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INFORMAL ECONOMY IN SUB-SAHARAN AFRICA : MAIN DRIVERS AND ESTIMATION OF HIS SIZE FROM IVORY COAST

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Abstract

In this study, we estimate informal economy for Ivory Coast, country from subsaharan Africa. We did it through revisiting of main drivers of informal economy in this area. We use MIMIC methodology for done this and follow Dell'Anno and al. (2018) to calibrate estimate score of informal economy to informal economy as a percentage of GDP from 1991 to 2018. We found with strong evidence that Public Government spending, inflation, trade openness explains negatively informal economy and taxation rates, unemployment rates explain positively informal economy. This study has its place, and is welcome as it is difficult for government officials to gather data and to take public macroeconomic policy to lead struggle against informal economy which predominates in Ivory Coast economy at 90%. We build a database on informal economy for Ivory Coast from 1991 to 2018. Following our estimation, we found in 2015 that informal economy represents 26,700,000,000 USD.

Keywords : Informal economy, resource mobilization, MIMIC, indirect method.

1. Introduction

Subsaharan African population is reaching 1.1 billion according to official estimates, when we look close towards these 1.1 billion of peoples, only 5% of them are unemployed and more than 90% of those who are employed are in informal situations. Taking account informal economy, by including decent work in, will help to reach Sustainable Developments Goals (SDGs) particularly, SDGs 8 (decent work and growth) and SDGs 1 (eradicate extreme poverty). Most countries in subsaharan Africa have high levels of debt and this level continue to rise despite the weakness of our economy to have the capacity to mobilize resources. Officials have difficulty in providing statistics about informal economy, and taking account of informal economy will help to raise the mobilization of resources.

In Ivory Coast, officials have difficulty in structuring this sector. In 2012 a study led by AGEPE (Agence d'Etudes et de promotion de l'emploi), found that more than 80% of work in

Ivory Coast were in informal situations, only 5% were formal in the private sector and only 4% were formal in the public sector. Following the results of another study in 2017 from reform of taxation commission in Ivory Coast, around 609700 productions units exercise in informal economy with a fiscal potential of 150 billion FCFA. The covid-19 has seriously impact informal economy in Ivory Coast. Regarding this, the government has created a fund in order to help actors from this economy. The fund was estimated at 100 billion FCFA. All this fact relates the fragility of this sector with low resilience, the predominance of this sector in Ivory Coast economy and the effort of government which need to be strengthened.

If we want to talk about informal economy, we need to look back from Arthur (1954). In his paper of 1954, Arthur found that there were two sectors in the economy, the modern characterizes by a strong level of industry and the traditional characterizes by a strong level of workers, therefore through the industrialization process, traditional workers will migrate towards the modern sector, absorbed by the industrialization. But the working paper of Hart (1973) found that the workers from traditional sectors in Ghana were not absorbed by the industrialization even worst there was a lot. The term informal being universal when the ILO (1973) in a publication, showed interest in this category of work. Therefore we can distinguish since three thinking schools about informal economy. The dualist led by Arthur (1954) and Harris and Todaro (1970) for them, informal economy will disappear as economy industrialized. On the other hand, Legalist school led by De Soto (1989) thought that informal economy is a way for entrepreneurs to escape taxation. Futhermore, structuralist school led by Moser (1978) Portes and al. (1989) thought that informal economy can't exist without formal economy. In 2002 the ILO (2002) broad the concept of informal sector to informal economy. This new concept of informal economy taking account from this change, informal firms and informal workers from formal firms and informal firms.

In the literature many instruments are used to measure the informal economy, we distinguish direct instruments and indirect instruments. MIMIC methods are widely used to forecast informal economy as their best fitting compared to other direct and indirect instruments. We follow this, and use this indirect instrument to forecast informal economy in the case of Ivory Coast. This method allows us to estimate informal economy as a latent variable (not directly observable), from some causes variables and some indicators variables suspect to have a significant impact on informal economy latent variable. This technique will predict levels score of informal economy from 1991 to 2018. We will calibrate this score to informal

economy as a percentage of GDP following Dell'Anno and al. (2018) method and we will draw following this, a database on informal economy for Ivory Coast from 1991 to 2018.

The rest of this paper is organized as follows, in part 2 we gather literature about informal economy, in part 3 we will discuss the methodology, in part 4 we present the results obtained, finally in part 5 we conclude.

