

The Shadow Economy: How to Measure and Model It

1. Introduction

“Shadow economy” and “informal economy” are only two of the terms used to denote a real socio-economic phenomenon the dimensions of which can be observed in various forms and to a varying degree in the economy of each country¹. Over the recent decades, the occurrence of the “shadow economy” has featured high on the agenda of numerous social groups and international organizations seeking how to measure the “hidden, illicit, informal, parallel, black or shadow” economy in their efforts to bring forward its public “identification” and to generate a public debate on the measures needed to curb and prevent it.

The negative effects resulting from the expansion of the informal sector are abundant and multi-faceted; therefore it is particularly important for them to be identified and minimized. The growth of the European market of electronic payments in all sectors for the last few years offers an opportunity to create the desired link that could substantially reduce “parallel” cash flows. This analysis sets itself the task of decomposing the term “shadow economy” down to its component parts and indicators, presenting different approaches to the measurement and modeling of this phenomenon, and outlining initiatives to reduce the “black” market through electronic payment systems.

2. Definition of the Term “Shadow Economy”

In order for the shadow economy to be measured it has to be clearly defined. One of the most common definitions of the term reads as follows: *“market-based production of goods and services, whether illegal or legal that escapes detection in the official estimates of the GDP”*.

At the personal level, a kind of measurement of the shadow economy could be the drastic change of the socio-economic status of individuals; at the macro-economic level,

¹ Kumanova A., Manolov V., *The Concept of Shadow Economy – Main Approaches to Its Statistical Estimation*, *Statistika Journal*, No. 2 of 1996 (in Bulgarian)

it could be the observance of atypical trends, such as growth rates in the consumption of goods and services, investment growth rates or the increased amount of money in circulation in stark divergence from the trends observed in the officially declared income levels. An example of the latter indicator is the discrepancy between the officially declared wages and salaries² in Bulgaria and the vigorous growth of consumer lending over the period from 2007 to 2008 (70 to 100 percent of approval of loan applications)³, which could not possibly take place because of the inability to repay loans regularly.

When the term “shadow economy” is defined, the following definitions are typically used: **the fiscal definition, the market definition, the legal definition, and the statistical definition**⁴.

- **Fiscal definition** – it confines the informal sector to activities which contravene tax regulations and fail to be reported by financial authorities. Examples of such activities are the hiding of sales by a company from the fiscal authorities, the false bookkeeping, or the sale of undervalued real estate.
- **Market definition** – it focuses on the difference between payable and non-payable services. From this perspective, the informal sector covers unregistered activities and undeclared labour against additional payment. Such activities are considered to be parallel to declared labour but outside its scope.
- **Legal definition** – it encompasses all activities conducted in contravention of the law. Its scope covers the trade in stolen vehicles and goods, drug trafficking, corruption practices, and money laundering.
- **Statistical definition** – it discerns those activities which should be reported in official statistics but they are not. The portion of the economy on which statistical data is completely lacking is viewed as hidden and it is not subject of statistical studies. Its scope includes the economy which is characterized by unwillingness to be put under observation, as well as that part of the formal economy which cannot be studied due to the lack of relevant data.

3. APPROACHES TO THE MEASURING AND MODELLING OF THE SHADOW ECONOMY

3.1. The Currency Demand Approach

² According to the National Statistical Institute, the average wage was BGN 544 in 2008.

³ BNB data.

