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The Size and Development of the Shadow Economy in Morocco [*]

Kamal Lahlou [¶] Hicham Doghmi [§] Friedrich Schneider [**]

Abstract

The objective of this paper is to estimate the size of the shadow economy in Morocco over the period 1988-2018. The CDA and MIMIC approaches are used while taking into consideration variables that reflect the features of the Moroccan economy such as the importance of currency in circulation, the size of the agricultural sector and the financial development process. Our results show that the evolution of the shadow economy exhibits three distinct periods: (i) over the first period 1988-1998, it is almost stagnant at around 40% of GDP; (ii) during the second period 1999-2008, it decreases to 32% -34% of GDP; (iii) during the last period 2009-2018, the declining trend is continuing but at a more moderate pace, to reach a level just below 30% of GDP. These results suggest that the strategies implemented by national authorities since the early 2000s to improve the institutional, economic and financial environment contributed to reducing the size of the shadow economy. However, the persistence of important shadow activities requires additional structural reforms particularly those related to education, judiciary system, tax policy and labor market.

Keywords: Shadow economy, MIMIC model, currency demand approach, financial development, structural reforms, Morocco.

JEL Classification: E26, H26, K42, O17, C22, C5, P11

Résumé

L'objectif de ce papier est d'estimer la taille de l'économie informelle au Maroc sur la période 1988-2018. Les approches CDA et MIMIC sont utilisées en prenant en considération les spécificités de l'économie marocaine telles que l'importance du cash, la taille du secteur agricole et le processus de développement financier. Nos résultats suggèrent que l'économie informelle présente trois périodes d'évolution distinctes: (i) au cours de la première période 1988-1998, l'économie informelle stagne quasiment à environ 40% du PIB; (ii) au cours de la deuxième période 1999-2008, l'économie informelle diminue à 32-34% du PIB; (iii) durant la dernière période 2009-2018, la tendance à la baisse se poursuit mais à un rythme plus modéré pour atteindre un niveau juste en-dessous de 30% du PIB. Ces résultats suggèrent que les stratégies mises en œuvre depuis le début des années 2000 pour améliorer l'environnement institutionnel, économique et financier ont contribué à réduire la taille de l'économie informelle. Toutefois, la persistance d'importantes activités informelles nécessite des réformes structurelles supplémentaires, notamment celles liées à l'éducation, au système judiciaire, à la politique fiscale et au marché du travail.

Mots clés: Economie informelle, modèle MIMIC, fonction de demande de monnaie, dévelopement financier, réformes structurelles, Maroc.

Classification JEL: E26, H26, K42, O17, C22, C5, P11

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1 Introduction

The shadow economy is a dominant feature of emerging and developing economies. Despite its downward trend over the past two decades (Medina & Schneider, 2018), the size of the shadow economy represents on average 30% of GDP and 70% of employment (Loayza, 2018).

An examination of the large literature dedicated to the shadow economy clearly shows that there are still several open questions. The first one is related to the definition of the shadow economy. These activities are qualified in several studies as part of the black economy, the underground economy, the unobserved economy or the cash economy, without really specifying the dimensions covered by these different terms and how they differ (OECD, 2017). Additionally, there is no consensual definition of the shadow economy and a large number of studies use the definition proposed by Schneider et al. (2010): "the shadow economy includes all market-based legal production of goods and services that are deliberately concealed from public authorities for any of the following reasons: (1) to avoid payment of income, value-added or other taxes, (2) to avoid payment of social security contributions, (3) to avoid having to meet certain legal labor market standards, such as minimum wages, maximum working hours, safety standards, etc., and (4) to avoid complying with certain administrative procedures, such as completing statistical questionnaires or other administrative forms".

The second question is related to the main actors in the shadow economy. The literature essentially distinguishes between informal workers and informal firms (ILO, 2013). Informal workers are workers in "informal units" and informal "self-employed" workers. Workers in informal units are all persons employed in at least an informal firm. Informal self-employed workers are self-employed workers and workers who are not employed under formal contractual arrangements or who do not benefit from social protection mechanisms and safety nets. As for informal firms, they are often identified by the following characteristics. First, they are not incorporated firms whose legal status sets them apart from their owners. Second, they do not have their account books but produce marketable goods and services. Third, they maintain the workers employed continuously and below a threshold determined by the country. Finally, they may not be registered and their employees are not declared.

Actors in the shadow economy can also be divided into several categories. Perry et al. (2007) distinguishes workers and informal firms by those who are excluded from the formal sector and those who leave it voluntarily. For Docquier et al. (2017), informality is a phenomenon closely related to livelihood activities that are prevalent in low-income countries characterized by the importance of sectors with low technological content. Kanbur & Keen (2014) divides informal workers and informal firms into three categories according to their degree of compliance with

regulations: evaders, avoiders and outsiders. The evaders are firms covered by the regulations but which operate in informality to escape it. Avoiders are firms that constantly adjust so as not to be targeted by the regulations. Outsiders are firms that operate in activities that are simply not yet covered by the regulations.

The identification of the actors engaged in the shadow economy made it possible to analyze another important dimension which is the key drivers behind its expansion. For instance, Loayza (2018) underlines the low level of economic development as the main driver of the expansion of the shadow economy. Specifically, the inability of the urban economy and social structures to support demographic dynamics and to integrate migrants from rural areas into the formal economy plays a major role in the development of informal activities. Dabla-Norris et al. (2018) and Ulyssea (2018) investigate the role of taxation and regulatory rigidity. High tax burdens and restrictive labor market regulations encourage firms to operate in the informal sector to reduce their costs. Also, Choi & Thum (2005) and Mendicino & Prado (2014) show that the non-systematic application of laws pushes firms to reduce contact with the public administration by remaining in the informal sector.

The third open question is related to the negative externalities of the shadow economy on the official economy. Even if the shadow economy could provide some flexibility to firms during their start-up phase or when they are going through a financial difficulty (Loayza, 2018), its expansion could obscure the country's formal economy. In fact, the presence of informal actors who do not pay taxes and social contributions is likely to create unfair competition between firms, reduce the profitability of formal ones and weaken their development capacities (Perry et al., 2007). Furthermore, many studies have concluded that the profusion of informal activities is associated with moderate economic growth due to the low accumulation of physical and human capital (Oviedo et al., 2009). Informality limits the options of firms in terms of financing as they are often unable to reach the standards of account reliability and transparency required by financial institutions. Moreover, since informal employment is generally characterized by non-compliance with labor regulations and the absence of social safety nets, the tendency to hire less-skilled workers who accept these conditions can slow down the human capital accumulation and the process of new technologies adoption (Docquier et al., 2017). OECD (2017) and Medina & Schneider (2018) highlight that the excessive use of cash to escape the control of tax authorities considerably slows down the development of payment systems. A study by ATKearney (2018)[1] finds a strong negative relationship between digital payments and the informal economy. In fact, increasing digital payments by 10% across each year for five consecutive years could add to GDP growth of 2-4,6%

[1]This study was commissioned by Visa and conducted by A.T. Kearney with support from Professor Friedrich Schneider.

for Egypt; 1,6-3,5% for Turkey; 1,1-2,4% for Poland and 1-2,2% for the Czech Republic.

The shadow economy is difficult to measure as its actors strive to remain undetectable. However, its measurement is very important to properly identify the factors behind its development, analyze its impact on the formal economy and, above all, implement appropriate public policies able to reduce its size. As such, the literature distinguishes two main approaches. The first "direct" tries to measure the size of the shadow economy through household and business surveys. The second, “indirect approach” uses econometric estimates and explores socioeconomic and institutional determinants such as cash in circulation, taxation, governance, and macroeconomic conditions. These two approaches[2] have advantages and limitations and are complementary because if surveys are made periodically due to their high cost, the model-based approach allows more regular monitoring of the evolution of the shadow economy.

Morocco is not spared by this phenomenon and the size of shadow activities remains significant despite the efforts undertaken by national authorities to simplify administrative procedures, reduce the tax burden, and facilitate access to bank financing. According to the last national survey on the shadow economy conducted by the High Commission for Planning (HCP)[3] in 2013, the shadow economy stands at 11.5% of GDP and contributes 36.2% to overall non-agricultural employment. A study by Roland Berger[4] estimates at about 21% of non-agricultural GDP in 2014. In a recent work by the IMF, using a Multiple Indicators Multiple Causes (MIMIC) model estimated on 158 countries, Medina & Schneider (2018) finds that the shadow economy in Morocco represents on average 34% of GDP over the period 1991-2015. This result is in line with the estimation made by Bank Al-Maghrib, which indicates that over the period 2006-2017 and based on the currency demand approach (CDA), the shadow economy accounts on average for 31.3% of GDP (Bank-Al-Maghrib, 2018, pp. 31-32).

In response to the COVID-19 pandemic, Morocco implemented a cash transfer program “Tadamon” to households working in the shadow economy and whose revenues have been negatively impacted by the lockdown. It turned out that 5.5 million households have benefited from this support[5]. This reality challenges the policies to be implemented and requires deepening thoughts on the shadow economy in a context of vulnerability of a significant part of the population to the risks of income losses and weak social safety nets. In light of this situation, an ambitious program for the gradual generalization of the social security coverage will be implemented. This program

[2]See more details on these two approaches in section 2.