2. Literature review

In this section, we discuss the literature on informal economy from Arthur (1954) to recent development.

In the middle of the 20th century, Arthur (1954) specialized in development economic, elaborate dualist theory, a theory which explain the path of development for developing countries. From this article, he distinguishes two sectors in economy, firstly the traditional sector characterizes by rural population living from agriculture which produces low wages, this population have a surplus of unproductive workforce and is attracted by the second sector characterize by industries which offer high wages. As economy developed more industry are created by absorbing excedent of working force. This dualist ideology is propulsed later by (Harris & Todaro, 1970).

In 1970 a study of Hart (1973) in Ghana found that the traditional sector was not absorbed by the modern sector, and unemployment was rising. He explains this situation by the low industrialization of the country. The term informal sector was used for characterizing categories of undeclared activities of persons which are not absorbed by industrial. This term was accepted when the ILO (1973) study this particular sector in Kenya. Since informal sector is a controversy subject in the environment of specialists.

We distinguish two other schools who attempt to explain the source of informal economy, firstly we have economists from legalists school, De Soto (1989) secondly economists from structuralist school Moser (1978) Portes and al. (1989). For the legalist economist, informal sector is a way for entrepreneurs to escape from fiscality when they reach for low cost of production. For the structuralist economist, informal sector can't exist without the formal sector, the labor force from informal sector is an opportunity for formal sector Moser (1978) Portes and al. (1989) to reduce their production cost. These authors defend a neo-marxist

ideology. Indeed wages from informal sector are lower than wages from formal sector, and this situation favors mondialisation by attracting multinationals firms.

In 21th century many authors continue to search for determinants of informal sector, by testing the theory with empiric methodology, and by estimating his size by various techniques.

Gautier (2001, 2002) test legalist theory. He attempted to bring in his two studies, origins of informal sector by analyzing the nexus between tax and informal sector. He tries to look if informal sector is caused by fiscal fraud Gautier (2001) by searching for an optimal taxation. For reaching this, he examines fiscal instrument tax and subvention using microeconomic methodology particularly (General Equilibrium Calculable), it firstly build a theoretical model and then test empiric relationship in madagascar. He builds hypothesis that informal sector excerce disloyal concurrence on formal sector. He concludes that, taking account of informal sector in taxation will afford the fiscal mobilization. It also concludes that inefficiency cause by fiscal fraud explain the growth of the informal sector.

In 2002, the ILO (2002) in his conference brings an important focus on informal sector. It replaces the term sector by economy. And since informal economy taking account for enterprise in informal situations and workers in informal situations from formal and informal firms. They linked informal economy to poverty and concluded that reduce informal economy will also reduce poverty.

From empirical view, we found in literature that some particular macroeconomic variables are considered as drivers of informal economy. Among these particular macroeconomic variables we cite tax level, unemployment rates, government size, trade openness, quality of institutions.

Among authors using mimic methodology to find drivers of informal economy in countries of subsaharan Africa. Some of them find that unemployment rates explains positively informal economy in subsaharan Africa in the most of case Igudia and al. (2016) Nchor and Adamec (2015) Sakarombe (2020) Makananisa and al. (2020) Tonuchi and al. (2020) YEO (2019) .

Some authors find positive link between tax burden and informal economy except Tonuchi and al. (2020), Nchor and Adamec (2015) who find low significance level to explain informal economy in the case of Nigeria, Kenya and Namibia.

From study that tested size of the government as determinant of informal economy, Nchor and Adamec (2015) find positive link between this macroeconomic variable and informal economy in the case of Nigeria and Kenya. On the other hand, Nchor and Adamec (2015) Sakarombe (2020) find negative link in the case of Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Zambia, Zimbabwe.

Majority of study lead in Sub-Saharan Africa find that good governance with good institutions, able to control corruption, or business freedom trains a negative link with development of informal economy Igudia and al. (2016) Tonuchi and al. (2020) Nchor and Adamec (2015) Sakarombe (2020).

Links between interest rates and informal economy vary from countries. Some study finds that interest rate describe positive relationship with informal economy in the case of Kenya Nchor and Adamec (2015) and doesn't explain informal economy in the case of Namibia, Ghana, Nigeria according to low level of significance level Nchor and Adamec (2015). Some others find negative relationship between interest rate and informal economy in the case of Nigeria Tonuchi and al. (2020).

