The fiscal theory of the price level: The case of Morocco

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Abstract

In this paper, we will use the econometric model and the price-level fiscal theory (PLFT), which looks at how the government surplus, debt, and inflation interact to apply a vector autoregression (VAR) model to the Moroccan economy. We first want to figure out how fiscal and monetary policy shocks affect the economy. The second thing we want to do is study how fiscal and monetary policy affects each other. So, the theoretical limits we used to determine our model are based on an FTPL framework. The general price level budget and Keynesian theories are not entirely wrong because of what we found. Also, the fact that most of the variation in inflation can be explained by changes in the money supply suggests that monetary policy works well in the Moroccan economy to control inflation. However, debt policy has little effect on this control. The government is worried about the level of public debt in Morocco because it positively affects the economy. Also, the positive effects over time should give the government confidence that the debt policy is working. So, debt dynamics still need to be a reason to worry because they would help the economy overall. Because it has a negligible effect on the economy immediately and lowers inflation, the government should pay less attention to the amount of debt and how quickly it grows.

Keywords: Deb, Fiscal theory, Inflation, Monetary policy, Moroccan economy, Price-level.
JEL Classification: C13; E00; E62.

Contents

> **Contribution of this paper to the literature**
> The theoretical efforts made to mobilize the key concepts of our work, namely monetary policy and fiscal policy, and their effects on the Moroccan economy.

1. Introduction

Many central banks, including the central bank of Morocco, battle mightily to keep inflation in check (Bank AlMaghrib). To complete this equally massive task, describing inflation is a requirement. Theoreticians place a strong emphasis on fiscal policy and hold that sound monetary policy is a necessary but insufficient precondition for managing inflation. For this reason, independent of the actions taken by the monetary authorities in pursuit of their inflation-targeting strategy, fiscal policy may be the action that establishes the level of prices in general. As a result, maintaining a level of prices that is steady and low in inflation has remained the core goal of macroeconomic management in many economies, including Morocco. Among the many factors that contribute to inflationary tendencies in an economy, including monetary shocks, structural shocks, demand shocks, external shocks, and demographic changes, government fiscal policy measures are also linked to the consumer price index. This topic is important because of the COVID-19 environment, which forces governments to take on debt to stimulate economic growth (Fiedler, Gern, & Stolzenburg, 2020; Urquhart, 2022).

The theoretical literature on the impact of fiscal policy on inflation was extensive throughout the 1990s. The writings of Leeper (1991); Sims (1994); Woodford (1994); Woodford (1995); Woodford (1996); Woodford (2001); Cochrane (1998) and Cochrane (2000) serve as the cornerstones of this idea. The traditional approach held that fiscal authorities would adjust primary surpluses to ensure government solvency at whatever price level and that the monetary aggregate was the only factor that determined the price level. Contrarily, FTPL argues that price level effects from fiscal shocks are plausible if fiscal policy can set primary surpluses independent of governmental debt. It looks at the possibility that fiscal policy could provide primary surpluses regardless of the total amount of state debt. To always respect the government's intertemporal budget restriction, the price level will adjust. These two categories of fiscal policy activity are referred to as non-Ricardian and Ricardian by Woodford (1995). Ricardian fiscal policy is appropriate when primary surpluses cannot be determined independently of public debt; non-Ricardian fiscal policy is appropriate when this is not the case. To promote macroeconomic stability and long-term economic growth, fiscal and monetary policy works together. However, the connection between the two initiatives might have an impact on macroeconomic metrics, particularly inflation.

However, Sargent and Wallace (1981) contend that monetary and fiscal policies cannot be incompatible in an economy. The coordination and application of monetary and fiscal policy determines how well the monetary authority controls inflation. Because of this, Leeper (1991) concentrated on two reliable institutions of policy: passive fiscal policy and active monetary policy, or the opposite. The monetary and fiscal supremacy systems described by Sargent and Wallace (1981) are comparable to these stable organizations.

Leeper (1991) argues that monetary authorities maintain control over inflation rates in the long run but lose control over overall price levels in the short run. Sargent and Wallace (1981) show that avoiding low inflation in the near run results in high inflation in the long run. To enhance the welfare of economic agents, monetary and fiscal policy must be integrated and coordinated immediately.

In this essay, we pose the question: To what extent does a state's price level get determined by its tax theory of inflation?

This project will be broken into the following sections moving forward: The first section's goal is to define the basic theoretical tenets of the fiscal theory of price level and public debt. The method used in the empirical inquiry will be covered in the second section. This data will be analyzed, and the results of the empirical study will be presented in the third part.

2. Literature Review

The classical form asserts that inflation is always and everywhere a monetary occurrence, while the more recent FTPL describes how inflation occurs. Both are based on Friedman's quantitative theory of money (QTM), which was published in Friedman (1963). The traditional theory holds that fiscal policy is inactive, agents behave in a Ricardian framework, and the requirement for liquidity has the greatest impact on the level of prices. Therefore, early 1980s research on the causes of inflation prioritized monetary policy while disregarding fiscal policy, which is theoretically just as crucial in accomplishing the same goal. The majority of these studies are predicated on the notion that the monetary authority ought to have complete control. Prices could increase as a result of this.

