

Tax Pressure and Macroeconomic Adjustment in Emerging Economies: Evidence from Morocco Using an ARDL-ECM Framework

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Abstract

This paper examines the macroeconomic determinants and dynamic adjustment of tax pressure in Morocco over the period 2000–2024 using an Autoregressive Distributed Lag (ARDL) model and its associated Error Correction Model (ECM). While the empirical literature on Moroccan taxation remains largely static and descriptive, offering limited insight into short-run adjustment dynamics, this study addresses this gap by providing a dynamic analysis of fiscal adjustment mechanisms in an emerging economy context.

The results reveal a mixed order of integration among the variables, justifying the use of the ARDL approach. Although the bounds test yields inconclusive evidence of cointegration, the error correction term is negative and highly statistically significant (-0.833 , $p < 0.01$), supporting the existence of a stable long-run relationship, consistent with small-sample evidence. The estimated speed of adjustment indicates that approximately 83% of short-term disequilibrium is corrected within one year.

In the short run, changes in the budget balance exert a positive and marginally significant effect ($p \approx 0.05$) on tax pressure. In the long run, inflation has a positive and weakly significant impact, while unemployment shows a negative but statistically insignificant effect. Public consumption and the budget balance display positive but weak effects, suggesting that macroeconomic variables alone provide only a partial explanation of fiscal dynamics.

Overall, the findings indicate that tax pressure in Morocco operates as an endogenous adjustment mechanism shaped by both macroeconomic conditions and structural constraints, highlighting the importance of institutional factors in understanding fiscal performance in emerging economies.

Keywords : Tax pressure, Fiscal policy, ARDL-ECM, Macroeconomic determinants, Fiscal adjustment.

Classification JEL : H20; H30; E62; C22

Paper type : Empirical Research

1. Introduction

Taxation plays a central role in shaping macroeconomic performance, particularly in emerging economies where fiscal policy serves as a key instrument for both resource mobilization and economic stabilization. In this context, understanding the determinants and behavior of tax pressure is essential for designing effective and sustainable fiscal policies. While a substantial body of literature has examined the relationship between taxation and economic growth, it provides only limited insight into short-run fiscal adjustment mechanisms and the interaction between macroeconomic imbalances and tax pressure, thereby leaving key dimensions of fiscal dynamics insufficiently explored, particularly in emerging economy settings.

Morocco provides a particularly relevant case study in this regard. Since the early 2000s, the country has implemented a series of fiscal reforms aimed at modernizing its tax system, improving revenue mobilization, and strengthening fiscal governance. Despite these efforts, the evolution of tax pressure reveals important structural transformations in both the level and composition of tax revenues. Over the period 2000–2024, tax pressure in Morocco remained broadly stable, fluctuating between approximately 20% and 25% of GDP, reflecting the resilience of fiscal revenues despite successive macroeconomic shocks and economic fluctuations. Following a sustained increase during the 2000s, tax pressure reached relatively high levels in the early 2010s before entering a phase of stabilization and moderate adjustment associated with fiscal reforms, slower economic activity, and external shocks, particularly the global financial crisis and the COVID-19 pandemic.

The composition of tax revenues further illustrates the structural characteristics of the Moroccan fiscal system. Value-added tax (VAT) consistently represents the largest source of tax revenue, accounting for approximately 30%–35% of ordinary fiscal revenues throughout the study period. This predominance reflects the strong reliance of the Moroccan tax system on indirect and consumption-based taxation. Corporate income tax (CIT) constitutes another significant component of fiscal revenues, generally contributing between 15% and 20% of total tax receipts, although its evolution remains relatively volatile due to its sensitivity to business cycles, corporate profitability, and fiscal reforms. Personal income tax (PIT), by contrast, exhibits greater stability over time and represents approximately 20%–25% of total tax revenues, reflecting the significant contribution of wage earners and formally declared income to the tax base. Meanwhile, customs duties display a persistent downward trend, largely driven by Morocco's progressive trade liberalization and increasing integration into the global economy through multiple free trade agreements.

Beyond their descriptive dimension, these stylized facts suggest that the evolution of tax pressure in Morocco cannot be fully understood without considering the macroeconomic adjustment mechanisms underlying fiscal performance. First, the predominance of indirect taxation contributes to relatively stable revenue mobilization but simultaneously raises important concerns regarding tax equity and distributive efficiency. Second, the relatively limited contribution of direct taxation highlights the structural narrowness of the tax base, the persistence of informal economic activities, and the difficulties associated with expanding fiscal capacity. Third, the relative stability of aggregate tax pressure despite recurrent macroeconomic fluctuations suggests the existence of fiscal adjustment mechanisms linking tax outcomes to broader economic conditions. These mechanisms remain insufficiently explored in the existing literature, particularly in the context of emerging economies characterized by structural rigidities and evolving fiscal frameworks.

In this respect, the Moroccan case highlights a fundamental limitation of current approaches: while the structure and evolution of tax revenues are relatively well documented, the transmission processes through which tax pressure responds to macroeconomic shocks and fiscal imbalances remain inadequately captured. This gap is particularly significant in the

Moroccan context, where the dominance of indirect taxation, the narrowness of the fiscal base, and the persistence of structural rigidities may alter the relationship between macroeconomic variables and fiscal performance.

Despite the growing body of research on Moroccan taxation, existing studies have largely focused either on the static relationship between tax pressure and economic growth—often within the framework of optimal taxation theories such as the Scully model—or on descriptive analyses of fiscal reforms and revenue trends. While these approaches provide valuable insights, they do not fully capture the fiscal adjustment processes underlying the evolution of tax pressure over time.