According to YEO (2019) trade openness describes positive relationship with informal economy in the case of Côte d'Ivoire. This result varies by countries and is different to this obtained by Sakarombe (2020). Sakarombe (2020) find negative relationship between informal economy and trade openness in the case of Botswana, Lesotho, Malawi, Mozambique, Namibia, Swaziland, Zambia, Zimbabwe.

In the case of Ivory Coast YEO (2019) Find also that financial institution development describes negative relationship with development of informal economy.

Now we have discussed literature review of informal economy, let's introduce in the next section methodology that we'll use in this study.

3. Methodology

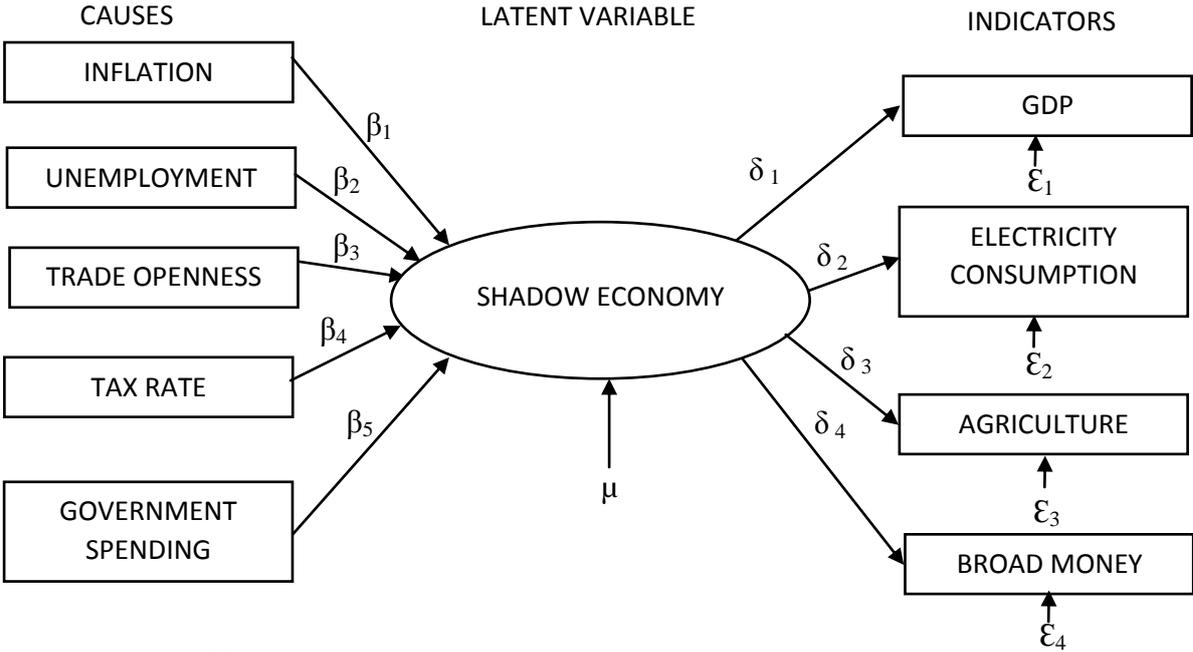
In this section, we discuss the methodology use in this study to estimate informal economy, particularly the MIMIC methodology.

Literature on the subject has drawn two types of methodology to estimate informal economy. Firstly, we have those classified as direct approach such as survey method, tax audits method. Secondly, we have those classified as indirect approaches such as currency demand approach, dynamic stochastic general equilibrium (DSGE) method and MIMIC method. In this study we focus on indirect approach particularly the MIMIC methodology, to estimate informal economy. Let's present this technique in the following line.

MIMIC stands for Multiple Indicator Multiple Cause, it is a variant of structural equation modeling and help to estimate latent variable or unobserved variable from variable suspect to cause significantly unobserved variable to indicators variables suspect to translate a change in the dynamic of unobserved variable. This technique is widely used by authors in literature who attempted to estimate shadow economy and it produces good result compared to other methods (direct as indirect) Dell'Anno and al. (2018).

