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Empirical Modeling of the Impact of Money Laundering on Governance, Economic and Financial Sectors in CEMAC Countries

Pierre Gaëtant ANGO NGUEMA[1], Louis Bernard AVELE OBAME[2], Fernand BOUDIANGUELA[3]

[1]University of Science and Technology of Masuku (USTM) – Gabon
Center for Studies and Research in International Development and Organizational Management (CERDIMO)

[2]National Institute of Management Sciences (INSG) – Gabon
Laboratory of Intelligence and Analysis of Management and Enterprises (LIAGE)

[3]University of Science and Technology of Masuku (USTM) – Gabon
Center for Public Economics (CEP)

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Abstract

With renewed uncertainties, market vagaries and poor governance in CEMAC countries, we attempt to understand the dynamics of money laundering based on empirical modeling of corruption. In panel data, this modeling is based on Completely Modified Least Squares (FMOLS, DOLS), impulse response functions (IRF) from the Vector Error Correction Model (PVECM) and a quadratic approach in Generalized Moments (SGMM). Over a period from 2000 to 2024, the analysis of stationarity specifies the persistent nature of corruption with an asymptotic convergence. The results suggest that the operational implications, on the fight against money laundering, concern adjustments in governance, unemployment, GDP, public debt, the primary balance, the financial system and the attractiveness of FDI in relation to the fight against corruption. The GMM system defines a threshold for which countries with a corruption perception index lower than 25.33 are exposed to the negative effects of money laundering; beyond this threshold, these effects are attenuated on economic growth. Robustness checks reveal that CEMAC States can structurally carry out institutional and political reforms, in order to adequately combat money laundering deviance, while those integrating uncertainties (notably stochastic shocks) reveal an unstable trajectory of corruption with differentiated results if corrective measures are not anticipated.

Keywords: Money laundering, Corruption, Governance, Financial development, Shocks.

JEL Rating : C13, C32, C33, C34, C51, C52, C43, C55, C82, E6
Type of research: Empirical research

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1. Introduction

The resurgence of corruption levels in the Central Africa region, characterizing the current economic situation, contributes to intensifying money laundering (IMF, 2024). Indeed, in addition to the 2023 coup d'état in Gabon, the Economic and Monetary Community of Central Africa (CEMAC) has recorded issues with the quality and dysfunction of governance mechanisms, with public administrations being susceptible to corruption. However, corruption has a severe and difficult-to-control manifestation, as it has always been a major obstacle to the emergence of CEMAC economies, even when these countries achieve a state of partial stability (Michael R., 2024). Amid socio-political instability, it undermines the integrity of economic indicators and distorts development forecasts. In the sub-region, particularly where public authorities are involved, it acts as a catalyst for money laundering by fostering illegal activities, hindering the promotion of transparency, the security of individuals and their assets, and seriously compromising the integrity of the financial system. Its detrimental effects on governance, human development, and stability are no longer in need of demonstration.

Today, it is important to note that CEMAC countries are modernizing the governance of organizations in the face of this corruption that fuels money laundering. With technological advancements, it is increasingly becoming a transnational challenge that disregards borders, as money now flows more easily within and outside countries, concealing illicit gains. But underlying all of this, the core issue lies in the fact that these countries have economic systems suffering from poor governance. The governance of most of these states, particularly those in transition, is not truly at a fixed standard, and this generates a number of problems, such as the negative effects of money laundering on the effective dynamics of economic growth, or potential positive effects on economic development due to the reinjection of illicit funds into the economy (Khelil et al., 2024).

In this regard, in some reflections on remedying money laundering problems, several authors have raised a number of questions: How can good governance be achieved? Which institution is responsible for governance? Is it the state or the market ? Should the state institution and the market institution be analyzed separately, or should they be examined together to move towards good governance? However, corruption is a phenomenon that occurs in all enterprises and international sectors of countries, involving political actors, civil society actors, and those who do not produce. These numerous actors have interests that are unfortunately divergent. Thus, governance appears poor when a group of actors appropriates the essential, or even the majority, of what is produced, without the others obtaining any share. This phenomenon is called the capture of public goods and/or state capture, which can originate from the central administration, not necessarily politicians. This capture can be illustrated by a set of indicators, among which we have corruption that stimulates money laundering.

Based on these facts, under the hypothesis of this capture, in this research, we attempt to shed light on the ambiguity of the existing dynamic relationships between money laundering and macroeconomic factors in CEMAC countries. Our contribution aims to anticipate the trajectory of corruption and to improve an analytical framework for the viability of anti-money laundering

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efforts in CEMAC countries, by highlighting the complex mechanisms at play between corruption, governance, economy, and finance.

2. Literature review

Although limited in the context of CEMAC countries, the existing literature on related subjects highlights the potential and mixed implications of money laundering, underscoring its theoretical and empirical importance.

2.1. The theoretical effects of money laundering

According to Théophile Ngapa (2016), money laundering represents a real threat to the global economy, and states are called upon to coordinate their efforts to effectively combat this scourge. This objective gave rise in 2000 to an anti-money laundering institutional and normative framework intended to rise to the level of European and international standards in this field. However, an analysis of the organic texts reveals no specific criminal jurisdiction granted to CEMAC countries or its institutions and organs. Furthermore, the decision-making process leading to the adoption of these texts raises questions of legality and legitimacy. Moreover, in seeking to align its anti-money laundering framework with international norms and standards, CEMAC lost sight of its own regional realities, to the extent that a domestication of the anti-money laundering approach is essential for greater effectiveness and for a better fight against corruption.

According to Lédaga, Wei, and Mfoubou (2020), there are two categories of corruption in CEMAC. Grand corruption, which consists of acts committed at a high level of government that distort policies or the central functioning of the state, allowing leaders to benefit at the expense of the public good. Petty corruption refers to the everyday abuse of entrusted power by low- and mid-level public officials in their interactions with ordinary citizens, who are often trying to access basic goods or services in places like hospitals, schools, police departments, and other agencies. The authors argue that political corruption is a manipulation of policies, institutions, and rules of procedure in the allocation of resources and funding by political decision-makers, who abuse their position to maintain their power, status, and wealth. This political instability generates difficulties in CEMAC, so that high corruption fosters border insecurity, unequal distribution of wealth, poor governance, high unemployment, a weak financial sector, and dual membership in other regional economies.

Some authors assert that money laundering poses significant risks to the stability and integrity of financial systems, which can have negative consequences on the overall quality of governance and public institutions in CEMAC states. Studies on the financialization of cultural industries by Pradié (2005) and on the impact of trade agreements on employment equity by Lamarche (2005) highlight the interconnection of economic activities and political outcomes. These studies suggest that illicit financial activities have considerable effects on various sectors of the economy, including governance and the quality of institutions. Furthermore, research on the importance of financial policies in CEMAC's economic growth by Nanfosso et al. (2015)

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emphasizes that money laundering undermines the effectiveness of these policies by distorting financial flows and compromising the integrity of the institutions responsible for their implementation.

Moreover, several authors argue that money laundering can, under certain conditions, have beneficial effects on the economy (Jaynes, 2015; González, 2015; Baker, 2016; Lombardi, 2017; Taylor, 2019; Ibrahim, 2020). Conversely, other authors highlight the harmful effects of money laundering on the economy (Rose, 2014; Emilien, 2016; Stiglitz, 2016), arguing that money laundering creates major market distortions by eroding investor confidence, increasing inequality, and causing massive capital flight, thereby worsening the fragility of local economic institutions. These authors believe that economies infiltrated by illicit funds become increasingly dependent on criminal activities, which exacerbates corruption and weakens public institutions.
In the financial field, some researchers believe that money laundering has positive effects (Cobham, 2005; Allen et al., 2009; Sene, 2016), arguing that the enhanced regulation implemented by financial institutions to combat money laundering improves the overall efficiency of the banking system. This implementation of anti-money laundering measures contributes to the modernization of technological infrastructure and the professionalization of employees. Concurrently, by putting pressure on banks and regulators, it pushes financial institutions to adopt more rigorous control systems and to invest in innovative tools for detecting illicit activities. However, others think that money laundering undermines trust in financial institutions and increases the risk of financial crisis due to the instability it generates (Congdon, 2013; Feinstein, 2014). This is because the system increases operational costs, which are ultimately passed on to customers in the form of higher fees and restricted services, facilitating the formation of speculative bubbles. When these bubbles burst, the effects are devastating, leading to large-scale financial crises and weakening local banking systems. Other perspectives focus on Foreign Direct Investment (FDI), with most supporting the view that money laundering and corruption deter incoming FDI in developing countries (Wei, 1997; Akermann, 1999; Sakkar and Aynul, 2001; Daude and Stein, 2001; Habib and Zurawicki, 2002; Anupam and Srinivas, 2002; Asiedu, 2003; Kapuria-Foreman, 2007; Quazi, 2014; and Hajzler and Rosborough, 2016). In some cases, money laundering actually attracts FDI (Kaufman, 1997; Bardhan, 1997; Glass and Wu, 2002; Egger and Winner, 2005; Ravi, 2015; Abotsi, 2016).