[3]The survey concerns production units that do not have accounting system according to accounting standards in Morocco. It covers only non-agricultural activities. However, commercial and artisanal activities carried out by farmers as secondary activities are considered. For more details, see Appendix A.

[4]This study was commissioned by the General Confederation of Moroccan Enterprises (CGEM) in 2018.

[5]See the following note presenting the 2021 Moroccan Finance Bill : https://cutt.ly/Ijrwps7.

which extends over the period 2021-2025 consists of four axes: (i) the extension of the health insurance, (ii) the generalization of family allowances, (iii) the expansion of the retirement system, and (iv) the enlargement of access to compensation for job loss.

The objective of this paper is to provide a more precise measure of the size of the shadow economy in Morocco over the period 1988-2018. To this end, we use the Currency Demand Approach (CDA) and the Multiple Indicator and Multiple Cause (MIMIC), and explicitly consider the features of the Moroccan economy such as the acceleration of currency in circulation, the size of the agricultural sector, and the financial development process.

The main contribution of this paper is to use financial development to measure the size of the shadow economy. We use the indices developed by Svirydzenka (2016) that consider the multidimensional nature of financial development and summarize how developed financial institutions and financial markets are in terms of their depth, access, and efficiency. Indeed, financial development contributes significantly to lowering the cost of financing, which makes the formal economy more attractive by allowing informal firms to develop through investment and new technologies. At the same time, they minimize the costs associated with the risks and uncertainties of operating in the shadow economy (Straub, 2005; Dabla-Norris et al., 2008; Blackburn et al., 2012; Capasso & Jappelli, 2013; Jacolin et al., 2019; Canh & Thanh, 2020). In contrast to the studies that investigate the correlation between financial development and the shadow economy, it is important to note that very few papers have used financial development to measure the shadow economy (see Din (2017) and Dybka et al. (2019)) despite the relevance of this issue for Central Banks in terms of payment system development, the transmission of monetary policy and financial inclusion[6].

The remainder of this paper is structured as follows. Section 2 presents a brief review of the estimation methods of the shadow economy. Section 3 presents our empirical strategy and data used to estimate the shadow economy in Morocco. Section 4 presents our empirical results and analyzes the evolution of the shadow economy in Morocco over the period 1988-2018. Section 5 concludes by providing some policy recommendations drawn from countries' experiences to contribute to the debates on policies that could reduce the size of the shadow economy in Morocco.

[6]Patrick & Akanbi (2017) shows that, in Zambia, higher levels of the informal economy are associated with higher lending rates and that the existence of informality dampens the transmission of changes in the policy rate to retail rates.

2 Brief review of estimation methods

This section[7] describes the various methodologies used to measure the size of the shadow economy[8]. These approaches fall into two categories: direct and indirect (including the model-based):

2.1 Direct approaches

(i) System of National Accounts Statistics – Discrepancy method

According to Gyomai & van de Ven (2014) and based on the handbook "Measuring the Non-Observed Economy" (OECD, 2002), the non-observed economy (NOE) includes the following activities:

- **Underground production**: activities that are productive and legal but are deliberately concealed from public authorities to avoid payment of taxes or compliance with regulations.
- **Illegal production**: productive activities that generate goods and services forbidden by law or that are unlawful when carried out by unauthorized procedures.
- **Informal sector production**: productive activities conducted by unincorporated enterprises in the household sector or other units that are unregistered and/or less than a specified size in terms of employment, and that have some market production.
- **Production of households for own-final use**: productive activities that result in goods or services consumed or capitalized by the households that produced them.
- **Statistical underground**: defined as all productive activities that should be accounted for in basic data collection programs but are missed due to deficiencies in the statistical system.

This disaggregation of the non-observable economy into five categories is the first step that allows its measurement. Well-defined criteria are required to clearly distinguish the different components, avoid double-counting, harmonize the process between countries, and allow comparisons. In this regard, different approaches are listed in the Handbook OECD (2002), but the commonly used one is the Eurostat Tabular Framework[9]. This approach is built by matching the NOE problem areas with the statistical measurement problems that a statistical office must address for exhaustive measurement of GDP. Given that the NOE types are defined to be mutually exclusive, they may be grouped in various ways to give insight into different aspects of the

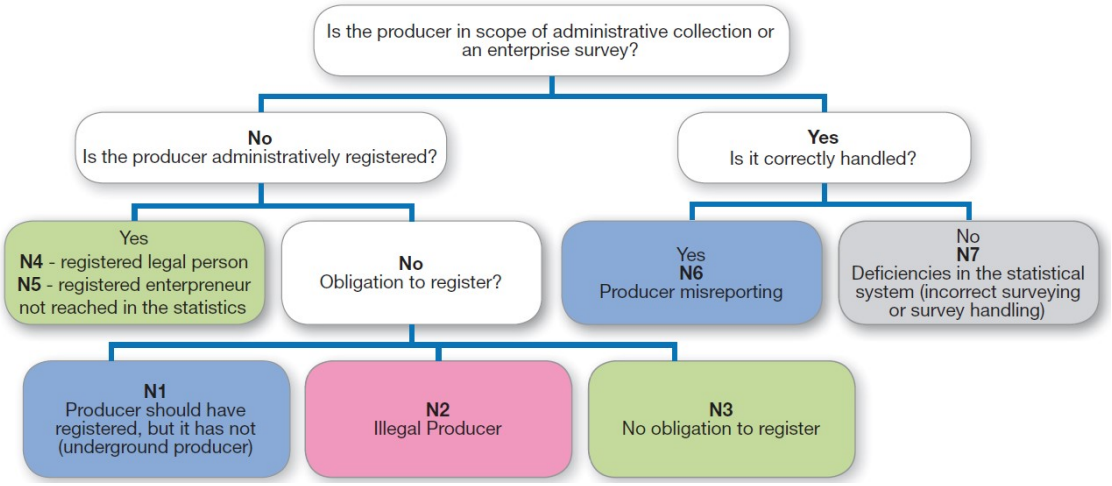
[7] This section is based on Schneider & Enste (2002); Feld & Schneider (2010); Williams & Schneider (2016).

[8] As an abundant literature is available about the various methods available to measure a shadow economy for example see (Schneider & Enste, 2002; Feld & Schneider, 2010; Schneider et al., 2010; Williams & Schneider, 2013, 2016).

[9] The Handbook OECD (2002) also presents the Unit and Labor Input Framework and the Production Income Framework.

NOE (Figure 1). Consequently, economic underground is N1+N6, informal, and own-account production are calculated by N3+N4+N5, illegal activities are represented by N2 and non-response problems are represented by N7.

Figure 1: Eurostat tabular approach to exhaustiveness



Source: Gyomai & van de Ven (2014)

The methods used to estimate the NOE from the National Account System perspective can be classified into two types (Eurostat, 2014): direct survey-based statistical methods (surveys on expenditure, income, labor, and time use) or indirect estimations based on available data sources for the different components of the GDP. Hence, the supply base approach relies on data on the supply of inputs that are used for producing goods and services (number of primary raw materials, land, fixed capital stock, etc.). The demand-based approach aims to assess production by using indicator data on specific uses of goods and services that sufficiently describe their production (major export and import commodities, administrative data indicating demand for a product such as motor vehicle registrations and building permits, etc.). Lastly, the income-based approach uses available data from administrative sources in some categories of income, which can be comprised to obtain an indication of production covered by the administrative system (income taxes, social security contributions, etc.).

(ii) Micro Approach: Representative surveys

This method is based on representative surveys designed to investigate the perception of the shadow economy, actual participation in shadow economy activities, and opinions about shadow practices. In Morocco, the HCP has conducted several national surveys on the informal economy during the last two decades[10]. The last one conducted in 2013 showed that the shadow economy

[10]Precisely three surveys in 2000, 2007 and 2013, see Appendix A.

represents 11.5% of GDP. The sectoral distribution of the shadow economy added value reveals that most of these activities take place in the commercial sector (43.1%), followed by the industrial sector (22.8%), the service sector (19.9%), and the construction sector (14.3%). The volume of employment in the informal sector is 2.3 million jobs, contributing to overall non-agricultural employment at 36.2%. Almost half of the employment is concentrated in the trade sector (47%), the rest being distributed between other services (24.1%), industry (20.1%), and construction (8.8%).

(iii) Micro approach: Measuring the shadow economy using surveys of company managers

Putniņš & Sauka (2015) and in a similar way Reilly & Krstić (2018) use surveys of company managers to measure the size of the shadow economy. They combine misreported business income and misreported wages as a percentage of GDP. The method produces detailed information on the structure of the shadow economy, especially in the service and manufacturing sectors. It is based on the premise that company managers are most likely to know how much business, income, and wages go unreported due to their unique position in dealing with both types of income. They use a range of survey-designed features to maximize the truthfulness of responses. Their method combines estimations of misreported business income, unregistered or hidden employees and unreported wages to calculate a total estimate of the size of the shadow economy as a percentage of GDP.

