INFLATION, INFLATIONARY TAX AND TAX EVASION IN ALGERIA: AN EMPIRICAL ANALYSIS OF UNDERLYING CAUSAL INTERACTIONS

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ABSTRACT

This article is an empirical study that aims to deeply examine the effects of the underlying interactions of inflation and inflationary tax on the size of tax evasion in Algeria. Accordingly, the analysis is grounded in the application of the Granger causality test within a vector autoregressive (VAR) model, covering an annual period ranging from 1980 to 2022. The findings reveal that, in the short term, the inflation rate has a positive impact on tax evasion, whereas the inflationary tax exerts a negative influence on it. Our approach strives to interpret these findings through the lens of inflationary financing theory. This theory elucidates how the inflation rate and the implicit revenues it generates contribute to the regulation of the scope of tax evasion in the country.

1. INTRODUCTION

In an environment characterised by frequent fluctuations in the economy, nations consistently encounter issues concerning inflation. This issue becomes especially pronounced when there is a decline in tax revenues, primarily caused by an increase in tax evasion, disrupting the equilibrium between government income and expenditure. Consequently, governments might adopt the strategy of increasing the money supply and may resort to printing more money, particularly in situations where inflation persists at elevated levels. Nonetheless, it is crucial to acknowledge that such actions frequently lead to a further escalation in prices, subsequently boosting the valuation of assets. This, in turn, generates implicit income for the government, surpassing the revenues obtained through taxation (OECD, 2013, p. 28-29).

Fiscal economic theory demonstrates that when inflation is very high within a country, it complicates how revenues are collected to finance expenditures due to the heavy tax burden. There are two distinct ways in which high inflation impacts the fiscal system: Firstly, to combat inflation, governments tend to lower tax rates. However, this may result in reduced public spending due to a lack of fiscal revenues, thereby impeding economic growth (Crane & Nourzad, 1986, p. 217 and Caballé & Panadés, 2004, 568-571) Secondly, heightened inflation entails individuals paying an indirect tax in the form of diminished purchasing power as the value of their money decreases. This directly affects fiscal policy, particularly in the long term. Indeed, most tax systems in developing countries are not automatically adjusted to inflation, causing a discrepancy between the timing of tax payment and/or revenue receipt and the actual value of post-payment revenues (Kwon et al., 2020, 1-3).

Algeria is notable for its consideration of this discrepancy, given that its economy is largely reliant on oil rent and characterised by limited productivity beyond hydrocarbon resources. In order to mitigate long-term financial losses, the Algerian State has consistently pursued policies leading to sustained inflation, thereby creating an implicit revenue stream that significantly supports public budgetary commitments (Dermechi, 2017, 116). However, when real incomes remain unchanged, inflation increases fiscal costs, leading individuals to avoid tax payments and engage in various forms of tax evasion.

Despite the acknowledged effects of inflation on tax evasion, empirical studies on the income effects of inflation remain limited. Thus, this article examines the short- and long-term consequences of inflation and inflationary taxes on the scale of tax evasion in Algeria. Our primary question is: What impact does the inflationary tax, driven by the inflation rate, have on the magnitude of tax evasion in Algeria? To address this, we formulate two hypotheses: H1: Inflation positively influences tax evasion; H2: Inflationary tax positively impacts tax evasion.

We adopt a multivariate analysis approach using the Vector Autoregressive (VAR) model to test our hypotheses. The selection of the VAR model stems from its capacity to address the endogeneity requirements of variables. As previously mentioned, inflation intrinsically interacts with the fiscal system, while the fiscal system itself reacts to inflation rates (Tabandeh et al., 2013, 101). Furthermore, the advantage of this approach lies in its ability to test the type of interactions between variables in terms of causality.

The remainder of the article is structured as follows: section two provides a concise overview of the relationship between inflation and tax evasion as discussed in

economic literature. Section three outlines the empirical methodology used in this study. Section four presents the study's findings. Section five offers an interpretation of these findings within the framework of economic theory. Section six highlights the novelty and contribution of this article. Finally, section seven summarises the key conclusions drawn from this study.

2. THE INTERPLAY OF TAX EVASION WITH INFLATION AND INFLATIONARY TAX IN ECONOMIC STUDIES

Existing research indicates that various factors, including institutional, demographic, and economic aspects, can influence tax evasion. This study aims to delve into the economic aspect of tax evasion, particularly focusing on the role of inflation. To shed light on this, we will refer to significant research in the economic literature, with particular attention to Fishburn's pioneering work (1981).

Fishburn's study, building upon Srinivasan's (1973), examined how inflation impacted the tendency for individuals to default on tax payments. Fishburn investigated the influence of income on tax evasion within an unindexed tax framework, adapting it to account for changes resulting from inflation-induced increases in nominal income. His findings revealed that defaults in payment are not linked to price levels when nominal income rises but real income remains constant. According to Fishburn's (1981) research, tax evasion increases alongside inflation due to households' efforts to maintain stable purchasing power.

Crane & Nourzad's, (1986, p. 221) analysed how inflation affected overall tax evasion in the United States between 1947 and 1981. They used a simple regression model based on the Ordinary Least Squares (OLS) method, finding a positive correlation between tax evasion and inflation. They also explored other determinants of tax evasion, concluding that it increases with tax rates and decreases with penalty rates.

A descriptive study on Latin American countries by Dornbusch & Simonsen (1987), pp. 68-69) followed by a study by Kiguel & Liviatan in 1988, found that moderate inflation rates boost tax revenue collection by limiting inflationary funding. However, as inflation rises, the collected financial resources diminish due to the burden of inflationary financing. On the other hand, tax payments are deferred until inflation rates rise. These findings are largely based on the Tanzi-Olivera effect (Tanzi, 1977), explaining the negative correlation between tax revenues and inflation rates.

Roubini & Sala-i-Martin (1992), p. 17) examined the enduring relationship between tax evasion, inflationary taxation, and inflation rates through the taxpayer's decision-making process. Their findings revealed that in countries with widespread tax evasion, governments often resort to repressive financial regimes to boost revenues through inflation. However, this strategy hampers financial operations' efficiency by reducing interest rates, leading to increased demand for money, fiscal burdens, and inflation rates.