Our model is specified like following, MIMIC 5 - 1 - 4 (five causes variables particularly, unemployment rates, tax rates, public investment, inflation rates, trade openness ; one latent variable shadow economy ; and four indicators variables particularly, growth domestic production, agriculture, electricity consumption per capita, broad money to GDP. The specification of our MIMIC is summarized by the path diagram present in the figure 1 below :

Figure 1 : Diagram path of our MIMIC model specification (MIMIC 5 – 1 – 4)



Source : own making

We have two types of equation in this model. The first one is called structural equation and link shadow economy index latent variable and causes variables. It is specified in equation (1). The second is called measurement equation and link indicator variables and shadow economy latent variable. It is specified in equation (2), (3), (4) and (5).

$$SE = \alpha + \beta_1 INF + \beta_2 UNEMP + \beta_3 OPEN + \beta_4 TAX + \beta_5 GOVSPEN + \mu \quad (1)$$

$$GDP = \lambda_1 + \delta_1 SE + \varepsilon_1 \quad (2)$$

$$ELEC = \lambda_2 + \delta_2 SE + \varepsilon_2 \quad (3)$$

$$AGR = \lambda_3 + \delta_3 SE + \varepsilon_3 \quad (4)$$

$$BROA = \lambda_4 + \delta_4 SE + \varepsilon_4 \quad (5)$$

$$\Sigma = \begin{bmatrix} \lambda(\beta\Theta\beta' + \Theta_\mu)\lambda' + \Theta_\varepsilon & \lambda\beta\Theta \\ \Theta\beta'\lambda' & \Theta \end{bmatrix} \quad (6)$$

Where :

Θ , Θ_μ and Θ_ε are respectively the covariance matrix of causes, covariance matrix of structural equation error term, covariance matrix of measurement equation error term.

INF, represent inflation capture by consumer price index annual percentage taking from IMF

UNEMP is unemployment rates calculate as the ratio between working population to total of population with working age taking from World bank database (WDI)

OPEN is trade openness calculate as the ratio between sum of import and export to two. We take this from World bank database (WDI)

TAX is tax level real value in USD taking from International Monetary Fund (IMF)

GOVSPEN is government spending capture by final consumption expenditure taking from World bank database (WDI)

GDP is GDP per capita taking from World bank database (WDI)

ELEC is electricity consumption per capita taking from International energy Agency (IEA)

AGR is Agriculture as percentage of GDP capture in World bank database (WDI)

BROA is broad money as percentage of GDP taking from World bank database (WDI)

Estimation of the model is done by minimizing the distance between empirical covariance matrices and covariance matrix generate by the model specified in equation (6). This model estimator Σ must be close to the empirical estimator S . We need to find by iterative approach

parameters which fill well with the reality. To deal with this and success this purpose, we use maximum likelihood techniques which implies multivariate normality of indicators. Therefore maximum likelihood function is specified as follows.

$$F_m = \log \text{ of det } (\Sigma) + \text{tr} [S \Sigma^{-1}] - \log \text{ of det } (S) - (p + q) \quad (7)$$

Where det is the determinant of the matrix, p and q are respectively number of causes variables and number of indicator variable, Fm stand for maximum likelihood function.

After estimation, we need to check for informations on the goodness of the model. Particularly we need to check for CFI (comparative fit index) TFI (Tucker-Lewis index) and SMSR (Standarize root mean squared residual).

The last step of estimation is to benchmark score obtain after mimic estimation to informal economy in percentage of GDP. To deal with this step, we follow Dell'Anno and al. (2018), benchmarking procedures. Benchmarking function for our study is specified as follows.

$$\left[\frac{SE_t^\eta}{pop_t} \frac{pop_{2000}}{Gdp_{2000}} \right] \left[\frac{Gdp_{2000} * pop_t p}{pop_{2000} Gdp_t} \right] \left[\frac{SE_{2000}^*}{Gdp_{2000}} \right] \left[\frac{Gdp_{2000}}{SE_{2000}^\eta} \right] \quad (8)$$

In the third parenthesis, the numerator represent exogenous value of SE for Ivory Coast in 2000 estimate by Medina and Schneider (2018). Especially for this point, we will give detail result in the result section with a table.

We use diverse sources of data to lead this study, among these data, some are taken from IMF, some are taken from World Development Indicators database of World Bank, some are taken from international energy agency, finally some others are taken from national sources.

We give trend for those data who present some missing values.

Estimation is principally done with stata 12.

4. Results

In this section, we present and discuss the result obtained after computing the estimation. Estimation are principally computed in stata software. We present the result obtained after mimic computation in the table 1 below. The fitting table which gives information on the goodness of the model is given after.