In contrast, a new school of thinking started to take shape in the 1990s. It claims that agents can act in non-Ricardian ways. When this happens, fiscal policy takes action and no longer has to alter its primary surplus to maintain sound public finances. Because the monetary authority must permit inflation to occur to maintain a balanced budget, inflation is a fiscal problem. However, the (relatively recent) fiscal theory of the price level (hence referred to as FTPL) contradicts the monetarist perspective.

There are important policy repercussions to the contrast between Ricardian and non-Ricardian regimes. Under the Ricardian system, sound monetary policy is both a necessary and sufficient condition for low inflation. The fiscal authorities should be forced to conduct a responsible and suitable fiscal policy as a result of an independent central bank with a strong institutional commitment to price stability. Under a non-Ricardian regime, sound monetary policy alone won't guarantee low inflation unless further steps are taken to limit the fiscal authority's latitude.

According to some experts, the combination of monetary and fiscal policy is the most effective method to stabilize the economy. For instance, Sargent and Wallace (1981) discuss this topic in their foundational work on unpleasant monetarist arithmetic. They highlight the challenges that arise when an economy's fiscal and monetary policies are not coordinated. In fact, the coordination and application of monetary and fiscal policies are essential to the regulation of inflation by monetary authorities. However, Samizafy (2013) and Huart (2013) contend that using debt to finance public deficits has less of a distorting effect than using seigniorage under inflationary pressures or

raising mandatory levies under conditions of declining household purchasing power and declining firm financing capacity. Despite the advantages of borrowing over seigniorage or tax increases, some academics, like Sargent and Wallace (1981), contend that borrowing would be bad for economic growth and the level of prices in general. Panizza and Presbitero (2012) state that these effects could be either short-lived or long-lasting.

As a result, it is important to understand the notions of dominant fiscal policy and dominant monetary policy developed by Sargent and Wallace (1981) to comprehend the actions of the two monetary and fiscal authorities. When monetary policy determines fiscal policy, regardless of what the fiscal authority requests, the monetary authority sets its aim for money supply expansion for the current and future periods. The amount of government credit that will be financed through seigniorage is therefore specified by the monetary authority. The fiscal authority's budget must be designed so that seigniorage and the sale of Treasury bonds can both be used to close budget gaps.

On the other hand, when the government creates its budget without assistance from the monetary authority, fiscal policy is in charge. This enables the government to discuss deficits and surpluses both now and in the future. Because the monetary authority must attempt to cover any deficit between the supply and sales of Treasury notes by seigniorage, the supply of Treasury bills is a constraint in this case. This type of monetary authority can still manage inflation, but it is less effective than it would be in a coordinated system where monetary policy is the primary concern. If the fiscal authority sells just Treasury bills, it might not be able to close the deficit. The monetary authority will therefore have to print more money and put up with more inflation in order to.

According to the fiscal theory of price level, a state's fiscal authority primarily affects the level of prices in its economy (Urquhart, 2022). The fiscal and monetary authorities are the two parties who, in theory, are in charge of this. But according to the fiscal theory of price level, this second actor will either have no part in making this decision or a minor one (Buiter & Sibert, 2017). Sadly, this theory is challenging to put into practice since the monetary authority will always have a significant influence and because it will be difficult to persuade the fiscal authority to pursue the appropriate course of action (Christiano & Fitzgerald, 2000). The price level's ambiguity and volatility will therefore work in your favor.

In the fiscal theory of price level, government debt is a key component, and how it is managed will affect price level. People who believe in this theory anticipate this, which is bad news for monetarists who wish to employ money management to stabilize the economy. The government budget depends on the idea of intertemporal. The budget is intended to be intertemporal in that it can, in the context of the government's contractual obligations, span several years.

The central bank, which oversees monetary policy, may intervene to provide stability or greater control over how prices are determined on the market. One of the numerous variables that must be taken into account while regulating the price level is taxes. This is one of the concerns with the fiscal theory of price level, thus monetary considerations must also be made (Buiter, 2002). We shall discuss interest rates, fiat money (the absence of which could support the fiscal theory of the price level), and monetary injections (such as the helicopter money created by the US Federal Reserve (Cochrane, 2021)), which are all related to these monetary issues. If prices stay where consumers think they should be and the government is to remain solvent, these items need to change or be coordinated with fiscal policy.

3. Theoretical Foundation

The fiscal theory of the price level has been the subject of substantial investigation and dispute among economists. Sargent and Wallace's fiscal dominance system, formulated in 1981, exemplifies this theory within a fixed monetary policy framework. However, it was only in the 1990s that Leeper, Sims, and Woodford provided alternative perspectives that challenged the mainstream interpretation of fiscal dominance. These economists established the potential of fiscal policy control without relying on monetizing public spending or seigniorage. Their contributions included notions such as Ricardian non-equivalence and central bank neutrality.

