economy imply the evasion of direct or indirect taxes, such that factors determining tax evasion will most certainly also affect the shadow economy. According to Allingham and Sandmo tax compliance depends on its expected costs and benefits. The benefits of tax non-compliance result from the individual marginal tax rate and true individual income. In the case of the shadow economy the individual marginal tax rate is often roughly calculated using the overall tax burden from indirect and direct taxes including social security contributions. The expected costs of non-compliance derive from deterrence enacted by the state, that is, the state's auditing activities raising the probability of detection and the fines individuals face when they are caught. Individual morality also plays a role in compliance and additional costs may apply beyond the tax administration's pure punishment in the form of psychic costs like shame or regret, but also additional pecuniary costs if, for example, loss of reputation results.

Individuals are rational calculators who weigh up costs and benefits when considering breaking the law. Their decision to partially or completely participate in the shadow economy is a choice under uncertainty, facing a trade-off between gains if their activities are not discovered and losses if discovered and penalized. Shadow economic activities *SE* thus negatively depend on the probability of detection *p* and potential fines *f*, and positively on the opportunity costs of remaining formal denoted as *B*. The opportunity costs are positively determined by the burden of taxation *T* and high labor costs *W* –individual income generated in the shadow economy is usually categorized as labor income rather than capital income – due to labor market regulations. Hence, the higher the tax burden and labor costs, the more incentives individuals have to avoid these costs by working in the shadow economy. The probability of detection *p* itself depends on enforcement actions *A* taken by the tax authority and on facilitating activities *F* accomplished by individuals to reduce detection of shadow economic activities. This discussion suggests the following structural equation:

$$SE = SE\left[\overset{-}{p}\left(\overset{+}{A}, \overset{-}{F}\right); \overset{-}{f}; \overset{+}{B}\left(\overset{+}{T}, \overset{+}{W}\right)\right].$$

Shadow economic activities may be defined as those economic activities and income earned that circumvent government regulation, taxation or observation. More narrowly, the shadow economy includes monetary and non-monetary transactions of a legal nature; hence all productive economic activities that would generally be taxable were they reported to the state (tax) authorities. Such activities are deliberately concealed from public authorities to avoid payment of income, value added or other taxes and social security contributions, or to avoid compliance with certain legal labor market standards such as minimum wages, maximum working hours, or safety standards and administrative procedures. The shadow economy thus focuses on productive economic activities that would normally be included in the national accounts but which remain underground due to tax or regulatory burdens.6 Although such legal activities would contribute to a country's value added, they are not captured in national accounts because they are produced in illicit ways. Informal household economic activities such as do-it-yourself activities and neighborly help are typically excluded in the analysis of the shadow economy.