Table 1.: Estimated Coefficient of our MIMIC (5 – 1 - 4) model

measurement structural	(1) SE	(2) gdp	(3) elec	(4) agr	(5) broa	(6) var(e.gdp)	(7) var(e.elec)	(8) var(e.agr)	(9) var(e.broa)	(10) var(e.SE)
infl2	-12.78*** (1.936)									
tax2	1.61e-07*** (1.87e-08)									
govspen	-26.27*** (6.494)									
open	-4.607* (2.785)									
unemp	18.39*** (6.439)									
SE		1 (0)	0.0801*** (0.00696)	-0.00505*** (0.00115)	0.00475*** (0.00178)					
Constant		472.1*** (164.9)	143.5*** (14.19)	27.41*** (1.226)	23.41*** (1.630)	2,086 (1,467)	275.2*** (75.67)	7.960*** (2.131)	19.12*** (5.117)	0 (1,412)
Observations	28	28	28	28	28	28	28	28	28	28

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source : from author, own make with stata and econometric software (particularly stata 12)

We found that all variables describe significant relationship with informal economy as their p-value lower than 1%. Public Government spending, inflation, trade openness explain informal economy negatively. On the other hand, taxation rates, unemployment rates explain positively informal economy. Let's give some interpretations of the results obtained in the following line.

In our economy, when public government spending rise, informal economy decreases as investment of the government must create more opportunities to converge towards formal work. The negative relationship between inflation and informal economy can be explained like this : high inflation translate high credit offer to the private sector by banks, and more opportunities of investment for private entrepreneurs. These investments are supposed to reduce informal economy. Negative relationship between trade openness and informal economy can be explained by positive effect of mondialisation in our case. Structuralist school theory is confirmed here, but we must accord lot of attention and incite the multinational firm to declare all their business. Positive relationship between tax rates and informal economy confirm the legalist school theory in our economy. Following this result, entrepreneurs prefer not to declare all their activity in order to pay less tax. On the other hand, Positive relationship between unemployment rate and informal economy confirm dualist theory but low industrialization of our country make that unemployment level rise considerably in our economy. This situation trains more people unemployed to lead their own business most in case in informal condition.

These results are consistent according to the best fitting of the parameters of the model. Parameters about the goodness of the model are shown in the table 2 below. In this, we have a coefficient of determination equal to 1. this value translate a good model. Also Akaike's Information criterium (AIC) and Bayesian information criterium (BIC) are lower which also reflect a good model, at the side of this, standardized root mean squared residual (0.045) is close to 0, Comparative Fit Index and Tucker-Lewis index are close to 1 respectively (0.759 and 0.651), all these indices reflect good fitness of the model.

Table 2. : information about the goodness of estimation of our MIMIC (5 - 1 - 4)

FIT STATISTIC OF THE MODEL					
Likelihood ratio	value	description	Information criteria	value	description
chi2_ms(18)	73.896	model vs. saturated	AIC	2696.280	
p > chi2	0.000		BIC	2717.595	
chi2_bs(26)	257.635	baseline vs. saturated			
p > chi2	0.000				
Population error	value	description	Baseline comparison	value	description
RMSEA	0.333		CFI	0.759	
90% CI, lower bound	0.256		TLI	0.651	
upper bound	0.414				
pclose	0.000	Probability RMSEA <= 0.05			
Size of residuals	value	description			
SRMR	0.088				
CD	1.000				

Source : from author, own make with stata statistic and econometric software (stata 12)

Notes : SRMR stands for Standardized root mean squared residual, CD stands for Coefficient of determination, RMSEA stands for Root mean squared error of approximation, CFI stands for comparative fit index, TLI stands for Tucker-Lewis index, AIC and BIC stand respectively for Akaike's Information Criterion and Bayesian Information criterion

We draw a database on informal economy in table 3. Result of benchmarking procedures are shown in the table 3 and graph 1 show evolution of informal economy as percentage of GDP compared to informal economy value in USD and GDP value in USD for Ivory Coast from 1991 to 2018. In the table of benchmarking procedures, SE represents shadow economy index obtained by applying equation (9) describes below with the help of estimated coefficients.

