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AN EMPIRICAL INVESTIGATION OF TAXATION AND EXTERNAL SHOCKS IN DEVELOPING COUNTRIES

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ABSTRACT

This study investigates the effects of external shocks on tax revenue performance in developing countries, with a particular focus on the roles of export dynamics, resource endowments, and political regime types. The empirical analysis utilizes data from the World Development Indicators and the Government Revenue Dataset.

Findings indicate that, in developing countries, natural disasters exert limited influence on tax collections. In contrast, exchange rate volatility and terms of trade shocks have pronounced effects. Trade-related shocks are generally associated with positive tax revenue outcomes across various country classifications, suggesting potential economic gains. Conversely, exchange rate shocks have a negative impact on tax revenues in both resource-rich and resource-poor countries. Furthermore, non-democratic regimes appear more vulnerable to external shocks compared to their democratic counterparts.

The study highlights the significance of economic structure and institutional shock-coping mechanisms in influencing revenue performance. It also highlights the critical role of political governance in determining a country's economic resilience and capacity to respond effectively to external economic disruptions.

1. INTRODUCTION

Taxes are crucial for development and strengthening state-society relations in developing countries. However, these governments often struggle to generate enough tax revenue to support growth. Their tax collection capacity is vulnerable to external shocks, which can severely disrupt revenue. International factors, such as conflicts and shocks, exacerbate this vulnerability, posing a threat to governance and political stability. Such instability can deter investors and weaken revenue systems. Therefore, boosting

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domestic revenue in developing countries is vital for development, though these nations often face difficulties sustaining it due to their susceptibility to shocks (Morrissey et al., 2016).

Developing countries often depend heavily on foreign exchange from commodity exports, making their tax revenues vulnerable to volatile price fluctuations. This narrow tax base, reliant on a few revenue sources such as oil, increases exposure to external shocks and global economic changes, challenging their ability to sustain and grow revenues. Additionally, the expansion of the informal economy and illicit trade undermines government budgets and the provision of public services, impacting sustainable development (Ehrhart & Guerinéau, 2013). These shocks affect overall tax collection, revenue stability, and fiscal flexibility, which are essential for economic recovery (Morrissey et al., 2016). While natural resource wealth has been shown to stabilize political regimes, especially autocracies, the effect of regime type on revenue vulnerability to external shocks is less clear (von Haldenwang & Ivanyna, 2018).

Previous studies suggest that democratization and accountability are often constrained in countries heavily reliant on non-renewable natural resource revenues, with a relatively weak national tax base. Econometric analyses across diverse countries provide further support for this argument. Additionally, Prichard et al. (2018) found that natural resource revenues tend to be lower in democratic regimes. Their study of the political resource curse in developing countries raises a critical issue, warranting further investigation into the complex interactions between taxation, dependency, and political governance.

Given the significance of these factors, understanding the dynamics of tax revenue performance, external shocks, and the political resource curse in emerging and developing countries is crucial. This study extends the work of Morrissey et al. (2016) by employing the expanded International Centre for Tax and Development (ICTD) database to examine the vulnerability of tax revenues to economic shocks in 80 developing countries, with a focus on exports, natural resources, and political systems.

The findings indicate that exchange rate fluctuations and terms-of-trade shocks exert a significant impact on tax revenues in developing countries, whereas natural disasters have a negligible effect. Trade shocks typically lead to an increase in tax revenues, whereas non-democratic countries are more susceptible to such shocks. This study contributes to the literature on taxation, vulnerability, and political influence in emerging and developing countries, highlighting their interdependence and broader economic implications. Furthermore, it provides valuable insights into how economic fluctuations and political regimes shape tax systems in these countries.

The remainder of the paper is organized as follows: Section 2 reviews the existing theoretical and empirical literature; Section 3 outlines the data and empirical methodology; Section 4 discusses the results and findings; and Section 5 concludes.

2. LITERATURE REVIEW

This section reviews both theoretical and empirical literature concerning tax efforts, revenue performance, vulnerability to external shocks, and the relationship between taxation and governance in both developing and developed countries.

2.1 Theoretical literature

Developing countries face significant challenges in raising tax revenue and achieving sustainable development due to various economic constraints. The political economy approach, as proposed by Wilford and Wilford (1978), provides a relevant framework for analyzing tax revenue performance and the effects of external factors on economic growth in developing countries. This approach emphasizes the role of political institutions in shaping policies that influence revenue generation and development.

Tax revenue performance depends on institutional quality, tax governance, and the level of corruption (Morrissey et al., 2016). Strengthening institutions can enhance tax compliance, reduce corruption, and improve administrative capacity. Political regimes also impact tax revenues (Arif & Rawat, 2018), with Jochimsen and Lehmann (2017) noting that revenue forecasts may be biased during elections, especially under left-wing governments, which are influenced by institutional factors such as parliamentary thresholds. Moreover, Arvin et al. (2021) find that taxpayer compliance is generally higher in democracies due to greater transparency and accountability.

The economic structure framework is essential for studying taxation, as it examines a country's economic composition and vulnerability to external shocks (Morrissey et al., 2016). These shocks' effects on tax revenues and growth in developing countries highlight the need for economic diversification (Wilford & Wilford, 1978). Many developing countries heavily depend on a few key sectors, such as agriculture or extractives, making their tax revenues vulnerable to fluctuations in commodity prices, natural disasters, and global economic shifts. With limited tax bases, diversification is crucial for mitigating the negative impacts on growth and development. Effective public institutions are also vital, requiring strengthened government capacity and institutional quality to achieve sustainable growth and improved tax performance.