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(1) Tax and social security contribution burdens	The distortion of the overall tax burden affects labor-leisure choices and may stimulate labor supply in the shadow economy. The bigger the difference between the total labor cost in the official economy and after-tax earnings (from work), the greater the incentive to reduce the tax wedge and work in the shadow economy. This tax wedge depends on social security burden/ payments and the overall tax burden, making them key determinants in the existence of the shadow economy.	E.g. Thomas (1992), Johnson, Kaufmann, and Zoido-Lobatyn (1998a,b), Giles (1999a), Tanzi (1999), Schneider (2003, 2005), Dell'Anno (2007), Dell'Anno, Gomez-Antonio and Alanon Pardo (2007)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(2) Quality of institutions or corruption	The quality of public institutions is another key factor in the development of the informal sector. In particular, the efficient and discretionary application of the tax code and regulations by the government plays a crucial role in the decision to work off the books, even more important than the actual burden of taxes and regulations. A bureaucracy with highly corrupt government officials tends to be associated with larger unofficial activity, while good rule of law through securing property rights and contract enforceability increases the benefits of being formal. A certain level of taxation, mostly spent in productive public services, characterizes efficient policies. In fact, production in the formal sector benefits from higher provision of productive public services and is negatively affected by taxation, while the shadow economy reacts in the opposite way. An informal sector developing as a consequence of the failure of political institutions to promote an efficient market economy, and entrepreneurs going underground due to inefficient public goods provision, may reduce if institutions can be strengthened and fiscal policy moves closer to the median voter's preferences.	E.g. Johnson et al. (1998a,b), Friedman, Johnson, Kaufmann, and Zoido-Lobatyn (2000), Dreher and Schneider (2009), Dreher, Kotsogiannis and McCorriston (2009), Schneider (2010), Teobaldelli (2011), Teobaldelli and Schneider (2012), Amendola and Dell'Anno (2010), Losby et al. (2002), Schneider and Williams (2013), Hassan and Schneider (2016), Williams and Schneider (2016)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(3) Regulations	Regulations, for example labor market regulations or trade barriers, are another important factor that reduces freedom (of choice) for individuals in the official economy. They lead to a substantial increase in labor costs in the official economy and thus provide another incentive to work in the shadow economy: countries that are more heavily regulated tend to have a higher share of the shadow economy in total GDP. Especially the enforcement and not the overall extent of regulation – mostly not enforced – is the key factor for the burden levied on firms and individuals, inducing them to operate in the shadow economy.	E.g. Johnson, Kaufmann, and Shleifer (1997), Johnson, Kaufmann, and Zoido-Lobatyn (1998b), Friedman, Johnson, Kaufmann, and Zoido-Lobatyn (2000), Kucera and Roncolato (2008), Schneider (2011), Hassan and Schneider (2016)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(4) Public sector services	An increase in the shadow economy may lead to fewer state revenues, which in turn reduce the quality and quantity of publicly provided goods and services. Ultimately, this may lead to increasing tax rates for firms and individuals, although deterioration in the quality of the public goods (such as public infrastructure) and of the administration continues. The consequence is an even stronger incentive to participate in the shadow economy. Countries with higher tax revenues achieved by lower tax rates, fewer laws and regulations, a better rule of law and lower corruption levels should thus have smaller shadow economies.	E.g. Johnson, Kaufmann, and Zoido-Lobatyn (1998a,b), Feld and Schneider (2010)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(5) Tax morale	The efficiency of the public sector also has an indirect effect on the size of the shadow economy because it affects tax morale. Tax compliance is driven by a psychological tax contract that entails rights and obligations from taxpayers and citizens on the one hand, but also from the state and its tax authorities on the other hand. Taxpayers are more inclined to pay their taxes honestly if they get valuable public services in exchange. However, taxpayers are honest even in cases when the benefit principle of taxation does not hold, i.e. for redistributive policies, if such political decisions follow fair procedures. The treatment of taxpayers by the tax authority also plays a role. If taxpayers are treated like partners in a (tax) contract instead of subordinates in a hierarchical relationship, taxpayers will stick to the obligations of the psychological tax contract more easily. Hence, (better) tax morale and (stronger) social norms may reduce the probability of individuals working in the shadow economy.	E.g. Feld and Frey (2007), Kirchler (2007), Torgler and Schneider (2009), Feld and Larsen (2005, 2009), Feld and Schneider (2010)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(6) Deterrence	Despite the strong focus on deterrence in policies fighting the shadow economy and the unambiguous insights of the traditional economic theory of tax non-compliance, surprisingly little is known from empirical studies about the effects of deterrence. This is because data on the legal background and the frequency of audits are not available on an international basis; even for OECD countries such data are difficult to collect. Either the legal background is quite complicated, differentiating fines and punishment according to the severity of the offense and the true income of the noncomplier, or tax authorities do not reveal how intensively auditing is taking place. The little empirical survey evidence available demonstrates that fines and punishment do not exert a negative influence on the shadow economy, while the subjectively perceived risk of detection does. However, results are often weak and Granger causality tests show that the size of the shadow economy can affect deterrence, instead of deterrence reducing the shadow economy.	E.g. Andreoni, Erard and Feinstein (1998), Pedersen (2003), Feld and Larsen (2005, 2009), Feld and Schneider (2010)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(7) Developmen t of the official economy	The development of the official economy is another key factor in the shadow economy. The higher (lower) the unemployment quota (GDP growth), the higher the incentive to work in the shadow economy, ceteris paribus.	Schneider and Williams (2013), Feld and Schneider (2010)
(8) Self-employment	The higher the rate of self-employment, the more activities can be performed in the shadow economy, ceteris paribus.	Schneider and Williams (2013), Feld and Schneider (2010)

