

# Estimation The Size of The Parallel Economy In Tunisia: An Analysis With The MIMIC Approach

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**Abstract:** Despite making significant progress in its political democratic transition, Tunisia remains highly vulnerable to economic shocks. The growth rate is too low and unable to reduce high unemployment, and the budget and current account deficits are large, inflation has increased and the population is very unhappy with the economic situation. Indeed the growth rate stood at 2.6% during the third quarter of 2018 against 2% in 2017 and 1% in 2016. The fall of the dinar worsens further, the exchange rate reaches 3.434 D for 1 Euro and 3.042 for 1 Dollar during the month of December 2018. This sharp depreciation of the dinar is due to the decline in exports, as well as to the shock of the revolution which has resulted in the explosion of the parallel sector and the massive importation of consumer products. This situation has also caused a budget deficit of 6.7% of GDP in 2017, to reduce the state acts mainly through tax measures for example by increasing the rate of VAT by 1 point. Public debt and external debt rose to 73% and 80% of GDP, respectively. Currency reserves continued to shrink to less than 80 days of import in March 2018. Inflation in turn accelerated to a record 7.1% in February 2018.

The objectives of this article are firstly to estimate the size of the parallel economy in Tunisia over the period 1985-2014, by using MIMIC's approach to model the existing relationships between the various variables. The second objective is to study the existing relationships between the unemployment rate and the size of the parallel economy. The causality test which is used is that of Toda and Yamamoto to determine the sense / direction / meaning of causality between the two variables.

The empirical results show that the unemployment rate, the fiscal burden, and the consumption expenditure are the main factors for the development of the parallel economy in Tunisia. Besides, Toda Yamamoto's test of causality indicates a one-way relationship ranging from the unemployment rate to the size of the parallel economy.

**Keywords:** Parallel economy, unemployment rate, MIMIC model, Toda Yamamoto's causality test.

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## 1 INTRODUCTION

The Measurement of the size and the development of the parallel economies, in countries under transition has been undertaken since the late 1980s based on the work of Kaufmann and Kaliberda (1996), Johnson and al. (1997) and Lacko (2000). While studying the development of the parallel economy, the empirical works suggests two important factors: the reduction of official working hours and the influence of the unemployment rate.

Enste (2003) points out that the reduction of working hours and early retirement, increases the number of hours worked in the parallel economy. In Italy, Bertola and Garibaldi (2003) present the hypothesis stating that an increase in the social burden can have an impact on the size of the parallel economy. Moreover, Boerie and Garibaldi found a strong positive correlation between the average unemployment rate and the informal employment in 20 Italian regions during the period 1995-1999.

Dell'Anno and Soloman (2006) found a positive relationship between the unemployment rate and the parallel economy using a SVAR analysis.

This article aims to estimate the size of the parallel economy in Tunisia and to examine its causal relationship with the unemployment rate, using the MIMIC (multiple indicators and multiple causes) model.

After recalling the definition and methods of measuring the parallel economy in the first section, we present in the second section, the MIMIC approach for the estimation of the size of the parallel economy in Tunisia for the period 1984-2014. In the third section, we present the results of our model. In the last section, we study the relationship between the unemployment rate and the parallel economy in Tunisia using the Toda-Yamamoto approach.

## 2 Definition and measures of the parallel economy

### 2.1 Definition of the parallel economy

The first obstacle to the study of the parallel economy lies in the definition itself. Indeed, there is no single definition, according to Feige (1989), it "consists of those economic activities and the income derived from them that circumvent or otherwise elude government regulation, taxation, or observation".

Smith (1994, p.15) presents four alternative definitions of the shadow economy ranging from a narrow definition; "marketbased production of legal goods and services that escapes detection in the official estimates of GDP", to a broad definition; "market-and non-market-based production of goods and services, whether legal or illegal, that are beyond detection or are intentionally excluded from official GDP estimates".

According to the United Nations System of National Accounts (SNA 1993, Para 6.34), the shadow economy (called the underground economy) "consists of activities which may be both productive in an economic sense and also quite legal (provided certain standards or regulations are

complied with) but which are deliberately concealed from public authorities (e.g. to avoid the payment of taxes and/or social security contributions or to avoid meeting certain standards or administrative requirements)".