More specifically, the existing literature can be broadly classified into two strands. The first focuses on the taxation–growth nexus within static frameworks, while the second emphasizes descriptive analyses of fiscal reforms and revenue structures. Despite their contributions, these approaches share a common limitation: they do not explicitly model the adjustment of tax pressure in response to macroeconomic fluctuations and fiscal constraints. As a result, they fail to explain how tax pressure evolves over time, how short-term disequilibria are corrected, and how macroeconomic variables interact within a coherent econometric framework.

To address this gap, this paper adopts a dynamic time-series approach based on the Autoregressive Distributed Lag (ARDL) model and its associated Error Correction Model (ECM), as developed by Pesaran, Shin, and Smith (2001). This framework is particularly suitable in the presence of variables integrated of different orders and for relatively small samples. It allows for the simultaneous estimation of long-run relationships and short-run responses, thereby providing a comprehensive understanding of the behavior of tax pressure over time.

Using annual data over the period 2000–2024, the study examines the impact of key macroeconomic variables—namely real GDP, inflation, unemployment, public consumption, and the budget balance—on tax pressure in Morocco. By doing so, it aims to identify the main drivers of fiscal performance and to assess the responsiveness of the tax system to macroeconomic imbalances.

This study contributes to the literature in a precise and differentiated manner. First, it provides one of the first dynamic empirical analyses of tax pressure in Morocco using a fully specified ARDL-ECM framework, thereby overcoming the limitations of static approaches and explicitly capturing both short-run adjustment processes and long-run equilibrium relationships.

Second, the paper identifies the speed and mechanism of fiscal adjustment through the estimation of the error correction term, providing new evidence on how rapidly tax pressure responds to macroeconomic disequilibria—an aspect that remains largely unexplored in the Moroccan context.

Third, the study establishes an explicit link between macroeconomic variables (inflation, unemployment, public expenditure, and budget balance) and tax pressure behavior, thereby offering a more integrated framework for understanding fiscal performance and extending existing studies that focus primarily on descriptive or long-run relationships.

To guide the empirical analysis, the study addresses the following research questions: To what extent does tax pressure in Morocco respond to macroeconomic conditions and fiscal constraints? Does a stable long-run relationship exist between tax pressure and its determinants despite short-run fluctuations?

Accordingly, the following hypotheses are formulated:

H1: Tax pressure in Morocco responds significantly to macroeconomic variables, particularly inflation, unemployment, and public consumption.

H2: Fiscal imbalances, as reflected in the budget balance, play a central role in shaping tax pressure dynamics.

H3: A stable long-run relationship exists between tax pressure and its determinants, supported by a significant error correction mechanism.

The remainder of the paper is organized as follows. Section 2 reviews the relevant literature. Section 3 presents the data and methodology. Section 4 reports the empirical results. Section 5 discusses the findings, and Section 6 concludes with policy implications.

2. Literature Review

2.1. Theoretical Foundations of Taxation and Economic Activity

The relationship between taxation and economic performance has been extensively examined in the economic literature, with particular emphasis on the trade-off between revenue mobilization and efficiency losses. Early contributions, notably by Ramsey (1927), established the principle of optimal taxation, suggesting that tax systems should be designed to minimize distortions while ensuring sufficient public revenue. Within this framework, the structure of taxation plays a critical role in shaping economic behavior and resource allocation.

Subsequent developments in optimal taxation theory have emphasized the non-linear relationship between tax rates and economic activity. The Laffer curve formalizes this idea by suggesting the existence of a threshold beyond which higher tax rates lead to a decline in tax revenues due to disincentive effects. This perspective has been further extended by Scully (1994), who proposes an empirical framework linking tax burden to economic growth, highlighting the existence of an optimal level of taxation that maximizes output.

From a macroeconomic perspective, Barro (1990) introduces an endogenous growth model in which public expenditure, financed through taxation, can enhance economic growth when it is productive. However, excessive taxation generates distortions that may offset these benefits.

While these theoretical contributions converge on the existence of a trade-off between taxation and economic performance, they diverge in their underlying mechanisms and policy implications. In particular, the optimal taxation framework emphasizes efficiency considerations, whereas endogenous growth models highlight the productive role of public expenditure. This divergence reflects an unresolved tension in the literature regarding the conditions under which taxation supports or hinders economic performance.

In parallel, the intertemporal government budget constraint (Barro, 1979) provides a theoretical foundation for understanding the relationship between fiscal deficits and taxation. According to this framework, persistent budget imbalances eventually require adjustments through increased taxation or reduced public spending, highlighting the endogenous nature of tax pressure in response to fiscal constraints.

Taken together, these theoretical approaches provide complementary but not fully integrated explanations of tax dynamics. To address this limitation, the present study adopts an integrated conceptual framework in which tax pressure is modeled as the outcome of multiple interacting mechanisms. Economic activity (proxied by real GDP) reflects the tax base expansion predicted by optimal taxation theory; public consumption captures the role of government expenditure emphasized in endogenous growth models; inflation embodies the Olivera–Tanzi effect; unemployment reflects labor market conditions affecting taxable income; and the budget balance operationalizes the intertemporal fiscal constraint. By explicitly linking each theoretical mechanism to an observable macroeconomic variable, this framework ensures consistency between theoretical foundations and empirical specification.

2.2. Macroeconomic Determinants of Tax Pressure

Beyond theoretical considerations, a substantial body of empirical literature has examined the macroeconomic determinants of tax pressure. One of the most robust findings concerns the role of economic activity. Higher levels of development, typically proxied by GDP per capita or real

GDP, are associated with increased tax revenues through broader tax bases and enhanced fiscal capacity (Tanzi, 1992; Gupta, 2007).