Leeper (1991) extended the nature of monetary and fiscal limits, indicating that they can exhibit either an active or passive character. Active regulation happens when an authority managing government debt may modify variables depending on its assumptions, effectively regulating fiscal policy. In contrast, the passive influence of government debt on the authorities can be noticed, as government activity tends to be driven by private sector optimization. Consequently, the fiscal authority complies with the norms defined by the monetary authority, giving rise to what some consider a flawed fiscal theory of the price level. In this perspective, the central bank is regarded as a powerful and active authority, not bound by budgetary restrictions, capable of responding to past, present, and predicted future circumstances. However, the necessity of collecting adequate tax income to balance the budget arises due to the limits imposed by consumer optimization and the active authorities. Consequently, the decision-making process of the passive authority is influenced by the prevalent present and historical variables linked to public debt.

Contrary to the opinions, McCallum (2000) questions the assumption made by certain researchers that changes in the money supply have no impact on the price level and argues for addressing the monetary component alongside fiscal policy. According to McCallum, the weak fiscal theory of the price level, which allocates greater power to the government than the central bank, justifies skepticism. Consequently, as usually understood, the fiscal theory of the price level is questioned. While accepting the soundness of the fiscal component of the theory, McCallum emphasizes the need to integrate the monetary component into the study.

Woodford (1998) extends the rationale underpinning the link between monetary and fiscal policy beyond the widely advocated yet undesirable alternative of relying on seigniorage as a source of government revenue. In investigating non-Ricardian fiscal policy, Woodford explores the wealth effect of higher government debt on the price level. These effects are consistent with rational expectations and frictionless financial markets, contradicting the premise of Ricardian equivalence. Woodford's methodology considers government debt maturity, indexation, and size differences. Moreover, Woodford criticizes the concept that a government cannot refuse to change its budget when debt reaches unsustainable levels and argues against the idea that the budget completely decides the price level within a model with several rational expectation equilibria. The inquiry also explores the consequences

of government debt on the price level under the assumption of adaptive, rather than rational, lifetime budget expectations. Finally, Woodford analyzes Ramsey's dynamic taxation in an optimal fiscal and monetary policy context. A non-Ricardian fiscal strategy is offered, wherein government purchases do not raise the present value of future tax receipts, leading to varied government bond equilibrium values. This policy regime can assure price stability when accompanied by appropriate monetary policy and government debt composition.

Carlstrom and Fuerst (2000) take a different approach, claiming that the central bank, rather than tax rules, holds power over the price level. This claim opposes the fiscal theory of the price level, which posits that tax rules determine price levels. Christiano and Fitzgerald (2000) define price stability as the notion that sustaining stable prices is a concern across all public policy domains. Cochrane (2001) analyzes the link between tax theory and stock market outcomes, considering Microsoft stock as a form of assessment. He proposes that if the future worth of a share of Microsoft stock is known in advance, such a method could provide more precise market price measures. Cochrane offers the concept of a price-level tax that could allow for economic functioning without dependency on fiat money. This strategy may also enable the government to satisfy its financial obligations over a longer intertemporal period, thereby testing the equilibrium restriction in a Ricardian economy. Creel and Sterdyniak (2001) emphasize that the fiscal or budgetary theory of the price level is primarily a theoretical construct, lacks empirical support, and has not exerted a substantial impact in evaluating its truth.

Buiter (2002) critically evaluates the fiscal theory of the price level, arguing against the premise that the government's intertemporal budget constraint must be anchored in identity. According to Buiter (2017), this author considers the fiscal theory of the price level as dead.

McCallum (2003) believes that the overall level of price determination is essentially governed by the fiscal policies of a specific state, with monetary phenomena relegated to a secondary role. The author concludes that the tax theory of the price level, which appears to be dominant in the contemporary economic landscape, can lead to confusion. McCallum criticizes the weak fiscal theory of the price level, which believes that the fiscal authority deceives financial authorities, and highlights his disagreement with this theory. Consequently, when presented with a choice between several rational expectations responses to a given model, the analyst's preference for a bubble solution involving increased asset values over an orthodox reaction entailing a rise in the quantity of money separates the fiscal theory.

McCallum (2006) offers a different critique of the tax theory of the price level, criticizing it as harsh and unusual. This approach forecasts a price level that greatly deviates from the nominal money supply and is largely affected by bond stocks.

Bassetto (2008) investigates the fiscal theory of inflation, emphasizing the significance of public debt, present and future budgetary plans, and spending in determining the price level without direct reference to monetary policy, which, in turn, indirectly affects the price level.