Alongside frameworks of political economy and economic structure, the capacity-building approach offers further insight into tax revenue performance in developing countries. Enhancing taxation and growth requires capacity development and institutional reform (Arif & Rawat, 2018), with a focus on improving tax compliance and anti-corruption efforts. Greater institutional capacity leads to higher revenue and GDP growth. Effective communication between governments and taxpayers, along with strong anti-corruption measures in tax administration, is key to compliance (Wilford & Wilford, 1978). Khan, Andreoni, and Roy (2019) emphasize that stronger governance enables countries to better withstand shocks and maintain stable tax revenues. Good governance promotes transparency, accountability, and efficient resource utilization, thereby reducing the shock effects and supporting sustainable growth.

In summary, the frameworks of economic structure, political economy, and capacity building offer a comprehensive understanding of factors affecting tax revenue performance, external shocks, and growth in developing countries. Economic structure emphasizes the need for diversification to mitigate shocks and sustain development (Usman & Landry, 2021), while political economy highlights the vital role of political factors and institutions in tax mobilization and economic growth (Wilford & Wilford, 1978).

2.2 Empirical literature review

The literature on tax revenue performance in developing countries primarily examines the determinants of tax revenue and the effects of external shocks on economic growth (Morrissey et al., 2016). Gupta (2007) highlights key structural factors that affect revenue, including GDP, agricultural composition, and trade openness, advocating for increased international aid, reduced corruption, and reforms in tax rates and credits to improve revenue mobilization. Von Haldenwang and Ivanyna (2010) analyzed tax performance across 177 countries, categorizing 36 as high performers, 41 as low performers, and 100 as average performers. They emphasize the importance of regional patterns and governance contexts in public finance reform, recommending development strategies tailored to each country's specific circumstances.

Le et al. (2012) conducted a comparative study of 110 developing and developed countries, analyzing non-oil tax revenue from 1994 to 2009 to assess taxable capacity and tax effort. Their findings highlight that macroeconomic factors, such as corruption levels and bureaucratic quality, have a significant influence on tax and fiscal revenue, which can sometimes impact per capita GDP. They also found that declines in population growth reduce the effect on tax collection performance. The study concludes that taxable capacity and tax effort vary across countries, income groups, and regions.

Focusing on Sub-Saharan Africa, Ahlerup, Baskaran, and Bigsten (2015) examined the impact of Value-Added Taxes (VATs) and autonomous revenue agencies (ARAs) on tax revenues from 1980 to 2010 across 47 countries. They found that VATs do not significantly affect total tax revenues in the short or long term. However, the creation of ARAs increased tax revenues, although these gains were not sustained over time. They argue that while tax innovations contribute, they are insufficient to overcome the broader revenue challenges in Sub-Saharan Africa.

Several studies have examined how external shocks affect economic structure and revenue stability in developed and developing countries. Raddatz (2007) used a panel Vector Autoregressive (VAR) method to study commodity price fluctuations, natural disasters, and global economic conditions on LICs. He noted that some country traits amplify the shock effects but acknowledged issues such as endogeneity and limited sample variation. He concluded that internal factors mainly drive economic instability, with external shocks having a marginal impact on GDP volatility.

Ebeke and Ehrhart (2011) studied tax revenue volatility in 37 Sub-Saharan African countries, finding that it pressures public investment and government consumption. They recommend increasing reliance on domestic and indirect taxes while avoiding public investment instability to enhance economic stability. Cashin, McDermott, and Pattillo (2004) analyzed terms of trade shocks in 42 Sub-Saharan African countries (1960–1996), finding shocks last an average of six years, with some countries facing short-lived shocks and others experiencing long-lasting ones.

Profeta, Puglisi, and Scabrosetti (2010) analyzed political variables, tax revenue, and public spending in developing countries using data from 1990 to 2005. They found no significant link between democratic institutions or civil liberties and tax revenue or its structure, challenging assumptions about how political institutions affect economic growth and policy. Garcia and von Haldenwang (2016) observed a U-shaped

relationship between political regimes and tax ratios, where both full autocracies and full democracies tend to collect higher tax revenues than intermediate regimes.

Several studies have examined the vulnerability of tax revenue to external shocks and its interaction with political regimes. Morrissey et al. (2016) showed that developing countries' economic structures increase sensitivity to shocks, with exchange rate pressures, terms of trade shocks, and natural disasters negatively affecting tax revenues in developing countries. Fuel exports significantly contribute to revenues, while agricultural exports have minimal impact; manufacturing and mineral exports show mixed effects. The study also suggests democracies are more resilient to shocks than non-democracies, though causality remains unclear.

Despite extensive studies on taxes, shocks, natural resources, and revenues, these areas are often studied separately. Only a few, such as Morrissey et al. (2016) and von Haldenwang & Ivanyna (2018), analyze revenue performance, shock resilience, and political regimes together. This study seeks to fill this gap by providing robust evidence on the links between taxation, external shocks, and political regimes.

3. DATA AND METHODOLOGY

This section outlines the data and empirical strategies used to examine the vulnerability of tax revenues to economic shocks in 80 developing countries, with a focus on exports, natural resources, and political regimes.

3.1 Data and data sources

According to the Government Revenue Dataset (GRD), total tax revenue is expressed as a percentage of total GDP. The GRD includes data on government tax and non-tax revenues, social contributions, grants, and natural resource extraction as a share of GDP, denominated in local currency. This dataset, compiled by ICTD/UNU-WIDER, complements data from other sources such as the OECD's Revenue Statistics and the IMF's Government Finance Statistics, as well as information from IMF Article IV country reports. The GRD aims to address the limitations of publicly available data by providing researchers with transparent and comprehensive datasets (McNabb et al., 2018). The study encompasses a total of 80 countries classified as low-income and lower-middle-income by the World Bank, yielding 2,655 observations spanning the period from 1980 to 2020, contingent upon data availability (see Table A2 in the appendices for the list of sample countries).