Inflation constitutes another key determinant of tax performance. The Olivera–Tanzi effect suggests that inflation may erode the real value of tax revenues due to collection lags, although moderate inflation can temporarily boost nominal revenues.

However, empirical findings on the impact of inflation remain inconclusive. While some studies confirm a negative effect through revenue erosion, others highlight a positive or neutral relationship depending on institutional efficiency and tax administration capacity. This ambiguity suggests that the inflation–taxation relationship is highly context-dependent, particularly in emerging economies.

Labor market conditions also play a crucial role. High unemployment reduces taxable income and consumption, thereby narrowing the tax base and exerting downward pressure on tax revenues.

Public expenditure represents another important determinant. According to Wagner’s law, economic development is associated with an expansion of public spending, which in turn requires increased revenue mobilization.

Finally, fiscal balance plays a central role in shaping tax dynamics. Governments facing persistent deficits often increase tax pressure in order to restore fiscal sustainability (Aizenman et al., 2017).

Empirical evidence from developing and comparable economies highlights the importance of structural constraints—such as informality, administrative capacity, and tax base concentration—in shaping fiscal performance (Brun et al., 2006; Lledó et al., 2011).

Overall, while there is broad consensus on the relevance of these determinants, the empirical literature shows significant variation in their magnitude and significance, reflecting differences in economic structures, institutional quality, and model specifications.

This variability reinforces the need for country-specific dynamic analyses capable of capturing both short-run adjustments and long-run equilibrium relationships.

2.3. Empirical Evidence from Emerging Economies

Empirical studies on tax pressure in emerging economies provide mixed but insightful evidence regarding its determinants and dynamic behavior. In developing countries, Tanzi and Zee (2000) emphasize the importance of tax structure, arguing that indirect taxation tends to be more effective in contexts characterized by administrative constraints and large informal sectors.

More recent contributions increasingly rely on dynamic econometric approaches to capture fiscal adjustment processes. The Autoregressive Distributed Lag (ARDL) framework, in particular, has gained prominence due to its flexibility in handling mixed orders of integration and small sample sizes (Pesaran et al., 2001).

However, empirical evidence remains uneven across regions. While dynamic modeling approaches have been widely applied in emerging and developing economies, evidence for North African countries—and especially Morocco—remains relatively limited and fragmented. In the Moroccan context, existing empirical studies provide valuable but partial insights. Early contributions, such as Achy (2003) and Bouoiyour and Miftah (2016), primarily examine the relationship between taxation and economic growth, without explicitly modeling the dynamic adjustment mechanisms of fiscal variables. More recent work by Fahim and Bourdane (2019), based on an ARDL framework, analyzes the impact of tax revenue composition on economic growth, highlighting differentiated effects of direct and indirect taxation. Nevertheless, the focus remains on growth outcomes rather than on the determinants and dynamics of tax pressure itself.

Similarly, Benkejjane et al. (2024) investigate the relationship between tax pressure and long-term economic growth using VAR and VECM approaches. Their findings suggest a weak and statistically insignificant long-run relationship, pointing to structural inefficiencies in the Moroccan tax system. While this study provides important insights into the macroeconomic role of taxation, it does not explicitly model tax pressure as an endogenous variable responding to macroeconomic fluctuations and fiscal constraints.

Overall, these contributions remain either growth-oriented or limited to specific modeling frameworks, and do not fully capture the dynamic interaction between macroeconomic variables and fiscal adjustment mechanisms. This limitation is particularly important in the context of emerging economies, where tax systems are shaped by structural constraints such as informality, tax base concentration, and administrative capacity.

These structural features are especially pronounced in Morocco, where the tax system remains characterized by a narrow base and a significant reliance on indirect taxation. As a result, understanding the dynamics of tax pressure requires an analytical framework capable of capturing both short-run adjustments and long-run equilibrium relationships.

Despite recent advances, empirical evidence on the dynamic determinants of tax pressure remains limited for North African countries, particularly for Morocco. This gap justifies the adoption of a dynamic econometric approach that explicitly models tax pressure as an endogenous variable within a macroeconomic and fiscal adjustment framework.

2.4. Contribution of the Present Study

Given the gaps identified in the theoretical and empirical literature, this study adopts a differentiated positioning. Rather than reiterating descriptive or static analyses, it focuses on the dynamic adjustment of tax pressure within a coherent macroeconomic framework.

Specifically, the study tests theoretically grounded hypotheses by examining how tax pressure responds to fiscal constraints (intertemporal budget constraint), macroeconomic conditions (inflation, unemployment, public expenditure), and short-run disequilibria captured through an error correction mechanism.

In doing so, it provides an integrated empirical framework that connects theoretical predictions with observed fiscal dynamics, thereby addressing the limitations identified in previous studies and offering a more comprehensive understanding of tax pressure in Morocco.

3. Data and Methodology

3.1. Data and Variables

This study relies on annual time-series data covering the period 2000–2024, selected to ensure both data availability and consistency with the major structural transformations of the Moroccan fiscal system. The choice of the starting year 2000 is motivated by both empirical and institutional considerations. First, it corresponds to the availability of consistent and harmonized macroeconomic and fiscal data from national sources (DEPF and HCP). Second, it marks the beginning of a phase of progressive fiscal modernization in Morocco, characterized by successive tax reforms, including the National Tax Conferences (Assises de la fiscalité) held in 2009, 2013, and 2019, as well as the adoption of Framework Law No. 69-19 on tax reform, which aims to enhance equity, efficiency, and transparency in the tax system. These elements contribute to defining a relatively coherent institutional period for analysis. This period captures key phases of fiscal reform, economic fluctuations, and policy adjustments, making it particularly suitable for analyzing the dynamics of tax pressure.

