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on the topic: «**METHODS OF ESTIMATING THE SHADOW ECONOMY
AND USING THESE METHODS TO CALCULATE THE SHADOW
ECONOMY OF UKRAINE**»

на тему: «**МЕТОДИ РОЗРАХУНКУ ТІНЬОВОЇ ЕКОНОМІКИ ТА ЇХНЕ
ВИКОРИСТАННЯ ДЛЯ РОЗРАХУНКУ РІВНЯ ТІНЬОВОЇ
ЕКОНОМІКИ УКРАЇНИ**»

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Introduction

Relevance of the topic. Nowadays, world's economic system improves with every year. New financial instruments and institutions are working to create better economic system in countries. However, with improve in official economy and economic system Shadow economy development also exists. Part of the economy which is in shadow should be thought by government as potential increase of the official economy. That is why governments should reform financial system and perform actions to overcome Shadow economy with intention to move to the official economy. For this purpose, should be performed accurate methods of calculation the shadow economy level. These methods will help estimate exact part of the economy which is underground. They also sometimes help to understand reasons of the existing shadow economy level as they are estimated by certain variables which affected by Shadow economy. That is why precise estimation will help in future deshadowing process. Especially for Ukraine it is crucial question to determine precise level of Shadow economy and its reasons. To perform new laws and tools to cope with Shadow economy Ukrainian government should know its size and reasons.

The aim of the study. The goal of this work is to determine which methods are used for shadow economy level estimation, which their benefits and disadvantages, their estimations for Shadow economy in Ukraine, modelling multiple causes and indicators (MIMIC) model for Ukraine. To achieve this goal, the following tasks were performed:

- To define shadow economy and its nature;
- To analyze methods of shadow economy level estimation;
- To discuss the relevance of these methods;
- To analyze Ukrainian Shadow economy estimates according to different methods;

- To use econometric modelling to calculate shadow economy level in Ukraine;
- To study tools for tackling Shadow economy;
- To give overview to Ukrainian deshadowing methods.

Object of the study. Object of this study is the Shadow economy in Ukraine.

Subject of the study. Subject of this study is different estimation methods for Ukrainian shadow economy.

Literature review. The following outstanding scientists made a significant contribution to study the Shadow economy and its estimation: F. Schneider, C. Williams, O. Nezhyvenko, E. Feige, Cagan, V. Tanzi, Lacko, Kaufman, M. Fleming, A. Buehn, M. H. Fleming, M. Robinson.

Methods and material used. For this study were used econometric methods for MIMIC calculation of the shadow economy level in Ukraine and system dynamics modelling for research of the tools to cope with Shadow economy. For statistics was analyzed the yearly aggregated data for different estimation methods of Shadow economy in Ukraine. Econometric part was examined with the help of quarterly reports of Ministry of Economics and Statistics Department in Ukraine for different variables and the statistical package EVIEWS 8 version and Stata 12. The last part includes basis using of system dynamics, working with Stella Architect.

This thesis consists of introduction, three chapters, conclusions, references, and appendices. In the first chapter it was observed definitions of Shadow economy, its impact on the economic system and its elements, also methods for shadow economy level estimation and risks of its underestimating. The second chapter contains data about shadow economy level in Ukraine by different methodology, used econometric modelling for MIMIC model for Ukrainian shadow economy level, provided comparing between official data, estimation of other scientists and this study estimation. In the third chapter it is described tools for overcoming shadow economy, used system dynamics modelling for creating and analyzing these tools in Ukrainian system, analyzed Ukrainian deshadowing methods.

Chapter 1

The definition of the shadow economy and methods for evaluating its level and risks

1.1. Definition of the Shadow economy and its impact on the formal economy

The shadow economy has existed for many years, since in history there always were and still are those who do their business informally or want to make more money without paying taxes. However, these two things are not the only ones which contribute into the shadow economy and sustain its level. There are much more actions which are included into the broad term shadow economy.

The term shadow economy is not the only one, which is used. Shadow economy could be also called as informal, hidden, undeclared [1]. Nevertheless, it is not about the how to call the shadow economy, it is more about its definition. As with difference in definitions some activities may count as informal activities and the others may not.

The main problem is that hidden economy does not have a proper definition, on which all scientists will agree. One of the broadest definitions for shadow economy provided by Friedrich Schneider is: “those economic activities and the income derived from them that circumvent or otherwise avoid government regulation, taxation or observation” [2]. In other words, every activity which also might provide owners with income, but escapes law regulations, government supervisions, and paying taxes should be considered as the shadow economy.

Another definition of the shadow economy is that every market-based activity in production of commodities or services, despite of their legality, that does not be included in GDP estimation [2]. However, there is a contradiction in those words in that informal economy may not be included in GDP estimation, but it is spent in legal economy, so it increases the GDP.

One more definition is designed by Feige and its essence is: “Whether the activity adheres to the established, prevailing institutional rules of the game... Adherence to the established rules of the game constitutes participation in formal economy... whereas noncompliance or circumvention of the established rules constitutes participation in informal economy” [3]. With Feige definition it is clear that he does not concern about monetary side of shadow economy and more focused on the question of its compliance with “institutional rules of the game” or avoiding them, which is in this case an informal economy.

It is also crucial to understand that high level of the shadow economy has a lot of drawbacks for future economic development as it leads to decline with increase in informal economy. Another thing is that institutions starts to rotten and their quality drops with occurrence of corruption. Citizens start to feel safe with working in shadow and do not want to go back to formal economy. All these not only stop economic development, but also make the system to work against the law.

It should be now regarded what to include in the shadow economy and which criteria is used for this. Firstly, all hidden activities should be divided by two categories:

- Legal nature, whether the activities are illegal or legal. Of course, they are always about breaking the law or some rules. Nonetheless, there is a difference between drug dealing and covering income.
- Payment methods if activity is made with some monetary transaction. For example, buying drugs or misreported/unreported employees wage both provide some money issues. In first example it is buying, in second it is covering some part or all the information for tax evasion. While there are activities such as smuggling, barter, and self-made work for yourself or without monetary reward for executor.

With such criteria it is better to understand that illegal activities are more about the law side. Because if in the country is prohibited to consume and sell drugs then such activities will never be legal under the law. From the opposite side, if drug selling is legal, but the revenue from this activity and quantity of sales are covered,

then this activity is legal, but the executor is deliberately cover up some pieces of information.

From the other hand, some activities may be explained as informal economy, but they are not a part of it. The most popular activities which do not contribute to shadow economy growth are self-made work and unrewarded help to others, for example neighbors. It is more simply with unrewarded help because there is no monetary transaction and in fact no taxes or law breaking are in place. However, it is difficult sometimes to distinguish self-made work from shadow economy. The reason is that when household plants some vegetables or anything else for their own use, this is not taxable activity and no law violation occur. However, when household starts to sell their greenery, then they should pay taxes and have legal documents with permission on selling. If it does not have legal documents or/and do not pay taxes, then this will be a shadow economy activity [4].

There are a plenty of reasons for doing business in shadow (See table 1.1). These reasons for covering some information about businesses are different.

Table 1.1 Reasons for covering the information about businesses

Reasons	Examples
Money issues	Avoid to pay taxes to have more income, avoid to pay social security contributions, avoid to make official job contracts with employees to not pay for their health issues or injuries from work place, cover up wage of employees to pay less taxes on it
Law and regulations	Also not signing official job contracts, paying less than minimal wage amount, violation of safety standards, violation of some administrative obligations, having illegal part of business which is covered

Source: elaborated by the author based on data [2]

The most popular reasons are linked either with money issues or law obligations (See table 1.2). Consequently, when people or firms start working

informally, they want to increase their profits or do not want to meet certain regulations and try to hide violations.

Regarding reasons for hidden activities from executor side, it is now helpful to understand what in the system allows to undertake informal deeds or what forces citizens to do that.

Table 1.2 What parts of the system are stimulating the shadow economy?

Reason for shadow economy occurring	Consequences
Risk of detection	With low detection risk there will be more shadow economy as people will feel safe to do so
Tax morale	With low level of tax morale citizens do not see reasons for paying taxes
Quality of institutions	Low quality of institutions means that the system could not do its work properly that is why citizens want to avoid being part of the system
Vertical trust	Low vertical trust means people do not trust their government and institutions, so they start avoiding law regulations
Horizontal trust	If citizens see that there is part of nation which works informal and they stay unpunished, legal workers and employers will also want to participate to the shadow side
Corruption	It is a part of institutional quality, but it is also much broader term. With corruption occurs collapse in system and all shadow activities can stay unpunished or even be encouraged by the system

Source: elaborated by the author based on data [5]

System can give have a lot of drawbacks, which develop the shadow economy level in the country or even in world. All reasons for informal economy existing connected to institutions and government. If institutions have low quality, trust level

or corrupted, then it will be resulted in hidden economy growth as all the citizens will feel unmotivated and safe to work informal.

With all negative impact from shadow economy on the economic development, positive impact from informality also exists. However, it is not as strong as negative side of the shadow economy. First positive consequence from shadow economy is that citizens can earn some money for themselves with alternative employment. It is helpful for those who are below the poverty line [6]. Another positive result from hidden economy is that it contributes to formal economy and all money which is earned in shadow will be spent in formal economy.