2.2. The empirical effects of money laundering

Recent empirical work highlights the impact of corruption on FDI. Ekodo R., Njaya J. B., and Ndam M. (2018) assessed the impact of corruption on FDI attractiveness in the six CEMAC countries. Using the Generalized Method of Moments (GMM) in a dynamic panel for the period 1996 to 2016, the results showed that control of corruption has a positive and significant impact on FDI attractiveness in this sub-region. Kouam J. C. and Nafé D. (2019) also proposed an empirical evaluation of the determinants of FDI attractiveness in CEMAC for the period 1987-2017. Among their findings, based on Ordinary Least Squares (OLS) with panel data, the econometric estimation using a fixed-effects model corroborates the idea that incoming FDI in CEMAC is a decreasing function of the corruption rate. Youbi Pouepi and Salouka, Y. (2024) analyzed the effect of corruption on FDI in the West African Economic and Monetary Union

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(WAEMU) zone using the Autoregressive Distributed Lag (ARDL) method with the Pooled Mean Group (PMG) estimator on a panel of eight countries during the period 2002-2021. The results reveal that in the long term, control of corruption has a negative and significant effect on FDI attractiveness.

Work focused on economic growth indicates, according to the conclusions of Stancu and Rece (2018), a short-term positive correlation between the volume of laundered money and GDP in several countries using OLS, suggesting that laundered money can temporarily stimulate economic activity. Similarly, the work of Zhang et al. (2021) focuses on a multivariate analysis model with a sample of 50 developing countries; their results reveal that money laundering is associated with an increase in the level of corruption, which in turn further drives economic growth. The work of Mohammadi and Khoshbakht (2023) examines the socio-economic development and oil dependency of developing countries using a modeling approach based on structural equation modeling with PLS-SEM. The results show that money laundering can have positive short-term effects on the economic development of developing countries due to the reinjection of illicit funds into the economy.

However, based on a panel data OLS analysis of 100 countries over a 15-year period, the results from Dreher et al. (2019) reveal that money laundering has a negative impact on human development, as it reduces public investment in education and health. The work of Osei and Agyemang (2019) and Fofana and Kone (2020) adopts a Vector Autoregressive (VAR) model and concludes that money laundering has deleterious consequences on economic development in several West African countries. Similarly, Akinwumi et al. (2021) reach the same results in the case of Nigeria, emphasizing that illicit funds divert essential resources that could otherwise be invested in development projects. In addition, the work of Chowdhury et al. (2022), focused on South Asian countries using an ARDL approach, shows that money laundering harms long-term GDP growth by increasing economic uncertainty and diverting financial resources to unproductive activities. These conclusions are also supported by the work of Zhang and Chen (2022) and Khan and Kaur (2023), who use a VAR model and find that money laundering harms long-term economic growth as well as the employment rate.

Empirical work also corroborates the idea that money laundering hinders the performance of an economy's financial system. The work of Mansour et al. (2020) relies on a dynamic panel analysis model of a sample composed of Middle Eastern and North African countries and highlights the existing correlations between bank capital ratios, liquidity, and systemic risk indicators. The results show that money laundering contributes to increased financial malfeasance, which compromises banking system stability. In a very recent study, Khelil, Khlif, and Achek (2024) synthesize the existing literature on the economic consequences of money laundering. The authors use an empirical study synthesis approach and focus on tax evasion, financial stability, economic growth, and FDI. The results point to various negative impacts of money laundering at the national level, affecting economic growth and the integrity of the banking system.

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We note that most of the aforementioned studies employ OLS and VAR, and focus on governance, FDI, the financial system, and GDP. We adopt the same logic and integrate unemployment, public debt, and the budget deficit into these macroeconomic factors due to the shock sensitivity of CEMAC countries. Methodologically, we opt for dynamic models based on Fully Modified Ordinary Least Squares (FMOLS) and the Panel Vector Error Correction Model (PVECM) for two reasons: (1) FMOLS is suited for asymptotically biased distributions and can avoid issues of endogeneity, serial correlation, and simultaneity posed by OLS (Phillips and Hansen, 1990; Hu et al., 2018; Yao et al., 2019; Engle et al., 2020). According to Deininger and Squire (1998), the pooled OLS estimator is seriously biased in the presence of unobserved time-invariant heterogeneity, and this model suffers from cross-sectional dependence. Failure to address these issues would lead to biased standard errors and thus invalid statistical inference; (2) If cointegration exists, the VECM can be used at the variable level, which is not the case for the VAR model. However, here we attempt to propose a critical threshold for money laundering using the System Generalized Method of Moments (System GMM) based on a quadratic approach.

H0: Given the controversies established in the literature, we hypothesize that the persistence and convergence of money laundering within CEMAC countries are constraints on the adjustment of the viability of (**i**) real GDP growth, (**ii**) the debt burden, (**iii**) the quality of policies and institutions, (**iv**) financial system performance, (**v**) foreign investment, (**vi**) the budget deficit, and (**vii**) the unemployment rate.

3. Methodology

According to the United Nations methodological framework (2024)[1]illicit financial flows (IFFs) refer to activities considered criminal offenses, as well as certain behaviors related to tax and trade practices. The proposed framework identifies four main types of activities that can generate IFFs: Tax and trade activities; Illegal markets; Corruption; Criminal and terrorist exploitation and financing activities. In the context of this study, we approach IFFs through corruption. Thus, through an analysis of dynamic cointegration relationships (Phillips and Moon, 1999; Stock and Watson, 1993), we analyze the behavior of money laundering by modeling corruption against macroeconomic factors in the CEMAC zone.

3.1. Model

We formulate the following basic model :

$$Y_{i,t} = f\left(\alpha, IPC, INF\right)_{i,t} + e_{i,t} \quad \textbf{(1)}$$

Where : ***Y***, a vector of dimension (7,1) which represents the matrix of explained variables; the variable of interest ***IPC*** is the Corruption Perceptions Index, allowing for an understanding of the weight of money laundering in this study. This index ranks countries[2] on a scale from zero (highly corrupt) to one hundred (entirely clean); the control variable ***INF*** denotes inflation

[1] https://unctad.org/publication/conceptual-framework-statistical-measurement-illicit-financial-flows.
[2] https://transparency.org.

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measured by the Consumer Price Index (in %). "***α***" is the matrix of parameters to be estimated; "***e***" is the matrix of error terms; and "***t***" is the annual time index for country "***i***". Specified for estimation purposes, model (1) takes the following linear form:

$$Y_{i,t} = \alpha_0 + \alpha_1 IPC_{i,t} + \alpha_2 INF_{i,t} + e_{i,t} \quad \textbf{(2)}$$

Where the variables in vector ***Y*** are: ***CPIA*** denotes the quality of policies and institutions, measured by the World Bank's Country Policy and Institutional Assessment score, which classifies countries' governance quality as strong if CPIA > 3.75, moderate if 3.25 < CPIA < 3.75, and weak if CPIA < 3.25; ***DEBT*** represents the external debt burden, measured by the ratio of external public debt to GDP (%) ; ***IDF*** denotes the financial development index, measured by the International Monetary Fund's overall financial score, which ranks countries' maturity and performance from zero (low performance) to one (high performance) ; ***CHOM*** denotes the unemployment rate of the population, referring to the share of the labor force that is unemployed but available for and actively seeking work ; ***DEFT*** represents the budget deficit, measured by the primary balance (% of GDP) ; ***FDI*** denotes foreign direct investment (% of GDP), corresponding to net inflows of investment aimed at acquiring a lasting management interest in an enterprise operating in an economy other than that of the investor ; ***GDP*** is the gross domestic product, measured by real economic growth (in %), which reflects the confluence of all domestic and external shocks.