However, the use of annual data over a relatively limited sample (25 observations) may raise concerns regarding the robustness of the estimations. In this respect, the ARDL modeling framework is particularly appropriate, as it is well suited for small samples and allows for

reliable estimation in the presence of variables integrated of different orders. Nevertheless, the results should be interpreted with caution, as the limited sample size may affect the statistical power of the tests and the precision of the estimated coefficients.

The dataset combines national and international sources to ensure consistency and completeness. Fiscal data, including tax revenues and the budget balance, are obtained from the Moroccan Ministry of Economy and Finance (DEPF), while macroeconomic variables—such as GDP, inflation, unemployment, and public consumption—are sourced from the High Commission for Planning (HCP), complemented where necessary by international databases such as the World Bank and the International Monetary Fund (IMF).

The dependent variable of the model is tax pressure (PF), defined as the ratio of total tax revenues to nominal GDP:

$$PF_t = \frac{\text{Tax Revenues}_t}{\text{Nominal GDP}_t}$$

This indicator captures the overall fiscal burden and is widely used in the literature to assess tax performance and fiscal capacity.

The explanatory variables are selected based on both theoretical considerations and empirical evidence and correspond to official statistical series expressed in consistent units over the period 2000–2024:

- Real GDP (PIB): proxy for economic activity; higher output is expected to expand the tax base.
- Inflation (INF): captures price dynamics and potential distortions in tax collection (Olivera–Tanzi effect).
- Unemployment rate (CHOM): reflects labor market conditions and affects the tax base.
- Public consumption (CG): expressed as a percentage of GDP, capturing expenditure pressures.
- Budget balance (DEFBUD): proxy for fiscal constraints and policy adjustments.

These variables capture the main real, monetary, and fiscal determinants of tax pressure.

The main variables correspond to the following official statistical series: total tax revenues, nominal GDP, real GDP, consumer price index, unemployment rate, public consumption expenditure, and budget balance. The dataset can be made available upon reasonable request to ensure the reproducibility of the results.

3.2. Model Specification

To analyze the relationship between tax pressure and its macroeconomic determinants, the following long-run model is specified:

$$PF_t = \alpha + \beta_1 PIB_t + \beta_2 INF_t + \beta_3 CHOM_t + \beta_4 CG_t + \beta_5 DEFBUD_t + \varepsilon_t$$

where:

- PF_t : tax pressure
- PIB_t : real GDP
- INF_t : inflation
- $CHOM_t$: unemployment rate
- CG_t : public consumption
- $DEFBUD_t$: budget balance
- ε_t : error term

This specification is consistent with the theoretical framework, in which tax pressure is endogenously determined by macroeconomic conditions and fiscal constraints.

It should be acknowledged that some explanatory variables, particularly public consumption (CG) and the budget balance (DEFBUD), may be jointly determined with tax pressure, raising

potential endogeneity concerns. Fiscal policy decisions can simultaneously influence and respond to changes in tax revenues, introducing potential reverse causality.

Within this context, the ARDL framework provides a partial mitigation by incorporating lagged values of both dependent and explanatory variables, thereby reducing contemporaneous feedback effects and allowing for a dynamic representation of the relationships. This approach is particularly suitable for small samples and yields consistent long-run estimates even in the presence of such interactions.

However, the objective of this study is not to establish strict causal inference, but rather to identify dynamic relationships between tax pressure and its macroeconomic determinants. Accordingly, the results should be interpreted as conditional associations within a dynamic framework.

Nonetheless, the potential endogeneity of certain variables cannot be entirely ruled out. Future research could address this limitation using alternative econometric approaches, such as structural VAR models or instrumental variable techniques.

3.3. Econometric Methodology: ARDL-ECM Approach

To capture both long-run relationships and short-run dynamics, this study employs the Autoregressive Distributed Lag (ARDL) model, as developed by Pesaran, Shin, and Smith (2001). This approach is particularly suitable in the presence of variables integrated of different orders and for relatively small samples.

The optimal lag structure is selected using the Akaike Information Criterion (AIC), ensuring consistency between the model specification and the empirical results.

The ARDL framework enables the identification of long-run relationships among variables, while short-run dynamics are captured through its reparameterization into an Error Correction Model (ECM).

3.4. Cointegration Analysis and Error Correction Model

The existence of a long-run relationship among variables is tested using the Bounds testing approach developed by Pesaran et al. (2001). This method compares the computed F-statistic with critical bounds values to determine whether cointegration exists.

When cointegration is established, the ARDL model is reparameterized into an Error Correction Model (ECM):

$$\Delta PF_t = \alpha + \beta_1 \Delta PIB_t + \beta_2 \Delta INF_t + \beta_3 \Delta CHOM_t + \beta_4 \Delta CG_t + \beta_5 \Delta DEF BUD_t + \lambda ECT_{t-1} + \varepsilon_t$$

where:

- Δ : first-difference operator
- ECT_{t-1} : error correction term derived from the long-run relationship
- λ : speed of adjustment toward equilibrium

A negative and statistically significant λ confirms the existence of a stable long-run relationship and indicates how quickly deviations from equilibrium are corrected.