Data on export composition is sourced from the World Bank Development Indicators (WDI). This dataset includes information on fuel exports, agricultural exports, agricultural value added, manufactured exports, mineral (non-fuel) exports, and imports, each expressed as a percentage of GDP. Analyzing each export category separately reveals how various sectors of the economy may respond differently to external factors, including their sensitivity to global changes and tax revenue implications. GDP per capita is used as a proxy for the level of development, as well as for the effectiveness of tax administration and collection (Morrissey et al., 2016).

Vulnerability is assessed using three exogenous shocks: the terms of trade, exchange rate pressure, and the intensity of natural disasters, similar to the methodology employed by Morrissey et al. (2016). The first shock is the exchange rate pressure index (ER_p), which serves as a proxy for shocks to export demand and foreign capital inflows. This index is commonly used in international finance literature (Aizenman & Hutchison, 2012; Kaminsky, Lizondo, & Reinhart, 1998; Morrissey et al., 2016). The underlying logic of the exchange rate pressure index is that, in response to an adverse balance of payments shock, a country may adopt various strategies, such as devaluing its currency or utilizing international reserves to stabilize the exchange rate (Morrissey et al., 2016). Data for the exchange rate pressure index were obtained from the World Development Indicators, specifically the total reserves and official exchange rate series.

The second shock examined is the terms of trade (ToT) index, which is derived from the Net Barter Terms of Trade (NBTT) available through the WDI. The third shock considered is the severity of natural disasters, measured in terms of casualties and damage. The study compares the number of people affected by each type of disaster relative to the total population. A ratio exceeding 1% indicates a disaster of significant severity. The intensity of natural disasters is measured following the methodologies outlined by Fomby, Ikeda, and Loayza (2009) and Morrissey et al. (2016). Data concerning natural disasters are obtained from the EM-DAT database. Supplementary details of this variable, along with descriptions of the variables employed in the study, are provided in Table A1 of the appendices.

3.2 Methodology

In line with Morrissey et al. (2016), this study employs an econometric approach to compare various estimation methods for assessing the relationship between factors influencing revenue performance and the total revenue as a percentage of GDP in developing countries. The primary empirical specification is as follows:

$$rev = f(\text{agri_x}, \text{min_x}, \text{fuel_x}, \text{man_x}, M, Y) + \varepsilon, \quad (1)$$

where total revenue (*rev*), agricultural exports (*agri_x*), mineral exports (*min_x*), fuel exports (*fuel_x*), manufactured exports (*man_x*), and imports (*M*) are expressed as a percentage of GDP, and ε represents the error term. To assess the impact of exogenous shocks on tax revenues, the study utilizes the following linear regression model, adapted from Morrissey et al. (2016):

$$rev_{i,t} = \alpha + \beta w_{i,t} + \Gamma X_{i,t} + \varepsilon_{i,t}. \quad (2)$$

In this equation, *i* refers to the country index, and *t* represents the year index. The dependent variable, *rev*, denotes total revenue as a percentage of GDP. The shock variable *w* encompasses terms of trade (ToT), exchange rate pressure (ER_p), and natural disaster intensity (NC). The vector *X* includes control variables as specified in equation (1), and ε represents the random error term.

The econometric estimator adopted in this study is primarily the Fixed Effects (FE) model. This methodology, inspired by Deschênes and Greenstone (2007, 2011) in their studies on climate shocks, addresses some of the issues associated with OLS estimation when examining the relationship between historical averages of revenues and external shocks (Morrissey et al., 2016). The FE panel estimation technique facilitates the analysis of random shocks by examining the correlation between fluctuations in external variables from their mean and changes in revenue (Morrissey et al., 2016). By applying fixed effects to demean the data and then performing OLS, the model is suitable for analyzing revenue volatility.

For the purpose of comparing tax revenues and vulnerability, the sample countries are categorized as resource-rich or non-resource-rich, following the classification framework by Eyraud et al. (2023), which is based on an IMF assessment of potential natural resources. Additionally, countries are classified as democracies or non-democracies according to the Polity IV index (Marshall, Gurr, & Jaggers, 2010). This classification is used to analyze the influence of political contexts on revenue performance.

4. RESULTS AND INTERPRETATIONS

Table 1 presents estimates from a range of econometric models examining the determinants of total revenue as a share of GDP in developing countries. The reported specifications include Fixed Effects (FE), Fixed Effects with Instrumental Variables (FE-IV), as well as System Generalized Method of Moments (GMM) estimators, both one-step and two-step. The statistical summary of the data used for the estimations is shown in Table A3 in the appendices.

The dependent variable across all regressions is total revenue excluding grants, expressed as a percentage of GDP. This variable serves as the primary indicator of fiscal performance in developing countries. The set of explanatory variables includes the shares of agricultural, mining, manufacturing, and fuel exports in GDP, which are intended to capture the influence of export composition on revenue outcomes. The analysis is confined to low-income countries and lower-middle-income countries, treated as a relatively homogenous group, to explore the relationship between export structure and fiscal capacity.

The coefficients on agricultural exports are consistently small and statistically insignificant across all model specifications (ranging from 0.004 to 0.005), suggesting a limited impact on total revenue. In line with the findings of Morrissey et al. (2016), the coefficients for fuel exports are uniformly positive and statistically significant (ranging from 0.053 to 0.085), indicating a robust positive association between fuel export intensity and total revenue performance. In contrast, manufacturing exports exhibit negative coefficients (ranging from -0.032 to -0.046), suggesting that a higher share of manufacturing exports in GDP may be associated with a reduction in total revenue; however, the statistical significance of these estimates varies across models. Mineral exports are negatively correlated with total revenue, with coefficients ranging from -0.015 to -0.061, indicating that a greater reliance on mineral exports may have an adverse effect on revenue generation, albeit with varying levels of significance.