Bajo-Rubio, Díaz-Roldán, and Esteve (2009) believe that monetary and fiscal policies have always influenced the price level. According to their interpretation, in the Ricardian framework, the monetary authority performs an active role, while the fiscal authority acts passively, responding to the activities of the tax authorities. Despite their legal independence, these two authorities are organically interconnected and work together continuously.

Buiter and Sibert (2017) suggest that the fiscal theory of the price level combines fiscal restriction with the demand for a balanced budget, offering substantial obstacles. Nonetheless, the authors indicate a continuous interest in the fiscal theory of the price level and advocate the introduction of flexible or dynamic price models within the framework of general monetary equilibrium with rigid nominal prices. These suggestions revive the concept of the fiscal price level. The authors also caution against potential disasters that may arise if policymakers mistakenly perceive price-level fiscal theory as the optimal approach for analyzing the effects of monetary and fiscal policies on inflation, aggregate demand, real economic activity, and the possibility of government default. Ignoring the contractual responsibilities of the government could result in increased costs, force adjustments to the budget, and generate other unfavorable repercussions.

Cochrane (2001) says that the budgetary theory of the price level opposes the government's fiscal authority against the central bank's monetary authority. These two entities must unite to address public debt and inflation. However, the divergent expectations and practices of the fiscal and monetary authorities render the budgetary theory of the price level ultimately absurd.

Managing budgetary restrictions demands the adoption of fiscal initiatives by the government. The central bank observes These budgetary initiatives, which operate passively but retain a heightened awareness of government actions. The government may also adjust its fiscal policies in reaction to the active operations of the central bank. While these exchanges occur, it remains the role of the fiscal authorities to regulate debt levels and decide pricing levels.

The intertemporal character of the government's budget allows for spreading debts, particularly long-term loans, based on different possibilities encompassing the fiscal theory of the price level and Ricardian equivalence theory. However, such a method carries the danger of inflation and may destabilize the desired equilibrium. The non-Ricardian fiscal theory of the price level reduces the degree of freedom in this regard, allowing the central bank the authority to adjust interest rates.

Understanding that the fiscal theory of the price level and monetary policy can vary between governments is vital. In hyperinflation, typified by extreme price increases, fiscal and/or monetary actions are required to calm the situation due to the instability in the value of money.

4. Empirical Evidence

Most researchers investigating debt's effects on economic growth are neither classicists nor Keynesians but lie somewhere in between. The non-linear approach to the relationship between debt and economic development argues that debt positively affects economic growth up to a certain point, then becomes negative.

Bohn (1998) and Canzoneri, Cumby, and Diba (2001) were the first to test the general theory of price-level budgeting in the real world. Using data from 1916 to 1995 and a method called linear regression, Bohn (1998) shows that the U.S. government altered its primary balance to reflect historical levels of debt in order to keep its finances stable. From 1916 to 1995, the monetary regime governed the U.S. economy. Canzoneri et al. (2001)

estimate the VAR for 1951−1995 U.S. data and find short-run evidence for the Ricardian regime hypothesis. Afonso (2002) estimated a VAR model using Canzoneri et al. (2001) for 15 countries in the area that do not adequately evaluate the price-level budget theory. However, particularly for Shaposhnikov and Tkachev (2006) extrapolates a VAR model from 1998 to 2005 to illustrate a non-Ricardian regime and predict the effects of fiscal policy on the price.

Fialho and Portugal (2005) demonstrate monetary dominance in Brazil using 1995−2003 data. In this framework, monetary and fiscal policy coordination resembles a game where the fiscal authority is passive, and the monetary authority is active. Monetary policy determines the surplus and debt for a given price level.

The general price level theory has not been looked at much in Africa, so the results are not as evident. Kenkouo (2015) says that Cameroon and the Congo are controlled by CEMAC regarding money and financing, while Gabon, Equatorial Guinea, the Central African Republic, and Chad have had varied results. Chuku (2016) discovers a financial advantage for Nigeria, unlike Alfredo and Ribeiro (2009).

Most of these investigations use linear models. Several regime-switching models (Chuku, 2016; Davig, Leeper, Galí, & Sims, 2006; Favero & Monacelli, 2005) investigate the general price level theory of finance in the U.S. and some E.U. countries to resolve these shortcomings.

Semmler and Zhang (2010) evaluated France and Germany's general price level theory from 1969 to 1998 using a Markov model. France's monetary and fiscal policies worked well together most of the time, particularly in the early 1970s and from 1980 to 1990. Germany's first and last policies were feeble strategic substitutes and complements. According to Davig et al. (2006), the two administrations alternated in the U.S. between 1948 and 2004. The average monetary-dominant regime lasts 22 quarters, while active fiscal policy lasts 15 quarters.

Favero and Monacelli (2005) state that U.S. fiscal policy operated from 1960 to 1980. It was dormant during the 1990s but reactivated in early 2001. These two findings disprove that U.S. policy was always passive after World War II.