3.5. Diagnostic and Stability Tests

To ensure the robustness of the estimated model, several diagnostic tests are conducted:

- Jarque–Bera test: residual normality
- Breusch–Godfrey LM test: serial correlation
- Breusch–Pagan test: heteroskedasticity
- Durbin–Watson statistic: autocorrelation check
- CUSUM test: parameter stability

These tests ensure that the model satisfies standard econometric assumptions and that the estimated relationships are stable over the sample period.

3.6. Empirical Strategy

The empirical analysis follows a sequential approach:

- Stationarity tests (ADF and Phillips–Perron)
- ARDL model estimation and lag selection
- Bounds test for cointegration
- ECM estimation
- Diagnostic and stability tests
- Economic interpretation of results

This structured approach ensures the robustness and internal consistency of the empirical analysis.

4. Empirical Results

4.1. Stationarity Analysis

Prior to model estimation, the time-series properties of the variables are examined using the Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) unit root tests. Ensuring stationarity is essential to avoid spurious regressions and to determine the appropriate econometric methodology.

Table 1. Unit Root Test Results

Variable	ADF (Level)	Prob.	PP (Level)	Prob.	ADF (1st Diff.)	Prob.	Order
PF	-1.551	0.491	-1.551	0.491	-5.410	0.000	I(1)
PIB	1.035	0.995	1.415	0.998	-5.351	0.000	I(1)
CG	-1.402	0.565	-1.402	0.565	-4.178	0.003	I(1)
DEFBUD	-3.064	0.043	-2.431	0.144	-3.957	0.006	I(1)
INF	-3.954	0.006	-3.357	0.023	—	—	I(0)
CHOM	-3.380	0.021	-3.304	0.025	—	—	I(0)

Source: Author's calculations based on HCP and DEPF data (EViews estimations).

The results indicate a mixed order of integration: tax pressure, real GDP, public consumption, and the budget balance are integrated of order one, whereas inflation and unemployment are stationary in levels. This combination of I(0) and I(1) variables justifies the use of the ARDL modeling framework, which accommodates such characteristics without requiring all variables to be integrated of the same order.

4.2. ARDL Model Estimation

Following the stationarity analysis, the ARDL model is estimated to capture the relationship between tax pressure and its macroeconomic determinants. The optimal lag structure is selected based on the Akaike Information Criterion (AIC), leading to the specification:

- **ARDL(1,0,0,0,1)**

Table 2. ARDL Estimation Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
PF(-1)	0.1666	0.2508	0.6640	0.5156
PIB	0.0099	0.0106	0.9320	0.3644
INF	0.00336	0.00161	2.0858	0.0524
CHOM	-0.00134	0.00234	-0.5719	0.5749
CG	0.00756	0.00545	1.3870	0.1834
DEFBUD	0.00257	0.00228	1.1269	0.2754
DEFBUD(-1)	0.00246	0.00181	1.3627	0.1908
Constant	-0.01385	0.06729	-0.2058	0.8394

Model Fit Statistics

Indicator	Value
R²	0.8088
Adjusted R²	0.7301
F-statistic	10.27
Prob(F-statistic)	0.000049
Durbin-Watson	1.95

Source: Author's calculations based on HCP and DEPF data (EViews estimations).

The model exhibits a high explanatory power, with approximately 81% of the variation in tax pressure explained by the selected variables ($R^2 = 0.8088$). The overall statistical significance of the model is confirmed by the F-statistic ($p < 0.01$), indicating that the regressors are jointly significant.

From an economic perspective, inflation exerts a positive and marginally significant effect ($p \approx 0.05$), suggesting that price dynamics influence nominal tax revenues, in line with the partial operation of the Olivera–Tanzi mechanism. Unemployment displays a negative coefficient, consistent with the erosion of the tax base during periods of labor market deterioration. The budget balance exhibits a positive sign, reflecting the role of fiscal constraints in shaping tax policy adjustments, although its effect remains statistically weak in the short run. Overall, these results point to a fiscal system that reacts to macroeconomic conditions, albeit with varying degrees of sensitivity across variables.

It is noteworthy that several coefficients are not statistically significant at conventional levels. This outcome may reflect the presence of multicollinearity among explanatory variables, as key macroeconomic indicators—such as GDP, public consumption, and the budget balance—are structurally interrelated. Such interdependencies can inflate standard errors and reduce the individual statistical significance of coefficients, even when the model remains jointly significant.

Furthermore, the relatively small sample size (25 observations) may limit the statistical power of the estimations, making it more difficult to detect significant individual effects. In this context, greater emphasis is placed on the joint significance of the model and the economic consistency of the estimated coefficients.

To further assess the robustness of these findings, the model was re-estimated by excluding major crisis periods, namely 2008–2009 and 2020–2021. The results from this restricted sample (21 observations) remain broadly consistent with the baseline estimates: coefficients retain their expected signs and comparable magnitudes, while the overall explanatory power remains high ($R^2 \approx 0.81$) and the model preserves its global statistical significance.

This robustness check suggests that the estimated relationships are not driven by exceptional macroeconomic shocks, but rather reflect underlying structural features of the Moroccan fiscal system.

Taken together, these findings support the reliability of the estimated model and justify focusing the interpretation on the direction and economic coherence of the relationships, rather than on the statistical significance of individual coefficients alone, particularly in a small-sample context.

4.3. Cointegration Analysis: Bounds Test

To test for the existence of a long-run equilibrium relationship, the Bounds testing approach is applied.

Table 3. Bounds Test Results

Statistic	Value
F-statistic	2.8188
t-statistic	-3.3227

Critical Values

Level	I(0)	I(1)
10%	2.578	3.858
5%	3.125	4.608
1%	4.537	6.370

Source: Author's calculations based on HCP and DEPF data (EViews estimations).