Fishlow & Friedman's (1994, p. 121) analysis in 1994 of three Latin American nations (Chile, Brazil, and Argentina) provided substantial empirical evidence demonstrating a positive influence of inflationary taxes on tax evasion.

Nicolini (1996, p. 792) analysed the effect of tax evasion on optimal inflationary tax using an equilibrium model, highlighting a positive correlation between inflationary tax and tax evasion.

Caballé & Panadés' (2004, pp. 583-587) analysis of American data explored the link between inflation rates and tax evasion. Their results indicated that tax evasion grows parallel to an increase in inflation rates. A similar conclusion was observed by Tabandeh et al., (2013, pp. 105-106), who used artificial neural network methodology on Malaysian data, covering the period from 1663 to 2011, asserting that inflation has a positive impact on tax evasion, particularly concerning government size and tax system complexity. This trend was further confirmed by Abdixhiku et al (2018, p. 28), who employed a fixed-effect panel model to examine 24 transitioning economies, revealing a direct correlation between tax evasion and rising inflation rates.

Nurunnabi's (2018, p. 44) analysis, using a sample of 38 nations and employing simple regression techniques on data from 1999 to 2007, found that, unlike other variables like fiscal governance, high inflation lowers tax evasion.

Despite a considerable lack of recent studies concerning the relationship between the inflation rate, inflationary tax, and tax evasion, we can conclude in summary that those examining the relationship between the inflation rate and tax evasion often yield similar results, suggesting that inflation is a factor that determines the level of tax evasion. However, the existing relationship between tax evasion and inflationary tax should be further emphasised, as studies analysing the level of tax evasion following changes in the degree of inflation are likely to lead to ambiguous and suboptimal outcomes. This is because the inflation rate generates implicit income, which in turn alters policy parameters in response to changes in levels of tax evasion.

3. DATA AND METHODOLOGICAL FRAMEWORK

3.1. Data

In order to analyse the relationship between inflation, inflationary taxation, and tax evasion, it is necessary to carefully choose relevant factors in order to explain the phenomena of tax evasion in relation to inflation and inflationary taxation. Our methodological stage is essential to building the model (VAR) that we have selected for our investigation. The following is a representation of the chosen variables:

Tax evasion: The measurement of tax evasion serves as a representation of the dependent variable, which is intrinsically unobservable.

The independent variables are instantiated by:

Inflation rate: Studies conducted in the literature suggest that the increase in general price levels is the main driver of tax evasion (Nicolini, 1996 and (Abdixhiku et al., 2018).

Inflationary tax: It serves as one of the factors influencing the fiscal system and, consequently, tax evasion within economies employing a repressive financial system (Roubini & Sala-i-Martin, 1992 and (Nicolini, 1996)

Government size: Within this study, we explore the government's role through the magnitude of its public expenditures. Previous research has shown that this variable can have both positive and negative impacts on tax evasion (Dell'Anno et al., 2007 and (Schneider & Savasan, 2007), particularly in Algeria, public expenditures are largely sustained by revenues generated from hydrocarbons, including income from the inflation tax and financial repression (Dermechi, 2017).

Tax Burden: represents a burden for economic agents, especially for producers. It is recognised as one of the key elements influencing tax avoidance (Tabandeh et al., 2013, p. 104 and Duan et al., 2018).

Corruption Perception Index: it stands as one of the primary determinants of tax evasion (Gang et al., 1996) and Tahseen & Eatzaz, 2010). Indeed, as the tax burden becomes excessively high, households often resort to the avenue of corruption by offering a portion of their funds to those responsible for tax design. The Corruption Perception Index, which is expressed as a percentage, is used to quantify corruption.

A significant issue that emerged during this study pertains to data collection as the statistical system in Algeria is not fully efficient, and certain data is subject to disclosure constraints. To address this, we had to independently estimate some data and gather others from various sources. Data collection frequency is annual, spanning from 1980 to 2022 (Table 1).

It is worth mentioning that all data has undergone logarithmic transformation.

Table 1: Description and source of data

Variable	Description and source of data
Tax Evasion (*TEV*)	The data from 2000 to 2020 is sourced from the Touhami, (2022) study. We estimated the data for the period between 1980 and 1999, as well as from 2021 to 2022, using the estimation method outlined in Touhami's (2022) study.[1]
Inflation rate (*P*)	Expressed using the Consumer Price Index (CPI) at constant prices (100=2012), extracted from the World Bank database: https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?locations=DZ
Inflationary Tax (*FT*)	Expressed as a percentage of total tax revenues. Calculated by using Giovannini & De Melo (1991, p. 4-6) formula: $FT = \pi (Mo - Md)$ where: π represents the annual change in the inflation rate while $(M_o - M_d)$ denotes the real stock of central bank money. [2]
Government size (*EX*)	Represented by public expenditures, expressed as a percentage of real GDP, extracted from Federal Reserve Economic Database: https://fred.stlouisfed.org/
Corruption Perception Index (*COR*)	Index ranging from 0 to 100, obtained from «The global economy.com » database: https://www.theglobaleconomy.com/Algeria/heritcorruption/
Tax Burden (*TB*)	Includes all taxes that companies are obligated to remit to the government, encompassing the corporate income tax (CIT) and the value-added tax (VAT). The data is sourced from the official document "Retrospective Statistics: 1963–2024" of the General Directorate of Prospective and Policy Analysis (DGPP-DRI) within the Algerian Ministry of Finance. These figures are presented as a percentage of the GDP.

Source: Authors' compilation.

1 There are two steps in this estimation process. Firstly, we utilise the formula: tax rate = total income taxes/GDP to ascertain the proportion of income taxes relative to the size of the economy. Secondly, we estimate the magnitude of tax evasion using the relationship: Tax evasion = (hidden income) * (tax rate). Data concerning hidden income is obtained from: https://data.albankaldawli.org/country/DZ.
For further information, refer to (Table 9) in the Additional Data section.
2 Idem.