To conclude, with all different definitions of the shadow economy, it is hard to choose the right one. It is better to understand the meaning of shadow economy, its impact and reasons than stop on choosing the definition, with negative impact of the economic development, shadow economy with all its pluses still makes a lot of harm to the economy. Legal nature and payment methods are key factors to distinguish informal economy activities. Main reasons for hidden activities are connected to monetary and law side. However, that is not only about those who do in shadow, it is also about those who allow to work in shadow. That is why system problems can always contribute to the shadow economy growth.

1.2. The methods of shadow economy level estimation and their differences

Measuring the shadow economy level is a very difficult task and results always are approximate and can vary regardless of used method. In this subsection methods for shadow economy level estimation will be elaborated on. It is crucial to know level of the shadow economy because this information provide which part of economy is in shadow and how fast and decisive government should be to solve the shadow economy problem.

To begin with, estimation methods divide into two groups: direct and indirect. Direct methods can be in two types. First type is surveys and questionnaire based on citizens replies. This method is commonly used in lots of countries and designed to

show approximate level of shadow economy. However, the results of these surveys should not be regarded seriously, because results depend on trustworthiness of the replies. If some people are not willing to share real information and lie questions, then sample already will not give truthful results. That is the reason why the cooperation between researchers and those who give responds is vital for results of the survey [7].

The next direct method is tax auditing method. The purpose of it in searching for fraud in declared taxes and real taxes that should be paid. With this search certain firms are checked for tax evasion. The main two disadvantages of this method are that the sample for search is biased, because in sample are only those who potentially do not pay taxes or pay them on low level, so the results are overestimated. Another minus is that method only looking for tax evasion, whereas shadow economy activities not only about paying taxes. Consequently, research results uncover only fraction of the informal economy [7].

Indirect methods are macroeconomic methods. They use the statistical data to measure and track the dynamic of the development of the shadow economy level.

First method to know is income-expenditure discrepancy method. The main goal of it is to check the information about difference in income and expenditures methods of GNP estimation, which should be equal [8]. If there is any gap between them in data, then it can be used to estimate the shadow economy size. Without any errors in data this method can provide researchers with almost perfect results of the shadow economy scale. The only one problem is that statistical data of GNP by income and expenditures always have omissions and errors. That is why the results of this method are mistaken and do not provide information about real size of the shadow economy [9].

Second method is known as labor force method. Its goal is to measure the shadow economy level by drop in labor force in formal economy. With all other factors remain stable if the labor force on official labor market decreased, then it moved to informal side and increase the shadow economy. However, main drawback of this estimation method is that other factors can influence labor force, so it is not

connected with informal economy. Citizens also may have both official and hidden job, which give errors to the results of the research [8].

Third method was developed by Feige and called transaction method. Its purpose is in assumption that there is a constant relation in time between volume of transactions and official GNP, as summarizes by the Fisherian quantity equation:

$$M \cdot V = p \cdot T \quad (1.1)$$

Where M – money, V – velocity, p – prices and T – total transactions [8]. Velocity of money and relation between total transactions ($p \cdot T$) and total GNP both official and hidden should be considered constant. The size of the informal economy can be measured by excluding official part of GNP from Total GNP. In this method one crucial assumption should be made that there was a year called base year in which there was no shadow economy or almost no shadow economy, so the ratio of total transactions to total GNP was basic and should remain constant in dynamics with no shadow economy occurring. Main disadvantage of this method is that for better evaluation information about all transactions should be available. Alas, it is hard to obtain all information about cash transactions as they are hardly trackable. One more minus of such estimation is that disparity in ratio of total transactions and total GNP could be because of other factors than only the shadow economy, so level of the shadow economy will be overestimated. That is why results of such method needed a lot of data information to make proper results.

Fourth method was created by Cagan [8] and developed by Tanzi [10] for US shadow economy size estimation and it is called currency demand method. The assumption of this method is that with increase in the shadow economy, increase in cash demand will take place. As all hidden entities do not want for their operations to be trackable, they use currency. For this method it is necessary to observe cash operations in dynamics and take into accounts such factors as: income increase, payment habits, tax morale, tax burden and law regulations. As in previous method currency method should be compared to the base year, where such variables as tax burden and law regulations are the lowest, because their increase forces people to go in shadow. This method is very popular for shadow economy level estimation in

plenty of countries. However, there are some negative sides in using this method. The most vital is that not all transactions in shadow economy made with cash, only certain fraction of it [8]. In currency method should be regarded not only tax burden, which regarded as only factor in lots of countries, but also tax morale and law regulations.

Fifth method is electricity consumption method which can be divided to Kaufman-Kaliberda method and Lacko method [11]. First one has the assumption that GDP growth is connected to electricity consumption increase. If electricity consumption rise, but GDP stagnate, then the shadow economy level increase. This method also requires basic year with data for electricity consumption and GDP to compare and make ratio with current data. However, there are few drawbacks in this methodology of shadow economy level estimation. First one is that not all informal activities require a lot of energy, so fraction of shadow economy remain hidden. Change in electricity consumption vary from country to country and depends on the period of the year, in winter consumption is higher than in summer.

This method was developed by Lacko. She suggested that fraction of shadow economy depends on household's electricity consumption. It includes all households' activities, which can be defined as part of informal economy. However, she observed only this part and assumed that with high household shadow economy part other parts of shadow economy also high. It can omit the real level of shadow economy.

All these indirect methods have one thing in common, they include only one indicator for shadow economy level estimation. Nonetheless, shadow economy occurs simultaneously in labor, currency, and production markets. That is why all these indicators should be include for measuring the whole size of the shadow economy.

Another thing which relates to currency approach is that only one cause commonly used for shadow economy measurement, while lots of causes have an impact on the informal economy. In regarding many indicators and many causes the MIMIC method is used. MIMIC means multiple indicators and multiple causes

estimation [8]. As the shadow economy parameters are hidden the idea of MIMIC is to build a covariance matrix to compare observable real variables with data to models' variables. Unobservable variables which connected to observable variables specified with them with the structural model. With this technique MIMIC regards both indicators and causes and provide results that confirm the relationships between factors. The goals are to estimate the connection between causes and indicators as observable variables and shadow economy hidden parameters and to test the theory match the data.

All methods have their pros and cons, but it should be noted that direct methods are better for studying part of the shadow economy and are not respective for seeing the whole picture. Whereas indirect methods are designed to estimate approximate shadow economy level [8]. The best of them is MIMIC, because it includes several variables as causes and indicators for shadow economy, while other methods consider only one indicator. Another advantage of MIMIC is that indicators can be excluded and included in the process of observing the informal economy level. However, it is hard to study certain part of the shadow economy with MIMIC method as it includes several variable. Data for also variables are required and it is sometimes to study the shadow economy in dynamics with lots of factors as data for them is missed or omitted.

1.3. Risks of underestimating the shadow economy level

Estimating the shadow economy level is a crucial task to understand the situation and implement correct measures. However, sometimes shadow economy level could be underestimated. This can lead to the situation where government may not provide policies to fight shadow economy and it is developing with every year. There is one reason for government to cover up real information about shadow economy that government does not want to show weaknesses of their economy to other countries as it could decrease number of international investors and lenders.

Underestimating of the shadow economy level in such case could lead to much more severe damage to economic stability and economic growth. Moreover, it will take years to lower the level of the shadow economy. The government's fear of losing investors and creditors is approved, because countries with high shadow economy considered to be unsecured for investors and their money.

Several causes can develop the shadow economy and then high shadow economy level will only strengthen this causes. With such situation there creates a loop between shadow economy and its causes. The fact is that developing of shadow economy also creates new problems to the economic stability of the country and may change economical system. That is why the underestimating of the informal economy impact may lead both to strengthen of its causes and to creating a new set of problems.

As for causes which could develop shadow economy and be strengthened by it. For example, horizontal trust that means people watch one another and if someone works in shadow then other may also want to do it. With some economic instability in country some citizens can be forced to move in shadow. While the others can still work officially, they will not want to, because they see that they could work in shadow as the other people. In such occasion, in first place people do not choose, but rather are forced to move in shadow, whereas other may deliberately choose to do so.

This could be with all reasons which make people to move in shadow. While it is starting with some exogenous cause, after that system is working and developing on its own. That is why timing and proper reaction to causes may prevent future development of the hidden economy.

However, there is a problem that sometimes policies which are implemented by government do not only give the expected result, but also worsen the situation. For instance, if there is low quality of institutions in country and high level of corruption, which both will develop the shadow economy level, and the government chooses to increase the number of supervisions to lower the shadow economy. Then it will not lead to the resolving of the problem. Low quality of institutions means

that quality of supervisions on a low level. While high level of corruption means that credibility of the supervisions is also low. That is why such policy will not only fail, but also contributed to the development of corruption and shadow economy, even more undermining the trustworthiness of institutions.

The significant role in underestimating the shadow economy level plays corruption. It may be the cause of the informal economy and may be developed by increase in the shadow economy level. One thing in common between corruption and shadow economy is that it does not exist the proper meaning of both. However, corruption is selfish use of status or all other deeds which cross the law border for self-benefit. Three types of corruption exist: individual, institutional, and societal [12]. First type is not crucial for the shadow economy development as it means that only some certain politics or institutional representatives are corrupted, which does not show the whole picture of the situation. Second type is more damaging for the economy and may lead to rise in the informal economy. It means that not the individuals, but whole institutions are corrupted, which undermines their public credibility and efficiency of work. That means supervisions of corrupted institutions are inefficient as citizens can pay for their law violations. The last type of corruption means that shadow economy cannot be treated unless there will be measures for fighting the corruption. Societal corruption affects institutions and influences individual behavior at all levels a politico and socio-economic systems [6]. Which can be understood as inefficiency of all public institutions, corruption tolerance in society and no willingness to fight it. Rather citizens in such situation choose to adapt to such situation and start thinking it is normal. Such occasion as prepared ground for shadow economy development.