Table 2: The main causes determining the shadow economy

Causal variable/No.	Theoretical reasoning	References
(9) Unemployment	The higher the rate of unemployment, the higher the probability to work in the shadow economy, ceteris paribus.	Schneider and Williams (2013), Williams and Schneider (2016)
(10) Size of the agricultural sector	The larger the agricultural sector, the more possibilities to work in the shadow economy, ceteris paribus.	Hassan and Schneider (2016)

Three methods of measurement:

1. *Direct procedures* using the micro level and aiming at determining the size of the shadow economy. An example of this method are surveys.
2. *Indirect procedures* that make use of macroeconomic indicators following the development of the shadow economy over time.
3. *Statistical models* that use statistical tools to estimate the shadow economy as an “unobserved” variable.

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.

- The main **disadvantages** of this method are the flaws inherent in all surveys. For example, the average precision and results depend greatly on the respondent's willingness to cooperate, it is difficult to assess the amount of undeclared work from a direct questionnaire, most interviewees hesitate to confess to fraudulent behavior, and responses are of uncertain reliability, which makes it difficult to calculate a true estimate (in monetary terms) of the extent of undeclared work.
- The main **advantage** of this method lies in the detailed information which can be obtained about the structure of the shadow economy, but results from these kinds of surveys are very sensitive to the way the questionnaire is formulated.

Direct Approaches

(1) 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.

- Fiscal auditing programs have been particularly effective in this regard. Since these programs are designed to measure the amount of undeclared taxable income, they may also be used to calculate the size of the shadow economy.
- However, a number of difficulties beset this approach.
- *First*, using tax compliance data is equivalent to using a (possibly biased) sample of the population. In general, the selection of taxpayers for tax audits is not random but based on properties of submitted (tax) returns that indicate a certain likelihood of tax fraud. Consequently, such a sample is not a random one of the whole population, and estimates of the shadow economy based upon a biased sample may not be accurate.
- *Second*, estimates based on tax audits reflect only that portion of the shadow economy discovered by income tax authorities, and this is likely to be only a fraction of all hidden income.

Direct Approaches

Methods of open inspections are applied by specially created regulatory agencies. They detect and deter the violations of tax, customs, currency, banking, antitrust legislations, of trade regulations, sanitary standards, fire safety rules, etc. The results of such inspections can be used for accounting and statistical purposes.

Special methods of economic and legal analysis (accounting, documentary, economic approaches) are used by experienced economists and accountants to detect traces, causes and conditions of economic crimes.

Direct Approaches

Statistical methods are based on the methodology of the system of national accounts (SNA). They are most appropriate for studying shadow economic activity at the macro level in order to estimate the hidden production of legal goods and services. The shadow economy is identified on the basis of indirect data. The production of unrecorded goods is determined by the balance method, which assumes the comparison of the data from different sources and the recalculation of the missing information. The advantage of statistical methods is the possibility of the quantitative assessment of the concealed part of the production economic activities. These procedures can be used to identify the production sectors of the shadow economy, to assess their scope, to formulate economic and legal policy. The most widespread among statistical methods are the method of specific indicators, the method of soft modeling, structural and expert methods.

Methods of specific indicators assume the use of the indicator reflecting the level of economic activities that was obtained directly or indirectly.

A further disadvantage of these two direct methods (surveys and tax auditing) is the point estimate character. In general they capture shadow economic activities only partially and may be seen as lower bound estimates. Going back to the definition of the shadow economy, this method captures mostly the amount of shadow labor activities in households and rarely in or between firms and these methods do not provide value added figures. However, they have one considerable advantage: they provide detailed information about shadow economy activities, the structure and composition of the activities as well as the socio-economic characteristics and motives of those who work in the shadow economy.