3.2. Methodology

The multivariate (VAR) technique is the foundation of the econometric methodology used in this work, and it provides a number of important benefits. Firstly, it tackles the issue of endogeneity in variables. Endogenous variables are frequently intrinsically linked to the explanatory aspects of tax evasion. Indeed, if inflation is acknowledged in economic literature as a determinant of tax evasion, it is equally important to consider that this inflation itself is influenced by the level of tax evasion because, tax evasion, being a violation of the law, can disrupt the monetary sphere, leading to general price fluctuations (Tabandeh et al., 2013, p.101.); Secondly, Granger causality tests aid in determining how each variable impacts tax evasion, with the VAR technique playing a pivotal role in this process. These tests illustrate the pathways through which shocks are transmitted between inflation, inflation-related taxes, and tax evasion. Thirdly, by employing cointegration tests, the VAR technique facilitates the estimation of the short- and long-term relationships between inflation, inflationary tax, and tax evasion. The VAR model used in this study is therefore given by Equation (1):

$$Y_t = \sum_{i=1}^{p} \alpha_i Y_{t-i} + S_t + \varepsilon_t \quad \text{.....(1)}$$

In which:

$Y_t = (TEV_t, P_t, FT_t, EX_t, COR_t, TB_t)'$ is a vector (6×1) comprising the endogenous variables at time t. The causal coefficients α_i are matrices (6×6) for lags from 1 to p where p is the number of optimal lags in the model, i = 1, 2,…p. i is the notation, in this case, it means that the series starts from i and ends in p. S_t vector determines elements, which may include constants, linear, or polynomial trends. ε_t is a white noise vector at time t.

Hence, if we convert the mathematical Equation (1) into an equation system using the six (6) random variables, then we will have the VAR (p) model as follows:

$$TEV_t = \sum_{i=1}^{p} \alpha_{1i} TEV_{t-i} + \sum_{i=1}^{p} \alpha_{2i} P_{t-i} + \sum_{i=1}^{p} \alpha_{3i} FT_{t-i} + \sum_{i=1}^{p} \alpha_{4i} EX_{t-i} + \sum_{i=1}^{p} \alpha_{5i} COR_{t-i} + \sum_{i=1}^{p} \alpha_{6i} TB_{t-i} + S_{1t} + \varepsilon_{1t}$$

$$P_t = \sum_{i=1}^{p} \alpha_{1i} TEV_{t-i} + \sum_{i=1}^{p} \alpha_{2i} P_{t-i} + \sum_{i=1}^{p} \alpha_{3i} FT_{t-i} + \sum_{i=1}^{p} \alpha_{4i} EX_{t-i} + \sum_{i=1}^{p} \alpha_{5i} COR_{t-i} + \sum_{i=1}^{p} \alpha_{6i} TB_{t-i} + S_{2t} + \varepsilon_{2t}$$

$$FT_t = \sum_{i=1}^{p} \alpha_{1i} TEV_{t-i} + \sum_{i=1}^{p} \alpha_{2i} P_{t-i} + \sum_{i=1}^{p} \alpha_{3i} FT_{t-i} + \sum_{i=1}^{p} \alpha_{4i} EX_{t-i} + \sum_{i=1}^{p} \alpha_{5i} COR_{t-i} + \sum_{i=1}^{p} \alpha_{6i} TB_{t-i} + S_{3t} + \varepsilon_{3t}$$

$$EX_t = \sum_{i=1}^{p} \alpha_{1i} TEV_{t-i} + \sum_{i=1}^{p} \alpha_{2i} P_{t-i} + \sum_{i=1}^{p} \alpha_{3i} FT_{t-i} + \sum_{i=1}^{p} \alpha_{4i} EX_{t-i} + \sum_{i=1}^{p} \alpha_{5i} COR_{t-i} + \sum_{i=1}^{p} \alpha_{6i} TB_{t-i} + S_{4t} + \varepsilon_{4t}$$

$$COR_t = \sum_{i=1}^{p} \alpha_{1i} TEV_{t-i} + \sum_{i=1}^{p} \alpha_{2i} P_{t-i} + \sum_{i=1}^{p} \alpha_{3i} FT_{t-i} + \sum_{i=1}^{p} \alpha_{4i} EX_{t-i} + \sum_{i=1}^{p} \alpha_{5i} COR_{t-i} + \sum_{i=1}^{p} \alpha_{6i} TB_{t-i} + S_{5t} + \varepsilon_{5t}$$

$$TB_t = \sum_{i=1}^{p} \alpha_{1i} TEV_{t-i} + \sum_{i=1}^{p} \alpha_{2i} P_{t-i} + \sum_{i=1}^{p} \alpha_{3i} FT_{t-i} + \sum_{i=1}^{p} \alpha_{4i} EX_{t-i} + \sum_{i=1}^{p} \alpha_{5i} COR_{t-i} + \sum_{i=1}^{p} \alpha_{6i} TB_{t-i} + S_{6t} + \varepsilon_{6t} \quad .....(2)$$

By following the approach delineated by Sims, (1980) in the context of estimating a VAR model, we adhere to the subsequent procedural steps:

- Test for unit root hypotheses to assess the stationarity of time series using the optimal lag (p) test based on the Akaike Information Criterion (AIC) and Schwarz Criterion (SC).
- Validate the VAR model by checking the normality of residuals through Skewness, Kurtosis, and Jarque-Bera tests, as well as the autocorrelation of residuals through the LM test and the stationarity of the model.
- Conduct the Granger causality test to ascertain whether a set of parameters in the VAR model is zero. This test is employed to analyse the extent to which tax evasion is influenced by inflation and inflationary tax, and/or vice versa.
- Perform simulation and analyse the impulse response of tax evasion to inflation and inflationary tax. This step involves conducting variance decomposition analysis using the Cholesky decomposition method. The ordering of variables is crucial, based on Granger non-causality test results and economic theory, to establish an appropriate variables order. Variance analysis provides insights into the significance of impulses on inflation and inflationary tax in the variation of each variable, especially the variable of interest, "tax evasion." This analysis assists in determining the direction in which inflation and inflationary tax shocks exert the greatest impact on tax evasion.