Of course, there is the maximum level of the shadow economy, which will mean that all economy and transactions in economy are in shadow. Which, in fact, cannot be the real case, but level of the shadow economy can be high enough to prove the insignificant role of government and institutions on operations in economy.

The last, but not least government should not underestimate and tolerate shadow economy level. However, it should not be overestimated also. In such case government can put too much press on the shadow economy participants, which obviously can erase all shadow economy. However, it should be remembered that shadow economy is a part of economy and with its collapse, the part of economy will disappear. That can create much more damage than the shadow economy itself. It should be remembered that the goal is to make informal side move to legal side without losing any part of the economy. That is the reason why the government should attract citizens and companies to move to formal economy, which will be beneficial for the economy.

In this chapter Shadow economy was defined as hidden part of the economy which violates laws and regulations. Reasons for performing shadow activities could be different and mostly depend on the society. However, Shadow economy differs with legal nature of it and payments methods of shadow transactions. Different methods for shadow economy level estimation exist, all of them have their advantages and disadvantages. One method which includes more variables than other. Thus, it has more significance in explaining shadow economy level by including various reasons and indicators is MIMIC modelling. This method could be disputable because different variables can be included, so different results may occur with every new variable. Measurement of Shadow economy is needed because it helps to prevent disastrous effects of Shadow economy in time and give more understanding to which strategies to cope with Shadow economy should be used. Ignoring Shadow economy could make a great damage to economical and societal system in country.

Chapter 2

Measurement and dynamics of shadow economy in Ukraine

2.1. Shadow economy dynamics in Ukraine

In Ukraine official level of shadow economy for the last years stayed on approximately 30% of GDP. Such results of estimation by Ministry of economics. However, from other sources such as the professor Schneider's estimation level of shadow economy in Ukraine equals approximately 45% of GDP. Of course, it depends of methods of estimation. The professor Schneider used MIMIC modelling, while Ministry of economics of Ukraine (MOE) used integral indicator.

Integral indicator is method which compound some other indirect methods together. All this method is judged by MOE and level of influence is given to every method which is included. This level of influence is measured from 0 to 1. Each of the methods included in calculation of integral indicator is multiplied by respective coefficient and added together. (See fig. 2.1).

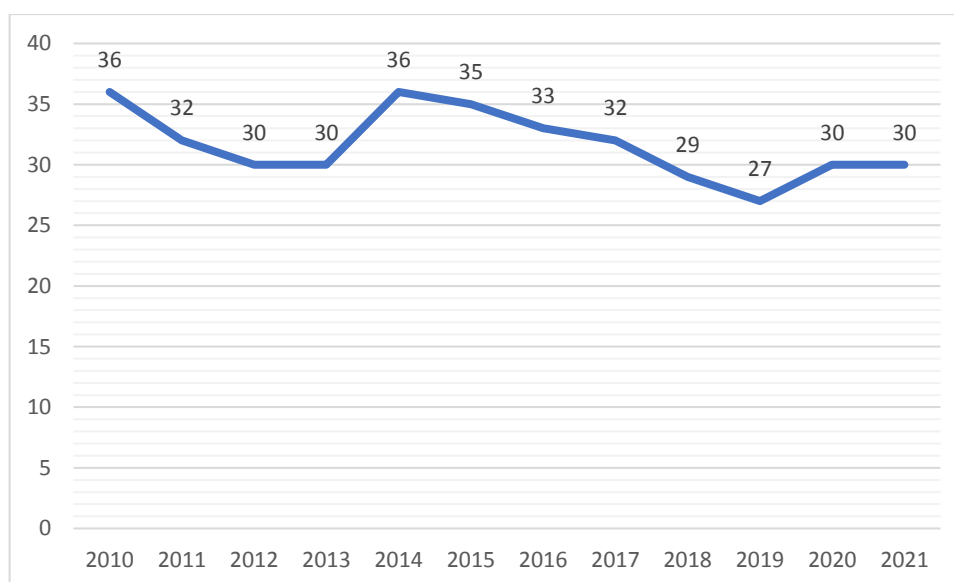


Figure 2.1 – Dynamics of Ukrainian shadow economy from 2010 to 2021 years

Source: elaborated by the author based on data [14]

Crises events such as global crises in 2008, revolution, annexation of Crimea and war in 2014, coronavirus pandemic and economic crises in 2020, increased level of shadow economy of Ukraine. The highest points of 36% were in 2010 and 2014 years, after which shadow economy level dropped slightly with every year.

Although, Shadow economy level presented as percentage from GDP gives approximate picture of lost budget to Shadow economy, it is better to use absolute GDP value and represent Shadow economy level in the same way (See table 2.1).

Table 2.1 Dynamics of Shadow economy level (integral indicator) and Nominal GDP of Ukraine from 2010 to 2021

Year	Nominal GDP (mln. UAH)	GDP growth	Shadow economy (mln. UAH)	Shadow economy growth
2010	1082569	-	389724,84	-
2011	1316600	21,62%	421312	8,10%
2012	1408889	7,01%	422666,7	0,32%
2013	1454931	3,27%	436479,3	3,27%
2014	1566728	7,68%	564022,08	29,22%
2015	1979458	26,34%	692810,3	22,83%
2016	2383182	20,40%	786450,06	13,52%
2017	2982920	25,17%	954534,4	21,37%
2018	3558706	19,30%	1032024,74	8,12%
2019	3974564	11,69%	1073132,28	3,98%
2020	4194102	5,52%	1258230,6	17,25%
2021	5459574	30,17%	1637872,2	30,17%

Source: elaborated by the author based on data [14], [15]

From data the pattern in Shadow economy rise could be found. In calm years in which economy is stable the Shadow economy growth is insignificant (2012,2013, 2018,2019). The main reason why this happening is that GDP grows with much

higher temps after economy shocks, whereas Shadow economy grows more in crises periods (2014,2015, 2020,2021).

Hard to say how much money Ukrainian budget lost because of unpaid taxes. The amount of Shadow economy shows that third part of GDP is underground economy. By calculating approximate amount of taxes compared to GDP paid in Ukraine for the last 10 years (19%), can be concluded that more than 300 000 million UAH taxes is lost in 2021 [16]. Unfortunately, it is approximate measurement and numbers of unpaid taxes may be higher or lower.

Nominal GDP does not show real growth of economy, because it adopts to new prices and exchange rate. That is why for better analysis of Shadow economy growth should be data about Real GDP or GDP in USD (table 2.2).

Table 2.2 Dynamics of Shadow economy and Nominal GDP of Ukraine from 2010 to 2021

Year	GDP (mln. USD)	GDP growth	Shadow economy (mln. USD)	Shadow economy growth
2010	136419	-	49110,84	-
2011	163160	19,60%	52211,2	6,31%
2012	175781	7,74%	52734,3	1,00%
2013	183310	4,28%	54993	4,28%
2014	131805	-28,10%	47449,8	-13,72%
2015	90615	-31,25%	31715,25	-33,16%
2016	93270	2,93%	30779,1	-2,95%
2017	112154	20,25%	35889,28	16,60%
2018	130832	16,65%	37941,28	5,72%
2019	153781	17,54%	41520,87	9,43%
2020	155582	1,17%	46674,6	12,41%

Source: elaborated by the author based on data [14], [15]

Data of informal economy growth is more realistic comparing to previous one. While share of Shadow economy rose, real numbers of it in USD dropped. The reason for this is that GDP lowered drastically in USD, because of exchange rate changes and economic crises. Shadow economy has the same patterns as GDP in the first and second tables. The one main difference is considerable growth of GDP in stable periods with light rise of informal economy and vice versa in crises periods.

In Ukraine income-expenditure discrepancy method is called “Household expenditure – retail turnover”, which has the same idea of calculation level of Shadow economy [17] (See fig. 2.2).

