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Determinants of subnational debt sustainability under fiscal centralisation: Evidence from Malaysian states

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ABSTRACT

This study examines subnational debt sustainability in Malaysia under fiscal centralization, using panel data for thirteen states from 2004 to 2023. Although Malaysia is constitutionally federal, fiscal authority is highly centralized, leaving state governments with limited revenue autonomy and strong dependence on federal transfers. Political alignment between state and federal governments is included as a key institutional factor influencing access to transfers and borrowing approvals. A panel autoregressive distributed lag (ARDL) model estimated using the Pooled Mean Group (PMG) approach captures heterogeneous short-run dynamics while imposing a common long-run equilibrium relationship. Robustness checks using the Augmented Mean Group (AMG) estimator indicate that state debt is negatively affected by federal transfers and economic growth in the long run, while short-run debt dynamics respond mainly to economic growth shocks. The contributions of own-source revenue, expenditure pressures, and political alignment are not statistically robust and cannot be conclusively established. Less fiscally capable states, such as Perlis, Kedah, Kelantan, Terengganu, Sabah, and Sarawak, converge more slowly toward long-run equilibrium, reflecting institutional constraints and reliance on federal support. These findings highlight the macroeconomic and institutional implications of fiscal centralization, intergovernmental coordination, and state-specific fiscal capacity, providing policy-relevant insights for enhancing fiscal discipline in Malaysia's quasi-federal system.

Contribution/ Originality: This study advances knowledge on subnational debt by examining how fiscal centralization and institutional factors shape debt sustainability in Malaysian states. It provides novel insights into the macroeconomic and political determinants of state debt dynamics, highlighting heterogeneity in fiscal capacity and convergence patterns under limited revenue autonomy.

1. INTRODUCTION

Public debt is a fundamental instrument for bridging government financing gaps and a key indicator of fiscal soundness and sustainability. When managed prudently, public borrowing can support economic development and productive public investment (Cecchetti, Mohanty, & Zampolli, 2010; Elmendorf & Mankiw, 1999). However, persistent increases in public debt may undermine long-term growth by crowding out private investment, weakening fiscal space, and increasing vulnerability to macroeconomic shocks (Halebić & Moćević, 2020).

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In many emerging and developing economies, excessive debt accumulation has heightened exposure to fiscal and financial crises, often resulting in austerity measures with adverse economic and social consequences (Halebić & Moćević, 2020). While the macroeconomic determinants of public debt have been widely examined, the issue of subnational debt sustainability, particularly under conditions of fiscal centralisation, remains relatively underexplored.

This gap is especially salient in quasi-federal systems, where constitutional decentralisation coexists with strong central control over fiscal resources. A quasi-federal system is a form of government in which states or subnational units have constitutionally guaranteed powers, but the central government retains significant fiscal authority, including control over major revenue sources and the allocation of intergovernmental transfers (Watts & Bahl, 2002).

This gap is especially relevant in quasi-federal systems such as Malaysia. While constitutionally federal (de jure), Malaysia exhibits quasi-federal features in practice due to strong fiscal centralization (Bakar, 2004; Ghani, Grewal, Ahmed, & Nor, 2019; Jalil & Karim, 2009). Both revenue authority and major expenditure functions are concentrated at the federal level, leaving state governments with limited own-source revenue and heavy dependence on federal transfers (Bakar, 2004; Ghani et al., 2019; Noh, 1991).

This dependence is particularly significant for less developed states such as Perlis, Kedah, Kelantan, Terengganu, Sabah, and Sarawak, which face chronic fiscal constraints, while more developed or high-income states do not necessarily avoid debt pressures. As a result, state governments operate within a constrained fiscal environment characterized by weak revenue autonomy, limited fiscal space, and high sensitivity to federal policy decisions (Bakar, 2004).

Malaysia's political landscape also underwent significant changes during the sample period, with potential implications for intergovernmental fiscal relations. The 2018 general election marked a historic shift, as Pakatan Harapan (PH) formed the federal government, ending Barisan Nasional's (BN) uninterrupted rule since independence. This transition altered long-standing federal-state political alignments and introduced new dynamics in fiscal coordination and policy implementation.

Following subsequent political realignments, the 2022 general election resulted in a unity government, further reshaping federal-state relationships. These political transitions provide an important institutional backdrop for analysing whether changes in political alignment are associated with variations in state-level debt dynamics within a highly centralised fiscal framework.

Since the early 1990s, Malaysia's overall fiscal position has weakened, accompanied by rising public debt and increasing pressure for fiscal consolidation (Noh, 1991). At the state level, recurrent revenue shortfalls, persistent fiscal deficits, and growing debt stocks have raised concerns about long-term fiscal sustainability and the effectiveness of intergovernmental fiscal coordination. Although state debt remains small relative to federal debt, its gradual rise reflects structural constraints faced by subnational governments within a highly centralized fiscal system.