2.2 Indirect approaches

Indirect approaches, alternatively called "indicator" approaches, are mostly macroeconomic in nature. These are in part based on:

(i) Discrepancy between national expenditure and income statistics

If those working in the shadow economy were able to hide their incomes for tax purposes but not their expenditure, then the difference between national income and national expenditure estimates could be used to approximate the size of the shadow economy. This approach assumes that all components on the expenditure side are measured without error and constructed so that they are statistically independent of income factors[11].

(ii) Discrepancy between official and actual labor force

If the total labor force participation is assumed to be constant, a decline in official labor force participation can be interpreted as an increase in the importance of the shadow economy. Fluctuation in the participation rate might have many other explanations, such as the position in

[11] See for example MacAfee (1980) and Yoo & Hyun (1998).

the business cycle, difficulty in finding a job, and education and retirement decisions, but these estimates represent weak indicators of the size of the shadow economy[12].

(iii) Electricity approach

Kaufmann and Kaliberda (1996) endorse the idea that electricity consumption is the single best physical indicator of overall (official and unofficial) economic activity. Using findings that indicate that electricity-overall GDP elasticity is close to one, these authors suggest using the difference between the growth of electricity consumption and growth of official GDP as a proxy for the growth of the shadow economy. This method is simple and appealing but has many drawbacks, including (i) not all shadow economy activities require a considerable amount of electricity (e.g. personal services) or they may use other energy sources (such as coal, gas, etc.), hence the only part of the shadow economy growth is captured; and (ii) electricity-overall GDP elasticity might significantly vary across countries and over time[13].

(iv) Transaction approach

Using Fischer's quantity equation, Money*Velocity = Prices*Transactions, and assuming that there is a constant relationship between the money flows related to transactions and the total (official and unofficial) value added, i.e. Prices*Transactions = k (official GDP + shadow economy), it is reasonable to derive the following equation Money*Velocity = k (official GDP + shadow economy). The stock of money and official GDP estimates are known, and money velocity can be estimated. Thus, if the size of the shadow economy as a proportion of the official economy is known for a benchmark year, then the shadow economy can be calculated for the rest of the sample. Although theoretically attractive, this method has several weaknesses, for instance: (i) the assumption that k would be constant over time seems quite arbitrary; and (ii) other factors like the development of checks and credit cards could also affect the desired amount of cash holdings and thus velocity[14]

(v) Currency demand approach (CDA)

Based on the discrepancy between the declared or official income and the income covered by the currency demand, the CDA assume that if the unregistered transactions are done with cash, as a result, the economic and other indicators would comprise information about the development of the shadow economy over time (Schneider et al., 2010). The first results with the CDA were obtained by Cagan (1958) who concludes, by analyzing the correlation between the increase of the currency demand and the tax pressure in the USA over the period 1919-1955, that it is caused by

[12] See for example Contini (1981), Del Boca (1981), and O'Neill (1983).
[13] See for example Del Boca & Forte (1982) and Johnson et al. (1997).
[14] See for example Feige (1979), Boeschoten & Fase (1984) and Langfeldt (1984).

an expansion of the shadow economy. Also relying on cash in circulation, Gutmann (1977) tried to derive the size of the shadow economy by assuming that over a period where it is almost at a very low level, the cash-to-deposit ratio corresponds to its natural level and should remain constant. Consequently, any deviation from this natural level is due to an expansion of the shadow economy and can be calculated, as a percentage of GDP, by using the quantity theory of money. In a seminal paper on the subject, Feige (1979) brought some extensions to Gutman's approach by integrating GDP, stock of money in circulation, and data about the shadow economy during the years when they are available. The purpose was to better measure the excess of cash which is due to the shadow economy compared to the natural level of cash that the economy needs.

Recent papers are mainly inspired by the approach proposed by Tanzi (1980, 1983) since it allows calculating the size of the shadow economy rather than only examining its dynamic. Tanzi suggests starting by the estimation of a cash demand function including economic factors such as GDP, wages, and interest rates and factors encouraging the expansion of the shadow economy representing mainly the tax burden. The cash driven by the shadow economy is then obtained from the difference between the cash estimated by the demand function and the cash derived from this same function but with low incentives to work in the shadow economy (see subsection 3.1 for a more detailed presentation of this model).

(vi) Multiple Indicators, Multiple Causes (MIMIC) approach

The introduction of the MIMIC was due to the seminal work of Zellner (1970). The pioneering works by Frey & Weck (1983) and Frey & Weck-Hanneman (1984) were the first to transfer the MIMIC approach into shadow economy measurement. This idea was then extended by empirical applications by Giles (1999, 2000), Giles et al. (2002), and followed by several contributions of Friedrich Schneider and its co-authors including Dell'Anno & Schneider (2003), Bajada & Schneider (2005), Dell'Anno & Schneider (2009), Schneider et al. (2010), Medina & Schneider (2018).

This method explicitly considers several causes, as well as multiple effects of the shadow economy over time. The methodology is based on the statistical theory of unobserved variables which makes use of associations between the observable causes and the effects of the unobserved phenomenon. In this case, the shadow economy to estimate is the variable itself (Loayza, 1999) (see subsection 3.2 for a more detailed presentation of this model).

3 Empirical strategy

This section presents the CDA and MIMIC models used to measure the size of the shadow economy in Morocco and provides detailed information on their estimation procedures.

3.1 CDA model

Based on the seminal papers of Cagan (1958) and Tanzi (1980, 1983), we consider the following currency demand function that explains the amount of cash in circulation outside banks by two components:

$$\ln(cash_t) = \alpha + \beta_1'.\ln(\mathbf{X}_{1t}) + \beta_2'.\ln(\mathbf{X}_{2t}) + e_t \tag{1}$$

α is a constant, $\mathbf{X}_{1t}$ is a vector of variables reflecting the structural demand for cash, $\mathbf{X}_{2t}$ is a vector of variables capturing the excess demand for cash unexplained by structural factors and associated with shadow transactions Ardizzi et al. (2014), β_1 et β_2 are the corresponding vectors of coefficients, and e_t is the disturbance term.

To measure the size of the shadow economy, we use the following three-step procedure:

Step 1: Econometric estimation

Before starting with the estimation of Eq. (1), we determine the order of integration of all variables using standard unit root tests: augmented Dickey & Fuller (1981) and Perron (1988). We further test for the presence of cointegration using the Engle & Granger (1987) and Phillips & Ouliaris (1990) tests.

Step 2: Computing the cash associated with shadow transactions

We compute the excess demand for cash payments $cash_t^{excess}$ as the difference between the estimated demand for cash from Eq. (1) $\hat{cash}_t$ and the demand for cash obtained from a restricted version of Eq. (1) $\bar{cash}_t$, by setting all the determinants of the shadow economy in $\mathbf{X}_{2t}$ to their lowest or highest values[15] during the period 1988-2018, in the manner of Schneider et al. (2010):

$$\ln(cash_t)^{excess} = \ln(\hat{cash}_t) - \ln(\bar{cash}_t) \tag{2}$$

Step 3: Computing the shadow economy level

The final step consists of converting the excess demand for cash to the size of the shadow economy se_t. Following Tanzi (1980, 1983), we use the quantity theory of money with the assumption of

[15] Depending on the variable, see subsection 4.1.

the equal velocity of money[16] V_t in both formal and informal economy:

$$se_t = cash_t^{excess}.V_t \tag{3}$$

Many substantial drawbacks of the CDA have been identified in the literature (Schneider & Enste, 2002; Schneider et al., 2010), pointing to several criticisms of its basic assumptions:

- All transactions in the shadow economy are done with cash;
- The cash flows generated by illegal activities are similarly considered as contributing to the shadow economy as the legal activities;
- The assumption of the equal velocity of money in the official and the shadow economy;
- The unrealistic assumptions of zero shadow production in the base year;

However, the CDA remains the most widely used approach for estimating the shadow economy, and some contributions have introduced innovations that overcome some of these drawbacks (see Ardizzi et al. (2014) and Dybka et al. (2019)).

3.2 MIMIC model

The multiple-indicator multiple-cause (MIMIC) model is a special case of the structural equation modeling (SEM) approach. The SEM framework allows combining measurement models, which involve statistical relationships between observed and unobserved variables, with a path analysis model that relates variables to their causal factors-.

Technically, the MIMIC model has two components. The first is the Structural Model that relates the shadow economy se_t (the latent variable) to a set of observed causal variables $\mathbf{X}_t$, to be described ahead:

$$se_t = \alpha'.\mathbf{X}_t + \eta_t \tag{4}$$

$\alpha = (\alpha_1, \alpha_2, ..., \alpha_q)$ is a vector of unknown coefficients, $\mathbf{X} = (\mathbf{X}_1, \mathbf{X}_2, ..., \mathbf{X}_q)$ is the vector of causes and η_t is assumed to be normally distributes, i.e $\eta_t \sim N(0, \sigma_\eta^2)$.

The second is the Measurement Model that links the shadow economy se_t to a number of indicators variables $\mathbf{Y}_t$ - reflecting the consequences of the shadow economy - to be described ahead:

$$\mathbf{Y}_t = \lambda.se_t + \epsilon_t \tag{5}$$

[16]The choice of the monetary aggregate to calculate the velocity of money depends on the features of the economies and the periods of time considered (Anderson et al., 2017). In this paper we use M2.

