The Non-Observed Economy in Morocco: Estimation, Evolution and Analysis

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Abstract

This study estimates the size of the non-observed economy (NOE) in Morocco and analyzes its evolution over the period 1977 - 2019. We estimate a currency demand function following Tanzi's (1980; 1983) Currency Demand Method, and put emphasis not only on the classical variables of the equation but also on other variables that are specific to the Moroccan economy's context. Therefore, we introduce a dummy variable that captures the impact of banking regulations, net remittances, consumer price index, the part of government's final public consumption in the Gross Domestic Product (GDP) and the part of public investment in GDP. Our econometric analysis shows that remittances have a negative effect on currency demand. The weight of taxation, reforms, rising living costs, the part of wages in the national revenue, the consumer price index as well as the parts of public consumption and investment in GDP have a positive impact on the quantity of currency circulating in the economy. The results also show that the size of the NOE averaged 42% over the entire period under study and reached 67% by 2019.

From a methodological point of view, we took into consideration the difference in money velocities between the formal and informal sectors using the Ahumada et al.'s (2006) correction. We also adopted the fully modified least squares (FM-OLS) in order to tackle the series' cointegration and to circumvent the serial autocorrelation issues.

Keywords

Non-observed economy, tax burden, fiscal evasion, money velocity, currency demand method.

1. Introduction

Informal activities are present in all economies but predominant in developing ones. The size of the informal economy in these countries was estimated at 35.1% of official GDP in 2006, compared to 33.7% and 16.6% respectively in transition and OECD countries (Schneider & al., 2010). In 2000, the informal sector accounted for 37.7% of GDP in North Africa (United Nations (2008)).

In Morocco, the informal sector contributed to up to 40.8% of employment in 2007. The latest data produced by the country's official statistics organization (Haut-Commissariat au Plan, HCP) through its survey showed that in 2013 this percentage reached 36%. During the same year, the informal sector contributed to 12.6% of the country's value added. This percentage excludes informal jobs and value created by the agricultural sector as well as the public and local government. It also omits revenues that evade taxes or are generated through illegal activities. The latest report on "the national survey on the informal sector" produced by the HCP provides data on the economic characteristics of informal production units (IPUs). The survey is limited to non-agricultural activities, but takes into account artisanal

and commercial activities carried out by farmers as secondary activities. The sample covers 11000 IPUs and the survey allows the assessment of value added generated by unregistered activities. However, it does not target incomes generated from tax evasion and illegal activities (such as corruption, money laundering, drug trafficking...etc.). (For more details, see HCP's website: <u>www.hcp.ma</u>).

Economic literature has dedicated an important part to the measurement and analysis of the informal economy's size and evolution. Tanzi (1999) and Giles (2000) explained that knowing the size of the informal economy makes the understanding of its effects on the formal economy possible. In addition, estimating the size of the informal sector allows tax gap deduction. Kelley (1994) emphasized that omitting the presence of informal activities while designing public policies would certainly reduce their intended effects. Other consequences of the NOE's omission from National Accounting System calculations include negative effects on the country's development ranking as well as its growth speed, poverty, inequality, negative impacts on business performance and quality of employment. Among the many repercussions, we cite also government tax revenues reduction, increase in tax burden, and probability of occurrence of fiscal crises...etc.

This study aims to estimate the size of the NOE in Morocco and to analyze its evolution during the period 1977 - 2019. The period covered in this work is characterized by the implementation of several tax reforms, the adoption of a structural adjustment plan targeting macroeconomic imbalances, loans' regulation, application of administered interest rates followed by their liberalization several years later... etc. It is also characterized by its length, allowing us to construct and run consistent econometric models. Therefore, we estimate a currency demand function using Tanzi's (1980; 1983) approach. We allow for the difference of velocities in the formal and informal sectors in our estimations by relying on the Ahumada et al.'s (2006) correction. We also adopt the FM-OLS method to take into consideration the series' cointegration and solve the issue of serial autocorrelation.

The central hypothesis we test in the present study is that the size of the NOE in Morocco, approached through excess currency that is unjustified by official GDP transactions, is impacted not only by the conventional variables of the currency demand equation, but also by context specific factors.