Imports as a share of GDP also demonstrate a strong and statistically significant positive association

Table 1 Determinants of revenue performance in developing countries
(Dependent variable: total revenue, % of GDP)

Variables	(1) FE	(2) FE-IV	(3) Sys. GMM (1-step)	(4) Sys. GMM (2-step)
Agric Exports	0.004 (0.026)	0.004 (0.026)	0.005 (0.017)	0.005 (0.012)
Fuel Exports	0.085*** (0.020)	0.085*** (0.020)	0.055* (0.032)	0.053* (0.030)
Manufacturing Exp.	-0.046** (0.019)	-0.046** (0.019)	-0.0355* (0.0210)	-0.032 (0.021)
Mineral Exports	-0.061* (0.035)	-0.061* (0.035)	-0.015 (0.019)	-0.021 (0.014)
Imports	0.117*** (0.011)	0.117*** (0.011)	0.068*** (0.019)	0.064*** (0.016)
Log (GDPpercap.)	0.027*** (0.002)	0.027*** (0.002)	0.009*** (0.003)	0.009*** (0.003)
L.totrev			0.746*** (0.081)	0.764*** (0.072)
Constant	-0.037*** (0.013)	-0.037*** (0.0127)	-0.035*** (0.013)	-0.039*** (0.013)
Adjusted R ²	0.132	0.132		
AR (1)			0.002	0.006
AR (2)			0.519	0.547
Sargan OID Test			0.000	0.000
Hansen OID Test			0.401	0.401
No. of Instruments			47	47
Number of countries	79	79	79	79
N	2,655	2,655	2,567	2,567

Notes: All export variables ($_x$), and imports (M), are measured as a ratio of GDP; GDP per capita (Y) is in logs; N refers to total observations. Robust standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1. FE-Fixed effects; FE-IV-Fixed effects with Instrumental Variables; General Method of Moments (GMM), OID, over-identifying.

with total revenue across all specifications. The coefficients, which range from 0.064 to 0.117, suggest that higher import levels are associated with increased fiscal revenue, potentially reflecting greater economic activity and consumption. The magnitude of this relationship appears stronger than that reported in Morrissey et al. (2016).

Finally, the natural logarithm of GDP per capita enters positively and significantly (with coefficients ranging from 0.009 to 0.027), suggesting that higher income levels are associated with stronger revenue performance. The lagged dependent variable (L. totrev) is included as an instrument in the FE-IV and system GMM models, and its coefficient is both positive and highly significant (ranging from 0.746 to 0.764), indicating a strong degree of persistence in revenue outcomes over time.

Table 2 reports the results of the analysis assessing the impact of exogenous shocks on revenue performance in developing countries. Country classifications follow the World Bank Development Indicators (WDI), encompassing both low-income and lower-middle-income economies (see Table A2 in appendices).

In Column 1, the results indicate that exchange rate shocks (ER_p) have a statistically significant negative effect on total revenue. Specifically, the coefficient for exchange rate pressure is -0.028 (robust

Table 2 Fixed effects estimation: effects of shocks on revenue performance in developing countries (Dependent variable: total revenue, % of GDP)

	Exchange Rate Shock (ER_p)	Terms of Trade Shocks (Tot)	Natural Disasters Shocks (NC)
	(1)	(2)	(3)
Shocks	-0.028*** (0.010)	0.023*** (0.004)	-0.001 (0.002)
Agricultural Exports	0.034 (0.026)	0.073*** (0.027)	0.066 (0.058)
Fuel Exports	0.109*** (0.018)	0.071*** (0.019)	0.125*** (0.025)
Manufacturing Exports	-0.034** (0.016)	-0.033* (0.019)	-0.067* (0.040)
Mineral Exports	-0.029 (0.031)	-0.053 (0.034)	-0.100* (0.052)
Imports	0.083*** (0.010)	0.087*** (0.011)	0.100*** (0.019)
Log (GDPpercap)	0.025*** (0.002)	0.023*** (0.002)	0.025*** (0.003)
Constant	-0.016 (0.012)	-0.116*** (0.021)	-0.031 (0.022)
N (Observations)	2,167	2,301	984
Adjusted R ²	0.157	0.131	0.132
Number of countries	69	77	74

Notes: The number of observations depends on data availability for shocks and total revenue. Robust standard errors in parentheses: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$, Terms of trade (tot) is in logs.

standard error = 0.010, $p < 0.01$), suggesting that exchange rate volatility significantly undermines revenue collection capacity in developing countries. While the coefficients for agricultural and mineral exports are positive and negative, respectively, neither is statistically significant. Manufacturing exports exhibit a negative and statistically significant coefficient, indicating that revenue derived from this sector is particularly vulnerable to external shocks, likely due to fluctuations in global demand and price instability. Fuel exports, on the other hand, are positively associated with revenue performance and statistically significant, reflecting their role in generating foreign exchange earnings and stabilizing local currency during periods of exchange rate volatility. Imports as a share of GDP also have a significant positive impact on revenue, reinforcing the importance of trade taxes and import duties as vital sources of government income in these economies. The results highlight the potential for sound tax policy to mitigate the adverse effects of exchange rate shocks. However, the findings also highlight the risks associated with overreliance on volatile export sectors, particularly in the context of globalization, which can exacerbate environmental degradation and economic vulnerability.