By assumption, given the incidence of long-term endogeneity biases on OLS estimates, we estimate dynamic models based on FMOLS and DOLS (dynamic OLS). Dynamic models are advantageous compared to static models because they facilitate the calculation of short-term and long-term elasticity's. Thus, equation (2) can then be written in the form of an error correction specification as follows:

$$\Delta(CPIA)_{i,t} = \mu + \beta_1 \Delta(IPC)_{i,t} + \beta_2 \Delta(INF)_{i,t} + \delta CPIA_{i,t-1} + \gamma_1 IPC_{i,t-1} + \gamma_2 INF_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(3)}$$

$$\Delta(DEBT)_{i,t} = \mu + \beta_1 \Delta(IPC)_{i,t} + \beta_2 \Delta(INF)_{i,t} + \delta DEBT_{i,t-1} + \gamma_1 IPC_{i,t-1} + \gamma_2 INF_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(4)}$$

$$\Delta(IDF)_{i,t} = \mu + \beta_1 \Delta(IPC)_{i,t} + \beta_2 \Delta(INF)_{i,t} + \delta IDF_{i,t-1} + \gamma_1 IPC_{i,t-1} + \gamma_2 INF_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(5)}$$

$$\Delta(CHOM)_{it} = \mu + \beta_1 \Delta(IPC)_{it} + \beta_2 \Delta(INF)_{it} + \delta CHOM_{t-1} + \gamma_1 IPC_{t-1} + \gamma_2 INF_{it} + \varepsilon_{it} \quad \textbf{(6)}$$

$$\Delta(DEFT)_{i,t} = \mu + \beta_1 \Delta(IPC)_{i,t} + \beta_2 \Delta(INF)_{i,t} + \delta DEFT_{i,t-1} + \gamma_1 IPC_{i,t-1} + \gamma_2 INF_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(7)}$$

$$\Delta(GDP)_{i,t} = \mu + \beta_1 \Delta(IPC)_{i,t} + \beta_2 \Delta(INF)_{i,t} + \delta GDP_{i,t-1} + \gamma_1 IPC_{i,t-1} + \gamma_2 INF_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(8)}$$

$$\Delta(IDE)_{i,t} = \mu + \beta_1 \Delta(IPC)_{i,t} + \beta_2 \Delta(INF)_{i,t} + \delta IDE_{i,t-1} + \gamma_1 IPC_{i,t-1} + \gamma_2 INF_{i,t-1} + \varepsilon_{i,t} \quad \textbf{(9)}$$

Where: Δ is the short-term operator; "$\boldsymbol{\beta_i}$", $\boldsymbol{i}$ = {1,2}, denotes the short-term coefficients; "$\boldsymbol{\gamma_i}$", $\boldsymbol{i}$ = {1,2}, denotes the long-term coefficients; "***μ***" denotes the constant of the models and "***ε***" the error term; "***δ***" represents the speed of adjustment. The error correction term must be significant and negative to highlight long-term causality.

3.2. Estimation technique

We use the FMOLS method developed by Pedroni (2004) and Kao and Chiang (2000), which allows for determining the long-term equilibrium relationship and indicates the long-term effect of the independent variables. According to several studies (Sadorsky, 2011; Hu et al., 2018; Yao et al., 2019), FMOLS is a non-parametric method that corrects for autocorrelation and heteroscedasticity by eliminating the correlation between explanatory variables and innovations. In addition to FMOLS, following Rahman & Velayutham (2020), we adopt the Dynamic Ordinary Least Squares (DOLS) method as an additional approach to verify the robustness of the results. The DOLS method is a parametric method that eliminates autocorrelation between explanatory variables and error terms by adding lagged terms of the explanatory variables.

We also perform parameter estimations using the requirements of the Panel Vector Error Correction Model (PVECM), which likewise preserves short-term and long-term dynamics, drawing inspiration from the methodology of Nouhaila and Ouakil (2019). The VECM incorporates unit root tests that rely on an actuarial definition and cointegration tests. Most importantly for us in this research is its ability to estimate the overall dynamics of a system and to describe its response to a shock at times "*t, t+1, t+2*" on the innovation terms "$\boldsymbol{u_{it}}$", using impulse response function (IRF) tools. Based on the unconstrained PVECM(k) modeling, the IRFs are calculated as follows :

$$IRF = \sum_{y=0}^{k} \frac{\partial y_{it}^{\omega} + y}{\partial u_{it}^{j}} \quad for \quad k = 1, 2... \tag{10}$$

To this end, under the control of the stability test (LM unit root test of the panel), the relationships to be estimated for the analysis of these impulse responses are of the following form:

$$\Delta Y_{i,t} = \eta_0 + \sum_{i=1}^{p} \eta_{p,1} \Delta Y_{i,t-p} + \sum_{i=1}^{p} \eta_{p,2} \Delta IPC_{i,t-p} + \sum_{i=1}^{p} \eta_{p,3} \Delta INF_{i,t-p} + \omega_i ECT_{i,t-1} + e_{i,t} \tag{11}$$

With ***Y*** representing the vector of endogenous variables; "***η***" representing the short-term dynamic coefficients of the long-term equilibrium model fit; "***ω***" being the negative-signed rate-of-adjustment parameter; and "***ECT***" being the error correction term. Given that the theory justifies that money laundering can have both positive and negative effects on an indicator, a transition threshold may exist. To verify this, we use the Generalized Method of Moments (SGMM) system, which includes a quadratic interaction term as follows:

$$Y_{i,t} = \alpha + \beta Y_{i,t-1} + \varphi_1 IPC_{i,t} + \varphi_2 IPC_{i,t}^2 + \zeta INF_{i,t} + \psi_t + \varepsilon_{i,t} \tag{12}$$

By differentiating ***Y*** by the corruption weight in equation (12), we obtain at the optimum:

$$\frac{\partial Y_{i,t}}{\partial IPC_{i,t}} = \varphi_1 + 2\varphi_2 IPC_{it} = 0 \quad \Rightarrow \quad threshold = -\frac{\varphi_1}{2\varphi_2} \tag{13}$$

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The result stems from the significance of the IPC variable and its square, as well as the opposing signs of their coefficients (positive for IPC and negative for IPC²). This translates into a Laffer curve (inverted U-shape) relationship between corruption and vector ***Y***. The confirmation is provided by the nonlinearity detection test proposed by Lind and Mehlum (2010), which helps avoid any ambiguity or misinterpretation regarding the type of relationship (convex, concave, monotone).

3.3. Data

The study focuses on the six countries of the Economic and Monetary Community of Central Africa (CEMAC), distinguished by their characteristics. Specifically, these are Cameroon, Chad, Gabon, Congo, the Central African Republic, and Equatorial Guinea. We concentrate our efforts on the period from 2000 to 2024 for each country, with statistical data limited by availability, giving us 25 observations per country for a total sample of 150 panel observations. The collected dataset primarily comes from the World Bank (WDI), the International Monetary Fund (IMF), Transparency International's Political Risk Services (PRS), Country Economy (CE), and secondary data from the annual review of Economic Outlooks for countries in the sub-region. For some countries, missing data were adjusted using the moving averages method. Table 1 summarizes the variables in the present study.

Table 1. Summary of study variables

Variable	***Code***	***Measurement Method***	***Sources***
Quality of Policies and Institutions	***CPIA***	Score: Strong if CPIA > 3.75; Moderate if 3.25 < CPIA < 3.75; Weak if CPIA < 3.25	IMF (2025)
Financial Development Index	***IDF***	Overall Financial Index (0 = low performance to 1 = high performance)	IMF (2025)
Public Debt	***DEBT***	External public debt ratio (% of GDP)	WDI (2025)
Corruption Perceptions Index	***IPC***	0 = highly corrupt countries to 100 = entirely clean countries	PRS (2025)
Budget Deficit	***DEFT***	Primary balance (% of GDP)	CE (2025)
Unemployment Rate	***CHOM***	Unemployment, total (% of population)	WDI (2025)
Inflation Rate	***INF***	Inflation, consumer prices (annual %)	WDI (2025)
Foreign Direct Investment	***FDI***	FDI, net inflows (% of GDP)	WDI (2025)
Gross Domestic Product	***GDP***	Real GDP growth (annual %)	WDI (2025)

Source: Authors, 2025

The analysis of Figure 1 reveals a varied and differentiated evolution of the CEMAC model series between 2000 and 2024. Indeed, we observe that the dynamics of the indicators are