At this point, it should be noted that in literature, the definitions and delimitations of the informal economy's contours are quite different (non-observed, unregistered...). The authors agree that there is no single definition of the informal economy (see examples: Tanzi (2002), Dell'Anno (2007), Dell'Anno et al. (2007) and Schneider et al. (2010)). In this study, we refer to all undeclared income-generating activities, tax evasion and illegal activities as "Non-observed Economy (NOE)" or "informal economy/informal sector".

Many authors sought to measure the size of the informal economy in Morocco by adopting different estimation methods. Schneider (2005) opted for a DYMIMIC model (Dynamic Multiple Indicators Multiple Causes model) and evaluated the size of the informal economy for a panel of 110 countries including Morocco. According to the author, the size of the informal sector stood at 36.4% of official GDP in 1999-2000. Schneider et al. (2010) concluded that this percentage was 35.6% on average between 1999 and 2006. Embaye (2007) estimated the size of the informal sector average between 1999 and 2006. Embaye (2007) estimated the size of the informal sector averaged 12% of GDP during the period from 2000 to 2005. The question of the informal economy's size and determinants in various countries and regions interested many researchers. We cite as exemples Schneider et al. (2010), Elgin et Oztunali (2012), Aktuna-Gunes et al. (2014), among others.

The common feature of these studies is that they consider several countries in their analyses and make their estimations over short periods. This prevents the phenomenon's assessment over time and leads to the production of divergent results, due to their sensitivity to estimation methods and to the choice of analysis periods. In our case, the series used are characterized by their length, which allows us to produce reliable econometric estimates.

The rest of the paper is structured as follows: Section 2 presents the literature review. Section 3 focuses on the methodological aspects. Data collection and characteristics are presented in section 4. Section 5 presents and interprets the econometric results. In the same section, we estimate and comment on the evolution of the NOE's size in Morocco over the entire period under study. The last section concludes.

2. Literature Review

2.1. Theoretical teachings

This paragraph presents the dominant theories formalizing the relationship between the formal and informal sectors. Thus, the legalist, structuralist and dualist schools identified by Chen et al. (2004) are presented here. New theories have been developed to link the formal and informal economies: these are the complementarity, voluntarist and integrative theories and are discussed in Williams (2006; 2007) and Chen (2008; 2012).

2.1.1. The dualist theory

The theory of the dual economy is based on the founding work of Lewis (1954, 1956), as well as other economists from the 1940s to the 1970s (Harris and Todaro (1970) Boeke (1953) and Hirschman (1957)) who focused on institutional dualism leading to the marginalization of social groups and their exclusion from formal economic activities (Clement (2015)). Lewis (1954, 1956) highlighted the presence of two economies resulting from the evolution of resources flows: factors of production (capital and labor) and goods, between the industrialized sector and the traditional agricultural sector. The first sector, seen as more productive and generating more profits given the accumulation of capital it allows, would attract more workers from the second sector. In fact, according to this theory, the industrial sector would even be able to produce agricultural capital goods, causing the gradual abandonment of workers from the agricultural sector. Those workers will migrate to the industrial sector, but not all of them will be hired, because the production of this sector is much more intensive in reproducible capital factor than in labor factor. This is because profits are partially reinvested to enrich capital resources in the industrial sector. These interactions will lead to the emergence of a "subsistence/informal" sector whose output, productivity and profits/revenues are much lower than those of the industrial sector. In other words, the informal sector exists because of the inability of the formal sector to create enough jobs to absorb the stock of unemployed people who have migrated to better-paying, more capital-intensive and therefore more productive sectors.

2.1.2. The structuralist theory

In contrast to the dualist approach, and drawing on the neo-Marxist current (Roubaud (2014)), the structuralist school considers that informality is not simply the result of a surplus of unemployed/unused labor factor that is replaced by capital factor. Proponents of this theory explain that the informal sector is the result of a capitalist system exploiting cheap inputs and labor to ensure a more competitive economy (Yusuff (2011) and Malooney (2004)). In other words, the formal sector makes use of informal sector workers and incorporates their outputs into the products traded in the formal economy. The formal economy benefits from lower production costs by exploiting workers who are underpaid and less protected than those working in the formal sector. To illustrate these interactions, Castells (2006) gave the example of a research carried out in Guatemala, that showed that several American clothing companies relocate their activities in search of low-cost labor. These firms supply local companies with inputs (fabrics, designs and even credit) but never offer social security schemes. The subcontracting companies use the manual labor of Indian women who are largely underpaid compared to the market wage.