$\lambda = (\lambda_1, \lambda_2, ..., \lambda_p)$ is a vector of unknown coefficients, $\mathbf{Y} = (\mathbf{Y}_1, \mathbf{Y}_2, ..., \mathbf{Y}_p)$ is the vector of indicators and ϵ_t has a multivariate normal distribution, i.e $\epsilon_t \sim MVN(0, \Sigma_\epsilon)$.

In addition, the structural disturbance term ϵ_t and the measurement error term ϵ_t are supposed to be uncorrelated with each other. Based on this assumption and by combining Eq. (4) and (5), we obtain the following reduced-form regression equation which expresses a relationship between the observed causes of the shadow economy; $\mathbf{X}_t$ and its consequences $\mathbf{Y}_t$:

$$\mathbf{Y}_t = \lambda.\alpha'.\mathbf{X}_t + \lambda.\eta_t + \epsilon_t \tag{6}$$

To estimate the shadow economy as a percentage of official GDP, we conduct the following two-step procedure:

Step 1: Econometric estimation

We estimate the MIMIC model in Eq. (6) with the Maximum Likelihood method (ML) which allows us to obtain ordinal estimates of the shadow economy $\hat{se}_t$ as a time-series index (an estimation of relative evolution of the size of the shadow economy over time). To assign a scale to $\hat{se}_t$, the MIMIC model requires choosing an indicator variable for normalization and setting its coefficient λ_1 in the vector λ to be unity (1 or -1) depending on the choice of the indicator variable. Specifically, the sign of the coefficient λ_1 depends on of the relation between the shadow economy and the selected indicator variable. For instance, the shadow economy is related positively to monetary indicators (e.g. M0 / M1), since most informal activities are reflected in the additional use of cash. Thus, one needs to set $\lambda_1 = 1$. Shadow economy is also negatively related to official income and production (e.g. GDP per capita), which implies $\lambda_1 = -1$.

Second Step: Calibration procedure

Then, we calibrate the ordinal estimates $\hat{se}_t$ (obtained from the first step) into cardinal values to compute the shadow economy as a percentage of GDP. Different calibration procedures exist in the literature and are discussed in detail in Dell'Anno & Schneider (2009). Here, we use the following multiplicative calibration that requires an exogenous estimation of the shadow economy for a specific year (the base year). For this purpose, we use the currency demand approach estimates resulting from this paper, and set the base year as of 1988:

$$(\frac{se}{GDP})_t = \frac{\hat{se}_t}{\hat{se}_{t=1988}} * (\frac{se}{GDP})_{t=1988} \tag{7}$$

where $\frac{se}{GDP}$ denotes the share of the shadow economy in official GDP, $\hat{se}_t$ is the value of the shadow economy index over time obtained through the estimation of the MIMIC model, $\hat{se}_{t=1988}$

is the value of the index in the base year 1988 and $\frac{se}{GDP}_{t=1988}$ is the exogenous estimation of the size of the shadow economy in the base year extracted from our CDA results, reaching 41% of GDP.

Although the MIMIC model offers the advantage of considering multiple potential causes of the shadow economy as well as its multiple effects, the model still suffers from several drawbacks and limitations that have been identified in the literature (see Breusch (2016) and Dybka et al. (2019)):

- The use of the calibration procedure and starting values, to convert the estimated index to actual values of the shadow economy as a percentage of GDP, have a great influence on the size and development of the shadow economy.
- The difficulty to differentiate between the selection of causes and indicators variables.
- The estimations are quite often highly sensitive concerning changes in the data, specifications, and sample size.

3.3 Data and variables

3.3.1 CDA model

The dependent variable in Eq. (1) is the amount of cash outside banks proxied by M0 monetary aggregate per capita.

We consider three factors related to the structural demand for cash payments $\mathbf{X_{1t}}$. First, as suggested by the monetary theory and following the Keynesian liquidity preference, we include the volume of transactions proxied by real GDP per capita and real short-term interest rate approximated by the interbank interest rate. The GDP per capita is expected to have a positive impact on the currency in circulation, since higher-income increases cash demand for transactions, while the short-term interest rate is expected to exert a negative impact due to rising opportunity costs of holding cash rather than deposits. We also consider the ratio of private credit to GDP to capture money creation by commercial banks making loans McLeay et al. (2014). Reflecting demand, this variable is expected to have a positive effect on cash in circulation[17].

We identify four factors in $\mathbf{X_{2t}}$ capturing the excess demand for cash payments unexplained by structural factors and associated with shadow transactions: tax burden, labor market dynamics, agriculture sector and financial development.

First, we use the ratio of tax revenue over GDP as a proxy for tax burden. A higher tax burden is expected to increase currency demand and decrease the demand for deposits. We account for

[17] Many studies approximate financial development with the ratio of private credit to GDP. However, in this paper we use other variables as proxies for financial development, as will be discussed further in this subsection.

the developments in the labor market by including unemployment. The higher is unemployment the higher is the demand for cash for informal transactions.

Second, we consider the size of the agriculture sector proxied by agriculture employment as a percentage of total employment and agriculture value-added per capita. The larger the agriculture sector is, the higher is the shadow economy reflected by the increasing demand for the currency. The agriculture sector in Morocco is relatively large and contributes on average to more than 11% of the total value-added and to approximately 40% to total employment. Angel-Urdinola & Tanabe (2012) who study the micro-determinants of informal employment in the MENA region (including Morocco) finds that the size of the public sector and the size of the agriculture sector are the strongest correlates of informality. Countries, where agricultural employment constitutes a large share of total employment (such as Morocco and Yemen), are associated with higher levels of overall informality. Moreover, Hassan & Schneider (2016) finds that agriculture value-added contributes positively to the demand for cash in Egypt, where this sector plays a significant role in the economy.

Finally, to capture the impact of financial development on the demand for cash, which is the main contribution of this paper, we use the indices developed by Svirydzenka (2016). Unlike simple proxies of financial development such as private credit and stock market capitalization that represent financial institutions only, these indices consider the complex multidimensional nature of financial development and summarize how developed financial institutions and financial markets are in terms of their depth, access, and efficiency[18]. Financial development is expected to have a negative impact on the demand for cash.

3.3.2 MIMIC model

We use the well-studied drivers of informality in the empirical literature as causal variables $\mathbf{X_t}$. A rising tax burden can incentivize informality and expanding the shadow sector. In our analysis, the tax burden is measured by the share of total tax revenue, direct taxes, or indirect taxes in GDP.

Given the importance of the agricultural sector in Morocco, as mentioned in the preceding sub-section, we also include the size of the agriculture sector measured by the agricultural value-added as a percentage of GDP and the share of agricultural employment in total employment.

To capture the impact of the labor market's dynamics on the development of informality, we include the unemployment rate. An increase in unemployment is supposed to give rise to shadow activities, mainly because a proportion of unemployed workers might seek opportunities to work

[18] As pointed out by Dybka et al. (2019), it is also relevant to analyze the impact of the development of electronic payment system on the shadow economy using data on the use of credit cards and ATMs. Unfortunately, these statistics are not available for the entire period.

in the shadow economy. Moreover, self-employed workers have substantial possibilities to hide income and evade taxes through aggressive tax avoidance and thus, contribute to the development of the shadow economy.

We also consider trade openness, the sum of export and imports of goods and services as a percentage of GDP, to account for the structure of the Moroccan economy. Since most of the international trade transactions take place in the formal sector, trade openness is expected to reduce the size of the shadow economy.

Finally, we investigate the impact of financial development on the shadow economy - which is the main contribution of this paper - measured by the indices developed by Svirydzenka (2016). Financial development is expected to reduce the size and development of the shadow economy overtime.

Because the shadow economy cannot be directly measured, we employ three variables as indicators Y_t that reflect the existence of the shadow economy. First, since the actors of the shadow economy don't want to be detectable, transactions are made in cash. To captures this feature, we use a monetary indicator; currency in circulation measured by the ratio M0 over M1.

Second, the shadow economy absorbs workers leading to a reduction in the availability of labor resources in the formal economy. Thus, the shadow economy is expected to be negatively related to the labor force participation rate, which represents the relative amount of labor resources available to produce goods and services.

Finally, shadow economy activities are also reflected in the state of the official economy. Given that shadow economy activities absorb a substantial share of productive resources and production factors, an increase in the size of the shadow economy would lead to a decrease in the official economy, and thus, to a depressing effect on its growth.We use GDP per capita as an indicator variable.

As we have mentioned in *Step 1* of the MIMIC estimation procedure, we need to normalize the model. Thus, we choose the currency in circulation as a scale variable and set the value of its related parameter λ_1 to a positive unit. Each variable included in the MIMIC model is expressed in natural logarithm and standardized by subtracting its mean and dividing by its standard deviation.

All variables and their role in the CDA and MIMIC models are summarized in Table 1. Explicit definitions, descriptive statistics, and sources of all the variables employed are provided in Appendix C.