To summarize:

Survey methods are likely to underestimate the shadow economy because people are likely to under-declare in surveys what they are trying to hide from authorities. In order to minimize the number of respondents dishonestly replying or totally declining to answer sensitive questions, structured interviews are undertaken (usually face to face), in which respondents slowly become accustomed to the main purpose of the survey.

The first part of the questionnaire aims to shape respondents' perceptions of the issues being explored.
The second part asks questions about the respondents' activities in the shadow economy.
A third part contains the usual socio-demographic questions.

Nevertheless, the results of the shadow economy estimates from survey methods are clearly lower-bound estimates compared to other approaches. They also rely on a very narrow definition of "classical" shadow economy activities.

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:

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.**

The Discrepancy between National Expenditure and Income Statistics

- This approach is based on discrepancies between income and expenditure statistics. In national accounting the income measure of GNP should be equal to the expenditure measure of GNP. Thus, if an independent estimate of the expenditure side of the national accounts is available, the gap between the expenditure measure and the income measure can be used as an indicator of the extent of the shadow economy.
- Since national accounts statisticians are anxious to minimize this discrepancy, the initial discrepancy or first estimate, rather than the published discrepancy, should be employed as an estimate of the shadow economy. If all the components on the expenditure side are measured without error, then this approach would indeed yield a good estimate of the size of the shadow economy.
- Unfortunately, however, this is not the case. Instead, the discrepancy reflects all omissions and errors in the national accounts statistics as well as the shadow economy. These estimates may therefore be crude and of questionable reliability

The discrepancy between the official and actual labor force

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

Within this method, the main indicator is calculated as:

$$X_{employment} = \frac{U_{ilo} U_{fsz}}{L - U_{fsz}}$$

$Uilo$ - number of unemployed, according to surveys of the employment service;
$Ufsz$ - number of officially registered unemployed;
L - total number of economically active population.

It is assumed that the productivity of labor in the shadow sector is the same as in the official sector, which implies that the share of the shadow economy in GDP is equal to the calculated indicator.

This method is easy to use, but estimates only part of the shadow economy associated with labor, and has a number of disadvantages. He does not consider the gray salaries paid on official work, the hidden profits of companies, etc. Also, this method has an unrealistic assumption about equal labor productivity in the formal and shadow economy, which leads to an underestimation of the share of the shadow economy. However, some modifications of this method are possible. Thus, weakening the assumptions of this approach can improve the accuracy of the estimates obtained and give interesting results in combination with other methods.

The transactions approach

- This approach has been fully developed by Feige. It is based upon the assumption that there is a constant relation over time between the volume of transactions and official GNP, as summarized by the well-known Fisher quantity equation, or
- ***M*V = p*T*** (with *M* money, *V* velocity, *p* prices, and *T* total transactions).
- Assumptions also have to be made about the velocity of money and about the relationships between the total value of transactions *p*T* and total (official + unofficial) nominal GNP. Relating total nominal GNP to total transactions, the GNP of the shadow economy can be calculated by subtracting official GNP from total nominal GNP.

However, to derive figures for the shadow economy, one must also assume a base year in which there is no shadow economy and therefore the ratio of $p*T$ to total nominal (official = total) GNP was “normal” and would have been constant over time if there had been no shadow economy. To obtain reliable shadow economy estimates, precise figures on the total volume of transactions should be available. This might be especially difficult 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. Also, the assumption is made that all variations in the ratio between the total value of transactions and the officially measured GNP are due to the shadow economy. This means that a considerable amount of data is required in order to eliminate financial transactions from “pure” cross payments, which are legal and have nothing to do with the shadow economy. In general, although this approach is theoretically attractive, the empirical requirements necessary to obtain reliable estimates are so difficult to fulfill that its application can lead to doubtful results. Again, here a very broad definition of the shadow economy is used, especially as all transactions (including criminal ones) are counted.