For an expanded analysis of the VAR model, the estimation in the short and long term necessitates the following progression: We estimate the long-term model using the Fully Modified Ordinary Least Squares (FMOLS) method to test the null hypothesis of "non-cointegration". This method provides consistent results with the standard Engel-Granger method, with parameters converging more rapidly (Stock & Watson, 2001, p. 113). In this step, the Augmented Dickey-Fuller (ADF) test is not suitable for analysing the stationarity of residuals as they are unobservable (Stock & Watson, 1988, pp. 1101-1102). Therefore, we test the stationarity of model residuals through the Engel-Granger test and the Phillips-Ouliaris test. If cointegration is significant, we proceed to short-term estimation using the Error Correction Model (ECM).

4. EMPIRICAL RESULTS

Initially, the statistical description of the variables employed is given in (Table 2).

Table 2: Statistical description of the variables

	TEV	COR	FT	P	TB	EX
Mean	729.395	41.65116	2.563325	8.688080	16.07349	17.03672
Median	689.0000	50.00000	2.065301	5.700000	16.01000	16.76379
Maximum	1167.000	50.00000	9.153517	31.70000	18.83000	22.78596
Minimum	412.0000	26.00000	0.108128	0.300000	13.41000	11.23158
Std.Dev.	213.0121	9.329635	2.180338	8.000965	1.366044	2.786875
Sum	31364.00	1791.000	110.2230	373.5875	691.1600	732.5789
SumSq.Dev.	1905714.	3655.767	199.6628	2688.649	78.37518	326.2002
Observations	43	43	43	43	43	43

Source: Authors' compilation using Eviews results.

4.1. VAR model estimation

The first step prior to estimating VAR involves conducting an analysis of the stationarity [3] of the variables (Table 3).

The VAR model with a lag of p=4 is ideally fitted based on the minimisation of the Akaike Information Criterion (AIC) and the Schwarz Criterion. [4]

At a lag of p = 4, we see that the inflation rate (*P*) and the inflation tax (*FT*) have positive influences on tax evasion: (+6.60 and +4.75, respectively). In contrast, corruption (*COR*), tax burden (*TB*), and government size (*EX*) all have a significant negative impact on tax evasion: (-2.04), (-0.56), and (-0.69), respectively.

3 Refer to (Table 10) in the Additional Data section.
4 Refer to (Table 11) in the Additional Data section.

Table 3: The tax evasion (*TEV*) regression estimation

	TEV	COR	FT	P	TB	EX
TEV (-1)	-0.009 (0.242) [-0.409]	0.436 (0.669) [0.651]	1.097 (1.492) [0.735]	1. 927 (1.663) [1.158]	0. 179 (0.113) [1.586]	-0. 182 (0.232) [-0.786]
TEV (-2)	-0.806** (0.206) [-3.903]	-2.078** (0.849) [-2.448]	6.270** (1.756) [3.570]	5. 074** (1.957) [2.592]	-0.412** (0.143) [-2.876]	-0.149 (0.273) [-0.547]
TEV (-3)	2.210** (0.526) [4.203]	-0.625 (0.788) [-0.794]	-1.444 (1.986) [-0.727]	1.818 (2.214) [0.821]	-0.412** (0.143) [-2.876]	-0.160 (0.294) [-0.545]
TEV (-4)	0.039 (0.274) [0.143]	-2.048** (0.891) [-2.297]	4.758** (1.891) [2.515]	6.604** (2.108) [3.132]	-0.569** (0.150) [-3.781]	-0.694** (0.309) [-2.247]
R-squared	0.859	0.856	0.928	0.967	0.969	0.934
Adj.R-squared	0.600	0.706	0.815	0.894	0.815	0.745

Source: Authors' compilation using Eviews results. Notes: ( ) Standard errors & [ ] t-statistics. ** Significance at the 5% level.

The results of the residual normality and error autocorrelation tests, which allow us to validate the VAR model, are shown in Tables 4 and 5, respectively. [5]

Table 4: Normality tests of residuals

	Skewness	Kurtosis	Jarque-Bera
Chi-sq	2.4001	2.8564	34.5958
Prob	0.4936**	0.1818**	0.2846**

Source: Authors' compilation using Eviews results. ** Significance at the 5% level.

Table 5: LM test of error correlation

Lag	LRE stat	df	Prob.	Rao F-stat	df	Prob.
1	49.89480	36	0.0818	2.116680	(36,11.5)	0.0964**
2	49.99373	36	0.0905	1.527333	(36,11.5)	0.2238**
3	34.95709	36	0.5180	0.770570	(36,11.5)	0.7365**
4	43.29590	36	0.1880	1.140817	(36,11.5)	0.4261**
5	50.37252	36	0.0582	1.687942	(36,11.5)	0.1714**

Source: Authors' compilation using Eviews results. ** The null hypothesis is accepted at a 5% level.

5 The results of the stability conditions of the VAR model are represented in (Table 12) in the Additional Data section.

The Granger-Causality test demonstrates a bidirectional and highly significant causality between tax evasion (*TEV*), inflation rate (P), and inflation tax (*FT*) at a 5% level. This finding suggests that not only can previous inflation rate and inflation tax values help forecast future values, but also the future value of the tax evasion variable (*TEV*). Furthermore, the results show that all variables included in the study statistically cause the tax evasion variable (Table 6).