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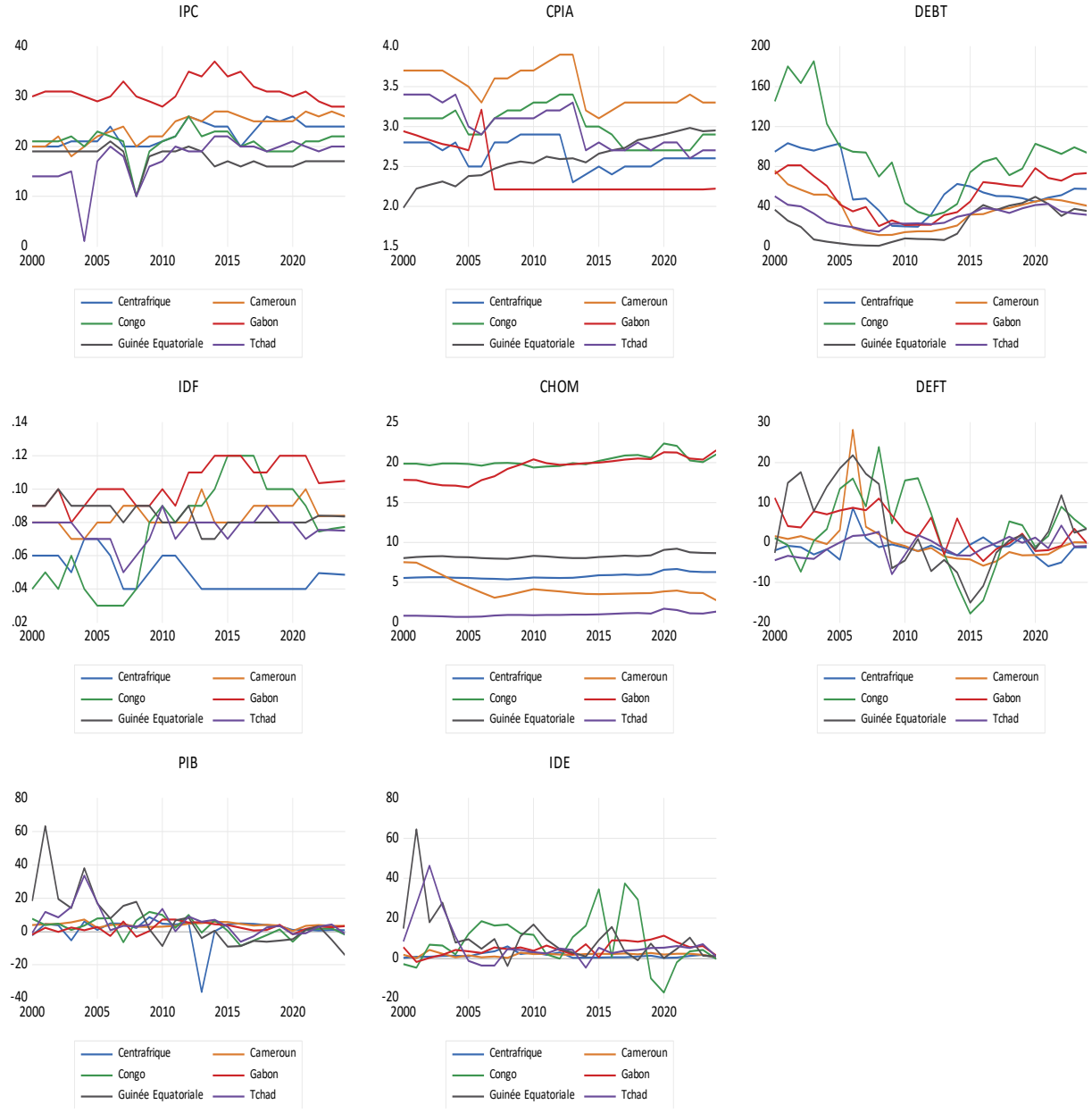
characterized by fluctuations, reflecting series instability over time and illustrating high volatility. The six countries are homogeneous in terms of the analyzed variables, showing no significant differences in their dynamics. We hypothesize that variations in money laundering could explain these different trends. The estimations performed will allow us to confirm or refute this.

Figure 1. Series dynamics for the period 2000-2024.



Source: Authors, 2025.

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According to the work of Lédaga N. S. et al. (2020)[3], in the CEMAC zone, money laundering has gained momentum and increased in scale, considering the impact stemming from corruption in public administrations. Corruption has become commonplace, and although reduction efforts have been recorded within the sub-region, it remains very pronounced. In attempting to reproduce their analyses, we provide Table 2 below, which shows the evolution and an overview of the position of these CEMAC countries in terms of corruption over the past six years.

Table 2. Corruption perception index within CEMAC

Country	*Rank*	*2019*	*2020*	*2021*	*2022*	*2023*	*2024*	*average score*	*Result*
Gabon	136	31	30	31	29	28	28	29.5	**Corrupt**
Cameroon	140	25	25	27	26	27	26	26.0	**Corrupt**
CAR	146	25	26	24	24	24	24	24.5	**Corrupt**
Congo	158	19	19	21	21	22	22	20.7	**very corrupt**
Chad	162	20	21	20	19	20	20	20.0	**very corrupt**
Equatorial Gu.	172	16	16	17	17	17	17	16.7	**very corrupt**

Source: Authors, based on data from Transparency International (2025)

Compared to the work of Lédaga N. S. et al. (2020), which indicated an average score for Gabon of 32.25 in 2020, ranking 123/180, our results show that it has regressed to a rank of 136/180 with a deteriorated average score of 29.5 in 2024, despite its recovery efforts through its anti-corruption campaign called "Operation Scorpion," which aimed to clean up Gabon's public finances. However, further efforts are still needed, as overall in CEMAC, the figures remain constant for most countries and alarming for others. Indeed, Congo, Chad, and Equatorial Guinea in particular have staggering figures. From 2019 to 2024, their average corruption indices are very close to zero, at 20.7, 20, and 16.7, respectively. Furthermore, these three countries are among the top 10 most corrupt countries in Africa in 2025[4]. All of this attests to the real political instability plaguing this region and the magnitude of money laundering in CEMAC. Moreover, CEMAC's average score of 22.24 corroborates the facts about its alarming dynamics from 2000 to 2024 (Table 3).

[3] https://doi.org/10.4236/ojps.2020.102021.

[4] https://afrique.le360.ma/autres-pays/societe/2020/01/25/29293-corruption-voici-les-10-pays-les-moins-et-les-plus-corrompus-dafrique-29293/.

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Table 3. Descriptive statistics

	Average	standard deviation	Coefficient of variation	Jarque-Bera	Joint Test
IPC	22.24	5.414	0.243	5.85**	0.053
CPIA	2.856	0.439	0.154	5.35**	0.068
DEBT	48.23	33.57	0.696	36.89	0.000
IDF	0.078	0.022	0.282	2.76**	0.252
CHOM	9.821	7.466	0.760	185.7	0.000
DEFT	1.262	7.031	5.571	24.25	0.000
GDP	3.528	8.889	2.519	74.69	0.000
INF	3.078	3.055	0.993	14.43	0.000
IDE	5.405	9.387	1.737	86.68	0.000
Obs	150	150	150	150	150

CV: Coefficient of variation; if CV < 0.3, low volatility; if CV > 0.3, high volatility
Joint test: Jarque-Bera normality test, Normality assumption if Prob(chi2) > 0,,05**

Source: Authors, 2025

Apart from corruption (CPI), governance (CPIA), and financial development (IDF), the univariate statistics (Table 3) indicate that the remaining indicators exhibit heterogeneous behavior, tending to reflect the high volatility of these variables, as the associated coefficients of variation are all greater than 0.30. This is not surprising given the analyses in Figure 1. The statistics reveal that debt, unemployment, the budget deficit, GDP, and inflation deviate from a normal distribution (Jarque-Bera test) with p-values < 5%. However, the non-normality of any regressor is not an issue, as the sum of random variables tends toward normality (central limit theorem). Moreover, the model's errors stem from the assumption of residual normality (Table 5, analysis of residual correlations), which is why the FMOLS model estimates are valuable in mitigating this bias.

The average governance quality is estimated at 2.856, reflecting weak policy and institutional quality, as it is below 3.25 (IMF score); the average public debt ratio is 48.23%, indicating a problem of over-indebtedness in the countries relative to the IMF criteria, which set debt sustainability thresholds below 30%; the average financial development is 7.8%, relatively very close to zero, suggesting very weak banking system performance; the average unemployment rate is around 10%, signaling economic issues where labor supply is high, reducing the overall purchasing power of households; the average budget deficit is 1.262%, highlighting the fiscal efforts that countries in the sub-region must address, with an average GDP growth rate of 3.058%, which remains below the World Bank's[5] projected expectations of around 3.4%; the average foreign direct investment rate is 5.405%, below the penetration rate suggested by the World Bank (10%), indicating a low level of attractiveness. We seek to explain whether money laundering justifies these observed averages.

[5]https://www.banquemondiale.org/fr/region/afr/publication/unlocking-forestry-sector-potential-economic-barometer-for-the-central-african-economic-and-monetary-community.

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Table 4. Pearson Correlation Matrix

	IPC	*CPIA*	*DEBT*	*IDF*	*CHOM*	*DEFT*	*PIB*	*IDE*
IPC		-0.31***	0.11	0.36***	0.45***	0.01	-0.18**	-0.17**
		(0.000)	(0.197)	(0.000)	(0.000)	(0.888)	(0.030)	(0.033)
INF	-0.07	-0.15*	-0.16**	-0.13	-0.13	0.12	0.11	0.19**
	(0.359)	(0.052)	(0.047)	(0.126)	(0.116)	(0.141)	(0.193)	(0.020)

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

In Table 4, we observe that there are significant correlations with corruption. However, these correlations are not concerning, as the coefficients are below 0.80, indicating an absence of multicollinearity, which is confirmed by the average variance inflation factor (VIF) test for values below 5 (Table 5). These analyses suggest that the estimated parameters would be unbiased, consistent, and efficient.

4. Results and discussion

4.1. Convergence of the OLS estimator towards the FMOLS estimator

Technically, the homogeneity of coefficients affects the directions and structures of unit root and cointegration tests. To achieve this, we apply the Hausman test based on Blomquist and Westerlund (2013), who propose a test on the homogeneous or heterogeneous nature of slope coefficients. Thus, the Hausman test reveals an endogeneity problem at the 10% significance level. Furthermore, we observe that heteroscedasticity (LR test) is a significant problem at the 1% level, meaning that the model errors do not have constant variance. This constitutes a violation of the basic assumptions of the OLS model. Additionally, except for debt, the primary balance, and FDI, the Pesaran and Yamagata (2008) Delta tests show that the null hypothesis of slope coefficient homogeneity is rejected at the 10% significance level. These results therefore support country-specific heterogeneity within CEMAC. However, all these limitations statistically justify that OLS is suboptimal and confirm our choice of FMOLS to mitigate these biases.