The currency demand approach

- The currency demand approach was first used by Cagan (1958), who considered the correlation between currency demand and tax pressure (as one cause of the shadow economy) for the United States over the period 1919 to 1955. Twenty years later, Gutmann (1977) used the same approach but without any statistical procedures. Cagan's approach was further developed by Tanzi (1980, 1983), who estimated a currency demand function for the United States for the period 1929 to 1980 in order to calculate the size of the shadow economy. His approach assumes that shadow (or hidden) transactions are undertaken in the form of cash payments so as to leave no observable traces for the authorities. An increase in the size of the shadow economy will therefore increase the demand for currency. To isolate the resulting excess demand for currency, an equation for currency demand is estimated over time. All possible conventional factors, such as the development of income, payment habits, interest rates, credit and other debt cards as a substitute for cash and so on, are controlled for. Additionally, variables such as direct and indirect tax burdens, government regulation, state institutions and tax morale, which are assumed to be major factors causing people to work in the shadow economy, are included in the estimation equation.

The basic regression equation for currency demand

$$\ln (C / M_2)_t = \beta_0 + \beta_1 \ln (1 + TW)_t + \beta_2 \ln (WS / Y)_t + \beta_3 \ln R_t + \beta_4 \ln (Y / N)_t + u_t,$$

with $\beta 1 > 0$, $\beta 2 > 0$, $\beta 3 < 0$, $\beta 4 > 0$, where *ln* denotes natural logarithms, *C/M2* is the ratio of cash holdings to current and deposit accounts, *TW* is a weighted average tax rate (as a proxy for 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 per capita income. Any “excess” increase in currency, or the amount unexplained by conventional or normal factors, is then attributed to the rising tax burden and other reasons leading people to work in the shadow economy. Figures for the size and development of the shadow economy can be calculated in a first step by comparing the difference between the development of currency when the direct and indirect tax burden and government regulation are held at lowest values, and the development of currency with the current (higher) burden of taxation and government regulation. Assuming in a second step the same income velocity for currency used in the shadow economy as for legal *M1* in the official economy, the size of the shadow can be computed and compared to the official GDP.

The currency demand approach

- The equation of regression for the demand for currency (M0 / M2) was the equation proposed by Tanzi [Tanzi, 1983]:

$$\ln (C/M2)t=\beta 0+\beta 1\ln(1+TW)t+\beta 2\ln (WS/Y)t+\beta 3\ln Rt+\beta 4\ln(Y/N)t+ut,$$

where, C/M2 - the ratio of the volume of cash to deposit accounts (M0/M2)

TW - average tax rate;

WS/Y - the ratio of the volume of salaries to national income;

R - interest rate on savings deposits;

Y/N - national income per capita.

- Assumed that $\beta 1>0$; $\beta 2>0$; $\beta 3<0$; $\beta 4>0$.

The currency demand approach

To determine the share of the shadow money supply in the resulting equation, those elements that stimulate the shadow economy are equated to zero. Thus, the share of the money supply M0 in M2, serving the official economy, is calculated, and a “net" money supply is defined. Subtracting the fraction of the "net" money supply M0 in M2 from the share of the money supply M0 in M2, the share of cash serving the shadow market in the money supply M2 is found. Using this indicator, it is possible to calculate the size of the shadow economy.

The currency demand approach

This method has a number of ***advantages***.

First, it covers part of the shadow economy associated with cash settlements.

Second, it allows us to assess the influence of various factors on the size of the shadow economy.

Third, it not only measures the dynamics of the shadow economy, but also allows you to determine the value of the shadow economy at a certain time.

The currency demand approach

The most commonly raised objections to this method are:

1. Not all transactions in the shadow economy are paid in cash. Isachsen and Strom (1985) used the survey method to find out that in Norway, in 1980, roughly 80 percent of all transactions in the hidden sector were paid in cash. The size of the total shadow economy (including barter) may thus be even larger than previously estimated.
2. Most studies consider only one factor, the tax burden, as the cause of the shadow economy. Other factors (such as the impact of regulation, taxpayers' attitudes toward the state, tax morality and so on) are not considered, because for most countries reliable data are not available. If, as seems likely, these other factors also have an impact on the extent of the hidden economy, it might again be higher than reported in most studies.