Focusing on the post-2004 period following the federal election, aggregate state debt rose from MYR 2,225 million in 2004 to a peak of MYR 3,778 million in 2010 due to borrowing for development projects. Debt then fell to MYR 1,450 million by 2013 after repayments and improved federal transfers, remaining relatively stable until 2018, and spiked dramatically to MYR 12,512 million in 2019 and MYR 12,198 million in 2020 due to short-term borrowing and higher expenditures, including early COVID-19 measures.

Debt subsequently declined to MYR 1,653 million by 2023 as fiscal pressures eased (General Audit Report, various years). Figure 1 illustrates these post-2004 debt dynamics, highlighting growth driven by development borrowing, temporary declines following repayments and improved transfers, short-term spikes due to fiscal pressures, and gradual stabilization after 2020.

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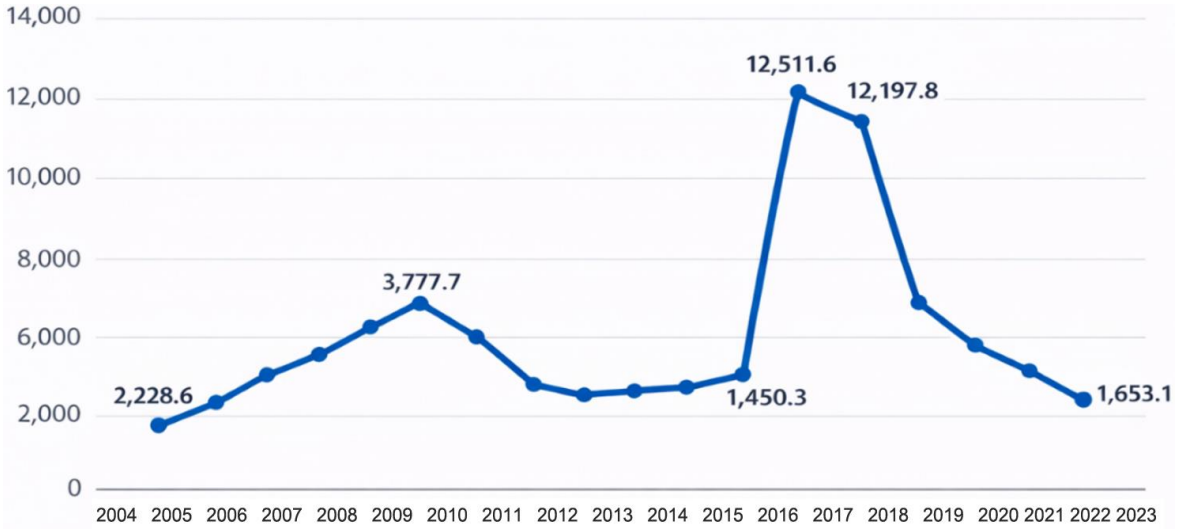

Figure 1. Aggregate Malaysian State Government Debt, 2004-2023 (MYR Million).

Source: State Financial Statement, various issues.

During the COVID-19 pandemic, the aggregate state debt-to-GDP ratio reached a historical peak of 8.97%, reflecting both adverse economic conditions and heightened fiscal pressures. While these figures do not pose an immediate threat to national macroeconomic stability, they mirror persistent fiscal deficits and structural weaknesses at the subnational level.

The accumulation of state-level debt is closely linked to long-standing fiscal imbalances. Since 1990, state governments' expenditures have consistently exceeded their internally generated revenues, resulting in chronic fiscal deficits. These deficits are not driven by extensive autonomous expenditure mandates, but rather by narrow revenue bases, weak revenue elasticity, and strong dependence on intergovernmental transfers (Ghani, Ruza, & Zaharudin, 2023). Cash-flow constraints have complicated debt servicing in several states, with delayed repayments leading to the capitalization of unpaid interest and gradual debt accumulation. To illustrate variations in subnational debt sustainability, Table 1 presents the debt-to-GDP ratios of Malaysian state governments from 2009 to 2023.

Table 1. Malaysian state governments' Debt to GDP ratio 2009–2023.

State	Mean (%)	Min. (%)	Max. (%)	Volatility	Risk Level
Johor	0.53	0.37	2.06	Low	Low
Kedah	2.77	2.03	9.89	High	High
Kelantan	4.29	2.96	7.75	Medium	Medium
Melaka	1.37	0.79	3.53	Low	Low
Negeri Sembilan	2.29	1.37	8.99	Medium	Medium
Pahang	4.27	1.51	7.38	Medium	Medium
Perak	0.76	0.33	2.42	Low	Low
Perlis	5.23	0.86	11.45	High	High
Penang	0.22	0.01	1.4	Very Low	Low
Selangor	0.29	0.02	1.89	Very Low	Low
Terengganu	2.34	0.56	5.07	Medium	Medium
Sabah	3.07	3.77	8.97	High	High
Sarawak	1.39	1.63	3.1	Low	Low

Source: State Financial Statement, various issues.