Ayoub, Farvaque, and Creel (2008). The budgetary theory of the price level distinguishes between Ricardian and non-Ricardian economic policies and their applicability to sub-periods in a country's economic history. Lebanon's transition from prosperity to conflict and reconstruction illustrates this theory. The authors want to evaluate the budgetary theory of the price level in situations where political regime changes establish macroeconomic benchmarks. Thus, the authors provide a theoretical framework for understanding the economic mechanisms at work in exceptional situations and a perspective on applying this budgetary theory of the price level. Lebanon's disastrous policy history allows economists to analyze changes in monetary and fiscal regimes. In this example, we show that Lebanon's recent past has three phases corresponding to one of the fiscal theories of the price level regimes. Thus, economic policies (monetary and fiscal) would transition from central bank dominance (1965−1974) to war economies and fiscal dominance (1975−1990) and back to monetary dominance (1991−2005). However, segregating policy regimes does not prove the fiscal theory. In monetarism, monetization and seigniorage may reduce the economic analysis of the fiscal regime-price level relationship. Thus, one must isolate monetary and fiscal relations to prove that Lebanon has a non-Ricardian regime.

Romero and Marín (2017) examine whether public debt increases inflation. They study government debt, economic growth, money supply growth, and inflation. Kwon, McFarlane, and Robinson (2009) use the net debtors of a sample of countries to execute a panel-based estimation. For countries with high public debt, increasing public debt is inflationary. Ngambo and Biligil (2019) also examine how Cameroon's changing public debt impacts economic development and CEMAC's monetary policy. The results indicate that Cameroon's short-term debt does not impair growth. The CEMAC budgetary theory of the general price level is true by Kenkouo (2020). Using CEMAC data, Bohn (1998) estimated an MSVAR Markov model. Over the entire period, Cameroon is in a monetary-dominated regime, while Congo, Equatorial Guinea, and Chad are fiscally dominated. The Central African Republic and Gabon alternated administrations for two years each. Structural monetary vector autoregression with fiscal variables and impulse responses evaluates fiscal policy actions. Recently, Urquhart (2022) examined public debt and inflation, considering the fiscal theory of the price level with data from Paraguay.

4.1. Methodology

Extensive cooperation is necessary between monetary and fiscal policies to effectively achieve macroeconomic policy goals. This study examines the interplay between these policies, focusing on two levels of cooperation: goal attainment, such as enhancing the financial system and establishing institutional and operational arrangements. The first level of interaction revolves around financing the budget deficit and its implications for monetary management. Monetary policy stances significantly impact the government's ability to finance the budget deficit by influencing the cost of debt payment and determining the availability of financing sources. Concurrently, the public sector's financing strategy and financial requirements constrain the degree of independence attainable for monetary policy. In numerous countries, fiscal policy has taken precedence over monetary policy, leading central banks to frequently finance public sector deficits, including those arising from quasi-fiscal activities. This subordination of monetary policy to fiscal demands has often resulted in inflationary tendencies. In recent years, a global effort has been made to modernize financial markets and establish institutional and operational frameworks to facilitate the design and implementation of more effective policies. These initiatives encompass utilizing market-based monetary and debt management instruments, measures to enhance central bank independence, and in some cases, establishing strict rules-based monetary arrangements like currency boards.

4.2. Data & Variables

This study investigates the causal relationship between gross domestic product per capita (GDP/PC), the inflation rate (INFL), the interest rate (I), the monetary aggregate (M3), and public debt (PD), as well as the impact of monetary policy on the administration of Morocco's public debt. It also addresses coordination issues between fiscal and monetary policy in Morocco. The government's financing strategy and financial requirements will restrict the monetary authority's operational independence. To analyze the interplay between monetary policy and fiscal policy and to identify the long-run relationship between the time series, the empirical demonstration of the methodology described above centers on Morocco. This investigation used Moroccan yearly time series from 1960

to 2022. The World Bank and International Monetary Fund (IMF) databases provided these statistics. Since policymakers use a variety of factors to figure out how the economy is doing, it may make sense to look at the economy using a variety of indicators. This may take the primary component of several measures of economic activity; however, past Taylor rule research has usually used the output gap or real marginal business expenses. Gross domestic product (GDP) measures economic activity. According to the research, the interest rate (I) and the amount of money in circulation (M3) are examples of monetary policy, while public debt (PD) is an example of fiscal policy.

To study how fiscal policy and monetary policy function together, we model fiscal policy in a more general fashion that allows for data that is sometimes different and only sometimes from the same source. This method can examine debt sustainability and monetary policy. Time series analysis necessitates 20 observations, according to McCleary, Hay, Meidinger, and McDowall (1980). Time-series models should be fitted with 50 observations for robust results. A time series should be long enough to capture the phenomenon of interest, but more data is preferable. The study encompasses annual data from 1960 to 2022. This is enough data observations for VAR model results. Morocco is the country we are investigating for this study, and the variables specified for the study are the following:
- Gross domestic product Per capita (GDP/GDP).
- Public debt (PD).
- Monetary aggregate (M3).
- Consumer price index (INFL).
- Interest rate (IT).