The F-statistic lies between the lower and upper bounds, leading to an inconclusive result regarding cointegration. However, as emphasized in the literature, such outcomes do not necessarily imply the absence of a long-run relationship.

In such cases, it is standard practice to complement the Bounds test with additional evidence derived from the Error Correction Model (ECM).

In this context, particular attention is given to the error correction term (ECT), whose sign and statistical significance provide additional evidence on the existence of a long-run relationship. As shown by Kremers et al. (1992) and Banerjee et al. (1998), a negative and statistically significant ECT coefficient may be considered sufficient evidence of cointegration, even when the bounds test yields inconclusive results, especially in small samples.

Accordingly, while the Bounds test does not provide a definitive conclusion, the ECM-based evidence strongly supports the existence of a stable long-run relationship among the variables. Nevertheless, this conclusion should be interpreted with caution. Given the relatively small sample size, the results may be sensitive to model specification and the statistical properties of the series. Therefore, the evidence of cointegration should be considered indicative rather than conclusive.

4.4. Error Correction Model (ECM)

The ECM results provide strong evidence of long-run equilibrium.

Table 4. ECM Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
ECT(-1)	-0.8334	0.1781	-4.6784	0.0001
ΔDEFBUD	0.00257	0.00126	2.0398	0.0536
Constant	-0.01385	0.00378	-3.6631	0.0014

Model Fit Statistics

Indicator	Value
R²	0.5203
Adjusted R²	0.4767
F-statistic	11.93
Prob(F-statistic)	0.000309
Durbin-Watson	1.95

Source: Author's calculations based on HCP and DEPF data (EViews estimations).

The estimated ECM equation is:

$$\Delta PF_t = -0.01385 + 0.00257\Delta DEF BUD_t - 0.8334ECT_{t-1}$$

The error correction term is negative and highly statistically significant (-0.833 , $p < 0.01$), confirming the existence of a stable long-run relationship among the variables. The magnitude of the adjustment coefficient indicates that approximately 83% of any short-term disequilibrium is corrected within one year, suggesting a rapid and relatively efficient fiscal adjustment process.

In the short run, the change in the budget balance has a positive and marginally significant effect, suggesting that fiscal imbalances trigger adjustments in tax pressure, consistent with short-term policy responses.

It should also be noted that the adjusted R^2 of the ECM (0.4767) indicates a moderate explanatory power in the short run. This suggests that short-term fluctuations in tax pressure are influenced by additional factors not explicitly captured in the model.

In particular, discretionary fiscal measures, legislative tax reforms, and changes in tax compliance behavior may play a significant role in shaping short-term tax dynamics. In the Moroccan context, tax policy is often subject to institutional reforms and administrative adjustments that are not fully reflected in standard macroeconomic variables.

Moreover, temporary shocks—such as crisis-related policy responses or sector-specific fiscal measures—may generate short-term variations in tax revenues that are difficult to capture within a parsimonious macroeconomic framework.

Taken together, these findings indicate that while the ECM provides a robust characterization of long-run equilibrium and adjustment dynamics, its short-run explanatory power remains inherently limited, calling for a complementary institutional interpretation.

4.5. Diagnostic and Stability Tests

To assess the robustness of the estimated model, several diagnostic tests are performed.

Table 5. Diagnostic Tests

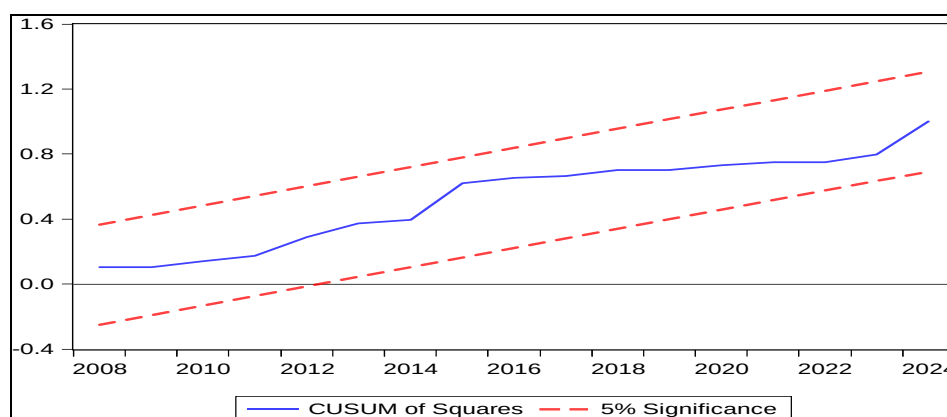
Test	Statistic	Prob.	Conclusion
Jarque–Bera	1.374	0.503	Residuals are normally distributed
Breusch–Godfrey LM	1.19	0.329	No serial correlation
Breusch–Pagan	0.757	0.592	Homoskedasticity
Durbin–Watson	1.95	—	No autocorrelation
CUSUM	Stable	—	Parameter stability

Source: Author's calculations based on HCP and DEPF data (EViews estimations).

The results confirm that the model satisfies all standard econometric assumptions. Residuals are normally distributed, no evidence of serial correlation or heteroskedasticity is detected, and the Durbin–Watson statistic indicates the absence of autocorrelation.

To further assess parameter stability over the sample period, the CUSUM of squares (CUSUMSQ) test is employed. The corresponding plot (Figure 3) shows that the cumulative sum of squared residuals remains within the 5% critical bounds throughout the period 2000–2024. This indicates the absence of structural instability and confirms that the estimated coefficients are stable over time.