Due to the different definitions of the parallel economy and its unobserved and hidden nature, it is difficult to obtain precise estimates of its size in the economy, and according to Schneider and al (2010) "Research in this field can be considered a scientific passion to know the unknown".

### 2.2 Methods of measurement

Because of its secret nature, the parallel economy is a difficult phenomenon to measure. It is therefore not surprising that the estimates of the extent of underground activities vary considerably depending on the method used to assess it. However, over the last two decades, considerable progress has been made in measuring the phenomenon and several sophisticated methods have been proposed. On the one hand, there are indirect methods based on macroeconomic assumptions that link the phenomenon to observable variables, and on the other hand, direct methods that seek to quantify the underground economy from microeconomic data. Indirect methods include, in particular, the monetary approach and the so-called latent variable approach (MIMIC), while the direct approach includes studies based on household surveys (employment survey or budget-consumption survey), Company survey (affiliation to the CNSS, declaration of fiscal existence) and the mixed survey or tax audit data.

The currency approach assumes that all transactions in the black are settled in cash (Gutman (1977), Feige (1979), Tanzi (1983) ...). In its simplest form, this approach also assumes that there is a base year during which the underground economy was non-existent. The rise in the demand for cash over bank deposits over and above the traditional macroeconomic variables over the years, serves to assess the growth of the parallel economy.

Another indirect approach of macroeconomic type is the latent variable method, instead of directly estimating the size of the (unobservable) underground economy according to a number of explanatory variables (fiscal pressure, regulatory index, Unemployment rate, inflation, consumer spending, etc.), a model is estimated to be linking these explanatory variables to some indicators of the economy. By imposing a normalization rule and setting the size of the parallel economy to a specific value for a base year, it becomes possible to predict its evolution over the period of the study.

## 3 Modeling of structural equations: The MIMIC model

In this section we will try to model the parallel economy using the model multiple indicators and multiple causes, a particular case of systems of structural equations. An econometric method for unobserved variables was used to circumvent these problems. This approach is based on the idea that the informal economy can be considered as a latent (unobserved) variable that is influenced by several causes and that affects several macroeconomic variables (indicators). It is for this reason that this method is known as MIMIC for "multiple indicators and multiple causes model".

Such an analysis makes it possible to estimate the relative size of the unobserved variable. In economics, MIMIC models have so far been exploited to study the evolution of the underground economy (Giles 1999a, 1999b, Giles and Tedds 2002, Giles, Tedds and Werknehg 2002, Tedds 1998, 2004). The main idea underlying this kind of model is to use observable variables to determine the form and magnitude of the latent variable

The equation that expresses the relationship between the latent variable and these causes is called the structural equation, while the equation that defines the relation between the unobservable variable and its indicators is called the measurement equation.

The structural equation is as follows:  
 $\eta_t = \alpha X'_t + \varepsilon_t$  (1)

Where  $X'_t = (x_{1t}, x_{2t}, \dots, \dots, x_{qt})$  is a vector (qx1) of variables which are each of the time series. Each 'time series'  $x_{it}$ , i ranging from 1 to q, is a potential causal variable of the latent variable  $\eta_t$ .

$\alpha = (\alpha_1, \alpha_2, \dots, \dots, \alpha_q)$ , vector (qx1) defining the causal relationships between the latent variable and its causal variables.

The measurement equation reveals the link between the latent variable and its indicators, in other words it expresses the unobservable latent variable as a function of a group of observable variables, it is written as follows:  
 $Y_t = \beta \eta_t + \mu_t$  (2)

Where  $Y'_t = (y_{1t}, y_{2t}, \dots, \dots, y_{pt})$  is a vector (px1) of variable (indicators)..

$\beta_j$ : j= 1.....p is a vector (px1) of regression coefficients which represents the amplitude of the expected variation of the corresponding indicator for a unit change of the latent variable.

Substituting (1) into (2) we obtain, the reduced form of the model becomes:  $Y_t = \Pi X'_t + v_t$  (3)

With  $\pi = \beta \alpha$  et  $v_t = \beta \varepsilon_t + \mu_t$

We can not estimate all the parameters  $\alpha_i$  and  $\beta_j$  individually, therefore we will include a condition of normalization of the coefficients of the indicators ( $\beta = 1 / -1$ ). According to Tedds (2005), the choice of the sign of  $\beta$  is arbitrary. The relative impacts of  $\eta$  on the other indicator variables are then measured against this pre-assigned value. Real GDP is generally chosen as a scale variable and is standardized in the model by setting its coefficient  $\beta_1$  to (1) or (-1).