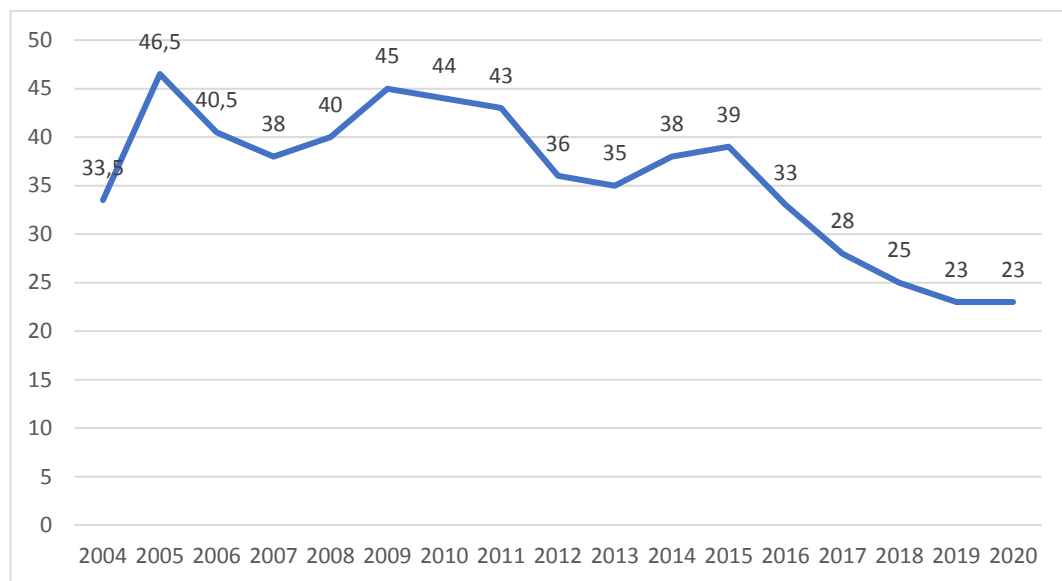


Figure 2.2 – Dynamics of “Household expenditure – retail turnover” method in Ukraine from 2004 to 2020

Source: elaborated by the author based on data [14], [16]

Results of this method were high in 2004-2016. In these years, the highest percentage was above 40%. However, by official data it started to fall after 2016 year. MOE points two reasons for such decline. First is regulations and new rules against Shadow economy, digitalization of economy and increase of minimal wage. Second reason is pandemic influence when people changed their priorities to necessities [14].

Electricity method had similar tendency to decrease in values. However, it could be doubtful to depend of this method because electricity consumption by

Ukrainians could drop, while electricity using by entities in informal sector may stay on same level or even rise (See fig. 2.3) [14].

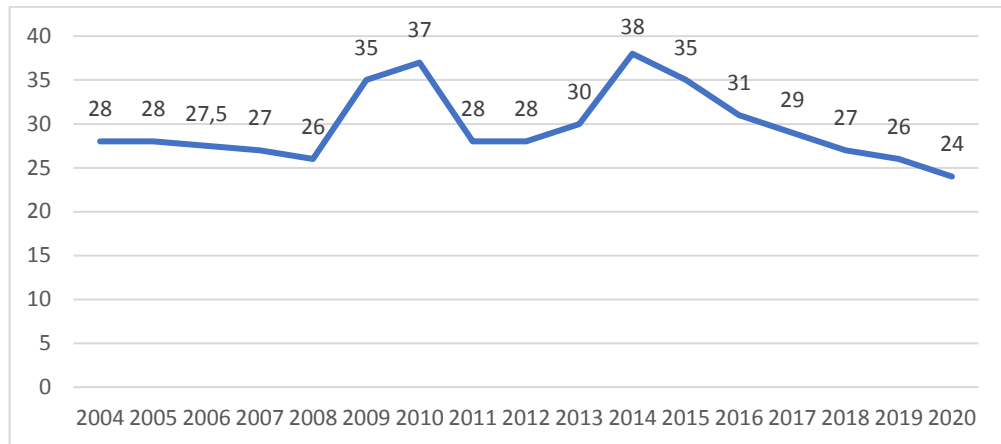


Figure 2.3 – Dynamics of electricity consumption method in Ukraine from 2004 to 2020

Source: elaborated by the author based on data [14], [16]

The highest values electricity method shows after 2008 year, when started world's crises, and in 2014, when started war. Considering that these years were stressful for Ukrainian economy it can be decided that pattern is close to the real one. Nevertheless, percentage of this method could easily underestimate the real level of shadow economy as it is highly dependable on stable population consumption.

Monetary method or how it is commonly called currency demand method shows nearly same results as integrated coefficient method (See fig. 2.4). Which could be true, because in crises periods use cash has more demand, which also stimulates Shadow economy.

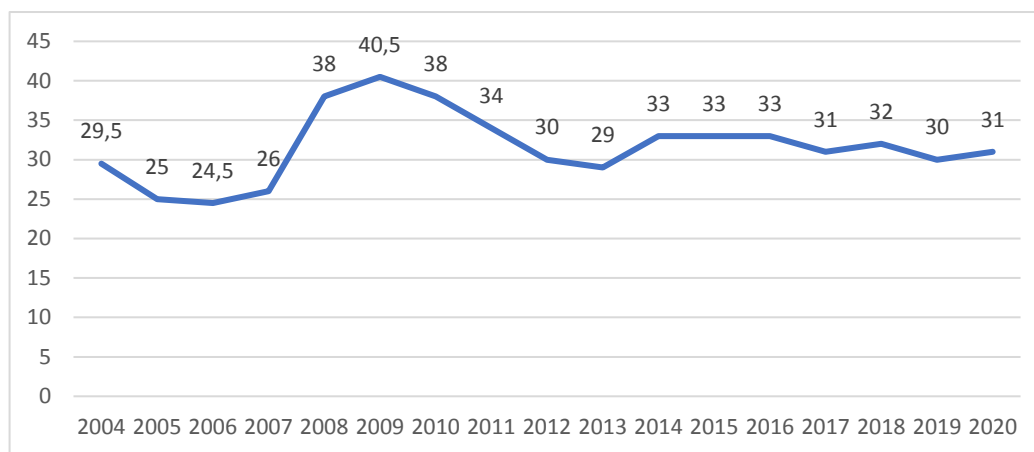


Figure 2.4 – Dynamics of currency demand method in Ukraine from 2004 to 2020

Source: elaborated by the author based on data [14], [16]

The highest results of monetary method can be seen in 2008-2010. However, in 2014 and 2019 it has insignificant increase. In those years values of this method is close to values of integral indicator. Reasons for estimation by monetary method to be truthful are that use of cash is falling and new limits on cash operations are implemented by law. That is why this method should show a decline. Nonetheless, it is still hard to make reliable data of all cash operations.

MIMIC method used by the professor Schneider is more reliable in estimation because of all data which included in this modelling (See fig. 2.5) [8]. Moreover, this method shows high results in informal economy level, these results is more truthful than those used by integrated coefficient method.

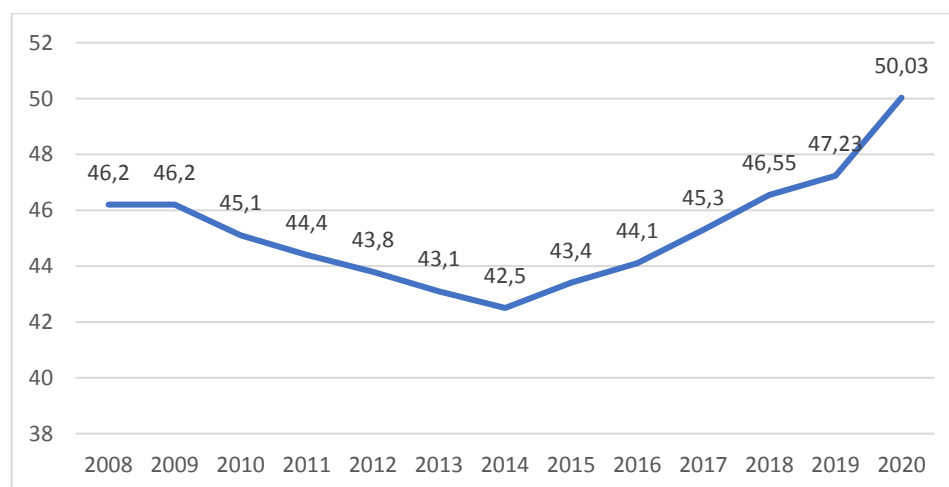


Figure 2.5 – Dynamics of the professor Schneider's estimation of MIMIC method in Ukraine from 2008 to 2020

Source: elaborated by the author based on data [14], [18]

These results differ from those of MOE by sometimes 15% [14]. However, it is always dependable on the method used for measurement. From this MIMIC modelling can be seen that in 2020 half of GDP were in shadow, which is approximately 2,5 trillion UAH or 47 billion USD. After 2014 started the rise of the level of Shadow economy which is also can be clarified by economic shock in Ukraine.

Considering all seen data, such conclusion can be made Shadow economy had similar pattern to GDP growth, except it rise with lower pace in stable times. A big difference exists in different methods, so results of Shadow economy level vary from 30% to 50% dependable on used methodology. Hard to notify which methodology is the best, because all of them have their pros and cons. That is why all of them could be truthful in certain period.

2.2. Estimation of shadow economy level in Ukraine by MIMIC modelling (econometric model)

MIMIC model gives results about shadow economy level by presenting the relationship between observable and unobservable variables. Observable variables divide into indicators and causes of the unobservable variables. Typically, MIMIC model divides into two parts: the structural equation model and the measurement model [19]. The structural equation model looks like:

$$\eta_t = \gamma' x_t + \zeta_t, \quad (2.1)$$

Where x_t - is a time series variable in the period t;

η_t – is latent variable in the period t;

Each time series x_t - is the potential cause of the latent variable η_t ;

ζ_t - is an error which adjusts equation;

γ' - is a “causal” relationship description between x_t and η_t .

This equation does not fully explain the unobservable variable that is why there is ζ_t which explains uncovered part. The assumption of MIMIC model is that

all variables are differences from their means and error does not correlate to the cause [19].

The measurement equation explains the latent variable in terms of observable variables:

$$\gamma_t = \lambda\eta_t + \varepsilon_t, \quad (2.2)$$

Where γ_t - is a time series indicator variable in the certain period t;

ε_t - is an error which exists in the model;

λ - is equation coefficient which shows the quantity of change in indicator for the unit change in unobservable variable;

η_t - is latent variable in the period t.