The data reveal substantial differences across states: Perlis, Kedah, and Sabah consistently exhibit higher and more volatile debt ratios, reflecting greater fiscal pressures and reliance on federal transfers. Kelantan and Terengganu experience moderate debt levels with fluctuations, suggesting manageable but persistent fiscal pressures. In contrast, Penang and Selangor maintain low and stable ratios, indicative of a stronger capacity to sustain debt

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without compromising fiscal stability. The table captures key fiscal events such as development borrowing and pandemic-related expenditures, providing a clear depiction of trends relevant to subnational debt sustainability.

Less developed states such as Kedah, Kelantan, Perlis, Sabah, and Terengganu exhibit higher mean debt ratios and greater volatility, indicating stronger fiscal pressures and reliance on federal transfers. In contrast, more developed states like Johor, Penang, and Selangor maintain low and stable debt levels, reflecting greater fiscal capacity. Terengganu illustrates how dependence on variable resource revenues, such as oil royalties, can affect state budgeting and debt management, particularly when transfers are delayed or politically influenced. Overall, these patterns underscore the interaction between fiscal centralization, institutional arrangements, and state-specific characteristics in shaping subnational debt sustainability in Malaysia.

A key structural factor underlying these challenges is Malaysia's high degree of fiscal centralization. The Federal Constitution assigns most major tax instruments to the federal government, leaving state governments dependent on a limited range of own-source revenues and federal grants. State-generated tax revenue accounts for less than half of total state revenue, while non-tax revenues, such as land premiums, petroleum royalties, fees, licenses, and investment income, have proven insufficient to finance both operating and development expenditures. Consequently, state governments face limited fiscal space and weak capacity to respond independently to economic shocks or manage debt sustainably (Bakar, 2004; Noh, 1991).

Institutional arrangements further restrict state borrowing autonomy. State governments are prohibited from external borrowing and may borrow domestically only with federal approval, typically for short maturities (Jalil & Karim, 2009). Even Sabah and Sarawak, which enjoy relatively greater autonomy, require approval from Bank Negara Malaysia for borrowing. As a result, state governments rely heavily on federal loans and transfers to finance development needs arising from economic growth and urbanization (Bakar, 2004). These approval mechanisms, including oversight by institutions such as the NFC, can reduce politically biased allocations while still limiting fiscal flexibility. This institutional framework contrasts sharply with more decentralized federations, such as Switzerland, where subnational governments possess substantial taxing authority and fiscal autonomy (Feld & Kirchgässner, 2001; Kirchgässner, 2013).

Beyond economic and institutional constraints, political factors may also influence subnational debt outcomes. The political economy literature suggests that expectations of federal support can weaken fiscal discipline at the subnational level. In Malaysia, political alignment between the state and federal governments may affect access to federal transfers, borrowing approvals, and the enforcement of fiscal rules. Institutional oversight mechanisms, such as NFC approval requirements, may moderate these effects, especially in less developed states, limiting the extent to which political alignment contributes to debt accumulation. Despite its potential significance, the role of political alignment in shaping subnational debt sustainability in Malaysia remains under-examined in empirical research.

Together, the debt-to-GDP data in Table 1, alongside the structural, institutional, and political context, illustrate how Malaysia's centralized fiscal system and limited state government autonomy create divergent debt outcomes across states, highlighting the challenges of maintaining state-level fiscal stability. These differences underscore the interaction between fiscal centralization and state-specific institutional and political conditions.

This study addresses these gaps by examining the long-run and short-run determinants of state-level debt sustainability in Malaysia under conditions of fiscal centralization. In particular, the inclusion of political alignment allows the analysis to assess whether observed political transitions translate into systematic differences in debt outcomes once institutional and fiscal constraints are taken into account. Using panel data for thirteen Malaysian states over the period 2004–2023, the study employs the Pooled Mean Group estimator within a panel ARDL framework. This approach allows for heterogeneous short-run dynamics across states while imposing a common long-run equilibrium relationship, making it particularly suitable for analyzing subnational fiscal behavior in a centralized quasi-federal system.

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Specifically, the study investigates the effects of state revenues, expenditures, and federal transfers on debt sustainability; the role of economic growth in moderating debt accumulation; and the influence of political alignment between state and federal governments, particularly in the context of post-2018 political transitions, on state-level debt outcomes. By integrating political considerations into the analysis of subnational debt sustainability, this study contributes to the literature on public finance and intergovernmental fiscal relations and provides policy-relevant insights for strengthening fiscal coordination and enhancing the sustainability of public finances in Malaysia's quasi-federal system.

2. LITERATURE REVIEW

2.1. Public Debt and Fiscal Sustainability

The relationship between public debt and economic performance has been extensively examined in the macroeconomic literature. Early theoretical contributions suggest that government borrowing can support economic growth by financing productive public investment, particularly during economic downturns. However, persistent and excessive debt accumulation may generate adverse long-term effects by crowding out private investment, increasing borrowing costs, and constraining fiscal flexibility. Empirical studies such as Reinhart and Rogoff (2010) and Checherita-Westphal and Rother (2012) provide evidence that high public debt levels are associated with slower economic growth, especially once certain thresholds are exceeded.