According to Dell'Anno (2006) in the MIMIC model, the vector of structural coefficients is proportional to the coefficient of the scale variable, when the sign of  $\beta_1$  changes, the parameters of the causal variables  $\alpha_i$  change from positive to negative sign and the opposite too.

In this study, the MIMIC model will be estimated using the maximum likelihood estimator using special software for the structural equations named LISREL.

### 3.1 Causes and indicators of the parallel economy

#### 3.1.1 The causes of the parallel economy

Studies and empirical models using data from several countries conclude that, in general, the main factors driving the growth of the underground economy are: taxes and contributions to social security, composition of the labor force, (Unemployment and self-employment) and the quality of governance.

\* **Tax burden ( $X_1$ )**: is a major cause of the increase in the parallel economy according to the majority of the literature. The higher the tax rate will be, the higher the production costs in the Formal economy, and hence lower profits after tax. This difference in costs and thus the benefits, between parallel and formal economy can be very large, for example in Germany and Austria the difference between pre-tax and after-tax profits can be assimilated to personnel expenses. This gap in costs is likely to push people to integrate into the informal sector to avoid paying these taxes.

Several empirical studies have confirmed the important impact of the tax burden on the development of the informal sector. Johnson and al (1998a, 1998b) find that taxes have a significant impact on the informal economy. Other studies show that in the United States a 1 percentage point increase in the marginal tax rate increases the parallel economy by 1.4% (Cebula 1997).

\* **Unemployment rate ( $X_2$ )**: The economic theory fails to give an index on the sign of this variable, being either positive or negative, the solution is to rule through the empirical analyzes for each country or group of countries.

Tanzi states "the relationship between the shadow economy and unemployment rate is ambiguous", He justifies this conclusion by the fact that many natures of unemployed make up the workforce of the underground economy; One part is classified as unemployed because they are part of the official producer force, the other part is pensioners, illegal immigrants, and there are people who have official work and another work in black.

Although the sign of the unemployment rate coefficient in the measurement equation is unpredictable, the majority of studies conclude that the informal economy plays an important role in reducing unemployment in the formal economy. In fact, the higher the rate of loss of work in the formal sector, the higher the unemployment rate, and as a consequence the relative share of the labor force in the informal economy increases, because Unemployed will seek employment in the informal sector.

Bajada (2005) finds a positive relationship between the parallel economy and the unemployment rate in Australia. Dell'Anno and Solomon (2007) found a positive relationship between Unemployment rate and the parallel economy in the United States. Schneider and al. (2010) found that the unemployment rate is an important factor in the development of the informal economy in transition countries as well as in OECD countries.

\* **Self-employment ( $X_3$ )**: the rate of self-employment as a percentage of the labor force is considered to be a determining factor in the parallel economy. According to Bordignon Zanardi (1997), the significant diffusion of small

businesses and the large proportion of professionals and self-employed in relation to the total labor force is an important indicator of the growth of the informal economy.

Theoretically, a self-employed person is motivated not to pay taxes to reduce his production costs and is therefore encouraged to work in black.

\* **Household final consumption expenditure ( $X_4$ ):** Household final consumption expenditure includes expenditure actually incurred by resident households to acquire goods and services to meet their needs. High consumption relative to the country's economic growth rate as measured by the GDP growth rate underlines a hidden source of income, namely the informal economy.

\* **Inflation rate ( $X_5$ ):** Inflation is the loss of the purchasing power of the currency which results in a general and lasting increase in prices. In our study, high inflation, as measured by the Consumer Price Index, indicates an increase in undeclared work.

### **3.1.2. The Indicators of the parallel economy**

\* **Gross Domestic Product ( $Y_1$ ):** Growth in the informal sector may reflect a recession in the formal economy as it relates to the relationship between the informal economy and official GDP. This may be due to the fact that both labor and capital are diverted to the informal sector during recessions.

The MIMIC approach suggests the need to set a coefficient to estimate the remaining parameters as a function of this scale variable. The value of the fixed parameter is arbitrary, but using a positive or negative unit value will make it easier to find the relative amplitude of the other indicator variables.