Likewise, indicators have causes deviation from their means. Additionally, there is an assumption that errors do not correlate with causes or indicators, therefore they can be judged as 0.

From Equations 2.1 and 2.2 can be derived MIMIC model's covariance matrix Σ . The purpose of this matrix is to show the link between observed variables with using their covariances. Decomposing the matrix derives the structure between the observed variables and latent variable [19]. The model's covariance matrix is:

$$\Sigma = \begin{pmatrix} \lambda(\gamma' \Phi \gamma + \psi) + \Theta_\varepsilon & \lambda \gamma' \Phi \\ \Phi \gamma \lambda' & \Phi \end{pmatrix} \quad (2.3)$$

Where Σ - is a function of the parameter λ , γ and Φ , Θ_ε and ψ [12];

Φ - is the covariance matrix of the causes;

λ - is equation coefficient which shows the quantity of change in indicator for the unit change in unobservable variable;

γ' - is a "causal" relationship description between x_t and η_t ;

Θ_ε - is covariance matrix of the indicators.

As latent variable is hidden, the parameters of the model should be calculated by using observable variables. The main goal of the calculation process is to discover number for the parameters and covariances which produce an estimate for Σ which is the mostly close to the sample covariance matrix of the observed variables.

For the MIMIC model estimation were taken two causes Unemployment and Tax burden or Tax government's budget income. Tax burden has strong positive correlation with Shadow economy growth. If there is implemented by government the increase of taxes, then Shadow activities will rise as some people do not want to pay more taxes. Small Tax burden stimulate people to work officially, but the more tax difference between official and unofficial work, the more people tend to work in shadow and provide shadow activities.

Unemployment influence of the Shadow economy growth is vague. In the situation when Shadow labor market is full increase of unemployment will lead to decrease in shadow economy as well as official economy. However, in situation when people gain nearly same in shadow economy as in official and shadow market is not full. Then Shadow economy level will grow with rise in Unemployment.

For indicators in MIMIC model were used Currency outside banks data and Real GDP data. Currency outside banks has positive correlation with Informal economy. With the rise of currency used outside banks, it should be concluded that Shadow economy rise is occurred. As most of the Shadow economy activities use cash as the main resource.

Real GDP have negative correlation with Shadow economy in short-term period because drop of Real GDP means the downfall of the economy, so people will go to the Shadow economy to save their income. Nonetheless, in long-term perspective growth of the Real GDP with the assumption of no government's deshadowing reforms implemented will lead to the increase in Shadow economy as well.

For the modelling process were used quarter data from 2010 to 2019 years, total number of observations is 40. Before making MIMIC model the data should be observed whether it is ready to be used in model. First step in observation data is to check every variable under the null hypothesis of a unit root test against the alternative of stationary (See table 2.3) [20]. In other words, all variables should be examined whether they are stationary or non-stationary, because non-stationary variables mean that they have trend and are not supposed to be used for modelling.

Table 2.3 Results of unit root ADF test for all variables in MIMIC model

Variable	Level		First difference	
	C	C&T	C	C&T
Real GDP	<i>0,9871</i>	<i>0,9085</i>	<i>0,0417</i>	<i>0,0032</i>
Currency outside banks	<i>0,9451</i>	<i>0,0370</i>	<i>0,0244</i>	<i>0,0962</i>
Unemployment	<i>0,0094</i>	<i>0,0215</i>	<i>0,0000</i>	<i>0,0024</i>
Tax income	<i>0,991</i>	<i>0,8322</i>	<i>0,0000</i>	<i>0,0000</i>

Source: elaborated by the author based on data [21], [22], [23], [24], [25], [26]

From the table could be seen that Currency outside banks and Unemployment are stationary variables at both level and first difference with 5% level Probability. While Real GDP and Tax income both are non-stationary at level and stationary at first difference. Which means that these variables should be converted to first difference and should be used in future modelling process with first difference to avoid omissions in model results.

Next objective is to check whether both causes are cointegrated with each indicator. This will give understanding if errors could be avoided in MIMIC estimation as they are near 0 value or not. For this for both indicators as dependent variables were made Johansen System Cointegration test with 2 lags and Intercept and trend in CE – no intercept in VAR option. That is because from previous examination this was the best option to perform cointegration test and have reliable results (See table 2.4 and table 2.5) [19]. The null hypothesis for this test is that there are no long-term relations between variables, so long-term MIMIC model should not be performed. If there is cointegration between variables, then null hypothesis can be rejected and thus both errors for first and second indicators equations can be counted as insignificant.

Table 2.4 Cointegration test results for Real GDP

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.542547	62.11139	42.91525	0.0002
At most 1 *	0.498642	33.95647	25.87211	0.0040
At most 2	0.223378	9.100834	12.51798	0.1742

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.542547	28.15493	25.82321	0.0242
At most 1 *	0.498642	24.85563	19.38704	0.0072
At most 2	0.223378	9.100834	12.51798	0.1742

Source: elaborated by the author based on data [21], [22], [23], [24], [25], [26]

Table 2.5 Cointegration test results for Currency outside banks

Unrestricted Cointegration Rank Test (Trace)

Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.644294	55.47266	42.91525	0.0018
At most 1	0.296477	19.29488	25.87211	0.0437
At most 2	0.180964	6.986963	12.51798	0.3459

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)

Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.644294	36.17778	25.82321	0.0015
At most 1	0.296477	12.30792	19.38704	0.0370
At most 2	0.180964	6.986963	12.51798	0.3459

Source: elaborated by the author based on data [21], [22], [23], [24], [25], [26]

From cointegration test results can be seen that with 5% level Probability in two out of three cases the null hypothesis can be rejected in both Tests (Trace and Maximum Eigenvalue) for Real GDP and Currency outside banks as dependent variables. It means that there is long-term relationship among causes and indicators. Moreover, both errors u_1 and u_2 can be avoided in the MIMIC estimation as they count as 0.

The next step in MIMIC modelling is creating model in STATA by connecting causes and indicators to latent variable, which will provide results in correlation coefficients for future MIMIC estimation with statistical information about these coefficients (See table 2.6).

Table 2.6 MIMIC model coefficients results in STATA

	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
Structural						
Shadow Economy <-						
Unemployment1thousandpend	-525,2588	117,6721	4,46	0,000	-755,8919	-294,6257
Summarybudgetstaxincome2ml	-0,02356	0,286418	0,08	0,034	0,5849246	0,5378115
Measurement						
RealGDP2mlnUAH <-						
Shadow economy			1 (constrained)			
cons	241134,3	50836,46	4,74	0	141496,7	340771,9
Currencyoutsidebanks1mlnUA <-						
Shadow economy	0,806259	0,232331	3,47	0,001	0,3508978	1,261619
cons	446145,3	56938,65	7,84	0	334547,6	557743
var(e.RealGDP2mlnUAH)	3,46E+09	1,52E+09			1,46E+09	8,19E+09
var(e.Currencyoutsidebanks1mlnUA)	3,23E+09	1,82E+09			1,07E+09	9,74E+09
var(e.SE)	8,38E+08					

Source: elaborated by the author based on data [21], [22], [23], [24], [25], [26]

From modelling results could be seen that all coefficients are reasonable as their Probability lower than 5% and the null hypothesis of their insignificance could be rejected. After that could be estimated MIMIC coefficients which are used to discover shadow economy level. However, for this purpose also should be used benchmarking, which is disputable method as sometimes for benchmark could be used unreliable data [10]. For benchmarking in this modelling where used benchmark from MOE shadow economy level results in 2010 year which were 36%

[14]. After the benchmarking with coefficients provided from MIMIC estimates the shadow economy level of Ukraine from 2010 to 2019 can be calculated (See fig. 2.6).

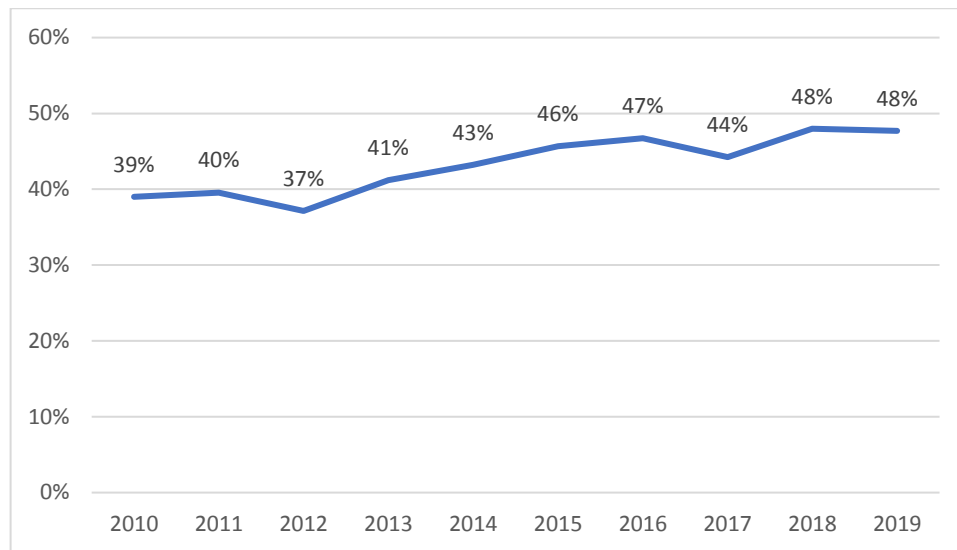


Figure 2.6 – Dynamics of the Ukrainian shadow economy (% of GDP) level estimated by MIMIC model

Source: elaborated by the author based on data [14], [21], [22], [23], [24], [25], [26]

As can be seen from the graph from 2010 to 2019 there was a gradual rise in Ukrainian shadow economy level with few drops in 2012, 2017 and 2019 years. The biggest increase in shadow economy level was from 2017 to 2018 in 3,75%. From this research nearly half of the official GDP is in shadow with 48% in the last two years of research's period.