While much of this literature focuses on national governments, recent studies have extended the analysis to subnational levels, highlighting the importance of debt sustainability within multi-tiered fiscal systems. Subnational debt sustainability is particularly relevant in emerging economies, where institutional capacity, revenue autonomy, and intergovernmental fiscal arrangements differ substantially from those in advanced economies. Persistent fiscal deficits at the subnational level can pose systemic risks to national fiscal stability, especially when implicit or explicit bailout expectations exist.

2.2. Subnational Debt, Fiscal Federalism, and Centralisation

The literature on fiscal federalism emphasizes the importance of aligning expenditure responsibilities with revenue-raising powers to ensure fiscal discipline and accountability. Vertical fiscal imbalances situations where subnational governments bear significant spending responsibilities but have limited revenue authority have been identified as a key driver of subnational fiscal stress and debt accumulation (Eyraud & Lusinyan, 2013; Ter-Minassian, 1997). In highly centralized fiscal systems, subnational governments often rely heavily on intergovernmental transfers, which may weaken incentives for prudent fiscal management.

Rodden (2006) argues that subnational debt problems frequently arise from "soft budget constraints," whereby subnational governments expect central government support in times of fiscal distress. Such expectations can encourage excessive borrowing and delayed fiscal adjustment.

Empirical evidence from both developed and developing countries suggests that stricter borrowing rules and hard budget constraints are associated with improved fiscal discipline at the subnational level, although overly restrictive constraints may also limit development spending.

Malaysia's fiscal federalism framework closely reflects these challenges. With most major tax bases controlled by the federal government and borrowing subject to federal approval, state governments face limited fiscal autonomy. This institutional arrangement heightens dependence on federal transfers and loans, making subnational debt dynamics closely tied to central government policies and intergovernmental fiscal relations. The reliance on federal transfers, some of which may be politically influenced, introduces additional complexity to state-level debt sustainability.

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2.3. Political Economy and Subnational Debt

Beyond economic and institutional factors, political incentives play an important role in shaping fiscal outcomes. Political economy theories of public debt emphasize how electoral competition, partisan interests, and intergovernmental political relationships influence borrowing behavior (Alesina & Tabellini, 1990). At the subnational level, political considerations may affect both fiscal discipline and access to central government resources.

A growing body of empirical literature demonstrates that political alignment between subnational and central governments can influence the allocation of intergovernmental transfers and fiscal support. Studies such as Arulampalam, Dasgupta, Dhillon, and Dutta (2009) and Veiga and Veiga (2013) show that politically aligned regions often receive more favorable fiscal treatment, particularly in discretionary transfers. This preferential treatment may relax budget constraints and contribute to higher debt accumulation among aligned subnational governments.

In the Malaysian context, historical evidence suggests that opposition-led states have faced stricter borrowing conditions and reduced access to federal resources, while politically aligned states may benefit from more lenient fiscal arrangements (https://www.wider.unu.edu/publication/political-economy-malaysian-federalism; (Jalil & Karim, 2008; UNU-WIDER, 2011)) Despite its importance, the role of political alignment in explaining state-level debt sustainability in Malaysia remains underexplored in empirical research, representing a key gap addressed by this study. This gap motivates the formulation of testable hypotheses linking fiscal, economic, and political factors to state debt outcomes.

2.4. Hypotheses Development

Grounded in the literature on public finance, fiscal federalism, and political economy, this study formulates testable hypotheses regarding the determinants of subnational debt sustainability in Malaysia. Based on the reviewed theoretical and empirical evidence, the following hypotheses are proposed.

H_1: State revenue has a negative long-run effect on state public debt.

Higher own-source revenue enhances fiscal capacity and reduces reliance on borrowing. In fiscally centralized systems, limited revenue autonomy constrains states' ability to finance expenditures, contributing to debt accumulation (Eyraud & Lusinyan, 2013). Therefore, increased state revenue is expected to improve debt sustainability.

H_2: State expenditure has a positive long-run effect on state public debt.

Persistent expenditure pressures, particularly when not matched by revenue growth, are a major driver of fiscal deficits and debt accumulation. In Malaysia, states face rigid expenditure responsibilities despite limited fiscal autonomy, suggesting a positive relationship between expenditure growth and debt. Proper fiscal management is essential to address these challenges effectively.

H_3: Federal transfers reduce state public debt in the long run but may increase debt in the short run.

Federal transfers can alleviate fiscal stress by supplementing state revenues and supporting debt servicing. However, in the short run, reliance on transfers may weaken fiscal discipline and delay adjustment, potentially increasing borrowing needs.

H_4: Higher economic growth reduces state public debt.