3. As discussed by Garcia (1978), Park (1979), and Feige (1996), increases in currency demand deposits are largely due to a slowdown in demand deposits rather than to an increase in currency caused by activities in the shadow economy, at least in the case of the United States.
4. Blades (1982) and Feige (1986, 1996) criticize Tanzi's studies on the grounds that the US dollar is used as an international currency so Tanzi should have considered (and controlled for) the presence of USdollars, which are used as an international currency and held in cash abroad. Frey and Pommerehne (1984) and Thomas (1986, 1992, 1999) claim that Tanzi's parameter estimates are not very stable.
5. Most studies assume the same velocity of money in official and shadow economies. As argued by Hill and Kabir (1996) for Canada and by Klovland (1984) for the Scandinavian countries, there is considerable uncertainty about the velocity of money in the official economy, and the velocity of money in the hidden sector is even more difficult to estimate. Without knowledge about the velocity of currency in the shadow economy, one has to accept the assumption of that money has equal velocity in each sector.
6. Ahumada, Alvaredo, Canavese, and Canavese (2004) show that the currency approach together with the assumption of equal income velocity of money in reported and hidden transactions is only correct if the income elasticity is 1.
7. Finally, the assumption of no shadow economy in a base year is open to criticism. Relaxing this assumption would again imply an upward adjustment of the size of the shadow economy.

The physical input (electricity consumption) method

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

The Kaufmann - Kaliberda Method

Let a be the elasticity of power consumption relative to GDP. Then, according to the assumption, the dynamics of energy consumption can estimate the dynamics of total GDP by the following formula:

$$\Delta TotalGDP = 1/\alpha * \Delta ElectricityConsumption$$

$\Delta TotalGDP$– increase in total GDP (%);;
$\Delta ElectricityConsumption$– consumption of electricity (%).

Johnson S., Kaufmann D., Shleifer A. [Johnson et al., 1997] noted that the elasticity for the republics of the USSR of electricity consumption relative to GDP is different during the growth of the economy and during the recession. As a result, two elasticity indicators were introduced: 1.15 during GDP growth and 0.87 during fall:

$$\Delta Total_{GDP} = \begin{cases} \frac{1}{1{,}15} * \Delta ElectricityConsumption\ if\ \text{GDP growth} \\ \frac{1}{0{,}87} * \Delta ElectricityConsumption\ if\ \text{GDP fall} \end{cases}$$

$OfficialGDP$ – the size of the official GDP, $TotalGDP$– total GDP. On the basis of $\Delta TotalGDP$, for all considered periods and a point estimate $TotalGDP$ given from the outside, the values of $TotalGDP$ for the whole period under consideration are calculated. The size of the shadow economy in this case will be the difference between the total GDP and the official ($TotalGDP - OfficialGDP$).

The Kaufmann - Kaliberda Method

- However, it can also be criticized on various grounds:
- 1. Not all shadow economy activities require a considerable amount of electricity (e.g. personal services), and other energy sources can be used (gas, oil, coal, etc.). Only a part of the shadow economy will be indicated.
- 2. Over time, there has been considerable technical progress so that both the production and use of electricity are more efficient than in the past, and this will apply in both official and unofficial uses.
- 3. There may be considerable differences or changes in the elasticity of electricity/GDP across countries and over time.