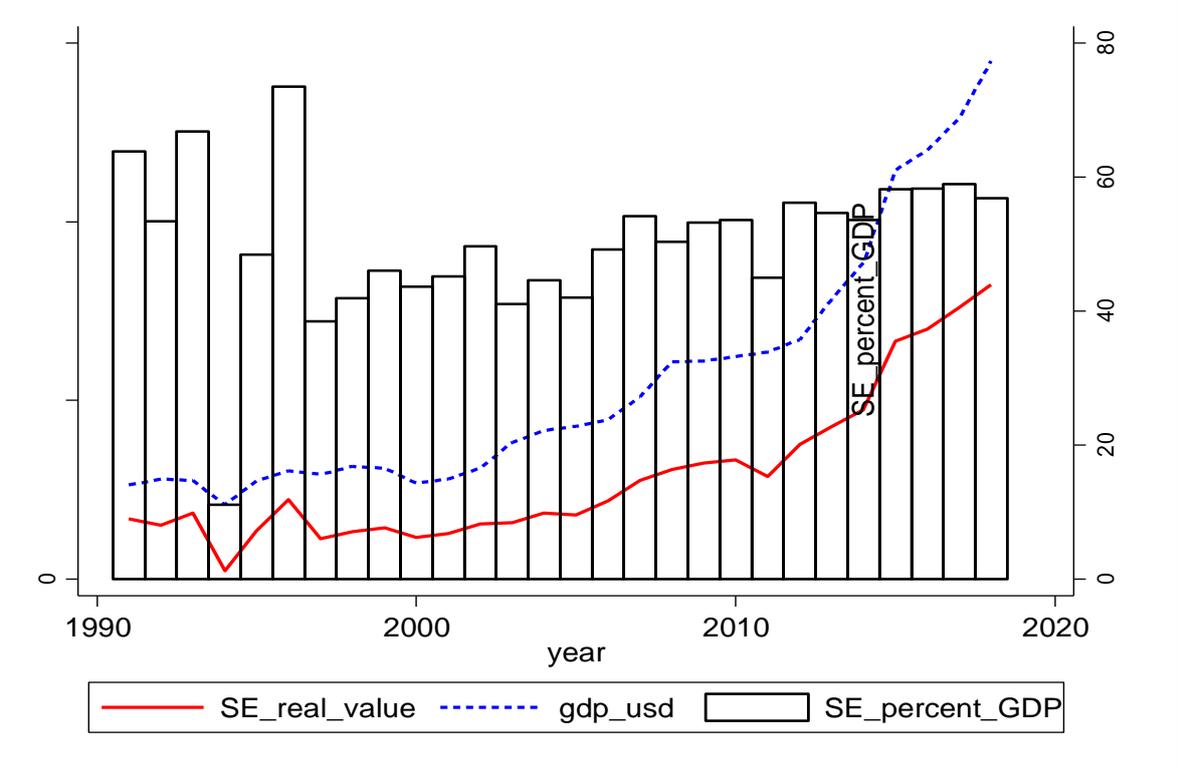
$$SE_t = (-12.78458 * Infl) + (1.61e-07 * Tax) + (-26.26638 * Govspen) + (-4.606898 * open) + (18.39404 * Unemp) \quad (9)$$

SE_2000 represents shadow economy index for year 2000. M_S_ESE_2000 is Medina and Schneider (2018) estimated fix shadow economy as percentage of GDP in 2000. GDP is growth domestic product value in USD. Pop is population. Pop_2000 represents fix population in 2000. SE_percent_GDP is Shadow Economy as percentage of GDP obtained by applying (9) formulas. Finally, SE_real_value is Shadow Economy value in USD.