There is no common view of the relationship between the shadow economy and economic growth. Some authors such as Adam and Ginsburgh (1985) for Belgium, Giles and Tedds (2002) for Canada, Chatter, Chaudhuri and Schneider (2003) for Asian countries, found a positive relationship between the underground economy and official GDP. While others such as Frey and WeckHannemann (1984) for 17 OECD countries, Loayza (1996) for 14 Latin American countries, Kaufmann and Kaliberda (1996) and Eilat and Zinnes (2000) for developing countries Transition, Dell'Anno (2003) for Italy, Dell'Anno, Gomez and Al-Anon (2007) for France, Greece and Spain, found a negative relationship. Finally, Schneider (2005) found a negative relationship for countries in transition and developing countries and a positive sign for developed countries.

\* **The labor force participation rate ( $Y_2$ ):** the labor force participation rate is calculated as the ratio between the active population and the working age population. According to Giles (1998), a decline in this rate over time may reflect a movement of labor from the formal economy to underground activities. By introducing this variable, as an indicator we study whether there is a flow of resources between the official and underground economy. Other studies, in particular those by Bajada and Schneider (2005), Dell'Anno and al. (2007) have included the participation rate of the labor force, as an indicator of the development of the parallel economy, even if the sign of this relationship remains ambiguous.

## **4 Empirical validation and calibration strategy**

The data series related to Tunisia's study are annual, covering a period from 1985 to 2014. The main source of data is the World Bank, for some variables the figures appear in the publications of the central bank of Tunisia. The series in level or in first difference are tested for the presence of the unit root, using the ADF test, in this phase the software used is the Eviews7.

### **4.1 Results of the MIMIC model**

The coefficients estimated by maximum likelihood are presented in the table below, these coefficients are directly compared to evaluate the relative weight of the variables in the explanation of the evolution of the parallel economy in Tunisia. Using the MIMIC 5-1-2 model, the variables whose coefficients are not statistically significant are eliminated.

**Table 1: Estimated coefficients of the MIMIC models**

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Models	Tax burden	Unemploy rate	Self Employ	Household consumption	Inflation rate	Labor force participation
	X1	X2	X3	X4	X5	Y2
MIMIC 5-1-2	0.49 (0.24)	0.59 (0.23)	0.06 (0.099)	0.24 (0.12)	0.09 (0.12)	0.32 (0.15)
MIMIC 4-1-2	0.47 (0.24)	0.58 (0.24)	-----	0.22 (0.11)	0.09 (0.082)	0.33 (0.16)
MIMIC 3-1-2	0.56 (0.24)	0.59 (0.24)	-----	0.22 (0.11)	-----	0.31 (0.15)
The model fit indices	Chi-square (p-value)		RMSEA (p-value)		AGFI Of	Degrees freedom
MIMIC 5-1-2	1.48 (0.83)		0.000 (0.85)		0.9	4
MIMIC 4-1-2	1.13 (0.76)		0.000 (0.79)		0.91	3
<i>MIMIC 3-1-2*</i>	<i>0.36 *</i> <i>(0.84)</i>		<i>0.000*</i> <i>(0.85)</i>		<i>0.96 *</i>	<i>2</i>

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Source: authors' work

Note : the values in presented in parentheses in the Table are P value

The estimate shows that the main causes of the underground economy among those included in the model are (in descending order): unemployment rate, tax pressure, household consumption expenditure, inflation rate, and self-employment. Among the criteria of choice of the model, the RMSEA or the approximate quadratic error of approximation. According to this criterion the three models are accepted, indeed they have RMSEA <0.08. According to the criterion of  $\chi^2$ , the model MIMIC 3-1-2 is the best indeed with a  $\chi^2= 0.36$  (the lowest value) and a P-Value = 0.84. Similarly, the AGFI criterion shows that the MIMIC 3-1-2 model is the best, this model is written:

$$\text{Measurement equations: } Y_{1t} = -1.00\eta_t + \mu_t \quad (4) \text{ and } Y_{2t} = 0.31\eta_t + \mu_t \quad (5)$$

$$\text{Structural equation: } \eta_t = 0.56X_{1t} + 0.59X_{2t} + 0.22X_{4t} + \varepsilon_t \quad (6)$$

## 4.2 Size of parallel economy: Calibration procedure

By estimating the coefficients of the MIMIC model, and assuming that the expected value of the error term  $\varepsilon = 0$ , we will only determine annual indices of the parallel economy and not values. The estimated indices will be the same transformation of the independent variables.