Table 1: Variables included in the CDA and MIMIC models

Category	CDA	MIMIC	Variables
Monetary aggregates	Dependent variable	Indicator	M0 / M1 M0 per capita
Macroeconomic	Structural demand	Cause – Indicator	GDP per capita Interbank interest rate Private credit Trade openness
	Excessive demand		Agriculture value added per capita
Labor and demographic	Excessive demand	Indicator	Unemployment Agriculture employment Self employment Labor force participation
Tax and regulatory burden	Excessive demand	Cause	Tax revenue
Financial development	Excessive demand	Cause	Financial development index Financial institutions index Financial institutions depth index Financial institutions access index Financial institutions efficiency index Financial market index Financial market depth index Financial market access index Financial market efficiency index

4 Empirical Results

4.1 Results of the CDA model

The results of the unit root tests from augmented Dickey & Fuller (1981) and Perron (1988) show that all the variables are non-stationary at level, but when taking the first differences, the variables become stationary, i.e I(1) (Appendix C). Additionally, the cointegration tests, based on the Engle & Granger (1987) and Phillips & Ouliaris (1990) tests, reveal the existence of statistically significant cointegration relations (Appendix E.).

Since the variables are all integrated of the same order I(1), we use the Fully Modified Ordinary Least Square (FMOLS) method à la Hansen & Phillips (1990) and the Canonical Cointegrating Regression (CCR) proposed by Park (1992) to estimate the long-run CDA model as per Eq. 1. This choice is motivated by the fact that FMOLS and CCR produce reliable estimates for a small sample size and can overcome the problems of endogeneity in the regressors and the serial correlations in the error terms. Table 2 presents the CDA estimation results. All the variables have the expected

signs and are statistically significant (mostly at the 1 or 5 percent level).

Model 1 (columns 1 and 2) can be viewed as a standard CDA specification covering the usual determinants studied in the literature and which reflect the economic activity (GDP per capita), money creation (private credit), the opportunity cost of holding cash (interest rate), tax burden (tax revenue) as well developments in the labor market (unemployment).

In model 2 (columns 3 and 4), we drop GDP per capita and include the agriculture value-added to better capture the feature of the Moroccan economy. This variable represents an important factor in the evolution of the demand for cash[19].

Finally, in model 3 (columns 5 and 6) we include a proxy for financial development. This specification is much more exhaustive because it considers variables that specifically reflect the features of the economy in Morocco such as the size of the agriculture sector (agriculture value-added) and the financial development process (access to the financial market)[20].

Based on model 3 (column 5), we calculate the size of the shadow economy in Morocco from 1988 to 2018. The results are presented in the next section.

[19] We do not find a statistically significant relation between agriculture employment and the demand for cash.
[20] The results based on the other financial development indices are not statistically significant.

Table 2: CDA estimation results, 1988 - 2018

Dependent variable:	*M0 per capita*					
	(1)	(2)	(3)	(4)	(5)	(6)
	FMOLS	**CCR**	**FMOLS**	**CCR**	**FMOLS**	**CCR**
GDP per capita	1.49***	1.52***	-	-	-	-
	[0.13]	[0.15]				
Agriculture VA	-	-	0,38***	0,43***	0,24***	0,22**
per capita			[0.08]	[0.11]	[0.08]	[0.13]
Interbank	-0.24***	-0.24**	-0,39***	-0,41***	-0.55***	-0.6***
interest rate	[0.04]	[0.04]	[0,08]	[0,08]	[0.08]	[0.10]
Private credit	0.35***	0.33***	0.9***	0.87***	1.17***	1.21***
	[0.08]	[0.09]	[0.11]	[0.13]	[0.13]	[0.18]
Financial market	-	-	-	-	-0.19***	-0.22**
access index					[0.06]	[0.09]
Tax revenue	0.51***	0.54**	0.56*	0.64*	0.53*	0.58*
	[0.18]	[0.22]	[0.37]	[0.47]	[0.29]	[0.36]
Unemployment	0.33***	0.35***	0.37**	-0.42**	0.50***	0.58***
	[0.18]	[0.08]	[0.16]	[0.17]	[0.13]	[0.16]
Constant	-10.18***	-10.52***	-0.68	-1.31	-0.88	-1.2
	[1.4]	[1.58]	[1.5]	[1.82]	(1.17)	(1.41)
$R^2 adjusted$	0.98	0.98	0.97	0.97	0.97	0.97
Observations	31	31	31	31	31	31

Note: All variables are in natural logarithm. Standard errors are in brackets; *, **, *** denote significance at 1%, 5%, and 10% significance levels. VA: value added.

4.2 Results of the MIMIC model

The MIMIC model results are presented in Table 3. We estimate several specifications with different combinations of the causal variables and keep only those who are statistically significant[21]. The causal variables identified in the empirical literature behave as expected based on our theoretical considerations. In addition, we were able to capture the impact of financial development on the shadow economy proxied by two indices: the financial market index and the financial market access index[22].

[21] We also test several other variables: self-employment, corruption, bureaucracy index, rule of law index and economic freedom index. Unfortunately, the results are not statistically significant.

[22] The results based on the other financial development indices are not statistically significant.

Specifically, in columns 1 and 2, we find a significant positive impact of tax revenue and unemployment and a negative impact of trade openness and financial market index and financial market access index. In columns 3 and 4, we drop trade openness and instead add agriculture employment. As expected, agriculture employment has a large positive impact on the shadow economy.

Finally, in column 5, we test all our five causal variables and their statistical significance remained unchanged. Specifically, a one standard deviation increase in the tax burden, unemployment and agriculture employment increase the size of the shadow economy by 0.24, 0.1 and 0.42 standard deviations, respectively. Similarly, a one standard deviation increase in trade openness and financial market index decrease the size of the shadow economy by 0.15 and 0.34 standard deviations, respectively. We use this as our baseline specification.

All in all, estimation outputs reveal that the main causes of the shadow economy in Morocco, among those included in the MIMIC model, are: agriculture employment, financial development (financial market index), tax revenue, trade openness, and unemployment. Additionally, our result provides empirical support for the important role of the financial sector in reducing the size of the shadow economy.

Concerning the effects of the shadow economy (indicator variables), we find as expected that a higher shadow economy is reflected in a lower GDP per capita and a lower labor force participation.

Based on the specification in column 5, we calculate the size of the shadow economy in Morocco from 1988 to 2018. The results are presented in the next section.

Table 3: MIMIC estimation results, 1988 - 2018

	(1)	(2)	(3)	(4)	(5)
Structural					
Tax revenue	0.40***	0.23*	0.17**	0.09**	0.24***
	[0.15]	[0.13]	[0.08]	[0.04]	[0.09]
Unemployment	0.16**	0.09	0.13***	0.11***	0.10**
	[0.07]	[0.06]	[0.04]	[0.03]	[0.05]
Trade openness	-0.45***	-0.31**			-0.15**
	[0.13]	[0.13]			[0.08]
Agriculture employment			0.48***	0.32***	0.42***
			[0.06]	[0.08]	[0.07]
Financial market index	-0.43**		-0.40***		-0.34***
	[0.18]		[0.10]		[0.11]
Financial market access index		-0.46***		-0.49***	
		[0.13]		[0.11]	
Measurement					
M0 / M1	1.00	1.00	1.00	1.00	1.00
GDP per capita	-1.53***	-1.54***	-1.64***	-1.47***	-1.62***
	[0.15]	[0.14]	[0.17]	[0.14]	[0.18]
Labor force participation	0.03	0.03	0.05**	0.05**	0.05**
	[0.02]	[0.02]	[0.02]	[0.02]	[0.02]
Chi2 BS	155.52	160.04	213.91	220.40	217.20
CD	0.98	0.99	0.98	0.99	0.98
Observations	27	27	27	27	27

Note: All variables are in natural logarithm. Standard errors are in brackets; *, **, *** denote significance at 1%, 5%, and 10% significance levels. CD is the coefficient of determination: A perfect fit corresponds to a CD=1.

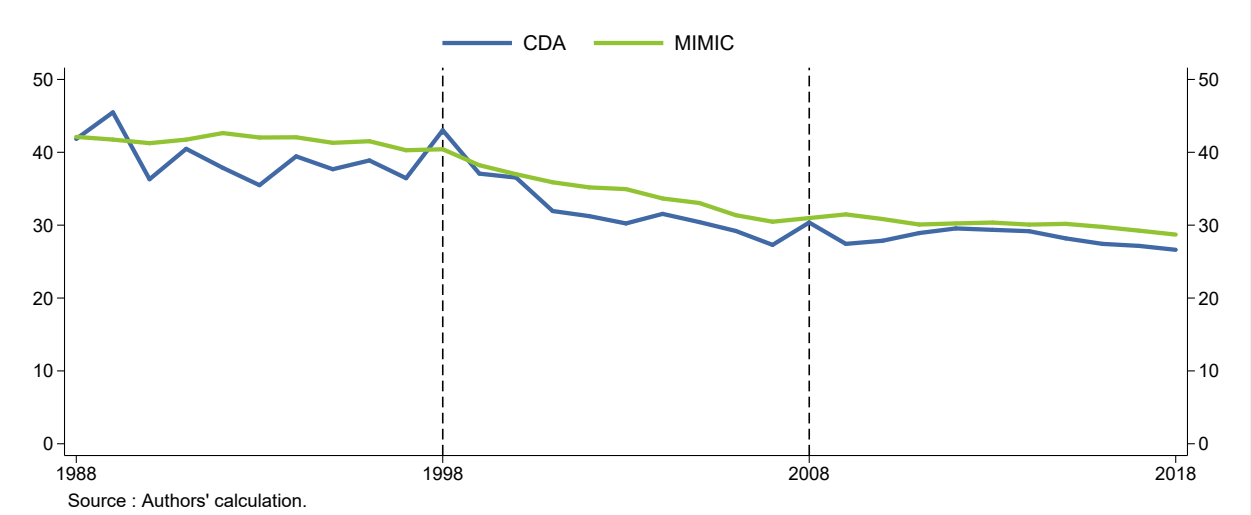
4.3 Shadow economy in Morocco

Figure 2 presents a comparison of the estimated paths of the shadow economy according to the CDA and the MIMIC models. The MIMIC-based estimate exhibits a similar trend to the one from the CDA model. We observe that the shadow economy accounts for a major share of the official economy, but its trend is decreasing over time, from 42% in 1988 to 29% in 2018 (MIMIC model), and from 42% in 1988 to 27% in 2018 (CDA model).