Based on the outcomes of the Granger-causality test among the variables and employing economic intuition, we can establish a causal transmission diagram among the variables as follows:

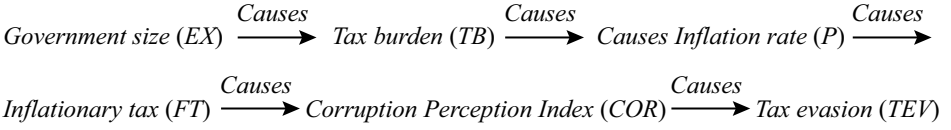

Table 6: Granger's test of non-causality

H_0: does not cause →	COR	FT	P	TB	EX	TEV
COR	-	(0.8257) [1.505]	(0.723) [2.064]	(0.291) [4.955]	(0.851) [1.355]	(0.0036) [15.579]
FT	(0.0125) [12.753]	-	(0.0015) [17.506]	(0.0047) [15.009]	(0.229) [5.617]	(0.0001) [23.324]
P	(0.1884) [6.147]	(0.0209) [11.559]	-	(0.103) [7.686]	(0.131) [7.086]	(0.0011) [18.352]
TB	(0.464) [3.587]	(0.1241) [7.233]	(0.048) [9.570]	-	(0.686) [2.268]	(0.0079) [13.827]
EX	(0.6951) [2.221]	(0.5110) [3.287]	(0.517) [3.246]	(0.004) [14.938]	-	(0.0128) [12.713]
TEV	(0.0721) [8.592]	(0.0011) [18.195]	(0.0165) [12.119]	(0.0004) [20.594]	(0.128) [7.138]	-

Source: Authors' compilation using Eviews results. Notes: ( ) P-value & [ ] Chi-sq statistic; ** The null hypothesis is rejected at a 5% level.

4.2. Simulation

The visual examination of the impulse response reveals that, following an instantaneous positive shock to the inflation rate and government size, there is an initial reaction of increasing tax evasion (+0.08). Similarly, a positive shock

to corruption (*COR*) leads to an increase in tax evasion (+0.06). In contrast, a positive shock to inflationary tax results in a statistically significant decrease in the magnitude of tax evasion (-0.01), and an instantaneous positive shock to the tax burden (*TB*) decreases tax evasion size (-0.06).

Based on the impulse responses obtained for each pair of variables and utilising the established causal transmission pathway, we confirm that a positive impulse on government size leads to a positive response of the tax burden (TB's response to EX: +0.015), followed by a negative response in the inflation rate (P's response to TB: -0.13) and a positive response of inflationary tax (FT's response to P: +0.17). This dynamic also induces a positive response to corruption (COR's response to FT: +0.04), resulting in a decrease in the level of tax evasion (TEV's response to COR: -0.03). [6]

4.3. Variance Decomposition

The variance decomposition of tax evasion indicates that the inflation shock constitutes a substantial portion of the tax evasion dynamics. Specifically, the inflation rate explains nearly 40% of the variance in the tax evasion forecast error. Conversely, the inflationary tax (*FT*) initially contributes a small proportion, approximately 2%, to the variation in tax evasion. However, its contribution gradually increases to over 20% of the tax evasion variable over time.

In the medium and long term, the variance of tax evasion (*TEV*) forecast error is explained by 18% through its innovations, 14.08% by government size (EX), 10.13% by tax burdens (*TB*), and 15.66% by corruption (*COR*).

Within the framework of this study, it is crucial to compare the variance decomposition of inflation forecast error and inflationary tax with that of government size forecast error. In the short term, about 34% of the fluctuation in inflation can be explained by the inflationary tax (*FT*), 2.4% by government size (*EX*), and 3.21% by tax evasion (*TEV*).

The results reveal that 46.06% of the fluctuation in inflationary tax can be explained by inflation, 21.12% by government size, and less than 0.60% by tax evasion.

Regarding the error variation of the government size forecast in the short term, 8.95% can be explained by the inflationary tax (FT) and 2.86% by the inflation rate. In the long term, however, inflation and the inflationary tax account for 24.69% and 10.66%, respectively, of the variation in the government size forecast

6 Refer to (Figure 1) in the Additional Data section.

error. Conversely, tax evasion (*TEV*) accounts for only 0.88% of this variance. A detailed breakdown of the remaining variables is shown in Figure 2. [7]

As a result, inflation-related shocks have a more significant, even significant, impact on tax evasion compared to shocks resulting from tax burdens and government size. However, it is important to note that the causal transmission effect between government size and inflationary tax is what underpins this impact.

4.4. Long run estimation

The Fully Modified Least Squares approach of long-term regression estimate reveals a negative correlation (-0.303) between tax evasion (*TEV*) and the Corruption variable (*COR*). Conversely, there are statistically significant positive correlations between inflationary tax (*FT*) and tax burden (*TB*) (+0.03 and +0.93, respectively). Other variables do not demonstrate significance (Table 7).

Table 7: Estimation results using the FMOLS approach

Variable	Coefficient	Std. Error	t-Statistic	Prob.
P	-0.001035	0.011849	-0.087365	0.9309
FT	0.038141	0.014919	2.556435**	0.0151
COR	-0.303592	0.147790	-2.054212**	0.0475
EX	-0.072470	0.122614	-0.591045	0.5583
TB	0.937529	0.185879	5.043766**	0.0000
C	0.014033	0.012495	1.123085	0.2690

Source: Authors' compilation using Eviews results. ** Significance at the 5% level.

The findings of the Phillips-Ouliaris and Engel-Granger cointegration tests, however, suggest that there is no globally significant cointegration relationship for the set of variables under investigation. Thus, we wrap up the long-term estimation process (Table 8).

Table 8: Results of the cointegration tests

Engle-Granger tau-statistic	-1.2235**
Phillips-Ouliaris tau-statistic	-1.3606**

Source: Authors' compilation using Eviews results. ** Null hypothesis is accepted at a 5% level.

7 Refer to (Figure 2) in the Additional Data section.

5. DISCUSSIONS

The findings obtained from the analysis of VAR model estimation are different from those obtained from impulse response analysis due to their disparate methodological foundations. Indeed, the Cholesky decomposition, which maintains variable order, improves impulse response analysis, whereas the VAR model estimate is based on reduced form. Therefore, instead of evaluating the effect of a disturbance in a single variable, as suggested by Sims, (1980, p. 4-6), it is more instructive to look into the dynamic reaction of all variables.

The examination of impulse reactions indicates a positive correlation between inflation and tax evasion. Specifically, there is a tendency for tax evasion to rise in the short term during periods of high inflation. In the immediate context, this response may be linked to individuals experiencing heightened financial strain, thereby enabling them to evade tax payments. This finding aligns with earlier research conducted by Caballé & Panadés, (2004, p. 581).