To convert these indexes into absolute values, we need an external estimate of the parallel economy in Tunisia for one year during the study period, and we can then use a calibration procedure. We will use the parallel economy rate in Tunisia for the year 1999 (Schneider (2007) and Schneider and al (2010)), which is equivalent to 38.4% of GDP as a benchmark for The estimate of the annual indices of the parallel economy in Tunisia for the period of study. We will follow the procedure of Dell'Anno (2007) in the analysis. According to it, this procedure replaces the two indices (indices of the evolution of the GDP compared with 1999 and the index of change in the ratio EP / GDP by 1999) in the measurement equation (2).

$$\frac{GDP_t - GDP_{t-1}}{GDP_{1999}} = \frac{\eta_t - \eta_{t-1}}{GDP_{1999}} \quad (7)$$

In the case of the structural equation (1) for the study period, a time series of the indices of the parallel economy (latent variable) will be obtained according to the following equation

$$\frac{\eta_t}{GDP_{1999}} = 0.56\Delta X_{1t} + 0.59\Delta X_{2t} + 0.22\Delta X_{4t} \quad (8)$$

Once we obtain the indices for all years of the study, we set the base year index to obtain the ratio of the parallel economy (as a percentage of official GDP) for that year, thereafter We apply the index of each year to obtain a time series of the parallel economy as a percentage of GDP according to the following reference equation:

$$\frac{\eta_t}{GDP_{1999}} \frac{\eta^*_{1999}}{GDP_{1999}} \frac{GDP_{1999}}{\eta_{t1999}} \frac{GDP_{1999}}{GDP_t} = \frac{\tilde{\eta}_t}{GDP} \quad (9)$$

$\frac{\tilde{\eta}_t}{GDP_{1999}}$  : Is the index of the parallel economy calculated by equation (8):

$\frac{\eta^*_{1999}}{GDP_{1999}} = 38.4\%$ , Is the exogenous estimate of the parallel economy.

$\frac{\tilde{\eta}_{t1999}}{GDP_{1999}}$  : Is the value of the index estimated by equation (8).

$\frac{PIB_{1999}}{PIB_t}$  : Is used to convert the index of changes in the parallel economy from the base year to the current GDP.

$\frac{\tilde{\eta}_t}{GDP_t}$  : Is the estimate of the parallel economy as a percentage of official GDP.

Consequently, and through the application of the calibration procedure throughout the study period, annual estimates of the parallel economy in Tunisia will be available for the period under review.

Table 2: Size of the parallel economy in Tunisia

Years	Paralleleconomy in% GDP	Unemployment rate
1985	38.9 %	14.46%
1986	39,81%	14.46%
1987	38,17%	14.46%
1988	38,43%	14.46%
1989	38,27%	14.46%
1990	38,49%	14.46%
1991	38,89%	15.2%
1992	39,25%	15.6%
1993	39,44%	16%
1994	38,33%	14.4%
1995	38,84%	15.6%
1996	37,68%	15.7%
1997	38,37%	15.9%
1998	39,05%	17.1%
1999	38,4%	16%
2000	38,28%	15.7%
2001	38%	15.1%
2002	38%	15.3%
2003	37,58%	14.5%
2004	37,91%	13.9%
2005	36,99%	12.9%
2006	37,06%	12.5%
2007	37,77%	12.4%
2008	37,24%	12.4%
2009	37,97%	13.3%
2010	38,42%	13%
2011	42,41%	18.3%
2012	40,21%	14%
2013	40,36%	13.3%
2014	41,49%	13.3%

Source: authors' work

### 4.3 The relationship between the unemployment rate and the informal economy in Tunisia: The Toda-Yamamoto approach

In this model, the unemployment rate has a coefficient of 0.59, in fact the structural equation is written as follows:  $\eta_t = 0.56 X_{1t} + 0.59 X_{2t} + 0.22 X_{4t} + \epsilon_t$  (09)

After having estimated the size of the parallel economy in Tunisia, we study the nature of its relationship with the unemployment rate. To do this, the approach of Toda and Yamamoto is applied. The causality test of Toda and Yamamoto (1995) is applied to level VARs when the variables are integrated or cointegrated.