Table 1. Variables used.

Components	INFL	GDP/Pc	PD	M3	IT
Mean	3.641	1949.948	73.713	76.790	5.486
Median	2.205	1477.644	68.736	74.222	4.956
Maximum	12.492	3795.380	117.714	128.869	8.500
Minimum	0.303	666.715	45.442	35.026	2.568
Std. dev.	3.378	975.671	19.086	31.769	2.072
Skewness	1.214	0.416	0.688	0.089	0.295
Kurtosis	3.452	1.662	2.496	1.395	1.521
Jarque-Bera	10.687	4.340	3.761	4.561	4.434
Probability	0.004	0.114	0.152	0.102	0.108
Sum	152.951	81897.83	3095.964	3225.212	230.420
Sum sq. dev.	467.980	39029320	14936.82	41381.09	176.102
Observations	42	42	42	42	42

The descriptive statistics of the data bring together all the data (mean, median, minimum value, maximum value, and standard deviation) and give us an idea of the level and the evolution of the data over time. Thus, the coefficients skewness, kurtosis, and the Jarque-Bera test statistic allow us to test the normality of the series studied. The table above is a representation of the descriptive statistics of the descriptive statistics of the variables studied. The table above shows that one of the most volatile variables is public debt and that GDP per capita is more volatile regarding standard deviation (std. dev.). We also note that debt, GDP per capita, the monetary aggregate, and the interest rate are normally distributed (Prob. Jarque-Bera > 5%), while the inflation rate is not. In this case, a heteroscedastic model would be preferable in the presence of ARCH.

4.3. Descriptive Statistics

The main variables of the study are annual series and presented in Figure 1 and their descriptive statistics in Table 1.
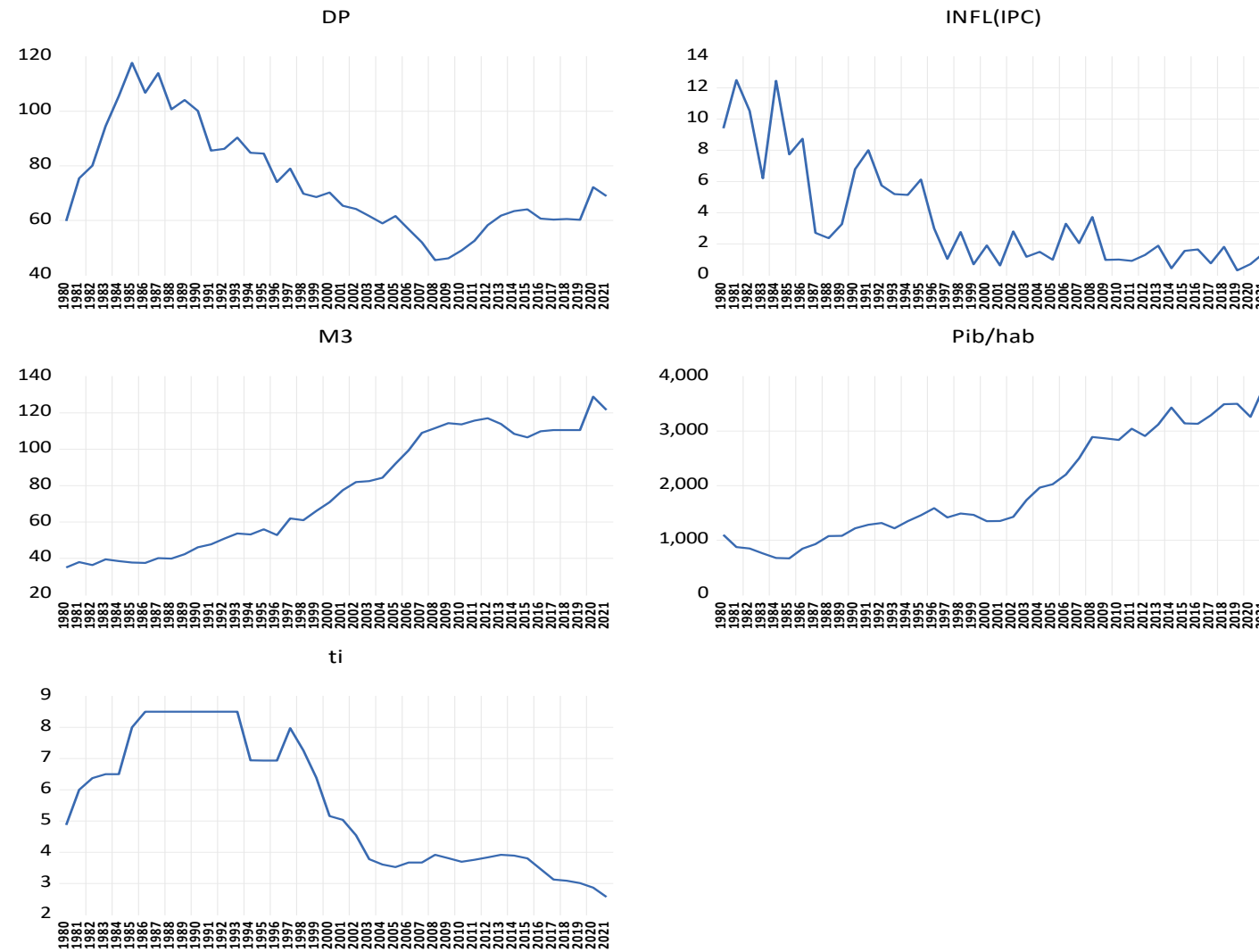