The unexpected result about the negative impact of inflationary taxation on tax evasion refutes the first hypothesis. Since inflationary taxation lowers the purchasing power of currency holders, minimal tax evasion in Algeria is indicative of moderate purchasing power. It is challenging to explain this conclusion, nevertheless, without taking into account the psychological factors that influence the agents' behaviours. According to Sims, (1980, pp. p.4-6), economic agents prioritise paying taxes when their purchasing power is limited, in line with the recommendations of Groenland & Van Veldhoven (1983, pp.p. 141-143); Fishlow & Friedman, (1994, p. p. 120) and Engel et al., (2020, pp. p. 4-6).

In our perspective, this view does not fit with the Algerian setting. Algeria's fiscal policy is based on both oil revenues and inflation finance (Boudjema, 2011, pp. 162-164). Taking these variables into consideration, we interpret the negative impact of inflationary tax as a result of dysfunctional revenue collection, particularly due to unequal effective tax rates, a prevalent reality in developing economies (Hoffmann & Zemanek, 2012, pp. 348-349). Therefore, according to our analysis, we posit that the state reduces tax rates by compensating for the deficit caused by inflationary taxation, which proves more profitable than the cost of tax fraud. This practice reflects the negative impact of government size on tax evasion (Vegh, 1989, p. 669). Research on the subject, such as the one by Graetz et al. (1986) has confirmed the negative effect of tax burden on tax evasion. Nonetheless, it is important to take into account that our research is carried out in the context of financial repression. We consider that the practice of a repressive financial system where effective tax rates are low, reflecting

negative real rates, can also account for the negative effect of tax burden on tax evasion. This suggests lower tax receipts, which in turn causes a sizable disparity to arise between revenues and expenses, increasing the level of domestic debt. Algeria's financial repression sustains domestic debt, creating implicit earnings from interest rates and inflationary taxation (Dermechi, 2017, p. 116). This process significantly alleviates the tax burden by financing operational expenses, which is evidenced by the unidirectional causality from the government size to the tax burden.

The negative correlation between the Corruption Perception Index and tax evasion can be explained in two ways in economic literature:

- Increased corruption renders tax evasion more costly than tax payment. Consequently, individuals are more inclined to immediately settle their taxes (Çule & Fulton, 2009, pp. 819-820 and Samadi & Tabande, 2013);
- The corruption encourages the informal sector and, thus, leads to an expansion of economic activity, increasing individual income and reducing the probability of default payment tax.

Given Algeria's quasi-rentier economy, we are inclined towards the first interpretation, which is considered more suitable (Ackerman, 1999, p. 104; Schneider & Enste, 2000).

The impulse response of tax evasion levels following a positive shock in government size is positive. We interpret this result as indicative of the inflationary, implicit, or hidden financing of public expenditure.

6. ORIGINALITY AND VALUE

This study emerges as a pioneering initiative in exploring the impact of inflation and inflationary tax on tax evasion in Algeria. Through its uniqueness, it provides an opportunity to demystify the role and relevance of inflation in controlling the level of tax evasion. The variables used in this article offer a multitude of insights into inflationary finance, an underlying mechanism that continues to significantly impact the Algerian economy despite being concealed. In other words, this study aims to clarify that implicit financing, which proves to be less costly, is the reason behind the state's support for an increased inflation rate. Simultaneously, the causality analysis within the framework of this study proves to be significant, both in terms of contributing to the body of knowledge and aligning the empirical component with the underlying theoretical hypotheses.

7. CONCLUSION

The main objective of this study was to examine the underlying connection between inflation, inflationary tax, and tax evasion in Algeria. The VAR model was employed using annual data spanning from 1980 to 2022. Our hypothesis, grounded in established economic principles, posited that inflation and inflationary taxes would positively impact the extent of tax evasion. However, the Granger causality test and simulation yielded an unexpected result: the inflationary tax seemed to mitigate the increase in tax evasion following an inflation rate shock. Furthermore, correlations were identified among key factors influencing tax evasion, including government size, tax burden, inflationary tax, and corruption. In summary, this study contributed to a better understanding of the role of the inflation rate and inflationary tax in controlling the size of tax evasion. Therefore, we outline some recommendations based on the findings attained:

1. Inflation Monitoring: It is recommended to closely monitor the inflation rate in Algeria to maintain an optimal level. Policymakers should exercise caution to ensure that inflation rates do not exceed this optimal threshold, which could help control the extent of tax evasion. In-depth investigations should be conducted to determine the threshold for inflation rates and inflationary taxes that maximise tax compliance while minimising distortion effects on the economy. Such research could provide crucial information to policymakers for the development of balanced fiscal policies.
2. Tax Compliance Promotion: Fiscal policies should be designed to promote tax compliance while supporting economic growth. This entails balancing incentives for compliance with economic growth objectives.
3. Taxation Management: Policymakers should also closely examine other factors influencing tax evasion, such as government size, tax burden, and corruption. Effective management of these aspects can help reduce tax evasion.

Conflict of interests

The authors declare there is no conflict of interest.

ADDITIONAL DATA

Table 9: Estimate of tax evasion and the inflationary tax in Algeria (1980-2022)

	Inflationary tax (% of total tax revenues)	Tax Evasion (Billion DZD)		Inflationary tax (% of total tax revenues)	Tax Evasion (Billion DZD)
1980	0.88	480	2000	0.10	529
1981	0.67	496	2001	2.06	581
1982	0.28	412	2002	2.71	615
1983	0.36	491	2003	2.20	666
1984	0.51	423	2004	1.91	647
1985	0.85	542	2005	0.58	666
1986	0.80	547	2006	1.04	689
1987	0.90	551	2007	2.87	661
1988	0.92	502	2008	2.44	741
1989	0.89	478	2009	3.26	802
1990	0.93	738	2010	2.10	812
1991	0.73	748	2011	2.45	842
1992	9.15	782	2012	4.79	952
1993	8.93	742	2013	1.79	944
1994	7.27	752	2014	1.78	931
1995	6.52	654	2015	2.92	1082
1996	5.16	776	2016	3.91	1042
1997	2.47	596	2017	3.96	1100
1998	1.87	502	2018	2.83	1052
1999	1.87	520	2019	2.45	1060
2000	0.10	529	2020	1.97	1015
2001	2.06	581	2021	3.42	1036
2002	2.71	615	2022	4.61	1167