Table 5. Endogeneity test and OLS parameter diagnostics.

	CPIA	*DEBT*	*IDF*	*CHOM*	*DEFT*	*GDP*	*IDE*
Hausman test	-3.92*** (0.000)	10.5*** (0.000)	0.32 (0.7472)	-3.26*** (0.000)	1.69* (0.093)	9.37*** (0.000)	73.44*** (0.000)
J-B test residues	8.65 (0.013)	99.85 (0.000)	3.07** (0.215)	9.32 (0.009)	45.57 (0.000)	1565.23 (0.000)	78.25 (0.000)
LR test	70.7*** (0.000)	94.5*** (0.000)	111.2*** (0.000)	162.3*** (0.000)	68.83*** (0.000)	141.2*** (0.000)	45.27*** (0.000)
Delta test	2.192** (0.028)	0.827 (0.408)	1.769* (0.077)	2.512** (0.012)	0.819 (0.413)	3.822*** (0.000)	1.483 (0.138)
Average VIF	1.01	1.01	1.01	1.01	1.01	1.01	1.01

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025.

4.2. Cross-sectional dependence test and panel stationarity analysis

Before proceeding with the empirical estimations of money laundering, we verified the stationarity properties of the series to avoid the risk of spurious regression. First, we analyzed the cross-sectional dependence among the series, which were found to be heterogeneous, in order to specify the type of unit root test to perform[6].. To this end, Pesaran (2021) developed a test based on pairwise correlation coefficients rather than their squares, which allows for checking and testing cross-sectional dependence under the null hypothesis of cross-sectional independence. Thus, with the exception of financial development (IDF), the Pesaran (2021) test in Table 6 shows that the panel is correlated at the 10% significance level, meaning each series exhibits cross-sectional dependence. Consequently, money laundering activities in one CEMAC country can have repercussions beyond its borders. Having identified cross-sectional dependence, Hoechle (2007) also suggests using Driscoll & Kraay (1998) standard error methods to correct this issue of cross-sectional dependence (see Table 9).

Table 6. Cross-sectional dependence test

	IPC	*CPIA*	*DEBT*	*IDF*	*CHOM*	*DEFT*	*PIB*	*INF*	*IDE*
Pesaran (2021)	6.02*** (0.000)	7.69*** (0.000)	2.79*** (0.005)	1.36 (0.174)	2.88*** (0.004)	1.99** (0.047)	2.66*** (0.008)	2.25** (0.025)	4.43*** (0.000)

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

Therefore, since cross-sectional dependence is evident, we analyze the stationarity of the series using Pesaran's (2007) second-generation unit root tests (CIPS and CADF). As the financial

[6] First-generation tests (Levin, et al. (2002, LLC), Im et al. (2003, IPS) and Hadri (2000)) are based on the assumptions of cross-sectional independence, and second-generation tests (CADF and CIPS) by Pesaran (2007) are robust to cross-sectional dependence and take into account the heterogeneity of slope coefficients.

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development (IDF) variable does not demonstrate cross-sectional dependence, the LLC and IPS unit root tests are calculated, as summarized in Table 7 below.

Table 7. Stationarity Test Results

	CADF	CIPS	LLC	IPS	Decision	Classification
IPC	0.000[b]	-2.788***[b]			Stationary	1st difference
CPIA	0.012[b]	-2.817***[a]			Stationary	1st difference
DEBT	0.000[b]	-5.052***[b]			Stationary	1st difference
IDF			0.0176**[a]	0.0073***[a]	Stationary	At level
CHOM	0.090[a]	-2.454** [a]			Stationary	At level
DEFT	0.001[b]	-3.592***[a]			Stationary	1st difference
GDP	0.089[a]	-3.653***[a]			Stationary	At level
INF	0.000[b]	-4.302***[a]			Stationary	1st difference
IDE	0.023[a]	-3.304***[a]			Stationary	At level

*Significant P-value if: <1%***, <5%**, <10%*; (a; b); t-CIPS: <-2.21 (10%), <-2.33(5%), < -2.55(1%).*
Stationary at level = a; Stationary in difference = b
Source: Authors, 2025

The results of the stationarity test indicate that some series are stationary at level, while other variables are stationary at first difference around the 10% significance level. Since the series are not integrated in the same order, cointegration tests will be used to analyze whether a long-term relationship exists among them. Two findings are particularly important to highlight: (***i***) we observe that corruption is not stationary at level, indicating its temporal instability; (***ii***) This actuarial definition provides evidence that corruption is highly persistent with asymptotic convergence.

4.3. Panel Data Cointegration Test

To determine cointegration among the model variables, the Westerlund (2008) bootstrap test is applied. This test is used in both cross-sectional dependence and cross-sectional independence cases, and it also accommodates heterogeneity among the panel units. The Johansen (1992) cointegration test is also proposed to examine whether a long-term relationship exists between the variables.

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Table 8. Panel Cointegration Test

Equation	*CPIA*	*DEBT*	*IDF*	*CHOM*	*DEFT*	*GDP*	*IDE*
Westerlund Panel cointegration test							
G_t	-3.034**	-1.613*	-4.736***	-5.560***	-5.677***	-8.501***	-2.469*
	(0.010)	(-0.050)	(0.000)	(0.000)	(0.000)	(0.000)	(0.070)
G_a	-2.665**	-0.561	-4.864***	-2.827**	-5.154***	-10.12***	-7.175
	(0.010)	(0.120)	(0.000)	(0.010)	(0.000)	(0.000)	(0.120)
P_t	-3.037***	-1.701*	-3.440***	-4.243***	-4.676***	-9.865***	-7.072*
	(0.000)	(0.070)	(0.000)	(0.000)	(0.000)	(0.000)	(0.090)
P_a	-4.514***	-2.791**	-5.671***	-4.851***	-5.399***	-18.98***	-8.291*
	(0.000)	(0.030)	(0.000)	(0.000)	(0.000)	(0.000)	(0.060)
Johansen Fisher panel cointegration test (P-value trace)							
CAR	0.053	0.001	0.037	0.043	0.044	0.012	0.010
Cameroon	0.003	0.000	0.001	0.002	0.002	0.001	0.053
Congo	0.000	0.000	0.000	0.002	0.001	0.002	0.001
Gabon	0.029	0.007	0.015	0.046	0.014	0.063	0.087
Equ. Guinea	0.013	0.000	0.034	0.003	0.000	0.011	0.000
Chad	0.000	0.000	0.000	0.000	0.000	0.000	0.000

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

The Westerlund (2008) test consists of four tests: Gι, Gα, Pι, and Pα. The first two are "group mean tests," where the alternative hypothesis is that at least one observation has cointegrated variables. The last two are "panel tests," and in this case, the alternative hypothesis is that the panel, considered as a whole, is cointegrated. These tests (Table 8) were calculated using the bootstrap method and are robust in the presence of cross-sectional dependence in the series. The tests are conducted with a constant and a trend. The results show that both the group mean statistics and panel statistics are significant at p-values < 10%, leading to the rejection of the null hypothesis of no cointegration. Furthermore, the Johansen test indicates that all CEMAC countries exhibit long-term relationships at the 10% significance level. In summary, the results suggest that a cointegration relationship exists among the series, implying they should move together in the long term and indicating long-term causality. To this end, we perform the Granger-causality Wald test to determine the causality among the series.

4.4. Dynamics of money laundering in relation to macroeconomic factors

The regressions obtained using the Driscoll & Kraay (1998) method (Table 9) show that governance, the budget deficit, economic growth, and foreign direct investment are important factors to integrate into the design of inclusive economic policies and the fight against money laundering in CEMAC countries, as corruption has a negative and significant effect on these factors. Similarly, these results reveal that it is essential to establish a favorable institutional environment through institutional reforms aimed at making public debt sustainable, granting

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greater independence to the central bank to stabilize the financial system, combating excessive unemployment, and strictly controlling corruption. This is because money laundering significantly influences the increase in public debt, rising unemployment, and has a multiplier effect on the financial system. These results firmly justify the resurgence of corruption in these economies.