⁴ Stoyanova K., Kirova and Kirova A., *Social Challenges of the Shadow Economy*, Gorex Press, Sofia, 1999; Kumanova A., Manolov V., *The Concept of Shadow Economy – Main Approaches to Its Statistical Estimation*, *Statistika Journal*, No. 2 of 1996 (in Bulgarian)

Measuring the shadow economy on the basis of the currency demand is an indirect macro-economic approach to the study of the phenomenon. The approach was first used by Cagan in 1958 who calculated correlation of the currency demand and the tax pressure (the two being major causes of the shadow economy) in the USA over the period from 1919 to 1955. Tanzi further developed the approach by making an econometric estimate of the total money in circulation in order to calculate the level of the shadow economy. The underlying assumption is that “hidden” transactions are undertaken in the form of cash payments, so as to leave no observable traces. A high currency to total money ratio is a sign of extensive shadow economy. The impact of conventional factors such as income growth, payment habits or interest rates is excluded from the estimate. This approach takes into account such variables as direct and indirect taxes and government regulation of the tax system, which turn out to be the main drivers of the growth of the informal sector.

3.2. The Physical Input (Electricity Consumption) Approach

The measuring of the shadow economy by tracing out the changes in the electric-power consumption was first introduced for Cuba and the USSR by Kaufmann and Kaliberda in the 1960's. That approach is applied primarily in transition countries where official statistical estimates are either lacking or seriously doubtful. The major assumption is that, in any country, the electricity to GDP elasticity should be close to one. The underlying hypothesis is that the growth of total electricity consumption is an indicator for the growth of official and unofficial GDP. The accuracy of the classical version of this analytical approach is potentially vulnerable as it ignores potential changes in consumption due to the introduction of new higher technologies.

3.3. The Formal Economy Index

The efforts to identify a measure of the shadow economy and to estimate its size led to the introduction of the “formal economy composite index” in Bulgaria in May 2011 within the framework of the Restriction and Prevention of the Informal Economy project carried out by the Association of Industrial Capital in Bulgaria with financial support from the Human Resources Development Programme. The index measures the formalization rate of the economy and its increase is a sign of the shrinkage of the shadow economy.

The index consists of two major component parts: a statistical part (VAT, money supply, number of employed people, excise taxes, foreign trade) and a sociological part (companies and employees). It is made up of ten elements the changes of which exert impact on the economy:

- Average duration of the working week;
- Average number of new applications filed by unemployed people;
- Amount of new orders placed with manufacturers of consumer goods and materials;
- Time limits for the delivery of new goods to traders by suppliers;
- Amount of new orders for fixed assets in the defence sector;
- Number of new house building permits;
- Capitalization of stock exchange indexes;
- Money supply (M2) adjusted for inflation;
- Long- and short-term interest rate spread⁵;
- Consumer expectations.

The composite index, in its entirety, provides representative information on the trends and challenges in the restriction of the informal economy.

3.4. *Empirical Models for Analysis of the Shadow Economy*

A. Structural Equation Model for Corruption and Shadow Economy

Unlike the foregoing models used to estimate the shadow economy, empirical models offer an opportunity to analyze the shadow economy and corruption, as well as their interrelationship. Empirical models study a wide range of potential causes and resulting effects of the two phenomena observed at the macroeconomic level.

These models build on the **structural equation model for corruption and shadow economy**⁶. The equation is based on the hypothesis that the reduction of corrupt practices substantially improves the quality of the economy and is immediately reflected in the signs of the shadow economy and also on the understanding that economic development policies would be inefficient if the reciprocal relationship between corruption and the shadow economy is not addressed⁷.

The structural equation model (SEM) provides the empirical equation needed to trace out the relationship between the two phenomena, presenting them as two different latent variables and examining their interrelationship with co-variation structures. The

⁵ The difference between the interest rates negotiated by commercial banks for the loans they approve and the payments under borrowed resources; the difference between the interest rate negotiated by the bank and the base interest rate.

⁶ Andreas Buehn and Friedrich Georg Schneider, Institute for the Study of Labor (IZA), <http://ftp.iza.org/dp4182.pdf>

⁷ Many international organizations such as the World Bank require from developing countries to have active anti-corruption practices, building on this hypothesis.

SEM consists of two parts: a structural equation and a measurement model explained in detail in Appendix 1.

B. The MIMIC Model

The statistical model MIMIC⁸ (multiple indicators, multiple causes) is a variety of the SEM used in estimating the size of the shadow economy, which makes it possible for the effects contributing to the development of per capita e-payments to be controlled for.