Toda and Yamamoto argue that F-Statistics used to test Granger's classical causality may not be valid when the series are integrated or cointegrated. The procedure of Toda and Yamamoto consists in estimating an augmented VAR ( $K + d_{max}$ ) where  $K$  is the optional delay number and  $d_{max}$  is the maximum integration order of the variables in the autoregressive vector (VAR).

The first step consists in determining the number of optional delay  $K$  and the maximum order of integration of the variables used, this number being determined by the use of the different levels of delay and the choice of the optimum level.

The second step consists in using the modified Wald procedure to test the causality of the VAR ( $K$ ) model; the optimal delay number is equal to  $(K + d_{max})$ .

In our study, we try to test the relationship between the size of the parallel economy ( $\eta_t$ ) and the unemployment rate ( $X_{2t}$ ).

The causality test of Toda-Yamamoto is represented as follows:

$$\eta_t = \alpha_0 + \sum_{i=1}^k b_{1i} \eta_{t-i} + \sum_{i=k+1}^{k+d_{max}} b_{2i} \eta_{t-i} + \sum_{i=1}^k c_{1i} X_{2t-i} + \sum_{i=k+1}^{k+d_{max}} c_{2i} X_{2t-i} + \epsilon_{1t}$$

$$X_{2t} = d_0 + \sum_{i=1}^k e_{1i} X_{2t-i} + \sum_{i=k+1}^{k+d_{max}} e_{2i} X_{2t-i} + \sum_{i=1}^k f_{1i} \eta_{t-i} + \sum_{i=k+1}^{k+d_{max}} f_{2i} \eta_{t-i} + \epsilon_{2t}$$

The null hypothesis  $X_{2t}$  does not cause  $\eta_t$ , is constructed as follows  $H_0 : c_{1i} = 0, i = 1 \dots K$ .

Similarly, the null hypothesis  $\eta_t$  does not cause  $X_{2t}$ , is constructed as follows  $H_0 : f_{1i} = 0, i = 1, \dots, k$ .

The Wald test is applied subsequently, in the absence of causality, the  $W$  statistic follows asymptotically a distribution of  $\chi^2$ .

**Table 3: Toda-Yamamoto test result**

VAR Granger Causality/Block Exogeneity Wald Tests  
Sample: 1985 2014  
Included observations: 25

Dependent variable: Unemployment\_Rate

Excluded	Chi-sq	df	Prob
Size_Parallel_Economy	4.90181579	2	0.08621527
All	4.90181579	2	0.08621527

Dependent variable: Size\_Parallel\_Economy

Excluded	Chi-sq	df	Prob
Unemployment_Rate	1.28350411	2	0.52636938
All	1.28350411	2	0.52636938

Source: authors' work from Eviews 7.2

According to the causality test of Toda and Yamamoto presented in Table 4. A unidirectional causality relation ranging from the unemployment rate to the size of the parallel economy in Tunisia.

### 5 Conclusion and main recommendations

The size of the parallel economy measured as a percentage of official GDP using the MIMIC model does not cease to increase especially after the Tunisian Revolution of 2011, when this economy reached 42.41% of the national GDP.

Our study has shown a positive relationship between the parallel economy and the unemployment rate, so the presence of the parallel economy plays the role of a buffer because it absorbs part of the unemployed population. Indeed workers who do not find an activity in the formal economy will look for one, in the parallel sector and therefore the informal economy has a substitution effect.

Similarly, our empirical results show unidirectional causality ranging from the unemployment rate to the size of the parallel economy. This capacity to absorb a large part of the unemployed must in no way, hide the major risk of the parallel sector on the Tunisian economy. Indeed, Tunisian policy makers need to recognize that it is more important to tackle causes rather than consequences to eradicate the informal sector.

However, and through our study, unemployment is the main cause of the development of the parallel sector in Tunisia. So to get around this problem, which is detrimental to our national development, the main recommendations are mainly the launching of targeted and high-capacity investments that can facilitate the transition to the formal sector. Likewise, all people must be encouraged to comply with the formalities rules by granting aid and subsidies and to facilitate their access to sources of financing, to grant them tax advantages during the years of their integration into the formal sector and to create free zones in border areas. Another solution that affects the quality of institutions is the need to improve the nature of the public-private relationship by simplifying and unifying administrative procedures. The final solution to this phenomenon is to apply heavier sanctions to participants in the shadow economy. The economic theory of crime (Becker 1968) indicates that the increase in anticipated penalties has the effect of increasing the costs of participation in informal markets. The increase of the anticipated penalties consists, either in increasing the sanctions applied to the sentenced increasing the likelihood that a participant will be caught and sentenced (more police surveillance, intensive investigations, allocates additional

resources to prosecutions...) which forces these stakeholders to better respect the law