Economic growth improves fiscal sustainability by expanding the revenue base and reducing debt-to-GDP ratios. States experiencing stronger economic performance are expected to accumulate lower debt levels over time.

H_5: Political alignment between state and federal governments increases state public debt.

Politically aligned states may benefit from preferential access to federal transfers and borrowing approvals, leading to softer budget constraints. However, institutional oversight mechanisms, such as NFC approval requirements, may moderate this effect, potentially limiting the extent to which political alignment influences debt accumulation.

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3. METHODOLOGY AND DATA

3.1. Model Specification

To examine the determinants of subnational debt sustainability in Malaysia, this study employs a dynamic panel data framework. Following Pesaran, Shin, and Smith (1999), the Pooled Mean Group (PMG) estimator is used to capture both short-run dynamics and long-run equilibrium relationships among fiscal, economic, and political variables. The PMG approach is particularly suitable because it allows heterogeneous short-run coefficients across states while constraining long-run coefficients to be homogeneous, reflecting Malaysia's shared institutional and legal framework. Moreover, PMG accommodates a mixture of stationary (I(0)) and first-difference integrated (I(1)) variables. The baseline long-run relationship is specified as:

$$Debt_{it} = \alpha_i + \beta_1 Revenue_{it} + \beta_2 Expenditure_{it} + \beta_3 Transfers_{it} + \beta_4 Growth_{it} + \beta_5 Alignment_{it} + \varepsilon_{it} \quad (1)$$

where:

- $Debt_{it}$= State-level public debt (or debt-to-GSDP ratio) for state i at time t.
- $Revenue_{it}$= Own-source state revenue.
- $Expenditure_{it}$= State expenditure.
- $Transfers_{it}$= Federal transfers received by the state.
- $Growth_{it}$= State gross domestic product (GSDP) growth.
- $Alignment_{it}$= Political alignment dummy (1 if the state government is aligned with the federal ruling coalition, 0 otherwise).
- ε_{it}= Error term capturing unobserved heterogeneity and shocks.

This model builds upon the theoretical and empirical frameworks commonly used in subnational debt literature, integrating both economic and political determinants of fiscal sustainability. By employing a PMG estimator, the analysis allows for heterogeneous short-run responses across states while estimating a common long-run equilibrium, consistent with the shared institutional and legal framework governing Malaysian states (Pesaran et al., 1999).

3.2. Data and Variables

The study uses an unbalanced panel of thirteen Malaysian states from 2004 to 2023. Data on debt, revenue, and expenditure come from the State Financial Statements and General Audit Department of Malaysia (2019), federal transfers from the Ministry of Finance Malaysia, and state GSDP and growth rates from the Department of Statistics Malaysia. All monetary values are in real terms, and descriptive statistics summarize variation across states and over time. Table 2 presents the definitions of variables and data sources in this study.

Table 2. Variable definitions.

Variables	Abbr.	Definition	Source
Debt	Deb	Debt-to-GSDP ratio	Audit Reports (2019)
Revenue	Rev	Own-source state revenue (Real MYR)	Treasury Reports
Expenditure	Exp	Total state expenditure (Real MYR)	State Financial Statements
Transfers	Tra	Federal transfers received (Real MYR)	Ministry of Finance Malaysia
Growth	Gro	Annual GSDP (real MYR)	Department of statistics Malaysia
Alignment	Ali	Political alignment dummy (1 = Aligned, 0 = opposition)	Malaysia Election Commission

Political alignment is included as a dummy variable to capture the influence of state-federal political relationships on subnational debt. These variables equal 1 if the state government is controlled by the same coalition as the federal government in a given year, and 0 otherwise. Political alignment is preferred over other proxies, such as cabinet representation or parliamentary seats, because it directly affects access to federal transfers, borrowing approvals, and enforcement of fiscal rules, which are the primary channels influencing state-level debt outcomes (Arulampalam et al., 2009; Veiga & Veiga, 2013).

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Table 3. Political alignment of Malaysian states (2004–2023).

Year	Johor	Kedah	Kelantan	Melaka	N.S'bilan	Pahang	Perak	Perlis	Penang	S'ngor	Trganu	Sabah	S'wak
2004	1	1	0	1	1	1	1	1	0	0	0	1	1
2005	1	1	0	1	1	1	1	1	0	0	0	1	1
2006	1	1	0	1	1	1	1	1	0	0	0	1	1
2007	1	1	0	1	1	1	1	1	0	0	0	1	1
2008	1	0	0	0	0	1	0	1	0	0	1	1	1
2009	1	0	0	0	0	1	0	1	0	0	1	1	1
2010	1	0	0	0	0	1	0	1	0	0	1	1	1
2011	1	0	0	1	1	1	1	1	0	0	0	1	1
2012	1	0	0	1	1	1	1	1	0	0	0	1	1
2013	1	0	0	1	1	1	1	1	0	0	0	1	1
2014	1	0	0	1	1	1	1	1	0	0	0	1	1
2015	1	0	0	1	1	1	1	1	0	0	0	1	1
2016	1	0	0	1	1	1	1	1	0	0	0	1	1
2017	1	0	0	1	1	1	1	1	0	0	0	1	1
2018	0	0	0	0	0	1	0	1	1	1	0	0	1
2019	0	0	0	0	0	1	0	1	1	1	0	0	1
2020	1	0	0	1	1	1	1	1	0	0	0	1	1
2021	1	0	0	1	1	1	1	1	0	0	0	1	1
2022	1	0	0	1	1	1	1	1	0	0	0	1	1
2023	1	0	0	1	1	1	1	0	0	0	0	1	1