Figure 3. CUSUM of Squares (CUSUMSQ) Stability Test



Source: Author's calculations based on HCP and DEPF data (EViews estimations).

This result is particularly important given that the sample period includes major external shocks, notably the 2008–2009 global financial crisis and the 2020–2021 COVID-19 pandemic. Despite these events, no evidence of structural breaks is detected, suggesting that the underlying relationship remains stable.

Nevertheless, it should be noted that the CUSUMSQ test provides a global assessment of stability. More formal structural break tests (e.g., Chow or Zivot–Andrews) could further strengthen this conclusion and are left for future research.

Overall, these findings support the validity, reliability, and robustness of the estimated model.

4.6. Economic Interpretation of Results

The empirical findings provide several important insights into the dynamics of tax pressure in Morocco.

First, despite the inconclusive Bounds test, the ECM results clearly confirm the existence of a stable long-run relationship, highlighting the relevance of dynamic modeling approaches in capturing fiscal behavior.

Second, the magnitude and significance of the adjustment coefficient indicate that the Moroccan fiscal system exhibits a strong capacity to correct short-term disequilibria, suggesting an effective adjustment mechanism in response to macroeconomic shocks.

Third, the positive relationship between the budget balance and tax pressure supports the intertemporal government budget constraint hypothesis (Barro, 1979), implying that fiscal imbalances tend to induce increased revenue mobilization efforts.

Fourth, the positive effect of inflation is consistent with the Olivera–Tanzi mechanism, reflecting the influence of price dynamics on nominal tax revenues, although this effect remains moderate.

Finally, the limited statistical significance of several macroeconomic variables suggests that tax pressure in Morocco cannot be fully explained by short-term macroeconomic fluctuations alone. Instead, it reflects deeper structural features, including the narrow tax base, the weight of the informal sector, and the concentration of the tax burden.

Overall, these results indicate that tax pressure should be understood as a dynamic and institutionally embedded variable, resulting from the interaction between macroeconomic conditions, fiscal constraints, and structural characteristics of the tax system.

5. Discussion

The empirical results provide a comprehensive understanding of the dynamic behavior of tax pressure in Morocco and yield several important insights when interpreted in light of the theoretical and empirical literature.

First, the confirmation of a stable long-run relationship—despite the inconclusive Bounds test—reinforces the relevance of the ARDL-ECM framework in capturing fiscal dynamics in contexts characterized by mixed integration orders. Beyond its methodological justification, this result highlights a key structural feature of the Moroccan fiscal system: its capacity to maintain long-term coherence despite short-term macroeconomic fluctuations. The magnitude and statistical significance of the error correction term indicate a strong adjustment mechanism, suggesting that tax pressure rapidly converges toward its equilibrium level. This finding provides empirical support for dynamic adjustment mechanisms predicted by intertemporal fiscal theories, while highlighting a relatively high speed of adjustment compared to typical developing country contexts.

Second, the prominent role of the budget balance confirms that fiscal policy in Morocco is strongly conditioned by budgetary constraints. The positive relationship between fiscal imbalances and tax pressure supports the intertemporal government budget constraint hypothesis (Barro, 1979). However, beyond this theoretical validation, the results indicate that

taxation operates primarily as a reactive adjustment instrument, mobilized ex post to restore fiscal equilibrium rather than as part of a forward-looking fiscal strategy.

This interpretation aligns with the trajectory of Moroccan fiscal policy, particularly following the 2012–2013 macroeconomic imbalances, which triggered a phase of fiscal consolidation. Successive Finance Laws relied on revenue-enhancing measures, including VAT adjustments, rationalization of tax expenditures, and gradual broadening of the tax base.

Third, the influence of inflation, although moderate, provides additional insights into the functioning of the Moroccan tax system. While the Olivera–Tanzi effect predicts a negative relationship between inflation and real tax revenues, the positive coefficient observed here suggests that nominal effects dominate. This result nuances the traditional Olivera–Tanzi mechanism by indicating that improvements in tax administration and collection efficiency can offset inflation-related distortions.

Fourth, the negative but statistically weak effect of unemployment underscores the complexity of the relationship between labor market dynamics and fiscal performance. This finding suggests that conventional labor market indicators may only partially capture effective economic activity in contexts characterized by a large informal sector, thereby limiting their explanatory power.

More broadly, the limited statistical significance of several explanatory variables indicates that tax pressure in Morocco cannot be fully explained by short-term macroeconomic fluctuations. Instead, it reflects deeper structural characteristics, including a relatively narrow tax base, the predominance of indirect taxation, and the concentration of the tax burden on a limited segment of taxpayers. This structural configuration is consistent with stylized facts observed in developing economies, where fiscal capacity is constrained by informality and administrative limitations.

From a comparative perspective, these findings align with the literature on developing and emerging economies (Tanzi and Zee, 2000; Gupta, 2007), which emphasizes the central role of institutional and structural factors in shaping tax performance. The Moroccan case illustrates a typical pattern in which reliance on consumption-based taxation compensates for the limited effectiveness of direct taxes. However, this reliance may also exacerbate distributional inequalities and limit the progressivity of the tax system.

At the same time, the results highlight an important limitation of purely macroeconomic approaches. While the ARDL-ECM framework captures dynamic adjustment mechanisms, it does not explicitly account for institutional quality, governance, or tax compliance behavior. This limitation underscores the need to integrate institutional dimensions into future empirical models, particularly in the context of ongoing reforms related to digitalization, tax transparency, and international tax cooperation.