year	SE	SE_2000	M_S_ESE_2000	gdp_usd	GDP_2000	pop_tot	pop_2000	SE_percent_GDP	SE_real_value
1991	374.6851	260.8835	43.64	1.1e+10	1.07e+10	1.2e+07	1.65e+07	63.8703	6.71e+09
1992	334.4866	260.8835	43.64	1.1e+10	1.07e+10	1.3e+07	1.65e+07	53.45429	5.99e+09
1993	410.6761	260.8835	43.64	1.1e+10	1.07e+10	1.3e+07	1.65e+07	66.82342	7.35e+09
1994	51.32949	260.8835	43.64	8.3e+09	1.07e+10	1.4e+07	1.65e+07	11.05574	9.19e+08
1995	297.6862	260.8835	43.64	1.1e+10	1.07e+10	1.4e+07	1.65e+07	48.43818	5.33e+09
1996	496.8595	260.8835	43.64	1.2e+10	1.07e+10	1.5e+07	1.65e+07	73.49709	8.89e+09
1997	251.3847	260.8835	43.64	1.2e+10	1.07e+10	1.5e+07	1.65e+07	38.45695	4.50e+09
1998	295.122	260.8835	43.64	1.3e+10	1.07e+10	1.6e+07	1.65e+07	41.92306	5.28e+09
1999	319.1355	260.8835	43.64	1.2e+10	1.07e+10	1.6e+07	1.65e+07	46.06545	5.71e+09
2000	260.8835	260.8835	43.64	1.1e+10	1.07e+10	1.6e+07	1.65e+07	43.64	4.67e+09
2001	282.9151	260.8835	43.64	1.1e+10	1.07e+10	1.7e+07	1.65e+07	45.21265	5.06e+09
2002	343.7884	260.8835	43.64	1.2e+10	1.07e+10	1.7e+07	1.65e+07	49.62395	6.15e+09
2003	350.8337	260.8835	43.64	1.5e+10	1.07e+10	1.8e+07	1.65e+07	41.0423	6.28e+09
2004	413.6189	260.8835	43.64	1.7e+10	1.07e+10	1.8e+07	1.65e+07	44.59787	7.40e+09
2005	401.3416	260.8835	43.64	1.7e+10	1.07e+10	1.8e+07	1.65e+07	42.00877	7.18e+09
2006	489.3313	260.8835	43.64	1.8e+10	1.07e+10	1.9e+07	1.65e+07	49.20451	8.76e+09
2007	617.129	260.8835	43.64	2.0e+10	1.07e+10	1.9e+07	1.65e+07	54.14616	1.10e+10
2008	683.4594	260.8835	43.64	2.4e+10	1.07e+10	2.0e+07	1.65e+07	50.34175	1.22e+10
2009	724.7655	260.8835	43.64	2.4e+10	1.07e+10	2.0e+07	1.65e+07	53.16546	1.30e+10
2010	745.4143	260.8835	43.64	2.5e+10	1.07e+10	2.1e+07	1.65e+07	53.58216	1.33e+10
2011	638.7709	260.8835	43.64	2.5e+10	1.07e+10	2.1e+07	1.65e+07	45.01252	1.14e+10
2012	840.6636	260.8835	43.64	2.7e+10	1.07e+10	2.2e+07	1.65e+07	56.14477	1.50e+10
2013	954.8073	260.8835	43.64	3.1e+10	1.07e+10	2.2e+07	1.65e+07	54.60008	1.71e+10
2014	1059.853	260.8835	43.64	3.5e+10	1.07e+10	2.3e+07	1.65e+07	53.58758	1.90e+10
2015	1489.177	260.8835	43.64	4.6e+10	1.07e+10	2.3e+07	1.65e+07	58.19727	2.67e+10
2016	1563.683	260.8835	43.64	4.8e+10	1.07e+10	2.4e+07	1.65e+07	58.30818	2.80e+10
2017	1699.325	260.8835	43.64	5.2e+10	1.07e+10	2.4e+07	1.65e+07	58.94523	3.04e+10
2018	1841.207	260.8835	43.64	5.8e+10	1.07e+10	2.5e+07	1.65e+07	56.81939	3.30e+10

Table 3. : estimated informal economy calibrated with Medina and Schneider (2018) 2000 value

Graph 1: evolution of informal economy compared to evolution of GDP from 1991 to 2018 (Ivory Coast)



Source : Authors own computation

5. Conclusion

In this study, we estimate from 1991 to 2018, informal economy in Ivory Coast a country from subsaharan Africa by revisiting the main drivers of informal economy in this country. We use MIMIC methodology a variant of structural equation which is widely used by specialists in the domain. We found that Public Government spending, inflation, trade openness explain negatively informal economy and taxation rates, unemployment rates explain positively informal economy. Futhermore, This technique allows us to estimate score of informal economy as a latent variable not directly observable. We success this and our model is well fit according to the charasteristic about the goodness of the model and statistical significance of the parameter obtain in our model. We calibrate informal economy score to informal economy as percentage of GDP following Dell’Anno and al. (2018) methodology and draw a database for informal economy for Ivory Coast from 1991 to 2018. We found for instance that in 2015, in Ivory Coast, informal economy represents 26,700,000,000 USD.

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