Note: Alignment determined relative to the federal ruling coalition each year: BN (2004–2018), PH (2018–2020), PN/Unity Government (2020–2023). Intermediate years assumed no change in state government unless official records indicate otherwise. Sabah and Sarawak are coded according to their cooperative status with the federal government. 1 = Aligned, 0 = Opposition or non-aligned.

Source: Election Commission of Malaysia (EC).

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Table 3 summarizes the political alignment of Malaysian states with the federal government over the sample period, capturing both prolonged alignment and periods of political turnover following the 2018 and 2022 general elections. Table 3 presents the political alignment status of Malaysian states relative to the federal government from 2004 to 2023. For much of the pre-2018 period, most states were aligned with the federal government under BN, reflecting a relatively stable political equilibrium. The 2018 general election introduced substantial variation in alignment, as several states transitioned into opposition status while the federal government changed hands. Subsequent political realignments and the formation of a unity government in 2022 further contributed to both temporal and cross-state variation in political alignment. This variation provides an empirical basis for examining whether political alignment systematically influences state-level debt dynamics within Malaysia's centralized fiscal system.

3.3. Methodology

3.3.1. Cross-Sectional Dependence Test

Before examining the unit root properties of the variables, it is essential to test for the presence of cross-sectional dependence in the panel data. Cross-sectional dependence may arise from common shocks, unobserved common factors, or spillover effects across cross-sectional units, which are common in macroeconomic and regional panel datasets. Ignoring such dependence may lead to biased and inconsistent results when applying conventional (first-generation) panel unit root and cointegration tests that assume cross-sectional independence (Baltagi, 2021).

To address this issue, this study first examines cross-sectional dependence using the Pesaran (2004) cross-sectional dependence (CD) test. The null hypothesis of the CD test is that cross-sectional units are independent, while the alternative hypothesis indicates the presence of cross-sectional dependence. A statistically significant CD statistic, indicated by a p-value lower than conventional significance levels, leads to rejection of the null hypothesis and confirms the existence of cross-sectional dependence. The results of this test guide the subsequent choice of appropriate second-generation panel unit root and estimation techniques that explicitly account for cross-sectional dependence.

3.3.2. Panel Unit Root Test

Given the evidence of cross-sectional dependence confirmed by Pesaran's (2004) CD test, the use of first-generation panel unit root tests, which rely on the assumption of cross-sectional independence, becomes inappropriate and may lead to inconsistent inference. To address this issue, this study adopts a second-generation panel unit root testing approach that explicitly allows for cross-sectional dependence.

Specifically, we employ the Cross-sectionally Augmented IPS (CIPS) test proposed by Pesaran (2007). The CIPS test extends the conventional augmented Dickey–Fuller (ADF) framework by incorporating cross-sectional averages of both lagged levels and first differences of the variables, thereby capturing unobserved common factors and cross-sectional dependence among panel units. The CIPS statistics are constructed as the average of the individual cross-sectionally augmented ADF statistics and provide a panel-level test for the presence of unit roots. The null hypothesis of the CIPS test is that all series in the panel contain a unit root, while rejection of the null hypothesis indicates that at least one cross-sectional unit is stationary.

3.3.3. Panel Cointegration Test

Before estimating the long-run relationships among variables, we first test for panel cointegration. Cointegration is important because even if individual variables are non-stationary, a linear combination may be stationary, indicating a stable long-run equilibrium. Ignoring cointegration can lead to biased estimates in dynamic models. In this study, we use the Westerlund (2007) panel cointegration test, based on an error-correction model (ECM) that allows for heterogeneity across panels.

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The test reports two statistics: the "some" statistic tests if at least some panels are cointegrated, while the "all" statistic tests if all panels share a common long-run relationship. The null hypothesis is no cointegration, and the alternative suggests a long-run relationship. A significant p-value for the "some" statistic indicates cointegration in some panels, while a significant p-value for the "all" statistic suggests a common long-run relationship across all panels. These results support the subsequent estimation of long-run coefficients using methods such as PMG or AMG.