Source: Authors' compilation

Table 10: Stationarity tests: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP)

		ADF		PP	
		I(0)	I (1)	I(0)	I(1)
Ln(TEV)	t- statistic	[-2.733]	[-8.040]**	[-2.644]	[-8.170]**
	prob	(0.229)	(0.000)	(0.263)	(0.000)
Ln(COR)	t- statistic	[-2.318]	[6.342]**	[-2.386]	[-6.387]**
	prob	(0.415)	(0.000)	(0.380)	(0.000)
Ln(FT)	t- statistic	[-3.746]**	-	[-3.742]**	-
	prob	(0.029)		(0.030)	
Ln(P)	t- statistic	[-3.085]	[-8.600]**	[-3.060]	[-8.689]**
	prob	(0.122)	(0.000)	(0.129)	(0.000)
Ln(TB)	t- statistic	[-4.299]**	-	[-4.158]**	-
	prob	(0.007)		(0.010)	
Ln(EX)	t- statistic	[-2.466]	[-4.384]**	[-1.838]	[-4.155]**
	prob	(0.342)	(0.006)	(0.668)	(0.011)

Source: Authors' compilation using Eviews results. ** The null hypothesis is rejected at a 5% level.

Table 11: Determining Optimum Lag

Lag	LogL	LR	FPE	AIC	SC	HQ
0	38.00181	NA	7.48e-09	-1.684306	-1.425740**	-1.592310
1	94.82308	92.70838	2.56e-09	-2.780162	-0.970198	-2.136191
2	119.6677	32.69027	5.34e-09	-2.193036	1.168325	-0.997090
3	168.6920	49.02435	4.09e-09	-2.878528	2.034230	-1.130607
4	251.1484	56.41748*	9.48e-10**	-5.323598**	1.140558	-3.023701*

Source: Eviews.12. ** Optimal lag order determined by the specified criterion.

Table 12: Stability Test Results

Root	Modulus	Root	Modulus
0.132047 + 0.955226i	0.964309	-0.818619 - 0.328262i	0.881982
0.132047 - 0.955226i	0.964309	-0.818619 + 0.328262i	0.881982
0.429446 + 0.856760i	0.958364	0.051491 + 0.845484i	0.847050
0.429446 - 0.856760i	0.958364	0.051491 - 0.845484i	0.847050
-0.397150 + 0.866750i	0.953406	0.620178 - 0.546560i	0.826649
-0.397150 - 0.866750i	0.953406	0.620178 + 0.546560i	0.826649
0.801160 - 0.467356i	0.927512	-0.483163 + 0.595860i	0.767134
0.801160 + 0.467356i	0.927512	-0.483163 - 0.595860i	0.767134
-0.900240 - 0.168400i	0.915855	0.730124 - 0.219653i	0.762449
-0.900240 + 0.168400i	0.915855	0.730124 + 0.219653i	0.762449
-0.648319 - 0.645398i	0.914799	-0.431804	0.431804
-0.648319 + 0.645398i	0.914799	-0.176883	0.176883

Source: Eviews.12. VAR satisfies the stability condition.