This approach also highlights the role that demand plays in the presence and evolution of an informal economy. Indeed, Roberts (1994) showed that individuals/households would enjoy greater utility by consuming goods and services produced at a low cost in the informal sector.

2.1.3. The legalist theory

The legalist school defends the view that the informal sector is composed of microentrepreneurs who circumvent taxation. The latter prefer to operate informally in order to escape regulation (de Soto, 1989). This theory, also called "orthodox" because it contrasts with the previous two, is liberal in its thinking. The legalist approach considers that entry into informality is a deliberate choice to circumvent the costs inherent to taxation or associated with obtaining a formal status and registering the activity.

2.2. Empirical literature teachings

Empirical studies that dealt with the estimation of the NOE's size used different methods and approached the informal economy by different variables and determinants. On one hand, there are direct methods based on household surveys of monetary or full expenditures (Fortin et al. (2009), Aktuna-Gunes et al. (2014) based on the work of Pissarides and Weber (1989) and Lyssiotou et al. (2004)). On the other hand, there exist also a set of indirect methods like the electricity consumption method (Johnson et al. (1997)) or the monetary methods (Cagan (1958), Gutmann (1977),

Feige (1979) and Tanzi (1980; 1983)), among others. Each of these methods¹ has its advantages and disadvantages that many authors identified, among whom we cite Georgiou (2007).

Concerning the determinants used to analyze the size and the evolution of the NOE in various contexts, they differ according estimation methods. We cite as examples, the conventional variables used originally by Tanzi (1980; 1983) in his currency demand equation to approach the size of the informal economy in the USA, which are the tax burden rate, real GDP per capita, interest rate and the share of wages in national income. Other authors added specific variables to the equation in order to understand the characteristics of the NOE in their contexts. Examples of these studies include : Macias and Cazavillan (2009) whose estimations introduced the share of remittances in GDP, Laflèche (1994) who used the number of ATMs in chartered banks to capture the effect that financial innovations might have on the quantity of money in circulation in the Canadian economy, Embaye (2007) who introduced the inflation rate, and Ardizzi et al. (2011) who took into account the expansion degree of banking activities in the 91 provincial regions in Italy by integrating the number of bank accounts per capita. Other methods might use different variables. Let us cite as example the MIMIC/DYMIMIC model, which is a variant of the structural equation models (Joreskog and Goldberger (1975)) that was applied to the NOE estimation in many contexts (Giles (1999), Dell'Anno et Schneider (2006), Dell'Anno et Solomon (2008), among others).

3. Methods

In this section, we focus on the currency demand method (Tanzi (1980; 1983)), that we apply to the Moroccan NOE. To the best of our knowledge, currency demand approach would be the most appropriate way to capture the size of the NOE. In contrast to other approaches that fail to capture all aspects of the informal economy as it is the case of the electricity consumption method, or household surveys...etc. (Georgiou (2007)), the currency demand method uses monetary aggregates that make it possible to catch all transactions generated in the economic sphere. Concerning the econometric estimation, we present also in this section the FM-OLS method.

3.1. The currency demand method

The currency demand method was first developed and applied to the case of the American economy by Cagan (1958). The author wanted to explain the long-term variations in the ratio "quantity of money that would be put into circulation to meet the transaction needs required by official GDP, relative to the money supply actually put into circulation in the economy". The two are supposed to be equal in the absence of informal transactions. Consequently, any difference would be attributed to the NOE. To do this, the author used a simple statistical analysis of historical data. It was only with the work of Gutmann (1977) and especially that of Tanzi (1980; 1983) that the method took on its econometric dimension. Since then, many authors applied the currency demand approach to the informal sector's estimation in many countries. As examples we can cite: Feige (1979), Faal (2003), Anamaria et al. (2009), Hernandez (2009), Macias and Cazavillan (2009), Magazzino et al. (2011), Pickhardt and Sarda (2011), Arby et al. (2012) among others. The fundamental assumption behind this approach is that transactions in the informal sector are mainly carried out through cash. Economic agents engaged in informal activities prefer carrying out their transactions in cash in order to reduce the likelihood of detection by tax authorities. Estimating the amount of money resulting from these transactions would allow us to assess the size of the NOE in Morocco.