Specifically, the evolution of the shadow economy exhibits three periods. First, over the period 1988-1998, it is almost stagnant at around 40% of GDP. During the second period 1999-2008,

the shadow economy decreases to 32% (MIMIC model)-34% (CDA model). Finally, the declining trend continued during the last period 2009-2018, but at a more moderate pace, to reach a level just below 30% GDP.

Figure 2: Size of the shadow economy in Morocco, 1988 – 2018 (% GDP)



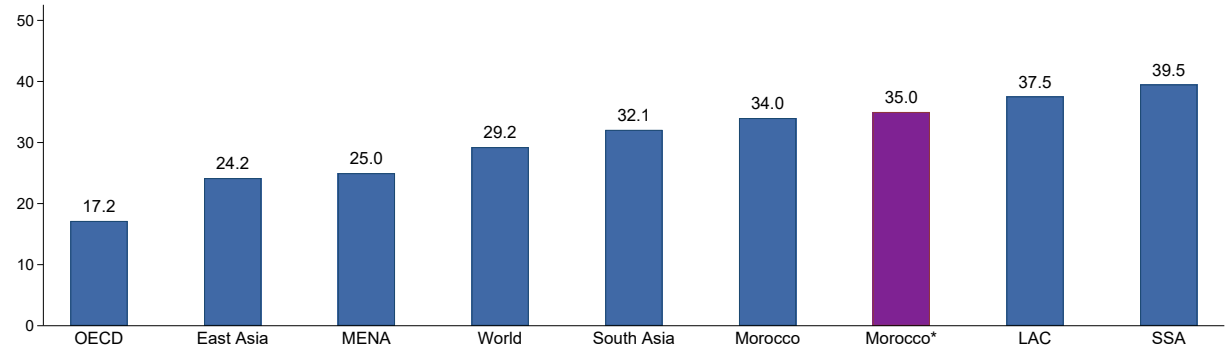
It is very important to underline that these estimates are constrained by several questionable hypotheses and limitations of the two approaches used. Ultimately, our results mainly aim to give indications on the evolution of the shadow economy in Morocco and especially to give insights on its implications on the quality of employment and firms' development. The analysis could be reinforced by regular and exhaustive surveys.

This relative lessening in the shadow economy in Morocco, which is also observed internationally as revealed by Medina & Schneider (2018), suggests that it is due to the reforms implemented by Morocco in terms of the simplification of administrative procedures through the creation of the Regional Investment Centers, the taxation system to lighten the fiscal burden on firms, the financial market to facilitate access to credit, as well as at the trade integration with the main partners. In the final section, we discuss in more detail the reforms and strategies that can contribute to reducing the size of the shadow economy in Morocco, based on successful international experiences.

Our results are in line with the estimates of Medina & Schneider (2018) who finds that the size of the shadow in Morocco is on average 34% over the period 1991-2015 (Figure 3). Compared to other regions, the shadow economy in Morocco is higher than in the OECD countries (17.2%) and MENA countries (25%) and lower than in the Latin American countries (37.5%) and Sub-Saharan African countries (39.5%). These results are also confirmed by data on informal employment. According to ILO (2018), informal employment in Morocco is around 80% of total employment, a

level that is higher than in the MENA countries (67%) but lower than in the Sub-Saharan African countries (86%).

Figure 3: Size of the shadow economy by region, 1991-2015 (% GDP)

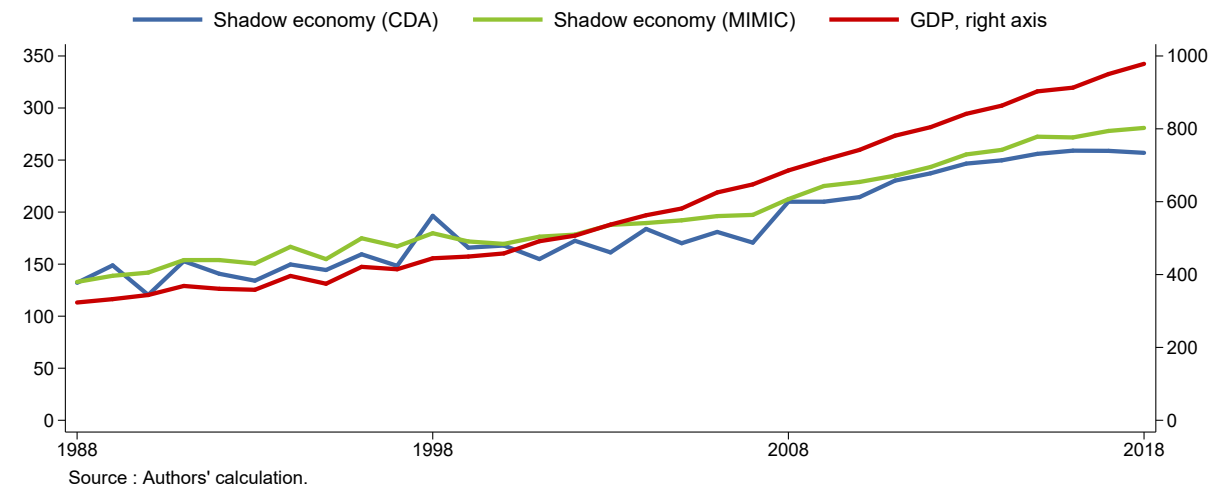


Note : LAC: Latin America Caribean, MENA: Middle East and North Africa, SSA: Sub-Saharan Africa, OECD: Organisation for Economic Co-operation and Development.

Source : * Authors' calculation based on MIMIC estimation. The rest of the data are from Medina & Schneider (2018)

Figure 4 compares the development of the official GDP and shadow economy in real values. Despite the substantial decline in the shadow economy to GDP ratio, we can observe that it increased significantly over the period 1990-2018. According to the MIMIC-based estimate, the shadow economy doubled in size, while the CDA model estimate showed a progressive increase at the end of the period.

Figure 4: Shadow economy and official GDP in Morocco, 1988 - 2018 (real values in billions of Moroccan dirhams)



Source : Authors' calculation.

5 Conclusion and policy implications

The aim of this paper is to measure the size of the shadow economy in Morocco during the period 1988-2018. Using the CDA and MIMIC models, our results show that if the shadow economy relative to GDP has experienced a decline over the period 1988-2018, from 42% to 29% (MIMIC model) and from 42% to 27% in 2018 (CDA model), this level remains relatively high. Additionally, our result provides empirical support for the important role of the financial sector in reducing the size of the shadow economy.

Important efforts have been made during the last decades to improve the business climate in Morocco. The country's ranking according to the Ease of Doing Business Index developed by the World Bank went from 177rd place in 2006 to 53rd place in 2020, which proves that the measures taken have had favorable effects. Nevertheless, if the shadow economy continues to progress, this means that some constraints persist in terms of administrative procedures, taxation and labor market regulation. There is a large literature devoted to policies aimed at reducing the size of the shadow economy (see Williams & Schneider (2013), OECD (2017), Loayza (2018) and World-Bank (2019)). It emerges from this literature that governments have several measures which are categorized under three main categories. First, a "do nothing" strategy can be adopted since the shadow economy is one of the main sources of new business creation and a starting point for emerging businesses. However, the profusion of informal entrepreneurship culture has negative impacts on firms working in legality, job security and tax revenues. Second, a policy to "eradicate" the informal sector can be deployed to reduce the size of the shadow economy through coercive measures (penalties, closure of firms, etc.). However, when this policy is implemented in an accelerated manner and without identifying the reasons for working in the informal sector, it can lead to unemployment, poverty and social tensions. Finally, governments can focus their efforts on "integrating" the shadow economy by making formality more attractive. This strategy should seek to increase the benefits of formality and reduce its costs. It is therefore appropriate to adopt "carrot" and "stick" measures depending on the constraints and characteristics of the concerned sectors.