3.3.4. Pooled Mean Group (PMG)

In this study, we apply the PMG model (Pesaran et al., 1999) to examine the dynamic relationships between key variables in our panel dataset. The model is particularly suited for panel data with mixed orders of integration, such as I(0) and I(1), as it does not require differencing or transformation, thus preserving valuable information (Pesaran et al., 1999). The PMG framework allows for heterogeneity in short-run dynamics while maintaining homogeneity in long-run relationships across panels, making it particularly useful for cross-country or cross-regional analyses where short-term dynamics may vary due to different economic or policy conditions (Dogan & Seker, 2016). Additionally, the inclusion of lagged dependent and independent variables helps mitigate potential endogeneity and capture temporal dependencies, providing more robust estimates by reducing biases from omitted variables (Blundell & Bond, 1998). The ability of the model to estimate both short-term fluctuations and long-term equilibrium relationships within a single framework enhances its explanatory power.

4. EMPIRICAL RESULTS AND DISCUSSION

4.1. Descriptive Statistics

Table 4 reports the descriptive statistics of the variables used in this study. On average, states have a debt-to-GSDP ratio of around 4%, with considerable variation across the sample. Own-source revenue and total expenditure exhibit substantial differences between states, reflecting heterogeneous fiscal capacities. Federal transfers also vary significantly, highlighting the role of intergovernmental support. Annual GSDP shows wide dispersion, indicating differences in economic size and growth across states. The political alignment dummy indicates that over half of the observations are from states aligned with the federal government. This distribution underscores the potential role of political alignment in shaping fiscal outcomes, as aligned states may experience different access to federal support and discretionary fiscal approvals compared with opposition-led states.

Table 4. Descriptive statistics.

Variables	N	Mean	SD	Min.	Max.
Deb	260	0.0399	0.0358	0.000142	0.165
Rev	260	1,353	2,076	44.36	13,133
Exp	260	1,656	1,938	129.1	11,761
Tra	260	499.6	385.0	93.47	2,098
Gro	260	37,552	24,723	3,080	179,646
Ali	260	0.562	0.497	0	1

4.2. Results of Cross-Sectional Dependence Tests

Table 5 presents the results of the Pesaran (2004) cross-sectional dependence (CD) test for all variables. The CD statistics for debt, revenue, expenditure, transfers, and annual GSDP are all highly significant, with p-values below 0.01. This indicates the presence of strong cross-sectional dependence across states, suggesting that shocks affecting one state are likely correlated with others. These results justify the use of second-generation panel unit root and cointegration tests that account for such dependence in subsequent analysis. The political alignment variable is a dummy variable indicating whether a state is politically aligned with the federal government. As a categorical

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variable, it does not exhibit stochastic trends and is inherently stationary, but its presence still informs potential institutional effects on fiscal outcomes.

Table 5. Pesaran CD Test.

Variables	Statistics	p-value
Deb	10.89	0.000
ln(Rev)	23.75	0.000
ln(Exp)	12.89	0.000
ln(Tra)	39.5	0.000
ln(Gro)	10.78	0.000

4.3. Results of Panel Unit-Root Tests

Table 6 reports the results of the cross-sectionally augmented IPS (CIPS) panel unit root test for the main continuous variables. At the level, revenue, expenditure, and transfers are stationary, while debt and annual GSDP are non-stationary. After first differencing, all variables become stationary at the 1% significance level, indicating that they are integrated of order one, I(1). Consistent with CD results (Table 5), the political alignment variable is a dummy and inherently stationary, so it is not included in the unit root tests. The stationary nature of political alignment implies that its effect on debt is likely reflected through policy discretion and administrative timing rather than long-term trending behavior. Since the main continuous variables are either stationary at the level or become stationary after first differencing, and at least two variables are I(1), the basic requirement for panel cointegration analysis is satisfied (Baltagi, 2021; Pesaran, 2004).

Table 6. Panel unit root test (CIPS).

Variables	Level	1st Difference
Deb	-1.616	-3.940***
ln(Rev)	-2.812***	-5.061***
ln(Exp)	-2.731**	-4.679***
ln(Tra)	-6.190**	-6.190***
ln(Gro)	-2.059	-4.047***

Note: **, and *** denote statistical significance at the 5%, and 1% levels, respectively. The null hypothesis of the CIPS test is that the series contains a unit root.

4.4. Results of the Panel Cointegration Test

Table 7 presents the results of the Westerlund (2007) panel cointegration test. The test reports two types of statistics: the "some" statistics, which examine whether at least some individual panels are cointegrated, and the "all" statistic, which tests whether all panels share a common long-run relationship. Both statistics are significant at the 5% level (some: 2.703, p = 0.034; all: 1.675, p = 0.047), leading to the rejection of the null hypothesis of no cointegration. This indicates the presence of a stable long-run relationship among the variables, both for some individual states and across all states. Combined with the results of the CIPS unit root test, which confirmed that the main continuous variables are I(1), these findings justify the estimation of long-run coefficients using the PMG-ARDL model in the subsequent analysis. This long-run framework allows the analysis to assess whether institutional and political factors, including state–federal alignment, meaningfully influence sustained debt outcomes.

Table 7. Westerlund Test for Cointegration.