As previously stated, tax burden rate, real GDP per capita, interest rate and the share of wages in national income are the classic variables in Tanzi's currency demand equation (1980; 1983). In this paper, in addition to the conventional currency demand equation variables, we include specific factors that capture the effects of tax reforms, the impact of banking regulations on transactions, the weight of the State in the economy (parts of government final consumption and public investment in GDP), net remittances and consumer price index.

3.2. Econometric estimation method

We estimate the currency demand equation using a log-linear model estimated by the FM-OLS initiated by Phillips and Hansen (1990). The choice of this method is justified by the fact that our series are integrated in different orders (I (1) and I (0)). They also have several cointegration relationships at the 5% threshold². Conventional Unit-Root tests (Augmented Dickey-Fuller (ADF) and Phillips Perron (PP)) showed that all the series are integrated of order 1, except WAGES_NI, CPI, GGOV_FINALCONSUMP, INVESTEXPEND_RATIO. The latter are level stationary (integrated

¹ That we do not present in this paper, as we only focus on the one we adopt which is the currency demand method.

² The results of these tests are available upon request.

of order 0). The Johansen cointegration test confirms the presence of seven cointegrating relationships at the 5% threshold (Trace statistic), and four cointegrating relationships according to the Eigenvalue statistic at the same threshold.

Therefore, the application of an Error Correction Model (ECM), where the series must be integrated in the same order would be inappropriate (Engle and Granger 1987 and Murray 1994). The introduction of non-stationary series in their differenced form will not allow the assessment of their long-term effects (Bühn and Schneider (2008)).

FM-OLS would therefore allow taking into account the series cointegration as well as the resulting endogeneity bias of the regressors. The method also corrects the residuals' serial correlation. In the presence of unit-roots in the series, FM-OLS provides hyper-consistent estimators to the extent that their convergence rate is higher than that of an ordinary least square (OLS) estimator (Phillips (1992; 1995)).

4. Data Collection

The series we use come from the statistical yearbooks produced by the HCP as well as the Central Bank of Morocco's published database (Bank Al-Maghrib (BAM)). Table 1, below, presents the variables and their sources:

Variable	Description and calculations*	Source
M1DEF	M1 aggregate deflated by the GDP deflator (1977-2019).	BAM
TBR	Tax burden rate: the sum of direct, indirect taxes, registration and stamp duties, customs duties, and employee and employer social security contributions, expressed as a percentage of non-agricultural GDP (1977- 2019).	
DMFA	Dummy variable taking into account the effect of specific provisions of the 1990, 1996 and 1997 Finance Acts. The variable takes 1 between 1977 and 1989, 3 between 1990 and 1995 and 2 between 1996 and 2019.	Economy and Finance Ministry
CSTGDP_CAPIT A	Constant GDP per capita deflated by the GDP deflator (1977-2019).	НСР
WG_NI	Share of wages in gross national disposable income (1977-2019).	НСР
INT_RATE	Interest rate on time deposits (1977-2019).	BAM
CPI	Consumer price index (1977-2019).	HCP
RATIOTRANS_ GDP	Share of net transfers as a percentage of GDP (1977-2019).	НСР
RATIO_FCGOV	Share of government final consumption in GDP (1977-2019).	HCP
RATIO_INVEST EXP	Share of public investment expenditure in GDP (1977-2019)	НСР

Table 1.	Variables	presentation	and	sources
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*Ratios calculated by the authors

We chose the monetary aggregate M1 as the endogenous variable. The idea behind this choice is because transactions in the informal sector are generally carried out in cash or by withdrawals from current bank accounts (immediately disposable non-cash money/scriptural currency). M1 aggregate showed a sustained increase over the entire period under study (Figure 1). We also note the slight increase in liquid monetary resources available to economic agents between 1990 and 1999. This period corresponds to the end of the credit supervision wave in Morocco and the beginning of banking sector's deregulation, the almost complete liberalization of interest rates, and the introduction of regulations concerning firms' banking transactions above certain amounts. The aggregate has grown steadily since 2001.