## REFERENCES

- Adam, C., and Ginsburgh, V., 1985. "The effects of irregular markets on macroeconomic policy: Some estimates for Belgium" *European Economic Review* Volume 29, Issue 1, 1985, Pages 15-33.
- Adriana, A., Davidescu, M., Dobre, I., 2012. "The causal relationship between unemployment rate and US shadow economy .A Toda-Yamamoto approach" *Journal of social and economic statistics* no 1, vol1.
- Bajada, C., Schneider, F., 2005. The shadow economies of the Asia-Pacific. *Pacific Economic Review* 10 (3), 379-401. Becker, G. S., 1968. Punishment: An economic approach. *Journal of Political Economy* 76, 169-217.
- Bertola, G. and Garibaldi, P., 2003. "The Structure and History of Italian Unemployment" CESifo Working Papers, 907 (2003), p. 2003
- Bordignon, M., Zanardi, A., 1997. Tax evasion in Italy. *Giornale degli economisti e annali di economia*, 169-210.
- Cebula, R. J., 1997. An empirical analysis of the impact of government tax and auditing policies on the size of the underground economy. *American Journal of Economics and Sociology* 56 (2), 173-185.
- Chatterjee S., Chaudhuri K., Schneider F., 2003. The Size and Development of the Indian Shadow Economy and a Comparison with other 18 Asian countries: An Empirical Investigation. *Presented at European Public Choice Society, Annual meeting 2003 in Aarhus (DK) (mimeo)*.
- Dell'Anno, R. and Schneider, F., 2003. "The shadow economy of Italy and other OECD countries: what do we know?" *Journal of public finance and public choice economicadelle scelte pubbliche*.
- Dell'Anno, R., 2007. "The shadow economy in Portugal: an analysis with the MIMIC approach" *Journal of applied economics* vol X No 2.
- Dell'Anno, R. and Schneider, F., 2006. "Estimating the underground economy: A response to T. Breusch's critique". Working Paper 06/07, Department of Economics, Johannes Kepler University of Linz.
- Dell'Anno, R. and Solomon, O., 2006. "Shadow economy and unemployment rate in USA. Is there a structural relationship?," *Annual Meeting of the European Public Choice Society, Finland, April 20-23, 2006*.
- Dell'Anno, R., Gómez-Antonio, M., Pardo, A., 2007. The shadow economy in three Mediterranean countries: France, Spain and Greece. a MIMIC approach. *Empirical Economics* 33 (1), 51-84.
- Dell'Anno, R., and Solomon, O., 2011. "Shadow Economy And Unemployment Rate In U.S.A. Is There A Structural Relationship? An Empirical Analysis". <https://hal.archives-ouvertes.fr/hal-00582021> Submitted on 1 Apr 2011.
- Eilat, Y., Zinnes, C., 2000. The evolution of the shadow economy in transition countries: consequences for economic growth and donor assistance. *Harvard Institute for International Development, CAER II Discussion Paper* (83).
- Enste, D.H., 2003. "Shadow Economy and Institutional Change in Transition Countries in Boyan Belev (eds.), *The Informal Economy in the EU Assessment Countries: Size, Scope, Trends and Challenges of the Process of EU enlargement*, Center for Study of Democracy, 2003, Sofia, 81-114.
- Feige Edgar, L., 1979. "How Big Is the Irregular Economy?" *Challenge* Vol. 22, No. 5 1(1979).
- Feige Edgard L., 1989. *The Underground economies, Tax evasion and information distortion*. Cambridge University Press. Cambridge.
- Frey, B. and Weck-Hanneman, H., 1984. «The Hidden Economy as an "Unobservable" variable», *European Economic Review*, 26, No. 1, pp. 33-53.
- Giles, David E.A. and Tedds, L.M., 2002. *Taxes and the Canadian Underground Economy*. Canadian Tax paper n.106. Canadian Tax Foundation. Toronto, 2002.
- Giles, David E. A., 1999a. «Measuring the hidden Economy: Implications for Econometric Modeling ». *The Economic Journal*, Vol. 109, No 46, pp.370-380.