In Column 2, the analysis focuses on the impact of terms-of-trade (TOT) shocks, measured in logarithmic form. Contrary to expectations, the terms-of-trade shock is positively and significantly associated with total revenue (coefficient = 0.023, robust standard error = 0.004, $p < 0.01$), suggesting that favorable changes in export prices relative to import prices can enhance fiscal performance. This finding is broadly consistent with existing literature. Agricultural and fuel exports, as well as imports as a percentage of GDP, are all positively and significantly associated with total revenue under TOT shocks. Manufacturing

exports remain negatively and significantly correlated with revenue, while mineral exports continue to exhibit a negative but statistically insignificant effect. Key contributors to improved terms of trade include rising import costs, declining export prices, and favorable exchange rate movements, all of which can enhance fiscal outcomes. However, the capacity of developing countries to sustain tax revenues in the face of trade shocks remains limited, underscoring the need for robust economic and fiscal policies to mitigate external volatility.

Column 3 examines the effects of natural disaster shocks (NC), which appear to have a negligible influence on total revenue. The estimated coefficient is close to zero (-0.001 , with a robust standard error of 0.002) and statistically insignificant, consistent with the findings of Morrissey et al. (2016). Nevertheless, fuel exports and imports maintain a positive and significant association with revenue, underscoring their resilience as revenue sources even during adverse events. Mineral exports are negatively associated with revenue under disaster shocks and are weakly significant at the 10% level. Additionally, prior studies suggest that natural disasters can lead to substantial declines in manufacturing exports from developing countries, likely due to disruptions in infrastructure, transportation, and energy supply chains. The adjusted R-squared values for the models corresponding to exchange rate shocks (ER_p), terms-of-trade shocks (TOT), and natural disaster shocks (NC) are 0.157, 0.131, and 0.132, respectively, indicating that these models explain approximately 13.1% to 15.7% of the variation in total revenue as a share of GDP.

In summary, the empirical results demonstrate that external shocks, particularly exchange rate pressure and fluctuations in terms of trade, significantly influence fiscal performance in developing countries. The nature and magnitude of these effects vary, emphasizing the importance of tailored fiscal and trade policies. Among export categories, fuel exports exhibit the most consistent and positive effect on revenue, while agricultural exports have minimal impact. Conversely, manufacturing and mineral exports tend to be negatively associated with revenue performance, although statistical significance varies. These findings underscore the importance of considering sectoral export dynamics and external vulnerabilities when formulating tax policy to enhance revenue mobilization, fiscal balance, and economic resilience in the face of global shocks.

Further, Table 3 presents the effects of external shocks on tax revenue in developing countries, disaggregated by resource endowment. Following the classification proposed in the IMF framework by Eyraud et al. (2023), the sample is divided into two groups: resource-rich and non-resource-rich countries, to assess the heterogeneous impacts of shocks across these groups (see Table A2 in the appendices).

Columns 1 and 2 display results for each group, indicating that exchange rate shocks exert a significant negative impact on total revenue in resource-rich countries. Specifically, the coefficient is -0.036 (robust standard error = 0.019 , $p < 0.01$), highlighting the fiscal vulnerability of these economies to currency instability. In contrast, for non-resource-rich countries, the estimated effect is smaller and statistically insignificant (-0.021 , robust standard error = 0.013), suggesting a more muted revenue response to exchange rate fluctuations.

Fuel exports continue to show large and statistically significant positive coefficients, reinforcing

Table 3 Fixed effects estimation: effects of shocks on revenues of developing countries, resource-rich (RR) vs. non-resource-rich countries (NRR) (Dependent variable: total revenue, % of GDP)

Shocks:	Exchange Rate Shock (ER_p)	Exchange Rate Shock (ER_p)	Terms of Trade Shock (Tot)	Terms of Trade Shock (Tot)	Natural Disasters Shock (ND)	Natural Disasters Shock (ND)
	(1)	(2)	(3)	(4)	(5)	(6)
	RR	NRR	RR	NRR	RR	NRR
Shock Level	-0.036* (0.019)	-0.021 (0.013)	0.030*** (0.006)	0.021*** (0.006)	-0.001 (0.003)	-0.001 (0.002)
Agric Exports	-0.010 (0.067)	0.016 (0.027)	-0.005 (0.050)	0.074** (0.032)	-0.060 (0.138)	0.076 (0.063)
Fuel Exports	0.124** (0.057)	0.105 (0.071)	0.093*** (0.020)	0.196** (0.092)	0.142*** (0.027)	0.149 (0.136)
Manufacturing Exp.	-0.306*** (0.066)	-0.010 (0.017)	-0.301*** (0.052)	-0.009 (0.021)	-0.209* (0.117)	-0.053 (0.044)
Mineral Exports	-0.021 (0.046)	0.056 (0.063)	-0.008 (0.040)	-0.046 (0.071)	-0.068 (0.070)	-0.095 (0.084)
Imports	0.163*** (0.046)	0.063*** (0.011)	0.151*** (0.021)	0.078*** (0.013)	0.168*** (0.034)	0.072*** (0.023)
Agric Value-Added	-0.141*** (0.031)	-0.080*** (0.015)	-0.124*** (0.025)	-0.040** (0.020)	-0.154*** (0.048)	-0.128** (0.060)
Log (GDP per capita)	0.019* (0.011)	0.020*** (0.002)	0.008** (0.004)	0.024*** (0.002)	0.007 (0.006)	0.026*** (0.005)
Constant	0.039 (0.069)	0.041*** (0.015)	-0.025 (0.031)	-0.103*** (0.035)	0.124*** (0.044)	-0.006 (0.043)
N (Observations)	685	1,482	811	1,490	380	604
R ²	0.260	0.153	0.224	0.119	0.176	0.150
Number of countries	22	47	26	51	24	50

Robust standard errors in parentheses ***p<0.01, **p<0.05, *p<0.1

their importance as a key revenue source, particularly for resource-rich countries. Manufacturing and mineral exports, on the other hand, exhibit weak and negative associations with revenue, although these effects are not consistently significant across both groups. Agricultural exports (as a share of GDP) and agricultural value added are not statistically significant in either group; however, agricultural value added appears to have a negative impact on revenue, particularly within the resource-rich sub-sample, suggesting potential structural inefficiencies in that sector.