"Figure 1. Evolution of the monetary aggregate M1 and its share in GDP over the period 1977-2019"

M1/GDP ratio slightly fell in late 2009 and early 2010, when the effects of the global crisis began to appear in the Moroccan economy. Since 2010, M1 resumed its course and reflected an increase in the quantity of money in circulation until the last year of the period under analysis. However, the behavior of M1/GDP ratio reflected an increase in the quantity of currency and scriptural money in circulation relative to transactions in the economy. This could be explained by three main hypotheses. The first is related to the increase in public investment in several sectors, particularly in value added creating industries (Industrial Acceleration Plan), which implies significant monetary creation. The second hypothesis is related to the new wave of privatization that has marked the last few years. Indeed, a privatization program has been re-launched during the years 2018 and 2019 and is part of the new strategic vision of the State as a shareholder. The last hypothesis would justify the increase in the quantity of money in circulation by an increase in the NOE's size.

The conventional variables in the money demand equation, three of which are shown in Figure 2, are the tax burden rate, real GDP per capita, the interest rate on time deposits and the share of wages in national income.



"Figure 2. Evolution of the currency demand equation's conventional variables in the case of the Moroccan economy between 1977 and 2019 (in % and under log)"

The tax burden rate (TBR), variable of interest in the currency demand equation, would reflect the increase in the size of the informal economy. Figure 2 shows that, overall, TBR in Morocco followed a downward trend between 1977 and 1985 before increasing due to the various measures taken under the Structural Adjustment Plan with the aim of restoring the country's macroeconomic equilibria. Two peaks in the TBR were then witnessed. The first one in 2008 and the second in 2014. This behavior is due to the different reforms that took place during this period, aiming at rationalizing, harmonizing, simplifying the tax system and reducing its secularity as well as broadening the tax base. Let us add that the reduction of the budget deficit was among the objectives of the Finance Act adopted in 2014 (Ministry of Economy and Finance (2014a)). This objective was indeed achieved following the introduction of new taxes and the raising of the rates of several tax categories ((Ministry of Economy and Finance (2014b)). The budget deficit was reduced to less than 4,9% (the target set by the 2014 Finance Act).

In empirical literature, the share of wages in national income plays a positive role in the quantity of money in circulation. Tanzi (1980; 1983) explains this relationship by the fact that wages are often paid in cash, unlike other types of income (i.e., interest on investments or dividends). In the case of Morocco, the evolution of aggregate wages in national income has been mainly affected by the trend in wages in the formal private sector. Civil servants' salaries have maintained a stable share, varying between 1.30% and 2.90% of gross national disposable income over the period 1980-2019, with a large decline in 1984. Finally, deposit interest rates, one of the classical variables of Tanzi's equation, are introduced to measure the opportunity cost of holding liquid money.

The specific variables we use to analyze the size and evolution of the NOE in Morocco, shown in figure 3, are the ratio of public investment expenditure to GDP, the ratio of government final consumption to GDP, and the ratio of remittances to GDP. In addition to these variables, we also introduce the CPI and a dummy that captures the provisions of the 1990, 1996, and 1997 Finance Acts.

The shares of government final consumption and public investment in GDP are proxies for the degree of government intervention in the economy. Thus, an intensified government presence in the market would lead to more regulation aimed at reducing the share of the informal sector in the economy. Also, an increase in public investment and government operating expenses would lead to an increase in aggregate demand in the economy, thus generating an increase in the quantity of money in circulation.

Figure 3 shows that the share of government final consumption in GDP has fluctuated between 15% and 22% over the entire analysis period. However, the share of public investment showed a downward trend until 1997, after which it began to increase. The introduction of net remittances as an explanatory variable for the quantity of money in circulation in the economy is essential because it would affect the portion of money destined to unobserved activities.



"Figure 3. Evolution of the Moroccan economy's specific macroeconomic variables over the period 1977-2019 (as a percentage of GDP)"

5. Results and Discussion

Given the methodological aspects discussed in section 3 as well as the characteristics of the series presented and analyzed in section 4, we adopt the following specification:

 $ln(M1DEF) = ln(TBR) + DMFA + ln(CSTGDP_CAPITA) + ln(WG_NI) + ln(INT_RATE) + ln(CPI) + ln(RATIOTRANS_GDP) + ln(RATIO_FCGOV) + ln(RATIO_INVESTEXP) + C$ (1) 5.1 Numerical Results

Variables	Coefficients
TBR	6,76* (2,70)
DMFA	1.89** (0,63)
CSTGDP_CAPITA	6.04* (2,41)
WG_NI	21.04** (5,96)

Table 2.	Econometric	results
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INT_RATE	4.72 ^{NS} (2,81)
CPI	4.14*** (0,63)
RATIOTRANS_GDP	-3,23* (1,72)
RATIO_FCGOV	11,93** (2,26)
RATIO_INVESTEXP	7,32*** (0,75)
С	-135,6*** (14,21)
Adjusted R ²	0,949
Long-run variance	0,021
Number of observations (N)	43

* Significant at the 10 % threshold; ** Significant at the 5 % threshold; *** Significant at the 1 % threshold. Standards errors in parenthesis. <u>Source:</u> Authors calculations using HCP and BAM data.