Figure 1. Variables of the study.

Table 2. Stationarity of variables.

Variables	Stationarity		
	ADF	**PP**	**KPSS**
INFL	I(0)	I(0)	I(0)
GDP/Pc	I(1)	I(1)	I(0)
DP	I(1)	I(1)	I(0)
M3	I(1)	I(1)	I(0)
IT	I(1)	I(1)	I(0)

Reading the results of the stationarity test of the substudy variables in Table 2, we can note the following remarks:

Starting with the Augmented Dickey-Fuller/ADF test, the GDP/Pc, DP, M3, and IT series are integrated into order 1 (stationary after the first difference). At the same time, INFL remains stationary at level (without differentiation). Similarly, the Phillippe-Perron/PP test shows that the GDP/Pc, DP, M3, and IT series are integrated series of order 1 (stationary after the first difference). At the same time, INFL remains stationary at level (without differentiation). Finally, the third Kwiatkowski-Phillips-Schmidt-Shin/KPSS test shows that all series are stationary at level (without differentiation).

4.4. Results

After estimating the VAR model, we estimated the optimal number of lags, which provides statistically significant results with the minor parameters. The results of the model estimation are presented below in Table 3. In our case, we chose the set of information criteria, namely: the Schwarz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQ), Akaike Information Criterion (AIC), Final Prediction Error (FPE), and Sequential Modified LR Test Statistic (LR), to select the model to be deployed.

Table 3. Results of the optimum number of delays.

Lag	LogL	LR	FPE	AIC	SC	HQ
0	−733.918	NA	1.97e+10	37.893	38.106	37.969
1	−557.860	297.943*	8620236.*	30.146*	31.426*	30.605*
2	−540.209	25.345	13426522	30.523	32.869	31.365
3	−519.518	24.404	20011153	30.744	34.156	31.968

Note: * p < 0.1.

Table 4 shows that the five variables are not cointegrated, i.e., they have no long-term cointegrating relationship. Consequently, the null hypothesis of non-cointegration is accepted, as the trace test indicates no cointegrating equations. Moreover, we need a cointegrating relationship to adopt Engle and Granger (1987) error-correction model. The next step is to use the VAR model.

Table 4. Results of the Johansen cointegration test.

Unrestricted cointegration rank test (Trace)				
Hypothesized		**Trace**	**0.05**	
No. of CE(s)	**Eigenvalue**	**Statistic**	**Critical value**	**Prob.****
None	0.511	66.104	69.818	0.095
At most 1	0.354	37.442	47.856	0.326
At most 2	0.280	19.959	29.797	0.425
At most 3	0.136	6.777	15.494	0.603
At most 4	0.022	0.923	3.841	0.336

Note: ** p < 0.05.

Table 5 below shows the estimated coefficients or effects of the VAR model. Indeed, the estimation results show that the effect of the interest rate on the inflation rate is positive and significant. In other words, a 1% increase in the interest rate raises the price level by 7%. Similarly, the effect of public debt on the price level is positive but insignificant, i.e., less than proportional: a 1% increase in public debt raises inflation by 0.677479. In addition, Moroccan GDP per capita has a positive (non-significant) effect on the price level in Morocco. On the other hand, the monetary aggregate (M3) has significant negative effects. A 1% increase in the monetary aggregate reduces the price by 69%.

Table 5. Results of estimation VAR.