Table 9. Driscoll & Kraay (Pooled OLS) Estimation Results

	CPIA	DEBT	IDF	CHOM	DEFT	GDP	IDE
IPC	-0.026***	0.583*	0.001***	0.605***	-0.307*	-0.560**	-0.278**
	(0.000)	(0.072)	(0.000)	(0.000)	(0.078)	(0.033)	(0.043)
INF	-0.025***	-1.171	-0.001	-0.234	0.186*	0.066	0.544
	(0.006)	(0.119)	(0.376)	(0.139)	(0.080)	(0.739)	(0.179)
Constant	3.522***	40.51***	0.049***	-2.922**	0.017	-0.196	9.913***
	(0.000)	(0.000)	(0.000)	(0.020)	(0.972)	(0.699)	(0.002)
R^2	0.128	0.035	0.136	0.208	0.038	0.032	0.061
Prob > F	0.000	0.100	0.000	0.000	0.133	0.070	0.122
Obs.	150	150	150	150	150	150	150

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

Although the Driscoll & Kraay estimates are particularly robust to problems related to violations of OLS basic assumptions, they do not solve the endogeneity issue in the model. It falls upon us to analyze the level of persistence of money laundering in the short and long term using FMOLS and DOLS (Table 10). Thus, we observe for both estimated models (FMOLS, DOLS) that the short-term causality tests (Wald) are all significant at the 1% level, indicating the joint influence of corruption and inflation on macroeconomic factors (CPIA, DEBT, IDF, CHOM, DEFT, GDP, FDI). Furthermore, the error correction terms (**Ec**) are negative and significant (p-value < 1%), positing that cointegration relationships exist and that shocks to macroeconomic factors in CEMAC countries correct themselves through feedback effects. In other words, short-term imbalances are corrected in the long run. In summary, our models prove their empirical validity.

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Table 10. Results of Estimated Cointegrated Dynamic Models

Equation	**(3)** Δ(ΔCPIA)	**(4)** Δ(ΔDEBT)	**(5)** Δ(IDF)	**(6)** Δ(CHOM)	**(7)** Δ(ΔDEFT)	**(8)** Δ(GDP)	**(9)** ΔIDE
FMOLS Estimates							
			Short-term relationship				
Δ(ΔIPC)	-0.013***	0.173	0.0006**	-0.011	0.034	-0.446**	-0.185*
	(0.003)	(0.276)	(0.015)	(0.325)	(0.825)	(0.029)	(0.099)
Δ(ΔINF)	-0.005	-0.209	-0.0005***	-0.006	0.172	-0.203	0.523***
	(0.102)	(0.181)	(0.008)	(0.573)	(0.315)	(0.162)	(0.001)
			Restoring force				
Ec	-1.116***	-0.680***	-0.231***	-0.096***	-1.094	-0.258***	-0.636***
	(0.000)	(0.000)	(0.000)	(0.008)	(0.000)	(0.001)	(0.000)
			Long-term relationship				
ΔIPC(-1)	-0.017**	-0.332***	9.05E-05	-0.031*	0.476*	-0.837**	-0.031
	(0.021)	(0.001)	(0.811)	(0.057)	(0.054)	(0.011)	(0.568)
ΔINF(-1)	-0.001	-0.222***	-0.0006	-0.009	0.321	-0.337	0.811***
	(0.923)	(0.004)	(0.112)	(0.610)	(0.245)	(0.179)	(0.000)
R^2	65.53%	45.28%	22.21%	2.37%	63.54%	26.49%	43.19%
Wald test	51.11***	11.15***	4.37***	2.39**	66.12***	13.59***	34.33***
	(0.000)	(0.000)	(0.001)	(0.041)	(0.000)	(0.000)	(0.000)
Obs.	132	132	132	132	132	132	132
DOLS Estimates							
			Short-term relationship				
Δ(ΔIPC)	-0.014***	0.092	0.0006*	-0.021	0.124	-0.372	-0.105*
	(0.004)	(0.686)	(0.096)	(0.175)	(0.533)	(0.134)	(0.070)
Δ(ΔINF)	-0.007**	-0.071	-0.0005*	0.001	0.201	-0.460*	0.550**
	(0.030)	(0.641)	(0.085)	(0.941)	(0.340)	(0.099)	(0.015)
			Restoring force				
Ec	-1.215***	-0.793***	-1.192***	-0.761***	-1.131***	-1.430***	-0.639***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
			Long-term relationship				
ΔIPC(-1)	-0.018**	-0.161*	0.0001	-0.037*	0.554*	-1.099***	-0.055
	(0.017)	(0.064)	(0.758)	(0.096)	(0.075)	(0.004)	(0.846)
ΔINF(-1)	-0.004	0.0792*	-0.0006	0.007	0.329	-0.959**	0.926***
	(0.478)	(0.091)	(0.285)	(0.766)	(0.333)	(0.048)	(0.005)
R^2	66.05%	49.87%	58.07%	34.47%	63.87%	75.58%	33.83%
Wald test	51.71***	16.90***	46.08***	16.97***	43.57***	95.62***	16.63***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Obs.	138	138	138	138	138	138	138

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

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The error correction coefficients specify that the quality of policies and institutions (Ec = –1.116) and the budget deficit (Ec = –1.094) adjust rapidly after a money laundering shock due to corrective mechanisms. In contrast, economic growth (Ec = –0.258), unemployment (Ec = –0.096), and the financial system (Ec = –0.231) take longer to return to equilibrium. Technically, in the short term, the FMOLS results show that money laundering significantly impacts, at the 10% level, governance, financial development, GDP, and FDI. Specifically, corruption degrades governance by fostering money laundering and weakening institutions. It slightly stimulates financial development through the temporary influx of illicit funds into the financial system, but this effect is artificial and unsustainable. Conversely, the impact of money laundering on economic growth is negative, likely due to the diversion of resources into unproductive activities. The attractiveness of foreign direct investment is negatively affected, as foreign investors are deterred by instability and lack of transparency. Although not statistically significant, theoretically we observe that money laundering positively encourages public debt and the primary balance of CEMAC countries, with a negative effect on the unemployment rate.
In the long term, we can observe that these effects worsen significantly. Within CEMAC countries, the quality of policies and institutions continues to deteriorate, while economic growth experiences a more pronounced decline. Paradoxically, money laundering reduces public debt, likely due to increased tax evasion, which diminishes public financing needs. However, this reduction is harmful as it results from weakened tax revenues. Changing the estimation technique, with slightly varied significance levels and indicator coefficients, the robustness check using the DOLS estimator shows that the signs of the determinants remained identical, confirming the baseline estimates.

Based on a comparison with the analyses of our predecessors, it appears that money laundering negatively impacts the quality of policies and institutions in its dynamics (both short- and long-term), and negatively affects FDI while positively affecting financial development in the short term, setting the system's trajectory beyond formal norms. Our results align with the conclusions of Nana Kuindja (2022), who asserts that in the presence of high levels of corruption and socio-political instability, environments highly conducive to the circulation of illicit flows emerge. In this context, foreign investments, the financial system, and their banks often face significant compliance problems, especially due to the sometimes questionable origins of circulating funds, clients who may be directly involved in illegal activities, or politically exposed persons. These results also allow us to align with Kouam J. C. and Nafé D. (2019) and Youbi Pouepi and Salouka, Y. (2024), who proved that corruption has a negative and significant effect on FDI attractiveness in the long term. However, in our case, the effects manifest in the short term. We reach the same results as Mansour et al. (2020), who demonstrate that money laundering contributes to increased financial malfeasance, compromising banking system stability. Considering the results from our estimations—namely that the effective dynamics of economic growth in CEMAC countries are impaired by variations in illicit flows—we converge with Dreher et al. (2019), Osei and Agyemang (2019), Akinwumi et al. (2021), Chowdhury et al. (2022), Zhang and Chen (2022), and Khan and Kaur (2023), in finding that money laundering harms long-term economic growth. Although our results also prove its deleterious effects in the short term.

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Our combined work has revealed a negative and significant impact of money laundering on public debt and unemployment in the long term. Our results tend to support the arguments of Corray et al. (2017) and D. Boussim (2024). Specifically, Corray, Dzhumashev, and Schneider, F. (2017) specify in their results that corruption increases public debt and debt service costs, especially when frequent government changes are associated with larger debts (Alesina and Tabellini, 1990), with unintended effects. D. Boussim (2024) showed that corruption acts as a parasite, diverting resources from productive activities and hindering economic progress. This results in a decrease in jobs and a rise in the unemployment rate. Furthermore, we observed that corruption promotes an increase in the budget deficit in the long term, bringing us closer to Al-Marhubi (1990), who stated that by reducing revenues and increasing public expenditures, corruption is the source of significant budget deficits, with their inflationary consequences for countries with underdeveloped financial markets.

In summary, these varied and cointegrated dynamics firmly underscore the urgency of combating money laundering within CEMAC countries. This challenge must be regarded not only as a matter of improving governance but also as a necessity for creating a healthy and sustainable economic environment. It is imperative to develop effective strategies that account for these different dimensions in order to build a more stable and prosperous future.

4.5. Robustness analysis

Table 11 presents the determination of the optimal number of delays to consider when estimating the PVECM model. The Aikake Information Criterion (MAIC), the Schwarz Information Criterion (MBIC), and the Hannan-Quinn Information Criterion (MQIC) are used.