The explanatory power of the model is high (adjusted $R^2 = 0.949$). FM-OLS method made it possible to consider the series' cointegration and corrected the resulting problem of residuals' serial autocorrelation. (Table 2)

As it is the case in almost all the previous studies that focused on estimating the size of the NOE in different contexts, the tax variable, approached by the tax burden rate, has a positive and significant effect on the quantity of money in circulation. The weight of taxation greatly increases the probability of economic agents to carry out their transactions in the informal sector. This result is widely shared in the previously mentioned literature.

Regulations limiting the amount of cash transactions that companies can carry out have a positive effect on the amount of money in circulation. The dummy variable is significant at the 5% threshold. This reflects companies' preference for informal activities to avoid taxing their profits.

GDP per capita significantly increases the quantity of money in circulation. First, let us recall that GDP growth in Morocco does not allow the stock of unemployed people to be absorbed, nor does it allow coping with the flows of new entrants into the labor market. The increase in poverty and the resulting inequalities will have a positive effect on the size of the NOE. As a result, even if the banking rate is increasing in Morocco, the use of banks as transactions intermediaries is still low. Indeed, many households and businesses are still paid in cash. Thus, an increase in their incomes would lead to an increase in aggregate demand, causing an increase in the amount of currency in circulation in the economy. Although this result is not consistent with Tanzi's (1980; 1983) conclusions for the US economy, it is compatible with the conclusions of studies conducted in developing or emerging countries (Hernandez (2009) and Macias and Cazavillan (2009)).

The share of wages in national income significantly increases the quantity of currency in circulation in the Moroccan economy. It should be recalled that overall formal wages in Morocco are affected by wage evolutions in the formal private sector. Since they are generally paid in cash, they increase the amount of money demanded in the economy. This result is in line with the previously cited studies.

Interest rate on term deposits is not significant. This result, also shared by Gadea and Serrano-Sanz (2002), reflects the fact that interest rates have been administered for a long period in Morocco, making them inadequate to reflect the opportunity cost of holding currency.

The expected significant and positive effect of CPI is well verified in this estimation. As a synthetic indicator of products prices' evolution, any increase in the CPI would reflect the preference of economic agents to go through the informal sector in order to circumvent any taxation likely to reduce their purchasing power.

Net remittances have a significant effect on the quantity of currency in circulation in the Moroccan economy. The negative sign of the variable seems to contradict the assumptions made above, as well as the results of the research that incorporated this factor into their currency demand equations (Macias and Cazavillan (2009)).

However, let us recall that in our case, only official remittances are considered. Since these consist largely of bank transfers, it is therefore understandable that an increase in their importance in GDP would have a negative impact on the currency in circulation, since they increase the quantity of money "in banks" (M2 and not M1).

In line with the assumptions made in Section 4, the shares of general government investment and final consumption expenditures in GDP have a positive and significant impact on the quantity of currency in circulation.

5.2 Graphical Results

After estimating the long-run relationship's coefficients between M1DEF and all the explanatory variables, we now deduce the size of the NOE in Morocco.

M1DEF = 6.76 TBR + 1.89 DMFA + 6.04 CSTGDP_CAPITA + 21.04 WG_NI + 4.72 INT_RATE + 4.14 CPI - 3.23 RATIOTRANS_GDP + 11.93 RATIO_FCGOV + 7.32 RATIO_INVESTEXP - 135.6 (1)

We follow Tanzi's methodology (1980; 1983) to infer the predicted values of M1DEF, by replacing the values of each series in the equation. These values correspond to the total quantities of cash and immediately disposable currency in circulation in the economy. We call these values $\widetilde{M1}$.