The model is a particular linear structural regression model which consists of observable and unobservable variables and specific causal relationships among the unobservable variables. Simulation is applied to the MIMIC model to trace out the average change of indicators over a period of n consecutive years and the results are transposed for a future period of n years so that to calculate various scenarios for the development of the behavioural pattern. Thus the analysis of an emerging or an existing trend becomes specific and reference values are characterized by high precision levels.

The main component parts of the MIMIC model are as follows:

- 1. Cash** – a major assumption in most studies of the shadow economy is that a considerable portion of informal transactions are carried out in cash so that to prevent detection, i.e. the money supply is a potential accurate indicator of the shadow economy. The money in circulation is a variable which is typically calculated through the levels and dynamic patterns of the money aggregates M0, M1, M2 and M3⁹. All money aggregates tended to grow in Bulgaria from 1998 to 2007. Within the framework of the currency board arrangements, the central bank does not have powers to control the money supply and the growth of money aggregates and therefore any increase can be correlated only to the real money demand in the country.
- 2. Real GDP** – a reference variable is needed in estimating the shadow economy so that to set a measurement scale. The real GDP reports the actual volume of economic performance since it represents the nominal GDP adjusted for inflation.

The graphic representation of the MIMIC model is given in Appendix 2.

⁸ The first to apply the model to the estimation of the shadow economy were Frey u Weck-Hannemann (1984)

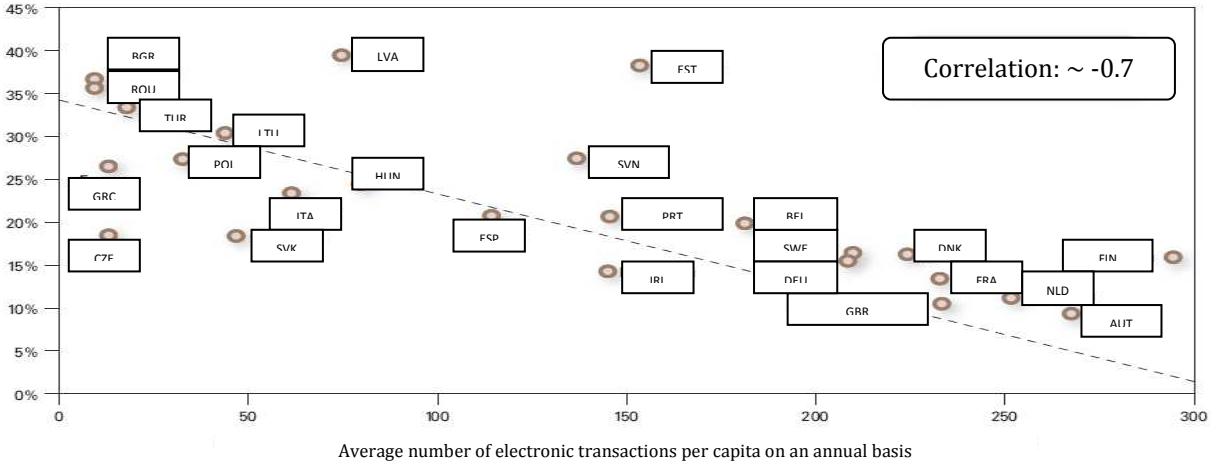
⁹ The money aggregate M0 includes the money in circulation – physical cash and coin outside banks. The official statistics in Bulgaria does not discern it as a separate indicator, although it is an integral part of M1. The money aggregate M1 provides information on “highly liquid money”. M2 determines the condition of “medium money” and M3 stands for “broad money”.

4. THE IMPACT OF ELECTRONIC PAYMENTS ON THE SHADOW ECONOMY

The establishment of a payment system and electronic financial solutions for each business entity is a common measure used to remove cash payments from the economic cycle and to replace them by an integrated system of registered payments, so as to gradually reduce and eliminate cash payments and the related anonymity of the payer and the payee.