Imports as a share of GDP have a consistently significant and positive effect on tax revenue for both country groups, underscoring the importance of trade-related taxes and duties in domestic revenue mobilization. Additionally, the logarithm of GDP per capita is positively associated with total revenue in both resource-rich and non-resource-rich countries, implying that higher levels of income per capita are correlated with stronger fiscal capacity.

Terms-of-trade shocks exhibit a statistically significant positive effect on tax revenues in both resource-rich (RR) and non-resource-rich (NRR) countries, as demonstrated by the coefficients reported in Columns 3 and 4, which are significant at the 1% level. Specifically, resource-rich countries experience a marginal revenue increase with a coefficient of 0.030 (robust standard error = 0.006, $p < 0.01$), indicating that improvements in terms of trade positively influence fiscal performance in these economies. Non-resource-rich countries similarly benefit from favorable terms-of-trade shocks, although to a lesser extent,

as evidenced by a coefficient of 0.021 (robust standard error = 0.006, $p < 0.01$). Both groups thus derive positive fiscal effects from terms-of-trade improvements, albeit with differing magnitudes. Additionally, fuel exports and imports as a share of GDP remain positively and significantly associated with tax revenue across both country groups. Manufacturing exports display a negative coefficient exclusively in resource-rich countries in the context of terms-of-trade shocks. Furthermore, agricultural value-added (Agri-VA) is negatively correlated with total revenues in both RR and NRR countries.

Columns 5 and 6 exhibit the impact of natural disaster shocks, which are found to have negligible and statistically insignificant effects on total revenue in both groups, with coefficients close to zero. Regarding economic variables, fuel exports exert a positive influence on revenues within resource-rich countries, while imports as a percentage of GDP are positively significant across both groups. Manufacturing exports are negatively related to revenue in the context of natural disasters, but only within resource-rich countries. The logarithm of GDP per capita consistently exhibits a positive association with tax revenue in both RR and NRR countries, implying that higher income levels correspond to greater fiscal capacity. Revenue losses attributable to natural disasters appear linked to declines in agricultural value-added and exports. Resource-rich countries continue to face the “resource curse,” wherein their dependence on natural resources and extractive industries weakens the tax base and reduces government revenue stability.

Model fit statistics further illustrate these dynamics; for example, the adjusted R-squared for the exchange rate shock (ER_p) model in resource-rich countries is 0.260, indicating that approximately 26% of the variation in total revenue can be explained by the included shocks and economic variables.

Overall, these findings suggest that resource-rich countries are more vulnerable to external shocks compared to their non-resource-rich counterparts. Systematic differences emerge in the impacts of exchange rate and terms-of-trade shocks on revenue performance between the two groups. Resource-rich countries benefit more from trade reforms but are also more susceptible to exchange rate volatility, likely due to their greater reliance on natural resource exports. Conversely, the adverse effects of economic shocks appear less pronounced in countries without abundant natural resources. These results underscore the crucial importance of implementing resilience-building and economic diversification strategies to mitigate the fiscal risks associated with external shocks.

Table 4 further differentiates countries based on their political regimes, examining how external shocks influence tax revenues in democratic versus non-democratic countries (see Table 5A in the appendices). The classification of democratic countries (D) follows the Polity IV dataset, identifying twenty-six countries in this category (see Appendices Table A2), consistent with the approach of Morrissey et al. (2016). Countries not classified as democratic are grouped as non-democratic (ND).

The findings of this study regarding exchange rate shocks largely corroborate those reported by Morrissey et al. (2016). Specifically, the analysis reveals no statistically significant impact of exchange rate shocks on tax revenue in democratic countries, with a coefficient of -0.157 and a standard error of 0.021. In contrast, non-democratic countries exhibit a statistically significant negative effect (coefficient = -0.034, standard error = 0.015, $p < 0.05$), indicating greater fiscal vulnerability to external shocks in these

Table 4 Effects of shocks on revenues of developing countries, democratic (D) vs. non-democratic countries (ND), fixed effects estimations