Then, we estimate $\widehat{M1}$ corresponding to the "legal" cash and scriptural money. In other words, we calculate the level of M1 corresponding to the state of the economy in which all economic agents declare their incomes. Tanzi (1980; 1983) calculates this element by using all the coefficients of the selected model, but assuming that the tax burden is equal to its lowest level over the entire analyzed period, to that corresponding to the first year of the selected period or to zero. In the latter case, the tax burden rate should be introduced in the form (TBR+1), so that ln (TBR+1)=0 when TBR=0. Like Tanzi (1980; 1983), we believe that the first approach is a more realistic way to calculate $\widetilde{M1}$. We adhere to the idea that it is not possible to imagine an economy where there are absolutely no taxes.

We calculate then the level data by applying the exponential form. We also take into account the impact of prices and cancel out the deflator's effect in order to obtain the estimated values of $\widetilde{M1}$ and $\widehat{M1}$ in nominal terms. The difference between the nominal values of the two series $\widetilde{M1}$ nom. and $\widehat{M1}$ nom. would in fact represent "illegal currency \ddot{M} " resulting from unregistered income-generating activities, tax evasion and illegal activities.

$$\ddot{M} = \widetilde{M1} nom. - \widehat{M1} nom \tag{2}$$

We calculate next the money velocity (v) for each period by dividing official GDP (GDP form.) by legal currency.

$$v = \frac{Form.GDP}{\widehat{M1}}$$
(3)

By multiplying velocity by illegal currency, we obtain informal GDP (GDP inform.) corresponding to the informal economy.

Inform.
$$GDP = \upsilon * \ddot{M}$$
 (4)

Tanzi (1980; 1983) assumes at this level that money circulates at the same speed in both the formal and informal sectors. However, Ahumada et al. (2006) have shown that this hypothesis is only valid if the elasticity of the quantity of money demanded in the economy relative to GDP equals 1. Since this condition is not met in our case (GDP coefficient is 6.04), we adopt the correction proposed by Ahumada et al. (2006) to consider the velocities' inequality in the two sectors.

This correction consists in raising the size of the informal sector obtained by the Tanzi method to the power $1/\beta$. β represents the elasticity of money demand in relation to GDP.

Figure (4) shows the evolution of the "informal GDP-to- official GDP" ratio calculated based on Tanzi's approach (1980; 1983) and with the application of the Ahumada et al.'s (2006) correction.



"Figure 4. Evolution of the NOE / official GDP ratio over the period 1977-2019 (comparison of Tanzi (1980-1983) & Ahumada et al. (2006) approaches)"

We note that despite the variability of the ratio "informal GDP to official GDP" over the studied period, the latter follows an upward trend. During the last four years of the seventies, informal GDP to official GDP ratio was around 24%. All along the eighties, the ratio dropped to an average of 14%, then picked up to 27.5% during the nineties. During the period 2000-2009, informal GDP to official GDP ratio jumped to 35%. From 2010 to 2019, informal GDP to official GDP surpassed 48% in average. These averages were calculated based on Tanzi's approach. For the same periods under analysis, the ratio averages according to Ahumada et al's (2006) correction were respectively 36.5% (1977-1979), 24% (1980-1989), 40% (1990-1999), 47% (2000-2009) and 59.5% (2010-2019).

In addition to the effect of other variables that may influence currency demand in the Moroccan economy, we believe that the evolution of informal GDP essentially follows that of the tax burden. It is worth noting that well before the adoption of the structural adjustment plan, Morocco set up a tax system in 1980 with the objective of involving citizens in national solidarity and targeting income in certain categories of taxes. These direct taxes on taxpayers' income operating in the formal sector seem to be among the reasons motivating their decision to operate in the informal sphere. It should be noted, however, that tax burden was at its lowest level during the eighties.

The share of informal GDP in official GDP increased between 1988 and 1991 because of tax and banking reforms undertaken as part of the structural adjustment plan previously mentioned in this paper.

The decline in informal GDP between 1996 and 2002 is due to several reasons. The first concerns the total exemption of exporting companies for the part of their income generated by exports during the first five years, and a 50% reduction in the corporate tax rate beyond this period, in order to encourage exports (Ministry of Economy and Finance (2010)). Then, there was the partial or total suppression of national solidarity participation tax on real estate income or profits generated by real estate corporates. Finally, regarding patent, an exemption from tax principal was introduced during the first five years for any natural person exercising an activity. All these measures and others had to encourage the formalization of several production units (Ministry of Economy and Finance (2010)).