The Lacko method

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

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

$$\ln E_i = \alpha_1 \ln C_i + \alpha_2 \ln PR_i + \alpha_3 G_i + \alpha_4 Q_i + \alpha_5 H_i + u_i \text{ , with } \alpha_1 > 0, \alpha_2 < 0, \alpha_3 > 0, \alpha_4 < 0, \alpha_5 > 0$$

and

$$H_i = \beta_1 T_i + \beta_2 (S_i - T_i) + \beta_3 D_i \text{ with } \beta_1 > 0, \beta_2 < 0, \beta_3 > 0$$

where i indicates the number assigned to the country,
E_i is per capita household electricity consumption in country i,
C_i is per capita real consumption of households without the consumption of electricity in country i in US dollars (at purchasing power parity),
PR_i is the real price of consumption of 1 kWh of residential electricity in US dollars (at purchasing power parity),
G_i is the relative frequency of months requiring heating in houses in country i,
Q_i is the ratio of energy sources other than electricity energy to all energy sources in household energy consumption,
H_i is the per capita output of the hidden economy,
T_i is the ratio of the sum of paid personal income, corporate profit and taxes on goods and services to GDP,
S_i is the ratio of public social welfare expenditures to GDP, and
D_i is the sum of the number of dependents over 14 years of age and inactive earners, both per 100 active earners.

Lacko’s method is also open to criticism:

1. Not all shadow economy activities require a considerable amount of electricity and other energy sources
can be used.

2. Shadow economy activities do not take place only in the household sector.

3. It is doubtful whether the ratio of social welfare expenditures can be used as the explanatory factor for the shadow economy, especially in transition and developing countries.

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

Indirect Approaches

The commodity flow method implies the construction of the balance model and the detection of weak points in the existing data base. The commodity flow, i.e. the behaviour of value in the process from production to use (consumption), is constructed for certain most important goods and product groups. This approach allows making a quantitative assessment of foreign economic mediation, including the extent of “shuttle” business.

The methods of soft modeling are aimed at calculating the relative size of the shadow economy by distinguishing the combination of factors determining it. This approach was used by D. Giles (1997); D. Giles, L. M. Tedds, W. Gugsa (2002); S. Chatterjee, K. Chaudhury, F. Schneider (2006), and others.

The structural method is based on the use of the information concerning the extent of the shadow economy in different production branches.

The expert method relies on the intuition and experience of qualified professionals, who determine the degree of data reliability, interconnections and relations that are difficult for quantitative description.

General remarks

- All methods described so far consider just one indicator to capture all effects of the shadow economy. However, shadow economy effects show up simultaneously in production, labor, and money markets. An even more important critique is that the causes determining the size of the shadow economy are taken into account only in some of the monetary approach studies that usually consider one cause, the burden of taxation.

References

- Shadow Economies in 10 Transition and 6 Developing OECD Countries: What are the Driving Forces? By Friedrich Schneider and Andreas Buehn *(May, 2013)*
- Allingham, M.G. and A. Sandmo (1972), Income Tax Evasion: A Theoretical Analysis, *Journal of Public Economics,* 1/3, pp. 323–338.
- Feige, E.L. (1986), A re-examination of the underground economy in the United States, *IMF Staff Papers,* 33, pp. 768–781.
- Feige, E.L. (ed.) (1989), *The Underground Economies. Tax Evasion and Information Distortion*, Cambridge University Press, Cambridge.
- Feige, E.L. (1994), The underground economy and the currency enigma, Supplement to *Public Finance/Finances Publiques*, 49, pp. 119–136.
- Feige, E.L. (1996), Overseas holdings of U.S. currency and the underground economy. In: Pozo, S. (ed.), *Exploring the Underground Economy*. W.E. Upjohn Institute for Employment Research, Kalamazoo, MI, pp. 5–62.
- Feige, Edward L. (2016a), Reflections on the Meaning and Measurement of Unobserved Economist: What Do We Really Know About the Shadow Economy?, *Journal of Tax Administration*, 2/2, Special Issue: The Shadow Economy.
- Feige, Edward L. (2016b), Professor Schneider's Shadow Economy (SSE): What Do We Really Know? A Rejoinder., *Journal of Tax Administration*, 2/2.
- **Review Article** Friedrich Schneider, Andreas Buehn **Shadow Economy: Estimation Methods, Problems, Results and Open questions** Open Economics 2018; 1: 1–29

Thank
you