This point is further reinforced by the adoption of Framework Law No. 69-19, which establishes a long-term vision centered on equity, neutrality, and efficiency. Such institutional transformations contribute to shaping fiscal dynamics beyond what can be captured by macroeconomic variables alone, thereby highlighting the multidimensional nature of tax pressure.

From a policy perspective, the implications can be structured around three main priorities. First, broadening the tax base—particularly through the integration of the informal sector—appears essential to enhance fiscal capacity. Second, strengthening direct taxation would improve equity and reduce excessive reliance on indirect taxes. Third, improving compliance through digitalization and administrative reforms would increase efficiency and revenue mobilization. These priorities differ in terms of feasibility and time horizon: while administrative improvements can yield short-term gains, structural reforms aimed at broadening the tax base require a longer-term institutional commitment.

Overall, the findings suggest that tax pressure in Morocco should be understood not as a purely exogenous policy instrument, but as a dynamic and institutionally embedded outcome resulting from the interaction between macroeconomic conditions, fiscal constraints, and structural characteristics of the tax system. This contributes to the broader literature by emphasizing the need to move beyond static and purely macroeconomic approaches toward a more integrated and dynamic understanding of fiscal systems in emerging economies.

6. Conclusion

This paper provides an empirical analysis of the dynamic determinants of tax pressure in Morocco over the period 2000–2024 using an ARDL-ECM framework. By simultaneously capturing long-run equilibrium relationships and short-run adjustment dynamics, the study offers a comprehensive perspective on the behavior of tax pressure in an emerging economy context.

The empirical findings confirm the existence of a stable long-run relationship between tax pressure and its macroeconomic determinants, as evidenced by the negative and highly significant error correction term. The estimated speed of adjustment suggests that deviations from equilibrium are rapidly corrected, pointing to a relatively strong fiscal adjustment capacity. Beyond its econometric significance, this result indicates that tax pressure operates as an endogenous adjustment mechanism, responding systematically to macroeconomic imbalances rather than functioning solely as a discretionary policy instrument.

At the macroeconomic level, the results highlight the central role of fiscal constraints in shaping tax dynamics. The positive relationship between the budget balance and tax pressure supports the intertemporal government budget constraint hypothesis, suggesting that taxation is partly mobilized to restore fiscal sustainability. Inflation exerts a positive but moderate effect, consistent with the Olivera–Tanzi mechanism, while unemployment negatively affects tax pressure through its impact on the tax base. However, the limited statistical significance of several variables indicates that short-term macroeconomic fluctuations alone cannot fully explain the evolution of tax pressure.

More importantly, the findings provide a differentiated validation of the theoretical frameworks mobilized in the literature. The intertemporal budget constraint is clearly supported, as fiscal imbalances systematically trigger tax adjustments. The Olivera–Tanzi effect appears to be mitigated in the Moroccan context, with nominal effects dominating due to improvements in tax administration. By contrast, the weak effect of public consumption provides only partial support for Wagner’s Law, suggesting that expenditure dynamics do not automatically translate into higher tax pressure. These results highlight the context-dependent nature of fiscal theories in emerging economies.

More fundamentally, the analysis underscores the importance of structural features of the Moroccan tax system. The persistence of a narrow tax base, the predominance of indirect taxation, and the concentration of the tax burden on a limited segment of taxpayers—particularly salaried individuals and formal firms—highlight the weight of institutional and structural constraints in shaping fiscal outcomes.

From a policy perspective, the findings call for a reorientation of fiscal strategy toward a more balanced, efficient, and equitable tax system. While the responsiveness of tax pressure to short-term imbalances reflects a certain degree of flexibility, it also reveals a reliance on reactive fiscal adjustments.

Policy recommendations can be structured according to their priority and feasibility. In the short term, improving tax compliance and administrative efficiency—through digitalization, strengthened audit mechanisms, and reduced collection inefficiencies—offers immediate gains. In the medium term, efforts should focus on broadening the tax base, particularly through the progressive integration of the informal sector and the rationalization of tax expenditures. In the

long term, a structural rebalancing of the tax system is required, involving the strengthening of direct taxation and a reduction in excessive reliance on indirect taxes.

Beyond its empirical contribution, this study contributes to fiscal theory by showing that tax pressure should be conceptualized as a dynamic and institutionally embedded outcome, rather than a purely exogenous policy instrument. By integrating adjustment dynamics and structural constraints, it extends standard models of taxation to better reflect the realities of emerging economies.

Nevertheless, some limitations should be acknowledged. The analysis relies primarily on macroeconomic variables and does not explicitly incorporate institutional quality, governance, or micro-level behavioral factors, which are likely to play a critical role in shaping tax outcomes. In addition, the use of annual data implies a relatively limited sample size, which may affect the robustness of certain estimations.

Future research can build on this framework through several operational extensions. First, the use of higher-frequency data would allow for a more refined analysis of short-term dynamics. Second, cross-country or regional comparisons could position Morocco within a broader comparative perspective. Third, methodological extensions such as nonlinear ARDL (NARDL) models could capture potential asymmetries in fiscal adjustment. Finally, integrating institutional indicators—such as governance measures or compliance proxies—would provide a more comprehensive understanding of fiscal dynamics.

Overall, the findings suggest that understanding tax pressure in emerging economies requires moving beyond a purely static view of taxation toward a dynamic and institutionally grounded perspective. In the Moroccan context, achieving a more efficient, equitable, and sustainable tax system will depend not only on macroeconomic adjustments, but also on sustained structural and institutional reforms.

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