Since 2002, the size of the informal economy has grown larger. The exceptional increase in tax revenues in 2008 is due to the good performance of direct and indirect taxes, the widening of the tax base by the suppression of certain allowances, accompanied by a reduction in the corporate tax rate to 30% (37% for financial companies), as well as the elimination of certain VAT exemptions, especially for investment transactions... These decisions led to increases in tax revenues, and consequently in tax burden.

Even with the increase in indirect tax revenues, the tax burden rate fell again between 2009 and 2012, following the decline in direct tax revenues (43% of total tax revenues in 2011 instead of 46% in 2006). This resulted in a decline in the share of informal GDP in official GDP between 2008 and 2012.

In 2013, informal GDP resumed its upward trend and took off to reach an unprecedented level in 2014 (71.20% and 78.73% respectively according to the methods of Tanzi (1980; 1983) and Ahumada et al. (2006)). The year 2014 was characterized by the introduction of new taxes and the increase in the rates of several others. We cite the following as examples: "The increase of the minimum amount to be collected as a minimum contribution under the Corporate Tax and the institution of this minimum for taxpayers subject to the Corporate Tax. The capping of the 55% flat-rate

allowance applied to pensions and life annuities, the maintenance of the tax exemption granted to the agricultural sector only for the benefit of the medium and small businesses, the removal of the exemption on income from the rental of new buildings, cancellation of the exemption and application of the 10% rate on catering services provided directly by the company to its employees...etc." (Ministry of Economy and Finance (2014b)). All these decisions to increase existing taxes, or to introduce new tax measures to increase government revenues and reduce the budget deficit, have had a positive impact on increasing the share of informal GDP in official GDP.

A resumption of the upward trend in NOE is observed after 2015 and continues until the end of the analysis period, reflecting an increase in the amount of money in circulation in the economy. This result confirms our hypotheses set out in the methodology section: the increase in public investment effort in several sectors, notably those of value-added industries (Industrial Acceleration Plan) and the new wave of privatization that marked the last few years justifies the increase in the quantity of money in circulation, and therefore the part intended to finance activities in the informal sphere.

6. Conclusion

As explained by several authors (Kelley (1994), Tanzi (1980; 1999), Dell'Anno et al. (2007)), the existence of a large informal sector in the economy has various effects on the observed macroeconomic variables. In several economies, the failure to consider the informal economy when calculating unemployment rate, for example, results in its underestimation (several individuals declare themselves unemployed while actually engaged in informal activities and generating incomes). Inflation rates may also be overestimated, since prices of goods and services are lower in the informal sector (Tanzi,1980). These variables are considered signals that help policy makers design public policies. If such variables were wrongly calculated because of the ignorance of the informal economy's presence, the designed public policies would be less effective.

Although national surveys on the informal sector allowed the determination of undeclared legal activities' share in the Moroccan value added, they were not able to estimate, from a macroeconomic point of view, the other components of the NOE (income from informal agricultural and unregistered activities, illegal activities and tax evasion revenues). The goal of this study was to estimate the size of the NOE in Morocco and to shed light on its evolution over a long period of time, allowing us to find consistent results.

The results highlight the effect of taxation on the informal sector's size. The effect of the other variables was clear. Banking regulations discourage companies from conducting their transactions by checks, thus avoiding taxation on their profits.

Formal wages in the economy are affected by wage evolutions in the formal private sector. Since they are generally paid in cash, they increase the demand for money in the economy.

Government final consumption and public investment as a percentage of GDP reflect the effect of government intervention, as well as the impact that their increase would have on aggregate demand in the economy. The sign of the consumer price index reflected the preference for liquidity in order to maintain high purchasing power. Finally, the signs of the interest rate on term deposits, constant GDP per capita and the share of net remittances in GDP seem counter-intuitive but are well justified in the context of the Moroccan economy.

From a methodological point of view, this study includes, in addition to the conventional variables of Tanzi's equation (1980; 1983), other variables specific to the Moroccan economy's context. The adoption of the FM-OLS method allowed taking into account the effects of series cointegration and correcting the residuals' serial autocorrelation. Consequently, we obtained consistent coefficients that consider the long-term relationship between the series. Finally, this work allows the inequality of money velocities' consideration in both the formal and informal sectors by applying the Ahumada et al.'s (2006) correction.

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