2.3. Comparing MIMIC model results with official data

In MIMIC modelling there could two ways of model improvement and having other results. First is to try another benchmark for MIMIC model. In this research were used as benchmark data from MOE for 2010 year in which shadow economy level was 36%. It is more appropriate to use official statistics from government because most researchers refer in their researches to official stated data. That is the reason why Professor Schneider research should be an example, not a benchmark.

Second way to improve MIMIC model is to include more variables. Two indicators are more than enough for MIMIC model, but in some cases, it is better to include 3 indicators if 2 are not completely explain and correlate with latent variable. As for causes, their number also could vary from 2 to even 5 or 6. However, they should not be included if they provide low explanation level for the model. The goal of improvement not in quantitative increase, but in qualitative results of the model.

As MIMIC model could be viewed as inappropriate because researchers use different variables and benchmarks providing completely different results. It is still better as it use more causes for shadow economy level estimation than other common methods. MOE results of shadow economy level in Ukraine, which uses integral index method for calculating shadow economy level, could be one of the best sources for comparing the results of MIMIC model from this research (See fig 2.7).

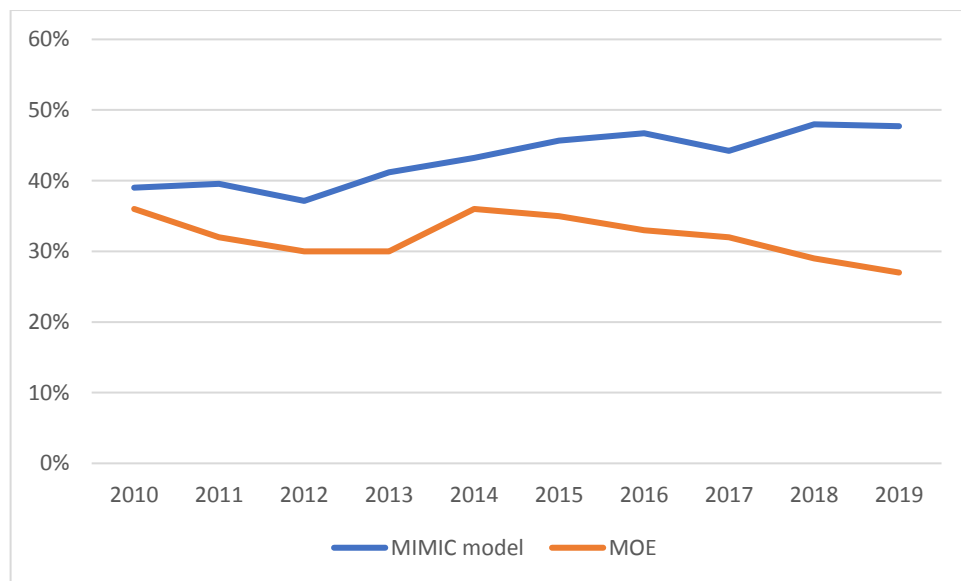


Figure 2.7 – MIMIC model results compared to MOE results

Source: elaborated by the author based on data [14], [21], [22], [23], [24], [25], [26]

For the figure can be seen that results of this research ad MOE differs in shadow economy level estimation in 11% in average. The biggest disparity is in 2019 in 21% and the lowest is in 2010 in 3%. These two results have common trend except period from 2014 to 2016 and 2017 to 2019 years. The reason for such difference could be in that some methods which are used in MOE methodology could vary in results because of data that is why giving another results than MIMIC

model from this research which were used another causes and indicators for measuring shadow economy level.

It is better to compare this research's MIMIC model with Schneider's MIMIC model as they both should be similar as they use some similar variables, but not all of them are the same which could give different results (See fig. 2.8). Moreover, Professor Schneider in his research could use another benchmark for MIMIC model which also influences the results.

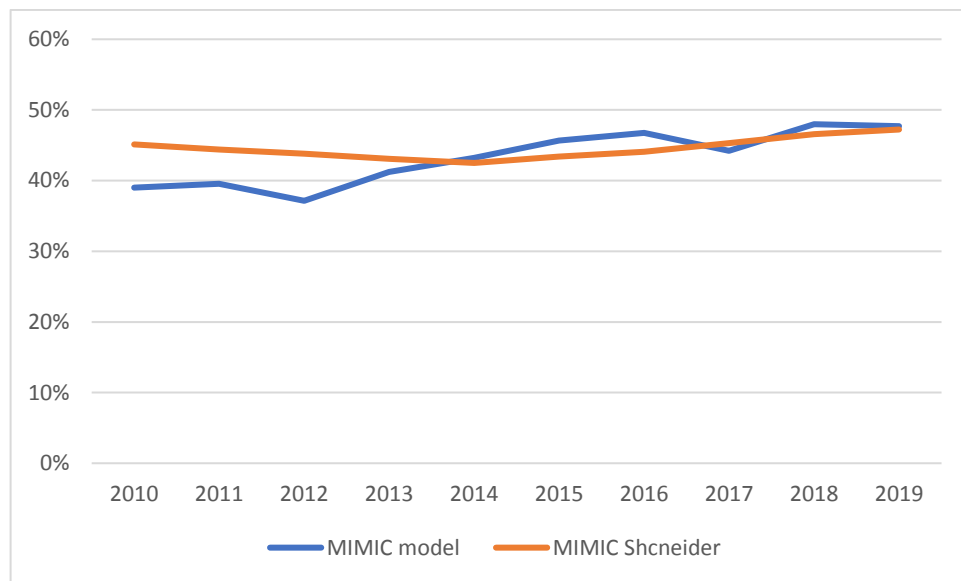


Figure 2.8 – MIMIC model results compared to Professor Schneider results

Source: elaborated by the author based on data [14], [18], [21], [22], [23], [24], [25], [26]

From the figure can be summarized that both models have similar pattern from 2014 to 2019 years. The difference in 2010 to 2013 years could be explained by that Professor Schneider's MIMIC model used another benchmark point probably earlier than this research's MIMIC model. As Professor Schneider had bigger data results started from 2004 [18]. That is why can be concluded that his research used for benchmark 2004 year and results in other years are all estimation from MIMIC coefficients to this benchmark. However, in later years disparity closes between the models which means that they both used similar data and by this data the gap were closed.

From all the results and comparing could be concluded that MIMIC model estimation of this research has satisfactory results as these results close to the results

from Professor Schneider. Nevertheless, the MIMIC model could be improved. The benchmark point should not be changed as it is better to use official sources. However, more causes in the future could be included in the model such as Regulations and their strictness coefficient, which is subjective, but it gives a better explanation for some part of the shadow economy. Average working hours also can be included in the model as they provide information about undeclared work. The lower the official working hours, the more undeclared work is performed [18]. Regarding indicators, their significance in explaining the unobservable variable is enough, so there is no need to include more indicators.

To summarize, the shadow economy in Ukraine is high as it equals more than 1,6 trillion UAH or 47 billion USD, which is a third part of the GDP. These results are due to the MOE estimation of the Ukrainian shadow economy level, which is based on an integral index. As giving the results only from one method such as electricity consumption method or currency method is not reliable because it considers only one cause. It is a better strategy for the MOE to consider all these methods and give the result based on all of them. MIMIC model results from Professor Schneider and this research are higher than MOE results, which can be understood as a difference between data in variables which are used in MIMIC modelling. MIMIC model results give 47% of the shadow economy in Ukraine for the 2019 year, which is half of the official GDP. However, MIMIC results could be disputable as they depend on the researcher's choice of variables to include in the model and which benchmark to use. That is why for a governmental institution it is better to calculate based on other methods but comparing with MIMIC results and considering MIMIC model results from independent researchers.

Chapter 3

Managing Shadow economy

3.1 Tools to tackle with Shadow economy

Tools for overcoming Shadow economy depends on type of shadow activity which needs to be tackled with. However, there are two different types of tools which help to lower and control Shadow economy. It is crucial for countries to remember that the goal is to move economy from shadow to official than to purge shadow economy. Even in shadow it is still part of the economy which helps some certain people and entities and with its falling there could emerge crises events in the economy system of the country. Of course, such activities as drug dealing will not move to the official economy as they are prohibited by the law. In cases where shadow economy could not be moved to the official also exists these two ways from above. Nonetheless, approving of the drug consumption for personal use as an example is implemented in some countries (Poland, Australia, Germany, Italy, Spain...) [28]. It is vague to understand how exactly it affects illegal drug dealing and drug consumption rate, also it is the question of the nation's mentality and morality level. This is an example that even with drug dealing not only fighting it and tighten the law which forbid it are the solution.