Shocks:	Exchange Rate Shock (ER_p)	Exchange Rate Shock (ER_p)	Terms of Trade Shock (Tot)	Terms of Trade Shock (Tot)	Natural Disasters Shock (ND)	Natural Disasters Shock (ND)
	D	ND	D	ND	D	ND
Shock Level	-0.017 (0.021)	-0.034** (0.015)	-0.011 (0.014)	0.030*** (0.011)	0.0002 (0.001)	-0.002 (0.002)
Agric Exports	0.066** (0.027)	-0.030 (0.087)	0.085*** (0.028)	0.058 (0.077)	0.058 (0.077)	0.024 (0.111)
Fuel Exports	0.176 (0.128)	0.112** (0.055)	0.220 (0.142)	0.066 (0.071)	0.297** (0.117)	0.116 (0.080)
Manufacturing Exp.	0.025 (0.049)	-0.046 (0.034)	0.034 (0.033)	-0.065 (0.046)	-0.107 (0.109)	-0.082 (0.053)
Mineral Exports	-0.107* (0.054)	0.0273 (0.046)	-0.112** (0.044)	-0.037 (0.053)	-0.053 (0.089)	-0.086** (0.037)
Imports	0.128** (0.053)	0.056* (0.030)	0.093*** (0.031)	0.083* (0.044)	0.195* (0.102)	0.081 (0.051)
Agric Value_Added	0.003 (0.041)	-0.135*** (0.024)	-0.032 (0.053)	-0.075** (0.034)	0.0519 (0.105)	-0.183** (0.072)
Log (GDP per capita)	0.029*** (0.008)	0.017*** (0.006)	0.026*** (0.008)	0.018*** (0.006)	0.019 (0.014)	0.019** (0.008)
Constant	-0.057 (0.062)	0.071* (0.036)	0.015 (0.097)	-0.090 (0.074)	-0.029 (0.110)	0.059 (0.061)
N (Observations)	724	1,443	826	1,475	360	624
R ²	0.205	0.193	0.284	0.121	0.152	0.176
Number of countries	22	47	25	52	24	50

D denotes Democracies and ND Non-democracies. The number of observations varies according to data availability. Robust standard errors in parentheses *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

regimes. One plausible explanation is that non-democratic governments may lack sufficient budget diversification and rely heavily on revenues from natural resource sectors, which are more exposed to global market volatility.

Regarding terms-of-trade shocks (TOT), the effect on revenue in democratic countries is negative but statistically insignificant (coefficient = -0.011, robust standard error = 0.014). This suggests an ambiguous fiscal response to terms-of-trade fluctuations within democratic regimes. Conversely, non-democratic countries demonstrate a statistically significant positive effect (coefficient = 0.030, robust standard error = 0.011 < 0.01), possibly reflecting their dependence on resource exports or distinct economic structures that enable them to capitalize on favorable trade terms. Notably, both regime types exhibit coefficients near zero for terms-of-trade shocks in other specifications, indicating a limited overall impact.

The study further identifies divergent effects of economic variables on total revenue across political regimes. Manufacturing exports consistently exhibit negative effects on revenue in both democracies and non-democracies. Fuel exports positively influence revenue in non-democratic countries (coefficient = 0.112 < 0.05) but are statistically insignificant in democratic countries (coefficient = 0.176, $p = 0.186$). Agricultural exports have a significant positive effect in democratic countries (coefficient = 0.066, $p < 0.05$), whereas the effect is not significant in non-democratic countries (coefficient = -0.030, $p = 0.472$). Conversely, agricultural value-added has a significant impact on revenue in non-democratic regimes.

The heightened exposure of non-democratic countries to exchange rate shocks may undermine the attractiveness of agricultural exports and deter foreign investment. Across both regime types, the logarithm of GDP per capita is positively correlated with total revenue, indicating that higher income levels are associated with greater fiscal capacity.

Collectively, these results highlight significant differences in how political regimes mitigate the impact of economic shocks on revenue performance in developing countries. There is compelling evidence that exchange rate shocks disproportionately reduce revenues in non-democratic countries compared to those in democratic countries. Conversely, non-democratic countries appear to derive greater fiscal benefits from improvements in terms of trade, potentially due to greater control over economic policies and resource allocation. The study, therefore, concludes that democratic regimes exhibit greater resilience to external shocks relative to non-democratic counterparts.

Overall, the findings of this study support several significant points raised by Morrissey et al. (2016), while also highlighting two key divergences. First, the study finds that terms-of-trade shocks have consistently favorable and statistically significant effects on revenues across various model specifications, contrasting with the findings of Morrissey et al. For example, a terms-of-trade shock equivalent to one standard deviation (0.4), corresponding to an approximate 25% decline in relative prices, is estimated to increase revenue by 0.6 percentage points in both resource-rich and non-resource-rich countries. This positive relationship likely arises from higher export prices enhancing exporter profits, thereby increasing corporate income tax collections. Additionally, appreciation of domestic currency in response to improved trade terms lowers import costs, boosts purchasing power, and stimulates consumption and investment, all of which contribute to stronger revenue performance.

Second, the study reveals distinct effects of fuel exports on tax revenues during economic shocks across democratic and non-democratic regimes (see Table 4). Given that fuel exports constitute a substantial portion of government revenues in many countries, reliance on these resources can diminish the willingness of individuals and corporations to voluntarily comply with tax obligations. Democracies, aiming to secure voter support, tend to impose lower taxes while providing more extensive public services. In contrast, non-democratic governments often allocate greater resources to social and security programs to maintain political stability. These dynamics help explain why democratic regimes demonstrate greater fiscal resilience to shocks, a conclusion consistent with Morrissey et al.'s earlier study.

CONCLUSION

This study investigated the impact of external shocks on tax revenue performance in developing countries, categorizing the analysis by resource endowments and political regimes. Findings indicate that natural disasters have a minimal influence on tax revenue outcomes, whereas exchange rate pressures and terms-of-trade shocks have a significant impact on fiscal performance. Notably, terms-of-trade shocks consistently exhibit positive coefficients across multiple model specifications, a result that diverges from

earlier findings by Morrissey et al. (2016). Furthermore, the effect of fuel exports on tax revenues differs between democratic and non-democratic regimes during periods of external shocks. Resource-rich countries, characterized by heavy dependence on natural resources and extractive industries, remain susceptible to the “resource curse,” with economic shocks exacerbating fiscal vulnerabilities. In contrast, democratic countries demonstrate greater resilience to such external shocks compared to their non-democratic counterparts.