Figure 1 illustrates graphically the correlation between the level of development of electronic payments and the percentage of the shadow economy in the EU Member States.

Figure 1. Correlation between the Size of the Shadow Economy and the Average Number of Electronic Transactions Per Capita in the EU



Note: EU-27 (no data available for Cyprus, Luxembourg and Malta) plus

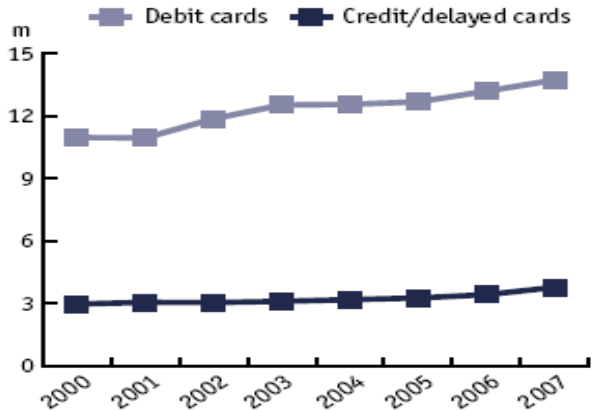
- | | | | |
|----------------------|----------------------|-----------------------|----------------|
| AUT – Austria | BEL – Belgium | BGR – Bulgaria | DNK – Denmark |
| EST – Estonia | FIN – Finland | FRA – France | DEU – Germany |
| GRC – Greece | HUN – Hungary | IRE – Ireland | ITA – Italy |
| LVA – Latvia | LTU – Lithuania | POL – Poland | PRT – Portugal |
| ROU – Romania | SVK – Slovakia | SVN – Slovenia | ESP – Spain |
| SWE – Sweden | CZE – Czech Republic | NLD – The Netherlands | TUR – Turkey |
| GBR – United Kingdom | | | |

Belgium is among the countries with the best developed market in terms of electronic payments; it adopted a centralized electronic payments system as early as 1974 with the introduction of the Centre for Exchange and Clearing (CEC), a subdivision of Belgium’s central bank. The CEC is intended mainly for transactions of individuals and it serves money transfers in the amount of up to EUR 500 thousand, checks worth up to EUR 50 thousand and all transactions carried out with debit or credit cards.

According to the National Bank of Belgium, the CEC accounts for 99.75 % of the total volume of inter-bank payments within the country. In 2007, the CEC reached four million payments a day on the average. Electronic payments in the consumer segment are the most important tool for the management of 42.8 % of almost 2.099 billion cash-free payments in the banking system. The number of credit cards increased from 10.96 million to 13.72 million over the period from 2000 to 2007, which represented an average of 1.32 cards per Belgian citizen.

Figure 2 reveals the trends in the issuance of debit and credit cards in Belgium (2000-2008). In 2008, Atos Worldwide, the main system servicing all ATM devices and POS terminals in Belgium, reported a growth rate of 7.9 % in the volume of transactions. The value of transactions also increased by 14.6 % over the period from 2005 to 2007.

Figure 2: Number of Debit and Credit Cards Issued in Belgium (2000-2008)



Source: European Central Bank

A study of the specialized electronic payments system VocaLink attempted to estimate the economic benefits of a real-time payments system in Belgium. Benefits were grouped together into five categories:

- ✓ reduced costs of managing transactions;
- ✓ switching to more efficient transactions;
- ✓ reduced number of failed payments;
- ✓ fraud prevention;
- ✓ greater advantages for consumers.

The study examined “a baseline scenario” in which Belgium refrained from a decision to introduce a real-time electronic payments system and a second alternative scenario in which the government introduced such a system in 2010. The former hypothesis revealed a steady growth in the transfer of loans, direct debit payments and the debit

card market prior to the introduction of a mandatory electronic payments system. In the latter scenario, the introduction of real-time payments substantially restricted the acceptance of check payments but steadily increased the volume of electronic payments.