Based on lessons from international experiences, measures to integrate the shadow economy into the formal sector have been favored as they proactively help to reduce its profusion while offering flexibility to minimize the social costs of transiting to the formal economy. These measures aim to improve the business regulatory framework which must be simple, clear, and adapted to all stages of the firm life, from its creation to its exit from the market. This modernization should involve the use of new information technologies and the improvement of all the institutions concerned by the regulatory processes, including central governments and local authorities. Portugal is considered as one of the best-performing countries in terms of business creation because it suc-

ceeded in considerably reducing the time and the cost taken to register a business. This success has been achieved through the introduction of a new Expedited Registration service, which offers a choice of pre-approved names on the Registry's website. The new platform deals also with the procedures related to tax administration and social security. The business standard statutes make the application quick and without recourse to a lawyer. Several countries have followed this model as Mexico, Chile and Ireland.

Moreover, an inadequately designed tax system could be a barrier to investment and growth and encourage fraud and informality. The tax system should tend towards simplicity and gradualness by reducing marginal tax rates and increasing the tax burden according to the size of the business. Many countries have introduced various benefits and tax breaks for certain categories of employees. Social security contribution limits, which make this component of the personal income tax system regressive, are an important feature in Austria, Canada, France, Germany, Greece, Ireland, Netherlands, Spain and Turkey. Self-employed workers in the Czech Republic, Greece and Portugal could pay lump-sum contributions or lower contribution rates than employees. Several European governments, such as France, Belgium, and the Netherlands, have introduced tax breaks in sectors where undeclared work is important. In Peru, the government supports the small and micro-enterprises through simplified tax mechanisms such as the single simplified regime and the special income tax regime . Both were applied to micro-enterprises and individuals to increase tax revenue. The government created also in 2003 a special regime for firms of 10 or fewer workers and extended it in 2008 to those with up to 100 workers, which provides various tax incentives and reduces labor obligations.

In Morocco, questions related to taxation come up regularly in discussions on the shadow economy. The public authorities have organized three national meetings [23] to draw the outlines of a less complex and progressive tax system.

Labor market regulation can be adapted to encourage firms to recruit and support them during difficult economic periods and ensuring employees' social security and stability. The wage and non-wage costs that firms face should match the productivity of workers and market conditions. Once the labor market is more adapted, regulatory compliance must be effectively enforced and target both formal and informal employment, with an emphasis on occupational health and safety. For example, Germany has carried out a comprehensive reform of the labor market to improve its efficiency and to remedy the problems of long-term unemployment. The reforms consisted of a series of progressive employment programs, "mini-jobs" and "mid-jobs", aimed at helping the unemployed or employed in the informal sector in the transition to formal employment. These jobs benefit from flat taxes for employers and no tax for employees. Eligibility requirements were

[23] The last national meeting was held in May 2019.

expanded with limits on income and hours of work. Other countries as Peru have tried to boost the formalization of work through the implementation of the e-payroll in 2007 to force employers with three or more workers to send monthly reports on their workers, pensioners, service providers, trainees, outsourced workers, and claimants directly to the National Tax Authority. Peru also increased the social coverage through different types of health insurance but especially thanks to the expansion of the integral health insurance scheme.

In Morocco, if thoughts on the reform of the labor code are in progress, the social repercussions of the covid-19 crisis are also reviving debates on social safety nets. An ambitious program aiming to generalize the social coverage was recently launched. The first part (2021-2023) will be devoted to the deployment of Compulsory Health Insurance and family allowances to all households, while the second part (2024-2025) will concern the generalization of pensions and compensation for loss of employment.

Cash is one of the main sources of the development of the shadow economy since the transactions are difficult to track by the tax authorities. To tackle this phenomenon, countries are trying to encourage the use of digital payments in different ways. First, the use of cash can be discouraged, as in Greece in 2015 where the government limited the amount of cash the Grecques could withdraw. This changed consumers' habits because, during the same year, each Greek carried out an average of 20 card transactions, compared to 8 in 2014. The total turnover generated by the cards amounted to 818 euros per capita in 2015, against 428 euros a year earlier. Second, some countries are proceeding with the development of the electronic payment infrastructure. In 2017, Poland created a 170 million US dollars funds to support payment by electronic terminals in traditionally cash-based sectors. This effort resulted in the establishment of 212,000 new terminals, representing an increase of more than 90% located mainly in small and medium-sized businesses in the retail, hospitality, and transportation sectors[24]. Finally, it is also possible to make the use of electronic payment compulsory. Hungary implemented an online cash register system in 2014 to reduce underreporting of sales. In parallel, a policy of subsidizing businesses, raising awareness, and training was carried out. From July 2018, online provision of billing data is mandatory. This system enabled the tax administration to carry out cross-checks (customers-suppliers) in real-time.

In Morocco, financial inclusion represents an important component of the policies that aimed to formalize the economy. An ambitious strategy was designed in 2018 to guarantee access for all individuals and businesses to financial products and services (transactions, payments, savings, financing and insurance, etc..). To achieve this objective, the plan is based on eight strategic measures which are mainly the result of large consultations with the Moroccan financial ecosystem

[24]Malaysia adopted the same policy in 2014.

including public and private actors: (1) development of Mobile Payments; (2) redesign the status of microfinance to make it a stronger lever for inclusion; (3) define and accelerate the development of more inclusive insurance; (4) manage the conditions for accelerating financial inclusion by banks; (5) set up a framework and tools to facilitate the financing of very small enterprises (VSEs) and individuals; (6) acceleration of the dematerialization of payments; (7) strengthen financial education actions and (8) develop a steering mechanism and governance dedicated to financial inclusion.

Finally, it is important to note that no single and isolated policy can lead to a significant decrease in informality. A formalization strategy should include well-integrated reforms that deal with the complexity and particularities of informality in each sector. Regarding the experiences mentioned previously, Morocco could benefit from the following measures:

- Achieving structural reforms, particularly in the areas of taxation, labor code, and social safety nets.
- Reinforcing the coordination and monitoring of the policies that target the shadow economy.
- Continuous assessment of developments in the shadow economy and strengthening of the detection system, through the exchange of information between the different institutions.
- Development of the tax administration capacities and processes for more targeted tax inspections.
- Collection of taxes and social contributions by a single fiscal administration and considering the opportunity to integrate gradually the e-payroll.
- Tax incentive schemes for formalization through broad consultations between the different actors.
- Public awareness campaign on the benefits of declared work and the negative externalities of the shadow economy.
- Strengthening the digitization of public administration and expanding the use of electronic payment as part of the National Financial Inclusion Strategy.

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Appendix

A The role of the HCP national survey in the analysis of informal activities and the exhaustiveness of the GDP calculation

After the surveys conducted by the HCP in 1999 and 2007, the 2013 National Survey on the informal sector updated information on production units operating in this sector, its mode of integration into the national economy, and its contribution to the creation of wealth and jobs. This survey provides the data necessary for establishing the accounts of the branches of the informal sector to guarantee certain exhaustiveness in the calculation of the GDP.

It should be noted that the survey concerns all non-agricultural production units which do not have accounts following the accounting regulations in Morocco. This means the presentation of accounting documents retracing both the flows for the year and the balance sheet of the assets and liabilities at the beginning and the end of the period. The informal sector as defined in the survey does not include illicit or illegal activities.

In 2013, the number of informal production units (IPUs) was 1.68 million. About 51.4% do not have a fixed office and operate in the construction, services, and trade sectors. For those with permanently fixed office or working from home, they are more present in the industrial sector. More than 80% of all IPUs and less than 40% of those with fixed office declare that they do not pay business tax.

The informal economy is dominated by small businesses and micro-enterprises. Commercial activities represent nearly 70% of total turnover. They are followed by activities in the industry (13.1%), services (9%), and construction (8.1%). More than half of the IPUs achieve an annual turnover of less than 100,000 Moroccan dirham, 35.3% less than 60,000 dirham, and 16.2% more than 360,000 dirham. In total, the IPUs achieved a turnover of about 410 billion dirham in 2013, the equivalent of an average annual increase of 6.5% since the last survey of 2007.

In 2013, the IPUs invested 3.366 billion DH, an annual increase of 3.2% since 2007, or a contribution of 1.1% to the national gross fixed capital formation. The service sector accounted for 50%, trade more than a third, industry 12.2%, and construction 5.3%.

With 103.346 billion dirham, the added value created by the IPUs represented, in 2013 around 12.6% of the total national added value. By sector, the contribution of IPUs to added value goes from 60% in trade to 29.3% in construction, 13.3% in industry, and 6.4% in services. To sum up and regarding the low contribution to taxes, informal activities contributed in 2013 to 11.5% of the national GDP.

In 2013, informal activities employed 2.4 million people, equivalent to 36.3% of total non-

agricultural employment. 233,000 independent employers recruited 420,000 employees and distributed 11.4 billion DH in salaries corresponding to nearly 4% of wage compensation at the national level. Almost half of the employment is concentrated in the trade sector (47%), the rest being distributed between other services (24.1%), industry (20.1%), and construction (8.8%).