Components	INFL	GDP/PC	PD	M3	IT
	0.451	9.014	0.677	−0.695	0.071
	(0.150)	(9.086)	(0.420)	(0.298)	(0.031)
INFL(-1)	[3.008]	[0.992]	[1.612]	[−2.326]	[2.263]
	0.000	0.661	0.006	0.002	0.000
	(0.001)	(0.067)	(0.003)	(0.002)	(0.000)
GDP/PC(-1)	[0.195]	[9.836]	[2.152]	[0.954]	[1.383]
	0.021	6.547	0.840	−0.109	0.009
	(0.033)	(2.004)	(0.092)	(0.065)	(0.007)
PD(-1)	[0.645]	[3.266]	[9.063]	[−1.668]	[1.317]
	−0.070	15.374	−0.345	0.777	−0.0163
	(0.045)	(2.772)	(0.128)	(0.091)	(0.009)
M3(-1)	[−1.545]	[5.545]	[−2.695]	[8.531]	[−1.680]

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Components	INFL	GDP/PC	PD	M3	IT
IT(-1)	-0.668 (0.400) [-1.667]	2.791 (24.24) [0.115]	-2.056 (1.121) [-1.834]	-0.820 (0.797) [-1.028]	0.758 (0.084) [8.942]
C	8.912 (4.534) [1.965]	-985.945 (274.326) [-3.594]	34.357 (12.686) [2.708]	30.153 (9.021) [3.342]	0.948 (0.960) [0.988]
R-squared	0.657	0.985	0.921	0.985	0.962
Adj. R-squared	0.608	0.983	0.909	0.983	0.956
Sum sq. resids	148.531	543709.7	1162.729	587.955	6.660
S.E. equation	2.060	124.637	5.763	4.0986	0.436
F-statistic	13.449	485.904	81.727	464.396	177.690
Log likelihood	-84.564	-252.774	-126.748	-112.769	-20.918
Akaike AIC	4.417	12.623	6.475513	5.793	1.313
Schwarz SC	4.668	12.873	6.726	6.044	1.563
Mean dependent	3.501	1970.736	74.053	77.809	5.501
S.D. dependent	3.293	978.330	19.195	31.461	2.095

Table 6. Causality between sub-study variables.

Pairwise granger causality tests			
Date: 06/28/23 Time: 12:51			
Sample: 1980 2021			
Lags: 2			
Null hypothesis:	Obs.	F-statistic	Prob.
PIB_HAB does not Granger Cause INFL_IPC_	40	2.068	0.141
INFL_IPC_ does not Granger Cause PIB_HAB		1.070	0.353
DP does not Granger Cause INFL_IPC_	40	4.616	0.016
INFL_IPC_ does not Granger Cause DP		4.331	0.020
M3 does not Granger Cause INFL_IPC_	40	2.388	0.106
INFL_IPC_ does not Granger Cause M3		1.914	0.162
TI does not Granger Cause INFL_IPC_	40	0.332	0.719
INFL_IPC_ does not Granger Cause TI		5.055	0.011
DP does not Granger Cause PIB_HAB	40	0.176	0.839
PIB_HAB does not Granger Cause DP		0.210	0.811
M3 does not Granger Cause PIB_HAB	40	11.221	0.000
PIB_HAB does not Granger Cause M3		0.328	0.722
TI does not Granger Cause PIB_HAB	40	1.082	0.349
PIB_HAB does not Granger Cause TI		1.708	0.195
M3 does not Granger Cause DP	40	4.973	0.012
DP does not Granger Cause M3		5.950	0.006
TI does not Granger Cause DP	40	0.050	0.950
DP does not Granger Cause TI		3.360	0.046
TI does not Granger Cause M3	40	1.736	0.190
M3 does not Granger Cause TI		4.801	0.014

Table 6 presents the results of the causality test between the substudy variables, which we will discuss in the next step:

5. Discussion

In this work, we studied the fiscal theory of the price level, first theoretically and then produced empirical evidence of the impact of public debt on the price level through a VAR model on Moroccan data. We have thus highlighted the long- and short-term effects of public debt on the price level—the results between our selected variables through Johansson cointegration and vector autoregression. We also performed a Toda-Yamamoto causality analysis because of the non-stationarity of the variables.

Our study shows two bidirectional causalities between debt and inflation on the one hand and debt and money supply on the other. A unidirectional causality can also be reported: money supply M3 and public debt cause interest; money supply causes GDP per capita; inflation causes money supply.

Similarly, the estimation results of our work confirm the theoretical contributions of researchers in the field:

1. The effect of public debt on the price level is positive but insignificant, i.e., less than proportional: a 1% increase in public debt increases inflation by 0.677479.
2. Moroccan GDP per capita has a positive (insignificant) effect on the price level in Morocco.
3. The monetary aggregate (M3) has significant adverse effects.

However, the estimation results show that the effect of the interest rate on the inflation rate is positive and significant, i.e., a 1% increase in the interest rate raises the price level by 7%. This contradicts the theoretical results.

Furthermore, the fact that the variation in inflation is mainly explained by the money supply, suggests that monetary policy is effectively controlling the Moroccan economy. However, this control is very weakly influenced by debt policy.

As a result, the level of Moroccan public debt is a matter of concern for the authorities, given the significant influence it exerts on the economy. Thus, while the positive impact should reassure us about the effectiveness of the debt policy, debt dynamics remain a concern insofar as they affect the economy. However, the authorities should pay less attention to the accumulation and speed of debt, given its minor immediate impact on the economy and the fact that it reduces inflation. This would place Morocco in a regime of monetary dominance.

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