Other countries, too, introduced policies based on electronic payments:

- Italy, where the Decreto Bersani law of 2006 envisaged imprisonment of up to five years for any retailer failing to issue a cash receipt;
- In the beginning of 2010, Russia, the United Kingdom and Singapore joined the group of countries effecting their government payments only electronically, including the payment of wages and salaries in the public sector, social benefits, fines and taxes all the way to the payments under public procurement contracts;
- Albania followed suit and reported over 7 % decrease of cash transactions and more than 5 % increase of its gross domestic product in 2010;
- The Mexican government established a special fund to support small retailers in the purchase of POS terminals;
- Columbia and Argentina introduced discounts on the profit tax charged on sales carried out with payment cards.

The potential of pre-paid cards and virtual cards becomes increasingly visible in the EU countries as they become an ever more preferred way of paying and using the bank payments system. The initiatives for development of little value payment (LVP) technologies and contactless payment underpin the strategic alternative to cash payments in the Netherlands and Italy.

The security of electronic payments is guaranteed through the applicable verification methods, the entry of a personal identification number upon the physical presentation of the card, the card validation code (CVC2) in online payments, and additional security codes provided by card organizations depending on the type of card product. The online and mobile banking offer access to updated information and traceability of all transactions, account balances and options for immediate payments.

Bulgaria's Initiatives to Fight the Shadow Economy

In the beginning of 2011, Bulgaria undertook legislative initiatives to restrict the shadow economy by adopting the Cash Payments Restriction Act (CaPRA)¹⁰ which entered into force on 26 February 2011. Thus the legislature laid down the terms and conditions for

¹⁰ Cash Payments Restriction Act promulgated in *The State Gazette*, No. 16 of 22 February 2011.

restricting cash payments within the territory of the Republic of Bulgaria. The new legislative measures are expected to reduce the informal sector in the national economy by promoting the reporting of real turnovers and, at the same time, by using the opportunities of the developed banking system. Similar statutory provisions exist in a number of EU Member States, e.g. France, Belgium, Italy and Luxembourg.

The chapter on the subject-matter of the new law reads that “any payment within the territory of Bulgaria in the amount of or exceeding BGN 15 thousand shall be effected only through the banking system, i.e. through a bank transfer or deposit to a payment account”. The law further envisages “gradual switch of the collection of revenues and other receivables from budget-supported undertakings to card payments. The banks servicing card payments shall sign contracts with the Ministry of Finance”. The law specifies the fines for non-compliance in the amount of 25 % of the total payment for individuals and 50 % for legal entities. The position of the European Central Bank with regard to the restrictions on cash payments in Bulgaria is particularly encouraging in the light of the policy established in the new Member State to restrict the shadow economy and to take preventive measures against money laundering.

The amendments to Ordinance No. 3 on the measurement of excise goods, which entered into force on 19 February 2010, contributed to the “formalization” of the shadow economy in the field of excise goods, provided for equal treatment of all business entities operating in excise goods and, last but not least, guaranteed the collection of the excise tax. In accordance with this Regulation, taxable persons are required to introduce measuring and controlling devices so that to prevent the delivery and dispatch of unreported excise goods.

The excise goods envisaged in the Ordinance are alcohol and alcoholic drinks, tobacco products, energy products and electricity, such as gasoline, diesel fuel, kerosene, bio-diesel fuel and energy products, coke or coal, and electricity for household and industrial purposes. They are subject to customs control with regard to their quantitative and physicochemical characteristics measured with various devices and systems.

Over the period from January to May 2011, the quantity of cigarettes seized was 134.5 million compared to only about 27 million during the same period of 2010. That was a five-fold increase on a year-to-year basis. Customs officers seized around 3.35 million pieces in May 2010 and over 44.6 million in May this year.