- Gutmann P. M., 1977. "Subterranean Economy". *Financial Analysis Journal*, November, 34, pp. 26-27.
- Johnson, S., Kaufmann, D. and Zoido-Lobato, P., 1998a. Regulatory discretion and the unofficial Economy, *The American Economic Review*, 88/ 2, pp. 387-392, 1998a.
- Johnson, S., Kaufmann, D. and Zoido-Lobato, P., 1998b. Corruption, public finances and the unofficial economy, *American Economic Review*, vol. 88, no. 2, pp. 387- 392, 1998b.
- Johnson, S. Kaufmann, D. and Shleifer, A., 1997. «The unofficial economy in transition », *Brookings Papers on Economic Activity, Fall, Washington D.C.*
- Joreskog, K. – Goldberger, A. S., 1975. «Estimation of a model with multiple indicators and multiple causes of a single latent variable», *Journal of the American Statistical Association*, 70, pp. 631-639.
- Kaufmann, D and Kaliberda, A., 1996. "Integrating the Unofficial Economy into the Dynamics of Post-Socialist Economies: A Framework of Analysis and Evidence" *World Bank policy Research Working paper* No 1691.
- Lacko, M., 2000. "Hidden Economy - an Unknown Quantity? Comparative Analysis of Hidden Economies in Transition Countries, 1989-95". *Economics of Transition*
- Loayza, N. V., 1996. The economics of the informal sector: a simple model and some empirical evidence from Latin America. In: *Carnegie-Rochester Conference Series on Public Policy*. Vol. 45. Elsevier, pp. 129-162.
- Schneider, F., 2005. Shadow economies around the world: What do we really know, *European Journal of Political Economy* 21, 598-642, 2005.
- Schneider, F., 2007. "Shadow Economies and Corruption All Over the World: New Estimates for 145 Countries" *Economics.E-journal*. Vol. 1, 2007-9 | July 24, 2007.
- Schneider, F and Enste, D., 2000. «Shadow Economies: Size, Causes and Consequences », *Journal of Economic Literature* 38/1, pp. 77-114.
- Schneider, F., Buehn, A., Montenegro, C. E., 2010. Shadow economies all over the world: New estimates for 162 countries from 1999 to 2007. *World Bank Policy Research Working Paper Series*, Vol.
- Schneider, F., 1997. "The shadow economies of western Europe". *Economic affairs*, 17/3, pp42-48.
- Schneider, F., Buehn, A., Montenegro, C. E., 2010. Shadow economies all over the world: New estimates for 162 countries from 1999 to 2007. *World Bank Policy Research Working Paper Series*, Vol.
- Smith, P., 1994. "Assessing the Size of the Underground Economy: the Canadian Statistical Perspectives ». *Canadian Economic Observer, Catalogue No. 11-010, 3.16-33, 18 March*.
- Tanzi, V., 1983. The underground economy in the United States: Annual estimates, 1930-80 (l' 'économie clandestine aux états-unis: estimations annuelles, 1930-80) (la' 'econom'ia subterr'anea' de estados unidos: Estimaciones anuales, 1930-80). *Staff Papers-International Monetary Fund*, 283-305. Tanzi, V., 1999. «Uses and Abuses of Estimates of the Underground Economy ». *The Economic Journal*, 109 (June), pp. 338-347-



Tedds, Lindsay M., 2005. « The Underground Economy in Canada », in Bajada et Schneider (2005), p. 157-176. Tedds, Lindsay M. (2005) « The Underground Economy in Canada », in Bajada et Schneider (2005), p. 157-176.

Toda, H.Y. et Yamamoto, T., 1995. « Statistical Inference in Vector Autoregressions with Possibly Integrated Processes », in Journal of Econometrics, Vol. 66, pp. 225-250 ([http://dx.doi.org/10.1016/0304-4076\(94\)01616-8](http://dx.doi.org/10.1016/0304-4076(94)01616-8)). Toda, H.Y. et Yamamoto, T. (1995), « Statistical Inference in Vector Autoregressions with Possibly Integrated Processes », in Journal of Econometrics, Vol. 66, pp. 225-250 ([http://dx.doi.org/10.1016/0304-4076\(94\)01616-8](http://dx.doi.org/10.1016/0304-4076(94)01616-8)).

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