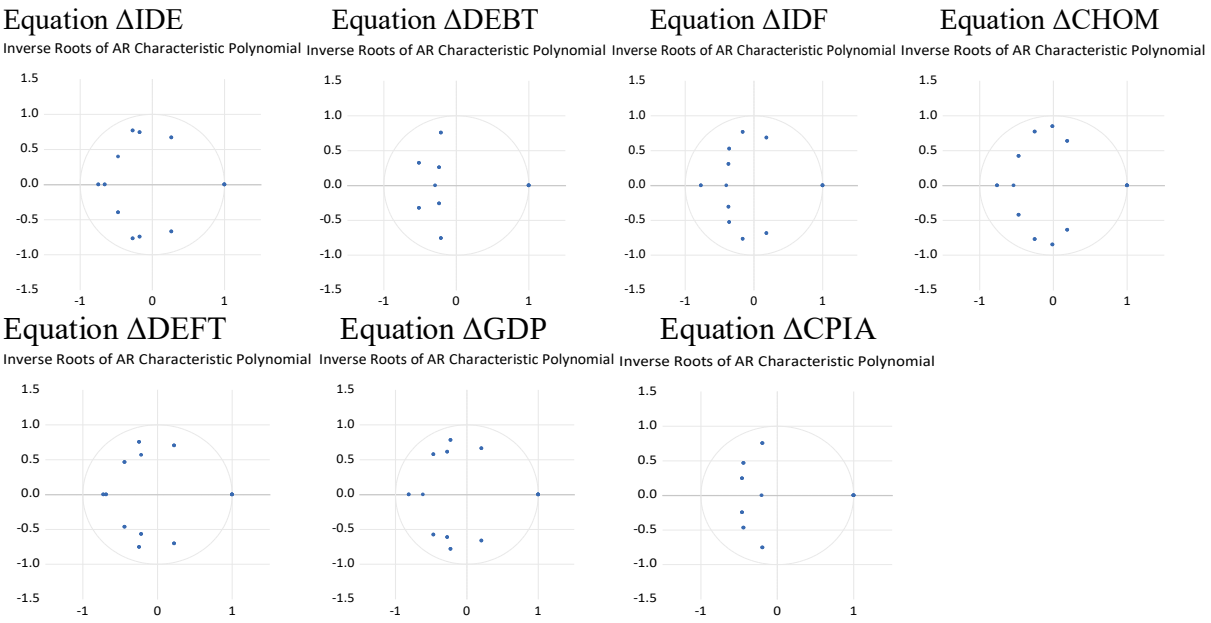
Table 11. Choice of the optimal delay

	Lag K optimal	CD	J	J p-value	MBIC	MAIC	MQIC
Equation ΔCPIA	3	.67116	5.5936	.77979	-37.032	-12.406	-22.400
Equation ΔDEBT	4	.74833	13.311	.14899	-29.314	-4.6882	-14.682
Equation ΔIDF	3	.76219	10.038	.34736	-32.587	-7.9613	-17.955
Equation ΔCHOM	4	.74405	7.9943	.53472	-34.631	-10.005	-19.999
Equation ΔDEFT	4	.72662	16.819	.05161	-25.805	-1.1801	-11.174
Equation ΔGDP	3	.87233	12.898	.16727	-29.727	-5.1019	-15.096
Equation ΔIDE	3	.84341	10.969	.27778	-31.655	-7.0301	-17.024

Source: Authors, 2025

The optimal lags for the PVECM model are K = 3 and K = 4, which allow us to fix PVECM(3) and PVECM(4) for estimating the equations under consideration. After first-difference fitting, the moduli of the accompanying matrix based on the estimated parameters can be analyzed using a stability test. According to Figure 2, we conclude that the models are stable because the moduli are less than one.

Figure 2. Stability test of the models



Source: Authors, 2025

The Granger causality test is used to determine the causal relationship between corruption and macroeconomic factors (Table 12). At the 10% significance level, there are bidirectional relationships or causality between corruption (CPI) and financial development (IDF), budget deficits (DEFT), GDP growth, and FDI in the long term. There are unidirectional relationships between corruption and debt (DEBT), governance (CPIA), and unemployment (CHOM) in CEMAC countries. This information is important because it indicates that FDI attractiveness, institutional governance and policies, the financial system, budget deficits, and GDP primarily cause money laundering in the sub-region's countries. This converges with the conclusion of Geert (2014), who asserts that the market, or at least the financial system, is the source of money laundering.

Table 12. Wald Test of Granger Block VAR Causality/Exogeneity - CEMAC

	Vector Δ(ΔY)						
	Δ(ΔCPIA)	Δ(ΔDEBT)	Δ(ΔIDF)	Δ(ΔCHOM)	Δ(ΔDEFT)	Δ(ΔGDP)	Δ(ΔIDE)
Δ(ΔIPC)	5.1	47.17***	17.16***	19.68***	14.32***	11.69***	11.46***
→ Δ(ΔY)	(0.1377)	(0.0000)	(0.0007)	(0.0014)	(0.0008)	(0.0029)	(0.0094)
Δ(ΔIPC)	13.11***	8.51	6.27*	9.12	25.02***	10.34***	29.77***
← Δ(ΔY)	(0.0044)	(0.1302)	(0.0990)	(0.1042)	(0.0000)	(0.0057)	(0.0000)

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

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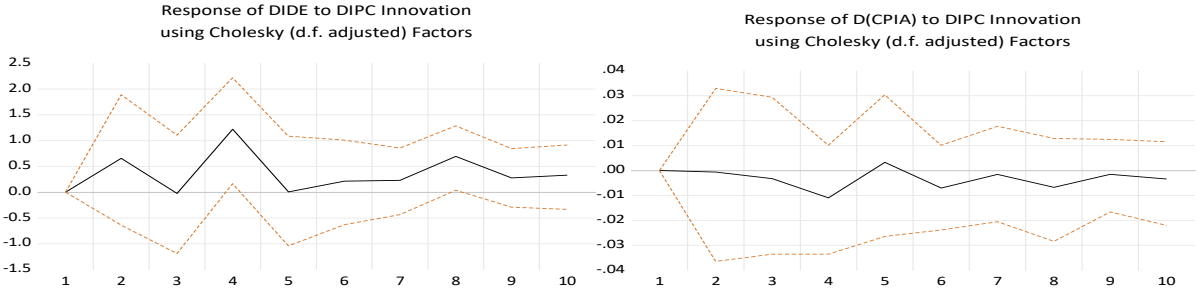
According to Figure 3, it is evident that based on the IRFs resulting from the shocks, the various macroeconomic factors interact with the corruption shock, showing interesting and varied dynamics. We observe that FDI initially responds positively to the shock. During the first two periods, a moderate perception of this money laundering may encourage some investors to take an interest in CEMAC markets, hoping to capitalize on emerging opportunities. However, from the third period onward, this positive trend begins to reverse. FDI attractiveness then starts to decline, indicating that a tolerance threshold has been reached and that money laundering is becoming a serious threat and a major constraint on economic activity.

The examination of the IRFs reveals a concerning trend in the quality of policies and institutions, with a very wide confidence interval from the initial periods following a corruption shock in the CEMAC zone. This trend clearly raises the issue of poor governance and institutional trust. Thus, the more the quality of governance and institutions in CEMAC countries deteriorates, the more the level of money laundering intensifies, accompanied by a high level of corruption. This deterioration shows how money laundering erodes trust in institutions over time. This situation makes efforts to improve governance extremely difficult. Weakened institutions risk falling into a vicious cycle, where the absence of corrective measures paves the way for new corrupt practices.

Figure 3.a. IRF of FDI and Governance to Money Laundering Shocks



Source: Authors, 2025

The IRFs show that the issue of public debt also warrants attention regarding its sustainability. We observe that after a money laundering shock, an increase in debt is recorded from the first period. This indicates that public expenditures in CEMAC countries, already under pressure, are exacerbated by inefficient management practices. However, it is interesting to note that this debt increase begins to stabilize in the fourth and fifth periods. This can be interpreted as a tendency toward fiscal consolidation, where policymakers appear to become aware of the dangers associated with over-indebtedness, debt sustainability, and the debt burden, and attempt to rectify public finances—although challenges remain significant: a high level of debt poses a number of challenges, notably requiring a substantial primary budget surplus to service this debt.