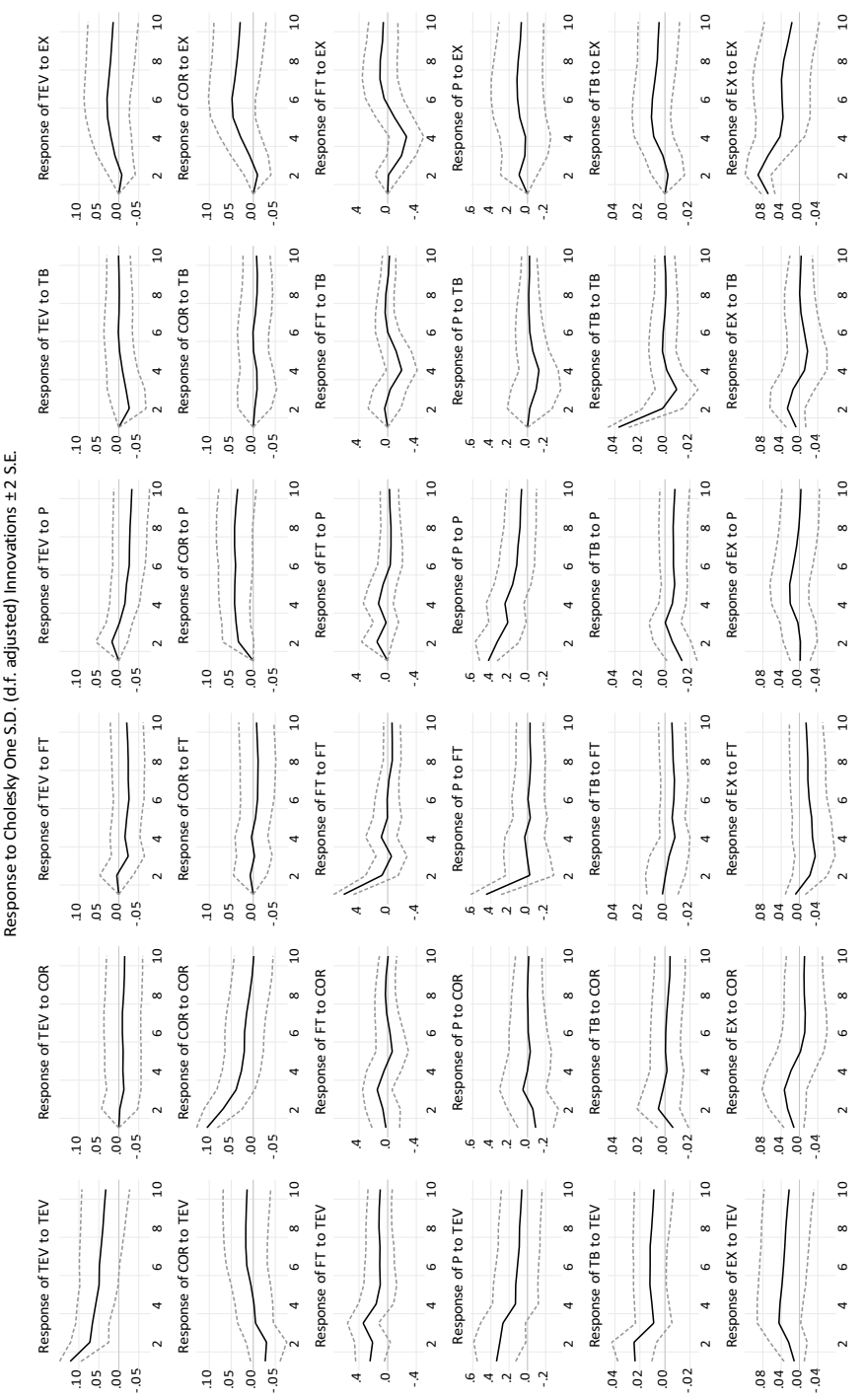

Figure 1: Response to Cholesky Innovations.
Source: Eviews.12

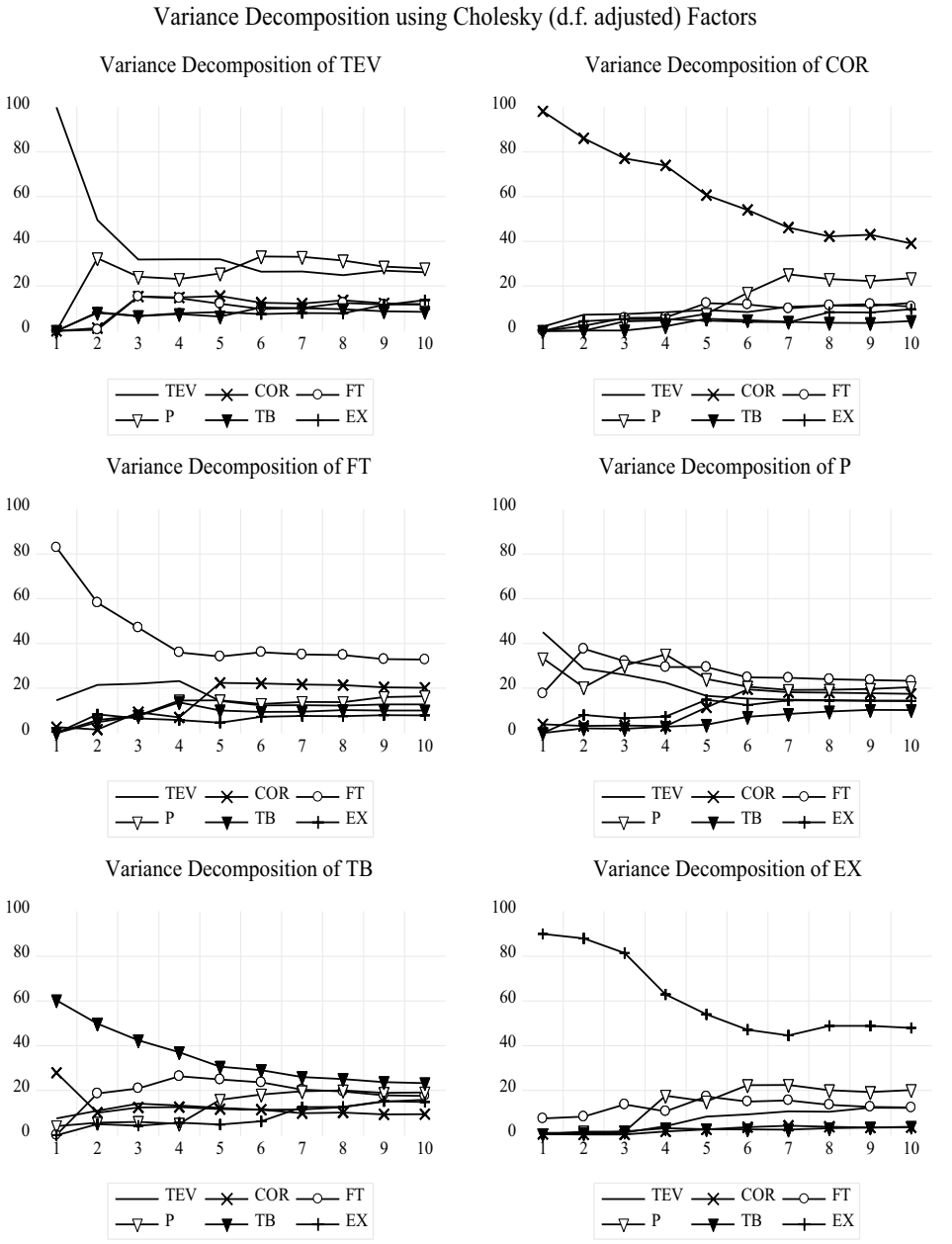

Figure 2: Variance Decomposition using Cholesky Factors.
Source: Eviews.12

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ИНФЛАЦИЈА, ИНФЛАЦИОНИ ПОРЕЗИ И УТАЈА ПОРЕЗА У АЛЖИРУ: ЕМПИРИЈСКА АНАЛИЗА ФУНДАМЕНТАЛНИХ УЗРОЧНИХ ИНТЕРАКЦИЈА

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САЖЕТАК

Овај рад је емпиријска студија која има за циљ да дубље испита ефекте фундаменталних интеракција инфлације и инфлационог пореза на величину утаје пореза у Алжиру. Стога, анализа је заснована на примјени Гренџеровог теста каузалности у оквиру модела векторских ауторегресија (VAR), у периоду од 1980. до 2022. године. Резултати показују да, у кратком року, инфлацијска стопа има позитиван утицај на утају пореза, док инфлациони порез има негативан утицај на утају пореза. Наш приступ настоји да тумачи ове резултате кроз призму теорије инфлационог финансирања. Ова теорија разјашњава како инфлациона стопа и имплицитни приходи које она генерише доприносе регулацији обима утаје пореза у земљи.

Кључне ријечи: *инфлација, инфлаторни порез, утаја пореза, Гренџерова каузалност, инфлаторно финансирање*.