The Excise Taxes and Warehouses Act of 1 January 2006 was amended in the beginning of 2011 and the amendments were promulgated in The State Gazette, No. 19 of 8 March 2011. In accordance with these changes, vehicles used to transport marked fuels have to be equipped with a global positioning system (GPS) device and vessels have to be

equipped with measuring and controlling devices in conformity with the requirements of the Excise Taxes and Warehouses Act and the Measurements Act. Thus the quantities of fuel transported within the territory of the country can be traced from point A to point B. Consumption decline due to the high prices of fuels. Nevertheless, customs authorities reported increased revenues. This fact can be interpreted as a positive effect achieved in the restriction of potential outflow of resources.

In accordance with the latest amendments to Ordinance No. 18 on the Registration and Reporting of Sales on Commercial Premises through Fiscal Devices (The State Gazette, No. 48 of 24 June 2011), all gas stations have been connected to the system of the National Revenue Agency (NRA) since the beginning of this year. 40 new gas stations have been “detected”, while another 400 have been suspended from operation because of failure to connect to the NRA system. A further measure under consideration is the introduction of lever meters in the fuel tanks of gas stations to complement the fiscal devices connected to the NRA system. Early connection to the tax system is required also for the fiscal devices of all commercial premises on which NRA inspectors have observed non-compliance with the procedures for registration, introduction or removal of cash registers. The amendments provide for establishment of the e-connection to the tax administration within ten days of the non-compliance report.

The deadline for connecting all cash registers to the NRA information system is 31 March 2012. The only exception from this rule covers the fiscal devices of pharmacies and grain traders who are registered under the VAT Act. In accordance with the latest amendments to Ordinance No. 18, retailers in pharmaceuticals have to provide for the remote connection of their fiscal devices to the revenue agency by the end of August, while grain traders are required to do so by the end of November 2011.

Commercial banks proposed some additional measures to restrict the shadow economy in Bulgaria through the introduction of e-payments to the government during the discussion at the meeting *Electronic Payments against the Shadow Economy*, including:

- ❖ Payment of wages and salaries and all other types of labour remuneration only electronically (through bank cards or bank accounts);
- ❖ Mandatory cash-free transactions for any payment of goods or services exceeding BGN 1,500;
- ❖ Option for payment of services in the public sector with bank cards;
- ❖ Amendments to the existing legislation in connection with the freedom of every consumer to choose a manner of payment either in cash or with a bank card;
- ❖ Reduction of the VAT due on card-based payments for a specific period of time (one or two years). The amount of the VAT due for this period should be

discussed further by a task force consisting of financial experts, representatives of the government and state agencies, as well as representatives of the banking sector;

- ❖ Statutory incentives for the payment of regular payments, bonuses, vouchers and other social benefits in the form of pre-paid cards so that to enhance the efficiency of payments and to curb “the black market”.

These measures imply that commercial premises should be equipped with POS terminals in order to accept card payments at:

- ✓ hospitals, medical centres, surgeries and dental offices;
- ✓ academic institutions;
- ✓ postal services, branches and offices;
- ✓ offices and customer centres of utility companies;
- ✓ municipal centres and offices for payment of local taxes and fees.

At present, the head of the Public Council for the Restriction and Prevention of the Informal Economy is chaired by Ms. Boryana Pencheva, Deputy Minister of Finance. The Council was set up in November 2009 within the framework of the project *Restriction and Prevention of the Informal Economy* implemented with EU funds by representatives of employers’ organizations and with the involvement of leading national media, government institutions and others.

5. Discussion

The shadow economy affects the state budget adversely and it is in a position to distort some major indicators like growth and unemployment rates or the real GDP. This entails important policy decisions in the public sector, which produce an immediate impact on the social environment and then backfire to the source. Globally, countries can recover their lost revenues from the shadow economy by concentrating payments into integrated electronic systems which provide opportunities for millions of transactions effected at millions of points all over the world at any point of time. The analysis of the prerequisites and indicators of the shadow economy and of its main tool, i.e. cash in circulation, gives grounds to many experts to believe that a major way to fight it is the broader use of electronic payments and the development of electronic technologies.