One observation lies in the concern over the performance and stability of the financial system. Technically, the IRFs reveal that CEMAC's financial system also suffers the consequences of money laundering. From the second period onward, economic actors' confidence in the financial system and its performance begins to deteriorate. This distrust creates a deterrent effect on

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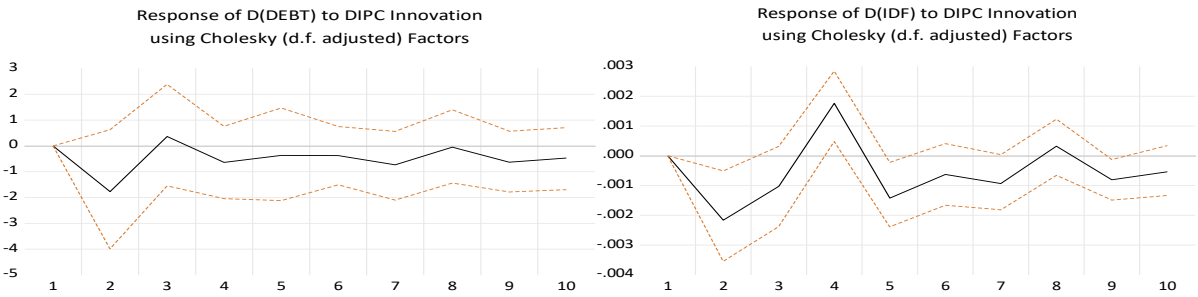
investments and restricts access to credit, leading to a slowdown in economic activities. Unfortunately, this dynamic becomes entrenched over time, creating an environment that is unfavorable to attractiveness, innovation, and growth. Thus, in the long term, it hinders the development of new projects that could stimulate the economy.

Figure 3.b. IRF of Debt and Financial Development to Money Laundering Shocks



Source: Authors, 2025

Unemployment shows an initially surprising response with a wide confidence interval throughout its dynamic. Indeed, we observe that when a money laundering shock occurs, there is an increase in unemployment noted from the second period onward. This phenomenon indicates that the economic climate in CEMAC countries deteriorates, leading to increased difficulties for capable agents seeking employment. However, this trend does not remain constant over time; the immediate effects of money laundering on the labor market begin to moderate, suggesting that other factors may also influence unemployment during this troubled period.

Regarding the budget deficit, the situation is alarming. A sharp increase is observable from the first period following money laundering shocks. Thus, the impact of corruption in these countries reflects poor management practices that exacerbate the need for public financing, leading to a growing deficit. Resources that are diverted must be laundered to leave no trace, which constitutes a significant loss for improving public services essential for the well-being of the population. This negative spiral is a major source of concern for governments that must manage increasingly tight budgets, especially since the current account is structurally in deficit.

Finally, the impact of money laundering on the economic growth of CEMAC countries is particularly and extremely concerning. The latter shows a negative reaction to money laundering shocks, with effects visible from the second period onward. The correlation between money laundering and economic slowdown is clear. In the long term, the consequences of money laundering not only hinder immediate growth but also impede the future development and prosperity of the affected countries. Consequently, the resulting economic stagnation can affect the standard of living and opportunities for future generations.

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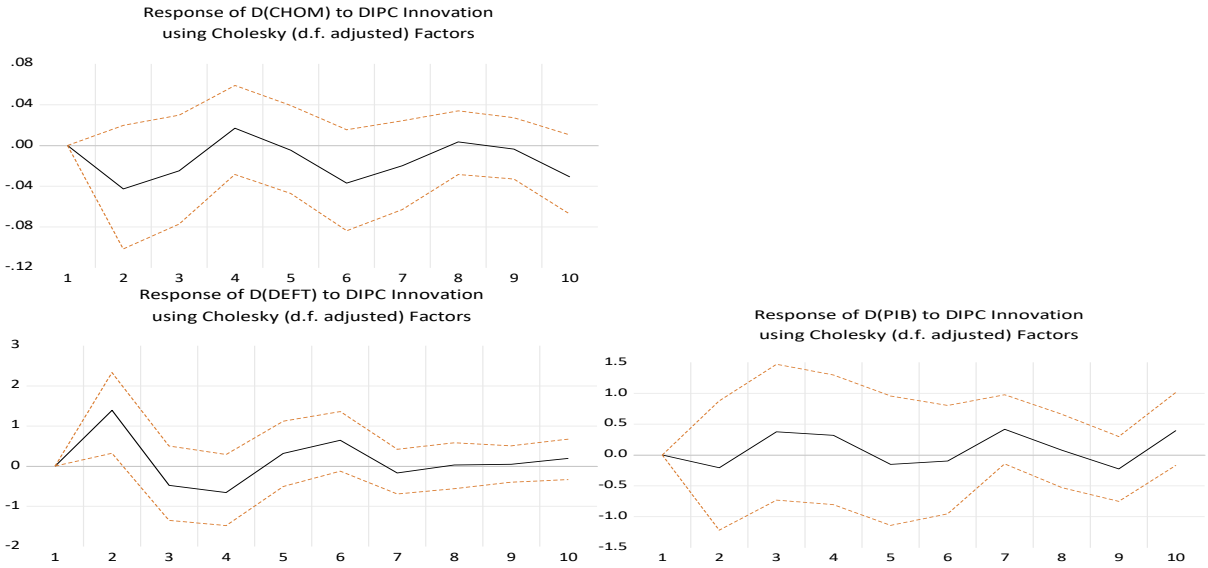
Figure 3.c. IRF of Unemployment, Deficit, and GDP to Money Laundering Shocks



Source: Authors, 2025

A fundamental aspect of this study stems from the evaluation of the critical corruption threshold estimation (Table 13). The estimation of equations using a quadratic approach that incorporates System GMM has enabled the determination, for the period 2000–2024, of a threshold significant at the 1% level, estimated at 25.33. This threshold conveys a dual perspective: firstly, if we consider the decision criteria of Transparency International's Political Risk Services, then all CEMAC countries with a Corruption Perceptions Index below 25.33 are exposed to the negative effects of money laundering, as countries with indices very close to zero are considered highly corrupt. Secondly, this threshold reflects a non-linear effect between corruption and economic growth, indicating that beyond this threshold, the effects of money laundering on economic activity are mitigated if states implement corrective anti-corruption measures.

Table 13. Lind and Mehlum (2010) Non-Linearity Test

Equation	CPIA	DEBT	IDF	CHOM	DEFT	GDP	IDE
t-value	0.19	0.23	1.07	0.23	1.45*	5.49***	0.86
	(0.423)	(0.407)	(0.142)	(0.408)	(0.074)	(8.8E-8)	(0.196)
Optimal IPC Threshold	5.12	33.81	12.37	5.06	**24.41**	**25.33**	25.45
Non-linearity	No	No	No	No	Yes	Yes	No

*(.) = Significant p-value if: < 1%***, < 5%**, < 10%**

Source: Authors, 2025

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5. Conclusion

The analysis of the dynamics and impact of money laundering has become routine for states and major financial institutions, as it enables addressing the various risks associated with excessive and concerning corruption in CEMAC countries and in developing countries in general. Through this work, we have attempted to demonstrate the sensitivity of governance quality, as well as the economic and financial sector, to a money laundering shock intensified by corruption. Overall, it appears that corruption exhibits persistence with asymptotic convergence on macroeconomic factors in both the short and long term. These results underscore the urgency of strengthening the fight against money laundering to limit its detrimental effects on the economy and promote sustainable development in CEMAC countries. The results prove the existence of a critical threshold from which this persistence has an influence: specifically, countries with a Corruption Perceptions Index (CPI) below 25.33 are exposed to the negative effects of money laundering; beyond this threshold, the impact of money laundering on economic growth is mitigated. The results suggest, based on deterministic simulations, that all CEMAC states can structurally implement institutional and political reforms, particularly in ethics, to effectively combat the negative deviations of money laundering, whereas simulations incorporating uncertainties (notably stochastic shocks) reveal instability in the trajectory of corruption with differentiated outcomes.

For a practical application of the results, an actionable roadmap is proposed: (a) Urgent institutional strengthening : prioritize reforms aimed at raising the corruption perceptions index above the critical threshold of 25.33. This requires an independent audit of key institutions and the establishment of anti-corruption agencies endowed with real powers and operational independence ; (b) Enhanced regional coordination : establish a common budgetary and financial monitoring mechanism at the CEMAC level, including the automatic exchange of tax information and joint monitoring of cross-border financial flows to detect and counter money laundering circuits ; (c) Cleaning up the financial sector : impose enhanced due diligence obligations on financial institutions, harmonize anti-money laundering regulations according to FATF standards, and invest in digital financial surveillance systems to trace illicit flows ; (d) Sustainable debt and deficit management : implement binding fiscal rules with primary deficit ceilings, condition new public borrowing on transparent and productive investment projects, and audit existing debt to identify portions linked to corruption ; (e) Inclusive growth and employment strategy : focus economic policies on diversification away from sectors vulnerable to corruption, support formal SMEs through facilitated access to bank credit, and link public job creation programs to transparent infrastructure projects ; (f) Improving FDI attractiveness : create single, transparent windows for foreign investors, guarantee the legal security of contracts, and regularly publish economic governance indicators to restore confidence ; (g) Evaluation and accountability framework : establish a common annual dashboard measuring progress on corruption perceptions index, debt, deficit, financial development, and unemployment rate, with peer reviews among CEMAC member countries. The coordinated implementation of these measures, supported by political commitment at the highest level and technical partnership with international financial institutions, is essential to break the vicious cycle of corruption-money

laundering-debt and lay the foundations for resilient and inclusive economic growth in the sub-region.

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