Two ways to tackle the undeclared work are direct and indirect tools [28]. Despite professor Williams said this about undeclared work it is also good in describing tools to overcome the whole shadow economy. As in an example above from two ways of eradicating shadow activity and transferring it to the official side, in transferring two sides exists, where one is direct pack of tools and second is indirect pack of tools. Direct tools are concrete and have straight effect on the shadow economy. It has positive and negative reinforcement impacts on the shadow economy (See table 3.1).

Table 3.1 Direct tools in overcoming shadow economy

	Increase of penalties	Increase of supervisions
Negative reinforcement	More fines for performing informal activity for both supply and demand sides. Toughing administrative and criminal responsibility for shadow activities	Increase number of inspections in differ spheres to look for shadow activities. Improve quality level of supervisions.
Positive reinforcement	Decrease taxes and bureaucracy. Increase accessibility of credit and information about how to move in official economy and its benefits.	

Source: elaborated by the author based on data [28]

Negative reinforcement means that people who perform shadow activities are influenced by fear of punishment. It is the reason why they will choose to move to the official economy. Positive reinforcement means increase in attractiveness of the official side and more benefits for making business in it [28].

Negative reinforcement has two major components: increase of penalties and increase of supervisions. Both components have major effect on people's fear because they increase fear of being caught. Increase of penalties focuses on the rise in fines and administrative/criminal responsibility for performing shadow activities. In such case those in shadow have a fear of more cash penalty for their actions or even great criminal responsibility, which forces them to choose official economy. Increase of supervisions concentrates on more detection risk for shadow economy actors. Its idea is in more inspections and improvement on their quality, which make those in shadow fear of being caught. However, both these elements could negatively influence on shadow economy or have no effect. In situation when quality of institutions is low, corruption is high and people's trust to the system is low, then such direct tools have no impact.

Positive reinforcement also has two components, which could be defined as one: curative measures and preventive measures [29]. Preventive measures are about preventing people of performing shadow activities mostly in tax reduction or

bureaucracy reduction way. It is helpful if country has high taxes and documentation complexity, so people do not want to spend time for paperwork and paying high taxes. Nevertheless, in most countries it is not the reason of high shadow economy and such changes will not decrease shadow economy. Curative measures mean that government attract people to official economy by showing its benefits and teaching how to deal with documentary or have a help with funding. However, as in previous situation in most occasions this is not the primary reason for performing shadow activities.

It is also a solution to make both negative and positive reinforcement changes together. It will increase benefits of moving to official economy which will be presented by government and increase punishments for those who will not want to do it. Although direct tools have some impact on shadow economy, the main problem is that they are not fight against reasons of shadow economy, but mostly against consequences of the shadow economy. That is why impact is so low.

Another way to overcome shadow economy which exactly hits its reasons is indirect tools. Indirect tools mean change quality of institutions increases “horizontal” and “vertical” trust in country [30]. Quality of institutions in most occasions could be the reason of high occurrence of shadow activities because it affects corruption, low quality institutions mean that they are corrupt. In this case lowering the corruption will lead to decrease in shadow economy. “Horizontal” trust means the level of trust among common people of non-performing shadow activities. For example, if people believe that low percentage of citizens perform shadow activities then they have lower probability of going to shadow. However, when people know that most of them perform shadow activities and work in shadow then they have high probability of moving to shadow. “Vertical” is similar to “horizontal” but means level of trust to government and institutions. With high trust in institutions and government people tend to stay in official economy. Ways to change “horizontal” and “vertical” trusts are improve tax morale and tax education of citizens. A website or special service which make public reports to where money from taxes go also is a solution [28]. Mostly increase both trusts mean change

mentality and behavior of citizens, which is secured but long process. That is why there will be no fast results.

To conclude, direct and indirect tools both help to tackle shadow economy. However, direct tools are fast in implementation, but low in results as they overcome consequences of shadow economy. Whereas indirect tools are long term, but they have a high effectiveness when they start to work. It is a question of situation in which tools should be implemented. Both could be effective in different countries and occasions.

3.2 Impact of direct and indirect tools on shadow economy (System Dynamics model)

As it was said above direct and indirect tools differ that they help to cope with consequences and reasons of the Shadow economy and their term of implementation. However, it is disputable which tools are better to implement and in which occasions they give the maximum result in overcoming shadow economy.

Below the effectiveness of direct and indirect tools will be tested in System Dynamics modelling process by Shadow economy part – undeclared work. As were stated before Professor Williams concerned primarily not about whole Shadow economy but about its part undeclared work. Nonetheless, his concepts fit for implementation to whole Shadow economy.

First is to create the Causal loop diagram which will recreate links between variables in model and show the whole structure of the model (See figure 3.1).

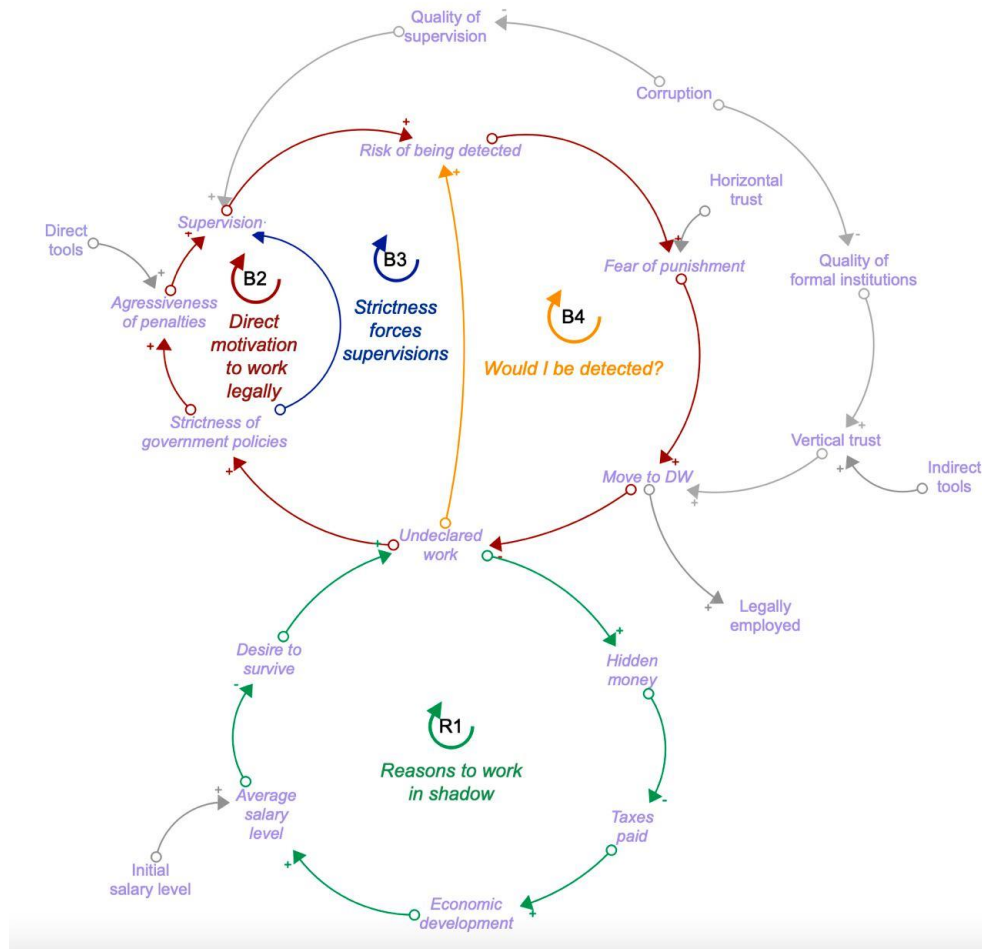


Figure 3.1 – Causal loop diagram for undeclared work in Ukraine

Source: elaborated by the author based on data [31]

There are 4 loops in model which represent reasons to work in shadow and motivation to move from shadow to official. First loop R1 is reinforcing loop which shows reasons to work in shadow, which mostly consists of money benefit. B2 loop is balancing and how direct tools motivate (force) to work officially. B3 is also connected to B2 as has impact of supervisions in it. B4 loop is about risk of being detected and how it affects the choice of shadow working.

Money reasons of working in shadow concerned taxes which should be paid if working in official economy and average salary level in official economy. People tend to have more money than they could in official economy by performing undeclared work by unpaying taxes [32]. Fear of direct tools, their implementation and changes from indirect tools come in the model as policies for solving the problem. However, mostly direct tools change quantitative aspect, but not the qualitative one.