Imports are shown to have a substantial impact on tax revenues, suggesting that reductions in import volumes may lead to corresponding declines in revenue generation for developing countries. Exports constitute a significant component of these revenues, with fuel exports exerting a positive and statistically significant effect. Conversely, the value-added contributions from agricultural and manufacturing exports are negatively associated with tax revenues. Gross Domestic Product (GDP) per capita emerges as a reliable proxy for economic growth, underscoring the importance for developing countries to adopt strategies that mitigate the adverse effects of external shocks on their revenue bases, which is critical for government financing and broader economic development.

The study further emphasizes two focal areas within taxation to elucidate the interplay between national tax systems, natural resource endowments, and political institutions in enhancing fiscal capacity and promoting economic development. It highlights the critical importance of economic structure and resilience-building measures related to revenue sources within diverse developing country contexts. Consequently, it is imperative that policymakers in developing countries recognize the role of political institutions in shaping economic vulnerability and formulating effective responses to external economic shocks. Future research should investigate the influence of non-resource revenues on fiscal capacity and economic progress in developing countries.

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Appendices

Table A1 Descriptions of the variables used in the empirical study

Total Revenue	Total revenue (percent of GDP)	ICTD UNU-WIDER Government Revenue Dataset
GDP per capita (current US\$)	GDP divided by mid-year population.	World Development Indicators 2024 (WDI 2024) Available online: http:// data.worldbank.org/data-catalog/worlddevelopment-indicators
Agricultural exports	Exports of agricultural commodities and food (percent of GDP)	Own construction based on data from WDI 2024
Mineral Exports	Exports of mineral (non-fuel) commodities (percent of GDP)	Own construction based on data from WDI 2024
Fuel Exports	Export of fuels (percent of GDP)	Own construction based on data from WDI 2024
Manufacturing Exports	Exports of manufactured commodities (percent of GDP)	Own construction based on data from WDI 2024
Imports	Merchandise imports (percent of GDP)	Own construction based on data from WDI 2024
Terms of trade	Terms of trade	Net barter terms of trade index (2015 = 100), export/import (WDI 2024)
Intensity of Natural Disaster	The measure of the intensity of natural disasters based on people killed and affected by natural disasters in every year t and every country j . Formula: Intensity $[j, t]$ = people killed $[j, t] + 0.3 \times$ Total affected $[j, t]$ / population $[j, t]$	Own construction based on Fomby/Ikeda/Loayza 2009 12-14; Morrissey et al, 2016. Data from the EM-DAT Database (http://www.emdat.be/)
Exchange rate pressure	Defined in text.	Own calculation. Source: IMF International Financial Statistics
Resource rich	Resource-rich country dummy	IMF Framework, Eyraud, Gbohoui & Mauro (2023)
Democracy	1 = democracy 0 = non democratic	Based on Polity II Dataset. Values above 6 are considered democracies http://www.systemicpeace.org/polity/polity4.htm

Table A2 List of developing countries in the full sample (low-income countries & lower-middle-income countries)

Full sample

Afghanistan, Algeria, Angola, Bangladesh, Benin, Bhutan, Bolivia, Brazil, Burkina Faso, Burundi, Cambodia, Cameroon, Cape Verde, Central African Rep., Chad, Colombia, Comoros, Dem. Rep. Of Congo, Rep. of Congo, Cote d'Ivoire, Djibouti, Egypt, Eritrea, Ethiopia, The Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, Honduras, India, Iran, Jordan, Kenya, Kiribati, Rep. of Korea, Kyrgyz Rep., Lao PDR, Lebanon, Lesotho, Liberia, Madagascar, Malawi, Mali, Mauritania, Micronesia, Mongolia, Morocco, Mozambique, Myanmar, Nepal, Nicaragua, Niger, Nigeria, Pakistan, Papua New Guinea, Philippines, Rwanda, Samoa, Sao Tome & Principe, Senegal, Sierra Leone, Solomon Islands, Somalia, South Sudan, Sri Lanka, Sudan, Swaziland, Syrian Arab Rep., Tajikistan, Tanzania, Timor-Leste, Togo, Tunisia, Uganda, Ukraine, Uzbekistan, Vanuatu, Vietnam, Yemen, Zambia, Zimbabwe.

Countries classified as resource-rich countries

Algeria, Angola, Bolivia, Burkina Faso, Cameroon, Central African Rep., Chad, Congo Rep., Dem.Rep. of Congo, Cote d'Ivoire, Ghana, Guinea, Iran, Liberia, Mali, Mauritania, Mongolia, Mozambique, Niger, Nigeria, Papua New Guinea, Sierra Leone, Sudan, Yemen, Zambia,

Countries classified as democratic countries

Benin, Bolivia, Cape Verde, Comoros, The Gambia, Ghana, Haiti, Honduras, India, Kenya, Lebanon, Lesotho, Madagascar, Mali, Mongolia, Nicaragua, Niger, Nigeria, Pakistan, Philippines, Senegal, Sierra Leone, Solomon Islands, Timor-Leste, Ukraine, Zambia

Table A3 Summary statistics for the variables

Variable	Obs	Mean	S.D.	Min	Max
Total Revenue	2655	0.178	0.111	0.07	1.274
Agric. Exports	2655	0.038	0.057	0	0.498
Fuel Exports	2655	0.023	0.072	0	0.686
Imports	2655	0.316	0.187	0	1.503
Manuf. Exports	2655	0.042	0.088	0	1.274
Mineral Export	2655	0.015	0.042	0	0.492
Log (GDP per cap.)	2655	6.646	0.919	3.435	9.226
Exchange Rate Press.	2167	-0.002	0.100	-0.663	1.078
Natural Disasters	984	1.268	1.414	0	15
Log (Terms of Trade)	2301	4.576	0.341	2.928	6.773