B Data sources and definitions

Table 4: Variables, descriptions and data sources

Variables	Description	Sources
Tax revenue	Overall taxes, including all forms of direct and indirect taxation at all levels of government, as a percentage of GDP.	Ministry of finance - Morocco
Financial development index Financial institutions Financial institutions depth Financial institutions access Financial institutions efficiency Financial market Financial market depth Financial market access Financial market efficiency	Financial development: aggregate of financial institutions and financial market development indices. Financial institutions (FI) include banks, insurance companies, mutual funds, pension funds, and other types of nonbank financial institutions. Financial markets (FM) include mainly stock and bond markets. Within FI and FM, different dimensions of the financial system are measured: depth, access and efficiency. Each index: [0-1, 1 = best development].	IMF - Svirydzenka (2016)
GDP per capita	Real gross domestic product divided by total population.	High Commission for Planning
Agriculture VA per capita	Agriculture value added divided by total population.	High Commission for Planning
Agriculture employment	The share of agriculture employment in total employment.	High Commission for Planning
Trade openness	The sum of exports and imports of goods and services measured as a share of GDP.	High Commission for Planning
Private credit	Domestic credit provided by the financial sector includes all credit to various sectors on a gross basis, except credit to the central government, which is net, measured as a share of GDP.	Bank Al-Maghrib
Interbank interest rate	The annual average of the interbank lending rate, expressed in percentage.	Bank Al-Maghrib
M0 per capita	The amount of cash outside banks held by resident sectors and nonresidents divided by total population.	Bank Al-Maghrib
M0 / M1	The amount of cash outside banks to M1 monetary aggregate, expressed in percentage.	Bank Al-Maghrib
Unemployment	The share of the labor force that is without work but available for and seeking employment, expressed in percentage.	World Development Indicators
Employment	The proportion of a country's population that is employed, expressed in percentage.	World Development Indicators
Self employment	The share of self-employed workers in total employment, expressed in percentage.	World Development Indicators
Labor force participation	The proportion of the population ages 15 and older that is economically active: all people who supply labor for the production of goods and services during a specified period, expressed in percentage.	World Development Indicators

C Descriptive statistics

Table 5: Descriptive Statistics, 1988-2018

	Mean	Median	Standard deviation	Min.	Max.	Observations
M0 per capita	31.4	25.4	17.1	10.0	64.8	31
M0 / M1	31.1	28.3	4.8	26.0	42.5	31
GDP per capita	18859.5	17800.4	4573.8	13412.8	26734.3	31
Interbank interest rate	5.3	3.3	2.9	2.3	9.6	31
Private credit	52.0	44.0	27.2	16.7	95.5	31
Trade openness	64.9	60.5	14.1	47.1	87.1	31
Agriculture VA per capita	2441.4	2301.5	755.4	1253.9	3699.4	31
Unemployment	12.8	11.3	3.8	8.9	22.9	31
Agriculture employment	43.2	44.4	3.3	38.1	47.2	29
Self employment	56.4	57.7	3.0	51.4	60.4	29
Labor force participation	52.1	52.5	1.3	48.5	53.4	29
Tax revenue	20.1	19.7	2.0	17.6	25.9	31
Financial development index	0.3	0.3	0.1	0.2	0.4	29
Financial institution index	0.4	0.4	0.1	0.3	0.5	29
Financial institution depth index	0.3	0.3	0.1	0.1	0.4	29
Financial institution access index	0.2	0.1	0.1	0.1	0.4	29
Financial institution efficiency index	0.7	0.7	0.0	0.6	0.7	29
Financial market index	0.2	0.2	0.1	0.0	0.4	29
Financial market depth index	0.1	0.1	0.1	0.0	0.4	29
Financial market access index	0.3	0.4	0.2	0.1	0.5	29
Financial market efficiency index	0.1	0.1	0.1	0.0	0.3	29

D Unit root analysis

Table 6: Unit roots tests — Currency demand approach

	ADF		PP	
	Level	First-difference	Level	First-difference
M0 per capita	-0.75	-6.66 ***	-0.64	-6.61***
GDP per capita	-1.31	-10.12***	-4.72	10.12***
Agriculture VA per capita	-2.18	-12.36***	-2.28	-29.39***
Interbank interest rate	-1.26	-3.44**	-1.56	-5.49***
Private credit	-2.12	-2.60***	-2.01	-2.59***
Fin Market Access	-0.92	-4.69***	-0.92	-4.62***
Tax revenue	-2.44	-5.71***	-2.44	-5.84***
Unemployment rate	-2.46	6.30***	-2.43	-6.43***

Note: All variables are in natural logarithm. *, **, *** denote significance at 1%, 5%, and 10% significance levels.

E Cointegration tests

Table 7: Cointegration tests - Currency demand approach

	Model 1		Model 2		Model 3	
	EG	PO	EG	PO	EG	PO
Tau-statistic	-7.9***	-8.9***	-5.6**	-5.8**	-7.1***	-7.2***
Z-statistic	-42.1***	-37.2***	-34.1**	-38.4***	-40.1***	-39.3***

Note: EG: Engle Granger. PO: Phillips Ouliaris. *, **, *** denote significance at 1%, 5%, and 10% significance levels.

Table 8: Residual robustness tests - Currency demand approach

	Model 1 (FMOLS)				Model 2 (FMOLS)				Model 3 (FMOLS)			
	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob
1	-0.398	-0.398	5.4024	0.020	-0.341	-0.341	3.9538	0.047	-0.162	-0.162	0.8925	0.345
2	-0.064	-0.264	5.5454	0.062	0.055	-0.069	4.0594	0.131	0.222	0.201	2.6296	0.269
3	0.020	-0.149	5.5607	0.135	-0.069	-0.082	4.2311	0.238	-0.038	0.025	2.6829	0.443
4	-0.007	-0.100	5.5625	0.234	0.119	0.082	4.7700	0.312	0.014	-0.035	2.6903	0.611
5	-0.017	-0.088	5.5746	0.350	-0.122	-0.063	5.3597	0.374	0.032	0.034	2.7297	0.742
6	0.049	-0.004	5.6736	0.461	0.132	0.082	6.0722	0.415	-0.035	-0.023	2.7805	0.836
7	0.040	0.074	5.7432	0.570	0.043	0.137	6.1506	0.522	-0.046	-0.074	2.8696	0.897
8	-0.306	-0.316	9.9165	0.271	-0.349	-0.355	11.573	0.171	-0.318	-0.345	7.3653	0.498
9	0.157	-0.173	11.068	0.271	0.075	-0.165	11.832	0.223	0.000	-0.083	7.3653	0.599
10	0.057	-0.067	11.227	0.340	0.002	-0.061	11.832	0.296	0.017	0.170	7.3787	0.689
11	0.060	0.092	11.412	0.409	0.171	0.184	13.327	0.272	0.157	0.252	8.6377	0.655
12	-0.077	0.010	11.731	0.468	-0.125	0.082	14.164	0.290	-0.058	-0.042	8.8175	0.718
13	0.018	0.007	11.749	0.548	0.127	0.070	15.087	0.302	0.034	-0.075	8.8846	0.782
14	-0.082	-0.100	12.154	0.594	-0.181	-0.071	17.056	0.253	-0.135	-0.182	9.9826	0.763
15	0.008	-0.120	12.158	0.667	0.048	-0.072	17.206	0.307	0.045	-0.082	10.110	0.813
16	0.134	-0.043	13.378	0.645	-0.016	-0.178	17.224	0.371	-0.082	-0.207	10.568	0.835

	Model 1 (CCR)				Model 2 (CCR)				Model 3 (CCR)			
	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob	AC	PAC	Q-Stat	Prob
1	1	-0.402	-0.402	5.5139	-0.383	-0.383	5.0117	0.025	-0.235	-0.235	1.8785	0.171
2	2	-0.064	-0.270	5.6604	0.030	-0.137	5.0438	0.080	0.205	0.159	3.3671	0.186
3	3	0.023	-0.152	5.6800	-0.060	-0.118	5.1739	0.159	-0.070	0.008	3.5471	0.315
4	4	-0.007	-0.103	5.6821	0.142	0.092	5.9432	0.203	-0.002	-0.051	3.5472	0.471
5	5	-0.018	-0.092	5.6955	-0.155	-0.079	6.8852	0.229	0.046	0.050	3.6316	0.604
6	6	0.052	-0.004	5.8046	0.173	0.115	8.1117	0.230	-0.037	-0.009	3.6868	0.719
7	7	0.045	0.083	5.8924	0.068	0.218	8.3106	0.306	-0.014	-0.048	3.6949	0.814
8	8	-0.306	-0.307	10.063	-0.356	-0.321	13.960	0.083	-0.315	-0.344	8.1097	0.423
9	9	0.165	-0.159	11.322	0.098	-0.158	14.404	0.109	0.016	-0.125	8.1209	0.522
10	10	0.064	-0.040	11.520	-0.002	-0.115	14.404	0.155	0.037	0.157	8.1858	0.611
11	11	0.051	0.109	11.654	0.153	0.136	15.605	0.156	0.142	0.233	9.2117	0.602
12	12	-0.083	0.013	12.024	-0.141	0.077	16.683	0.162	-0.062	-0.050	9.4166	0.667
13	13	0.014	-0.002	12.036	0.144	0.073	17.866	0.163	0.034	-0.052	9.4806	0.736
14	14	-0.080	-0.104	12.417	-0.179	-0.010	19.789	0.137	-0.115	-0.119	10.283	0.741
15	15	0.002	-0.127	12.418	0.044	-0.032	19.911	0.175	0.062	-0.034	10.531	0.785
16	16	0.133	-0.051	13.623	-0.006	-0.154	19.913	0.224	-0.082	-0.221	10.987	0.810