For the modelling process should be presented historical data which will be recreated by model. For this purpose, were used Ukrainian data of undeclared workers (See figure 3.2)

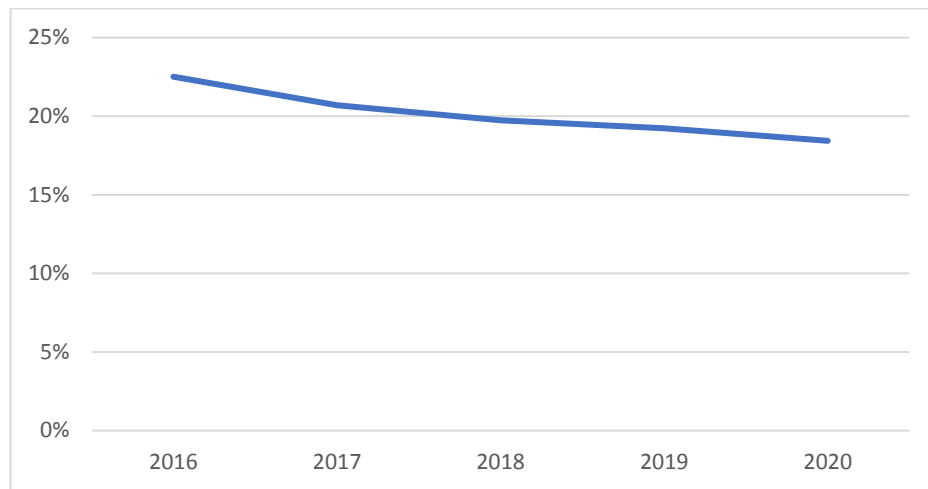


Figure 3.2 – The dynamics of undeclared work level in Ukraine

Source: elaborated by the author based on data [33]

From the graph could be seen that undeclared work in Ukraine decrease slowly from 2016 to 2020, which could be due to many reasons mostly due to deshadowing reforms. In average every fifth employee is working informally. This is where the question which tools will help tackle this problem better occur.

From the modelling process were tested 3 different approaches (See Appendix A). First was about implementing only direct tools which consists of fines and supervisions increase. This implementation gave immediate result in lowering undeclared work under historical value, but after few years it recreates fully the historical graph. That means direct tools only short-term solution which most likely will not last long.

Second approach was implementing only indirect tools which consisted of tax education and “vertical” trust increase. In this occasion model showed that only after 4 years there could be seen slight results of these policies. Therefore, more broad examination of indirect tools should be implemented in the future.

The last approach was the most successful as its purpose in compounding direct and indirect tools and their effects. These methods complement each other in such way that direct tools work in the begging of implementation and then are fixed

by indirect tools as they start to work as well. It is the best strategy to implement both short-term and long-term tools which affect undeclared work through all periods.

Considering Shadow economy, for shadow economy activities both tools for tackling shadow economy as for undeclared work as its part should be implemented by government to have the maximum effect on the lowering shadow economy. However, it is hard to consider in which way indirect tools should be implemented and much easier to calculate how direct tools should be made. Both have positive effect and dependable on the circumstances in the country and certain sphere which they will affect.

3.3 Ukrainian policies to lower Shadow economy level

For Ukraine question of overcoming Shadow economy is crucial as third part of its GDP is in shadow. In 2021 by Ukrainian government were created special committee to tackle Shadow economy problem [33]. Moving shadow sector to the official will give benefit to the Ukrainian economy and will improve trust level in Ukrainian economic system, which will lead to increase in investments.

Strategies for fighting against Shadow economy differ on liberal, conservative, radical, and tackling corruption [36]. While tackling corruption consider only corruption, other methods describe how to tackle with all shadow sectors. In tackling the corruption is described ways to tackle corruption with tough criminal punishments for performing it. It will benefit the economy by increasing level of investment attractiveness and trust to the system. In Ukraine already exists National anti-corruption bureau of Ukraine which cope with this problem.

Conservative strategy of fighting Shadow economy means fight illegal side of shadow economy and corruption. It proposes tough punishments and methods to tackle with this problem. However, it is not helping with other shadow economy sectors, focusing only on one illegal sector. This also helps to implement such strategy as it is not complex.

Radical strategy considers eradication of all shadow activities by all possible methods. It is the worst option as it destroys part of the economy, not transferring it. With such strategy could be such consequences that crises will occur, and high level of inflation and low GDP growth will be in place.

Liberal strategy is the best option for transferring shadow sectors to the official economy. It suggests controlling spheres with the highest level of shadow economy and focus on them. It helps to control level of shadow economy and decrease it slightly by moving it to the official economy by parts. These are the reasons why this strategy should be implemented to tackle shadow economy.

Same said ex-minister of Ukrainian economy Oleksiy Lubchenko. He suggested that Ukraine should focus on Shadow economy in financial and tabaco spheres.

The best strategy for minimizing shadow activities is to provide environment where will be minimal use of cash. By increasing electronic payments among customers and merchants shadow activities will lower as they mostly use cash than electronic payments. Moreover, controlling the amount of electronic payments institutions could track shadow activities. Attracting Supply side to have POS-terminals as mandatory also will help to lower shadow payments [36].

In Ukraine laws about POS-terminals usage and limited electronic payments or transactions. Law about mandatory POS-terminals and registry of payment transactions was obliged Ukrainian individual proprieties to have POS-terminals to provide their clients with possibility of electronic payments [37]. However, this law has some negative feedback from public as some private entrepreneurs do not sell anything to the clients physically, especially in IT-sector. Even with this miscalculation this law provides right future path for deshadowing Ukrainian economy as it spreads electronic payments among Supply side.

Another law in Ukraine which were implemented in 2017-year control electronic payments stating that payments between households could not exceed 10 000 UAH and households to private entrepreneurs could not exceed 50 000 UAH [38]. This law regulated payments among households and private proprieties in

Ukraine. These law helps to control Shadow economy in the way that all payments between stated sides of the law which exceed certain amount are forbidden in both electronic and cash equivalents.

One of the recent laws in Ukraine which prohibit electronic transaction between individuals with more than 5 000 UAH [39]. Of course, it has additions as relatives could transfer to each other more than stated in this law and in some cases where it is about buying goods or services is also allowed. This law is also concentrated on countering funding of terrorism and weapon of mass destruction. It is acting in two spheres of Shadow economy; one is undeclared work which was entering by regulating transaction amounts between unrelated people. Another sphere is illegal economy in which where affected terrorism funding and selling of weapons.

Ukraine also use indirect tools to change its Shadow economy level. Mostly It focuses on attracting people to work as private entrepreneurs, which categorized in Ukraine by 4 categories. Those categories mostly divided by revenue from operations and amount of people which may be employed by private entrepreneur. One more thing which differs private entrepreneurs in Ukraine is taxation, for each category there is different taxation rate.

Ukraine is trying to overcome its Shadow economy by implementing new laws, reforming institutions, and concentrating on certain problems, which helps to identify the weakest spots and reform them first.

To conclude, best ways to fight Shadow economy is to implement direct and indirect tools. By changing fines and supervisions the short-term effect on Shadow economy will occur, which then will be reinforced by long term effect from indirect tools. Focusing not only on consequences, but on reasons of the Shadow economy will help effectively lower it and increase official economy. It is har to evaluate which indirect tools should be implemented and how wthey will influence economy in the future. However, high Tax morale of citizens, high “vertical” and “horizontal” trusts will help to eradicate consumption of shadow products and services, which will lead to mass moving to official economy. In Ukraine there is already

implementing laws as direct tools which make it difficult to perform shadow activities. Mostly Ukrainians deshadowing strategy focusing on increasing electronic payments as they are trackable and could be easily controlled by institutions such as Tax service. Moreover, Ukraine concentrates on implementing indirect tools by easing the procedure of becoming private entrepreneurs, which attract people to perform in official economy.

Conclusions

In this thesis work it was determined definition and nature of Shadow economy, different methods of shadow economy level estimation, modelled MIMIC model for Ukraine and compared with other methods results, determined which tools are better for overcoming Shadow economy and which deshadowing methods were implemented by Ukrainian government.

In first chapter of this work Shadow economy was defined as hidden part of the economy which violates laws and regulations. Reasons for performing shadow activities could be different and mostly depend on the society. However, Shadow economy differs with legal nature of it and payments methods of shadow transactions. Different methods for shadow economy level estimation exist, all of them have their advantages and disadvantages. One method which includes more variables than other. Thus, it has more significance in explaining shadow economy level by including various reasons and indicators is MIMIC modelling. This method could be disputable because different variables can be included, so different results may occur with every new variable. Measurement of Shadow economy is needed because it helps to prevent disastrous effects of Shadow economy in time and give more understanding to which strategies to cope with Shadow economy should be used. Ignoring Shadow economy could make a great damage to economical and societal system in country.

In the second chapter were performed MOE results for shadow economy level in Ukraine by different results and Professor Schneider's MIMIC model results. From which can be concluded that shadow economy level in Ukraine is high but vary depending on used methodology. By making MIMIC modelling for Ukraine in this thesis work where used two cause and two indicators for the latent variable. Model improvement of data helped to gain reliable results, which were compared to MOE results and Professor Schneider's results. Comparing to MOE there is a difference if results mostly because different methodology and variables were used in each research. As for Professor Schneider's MIMIC model its results were similar

to the results of this thesis work research with slight difference which could be explained by different benchmarking usage.

In the third chapter of this thesis work were examined which tools are better for overcoming Shadow economy. From two sets of tools: direct and indirect, both are different and thus have different impact on shadow economy. Direct tools are short-term and concentrate on change of laws, while indirect tools are long-term and focus on societal and institutional change. By examining both sets of tools were concluded that best option to use both sets of tools to tackle Shadow economy, because it will give much more results than using only one of them. Ukraine is implementing deshadowing strategy focusing on spreading electronic transactions and regulating them. Ukrainian government also attracts people from Shadow sectors of economy to move to the official economy by working with status of individual proprietor. These strategies are helpful in fight against Shadow economy and best in them is that Shadow activities are transferring from shadow to official side.

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Appendix A

The System Dynamics of Undeclared Work in Ukraine