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Appendix 1: Structural Equation Model for Corruption and Shadow Economy

The model is as follows:

$$\eta = B\eta + \Gamma x + \zeta,$$

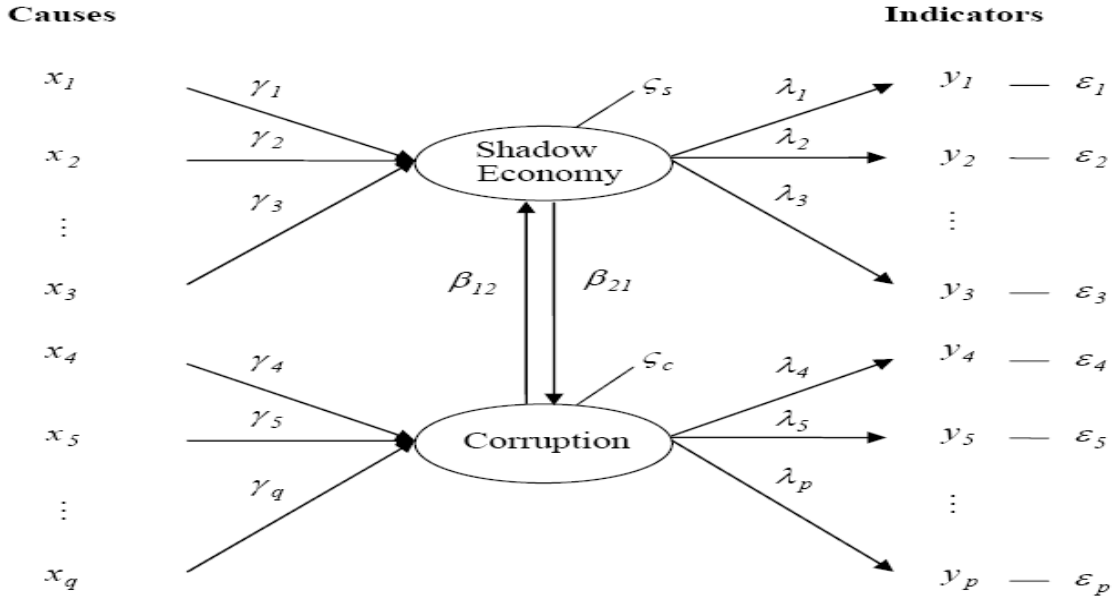
where each x_i , $i = 1, K, q$ in vector $x' = (x_1, x_2, \dots, x_q)$ is a potential cause of one of the two latent variables contained in vector η . The individual coefficients $\gamma' = (\gamma_1, \gamma_2, \dots, \gamma_q)$ in matrix Γ describe the relationship between the latent variables and their causes. Each latent variable is determined by a set of exogenous causes. Vector ζ represents the unexplained components, the covariance matrix for which is abbreviated by Ψ . Φ is the covariance matrix of the causes. Matrix B shows the influence of the two latent variables on each other, i.e. the influence of the shadow economy on corruption and vice versa.

The measurement model links the two latent variables to its multiple observable indicators with the assumption that the latent variable determines its indicators. The model is as follows:

$$y = \Lambda\eta + \varepsilon,$$

where $y' = (y_1, y_2, \dots, y_p)$ is the vector of indicators for corruption and shadow economy, Λ is a matrix of regression coefficients, ε is a vector of white noise disturbances.

The testing of the hypotheses about the theoretical relationships between the latent variables and their causes and indicators facilitates their practical analysis.



Appendix 2: Graphic Representation of the MIMIC Model

This is a graphic representation of the inverse proportionality in the relationship between the growth of electronic payments and the reduction of the shadow economy through the introduction of cash-free payments. Each five-percent increase of cash-free payments yields a three-percent reduction of the shadow economy on the average.