Variables	Statistic	p-value	Results
Deb	2.703	0.034	Reject H_0 → Some panels are cointegrated
Deb	1.675	0.047	Reject H_0 → All panels are cointegrated

Note: The null hypothesis is no cointegration; the test includes both panel means and time trend.

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4.5. Short- and Long-Run Relationship Results

Table 8 reports the results of the MG and PMG estimations. The results of the MG estimation are presented first. In the long run, most coefficients are statistically insignificant except for economic growth, which has a negative effect on debt, suggesting that higher growth contributes to reducing state debt levels. In the short run, the error-correction term is negative and highly significant, indicating that deviations from the long-run equilibrium are corrected over time. Among the short-run dynamics, only changes in GSDP are significant, while other variables, including revenue, expenditure, transfers, and political alignment, do not show significant short-term effects. This indicates that short-term political alignment alone does not immediately drive debt outcomes, consistent with institutional constraints in highly centralized systems (Veiga & Veiga, 2013). The PMG estimation offers further insights. In the long run, expenditure positively affects debt, while federal transfers and economic growth have negative and statistically significant impacts, consistent with expected fiscal relationships. Revenue and political alignment remain insignificant. The lack of significance for political alignment in PMG may reflect the constrained fiscal autonomy of Malaysian states, where formal approval procedures and NFC oversight limit discretionary borrowing even for politically aligned states. In the short run, the ECM term is negative and significant, confirming the presence of a long-run equilibrium. Among the short-term coefficients, only growth remains significant, while other variables have no notable short-term effect. These results suggest that, while fiscal transfers and growth support debt sustainability over time, states' own revenue and political alignment have a limited direct impact under Malaysia's centralized fiscal system. The Hausman test fails to reject the null hypothesis of long-run coefficient homogeneity, supporting the use of PMG over MG. Overall, the PMG model is preferred as it efficiently captures both short-run heterogeneity across states and long-run homogeneity in the relationships between debt and the explanatory variables.

Table 8. Results of MG and PMG estimation.

Variables	MG	PMG
Long-run		
ln(Rev)	-0.017	-0.002
	(-0.93)	(-0.59)
ln(Exp)	-0.002	0.015***
	(-0.15)	(6.14)
ln(Tra)	0.031	-0.028***
	(0.77)	(-10.15)
ln(Gro)	-0.114**	-0.015***
	(-2.15)	(-7.99)
Ali	-0.001	0.001
	(-0.63)	(0.97)
Short-run		
ECM	-0.552***	-0.336***
	(-4.33)	(-2.66)
Δln(Rev)	-0.003	-0.002
	(-0.95)	(-0.40)
Δln(Exp)	0.002	-0.010
	(0.50)	(-1.52)
Δln(Tra)	0.020	-0.012
	(0.88)	(-0.60)
Δln(Gro)	-0.034**	-0.048***
	(-2.37)	(-3.54)
ΔAli	0.001	0.000
	(0.46)	(0.27)
Cons	0.449***	0.088***
	(4.69)	(2.92)
Log likelihood		962.379
Hausman $\chi^2(5)$	5.76	
Hausman $\chi^2(5)$	*p*>χ^2=0.330	

Note: z-statistics in parentheses; *** p<0.01, ** p<0.05.

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Table 9 summarizes the hypotheses, their expected signs, PMG long-run results, and whether the empirical evidence supports each hypothesis. The results show that expenditure, federal transfers, and economic growth are significant determinants of long-run debt, supporting H2–H4. In contrast, revenue and political alignment are not statistically significant, indicating that increased own-source revenue alone does not necessarily reduce debt, and political alignment with the federal government does not significantly increase debt. The limited effect of political alignment may reflect institutional constraints, such as NFC oversight and formal approval procedures, which reduce the potential impact of political favoritism on state borrowing. Overall, the table highlights the importance of fiscal structure, institutional arrangements, and economic conditions in shaping subnational debt outcomes.

Table 9. Hypotheses summary.

Hypothesis	Expected sign.	PMG Result	Supported	Comment
H1: Revenue	-ve	-0.002	No	Limited revenue autonomy may constrain debt reduction
H2: Expenditure	+ve	0.015***	Yes	Expenditure pressure drives debt accumulation
H3: Transfers	-ve	-0.028***	Partially	Long-run reduction observed; short-run effect is insignificant
H4: Growth	-ve	-0.015***	Yes	Economic growth improves debt sustainability
H5: Political Alignment	+ve	0.001	No	Institutional rules, such as NFC oversight, may reduce the effects of political favouritism

Note: *** p<0.01. PMG coefficients are from long-run estimates (Table 7). The table highlights which hypotheses are empirically supported and links results to the institutional context.

5. ROBUSTNESS CHECK

To assess the robustness of the PMG results, we estimate the long-run relationships using the Augmented Mean Group (AMG) estimator, which accounts for cross-sectional dependence and unobserved common factors. As shown in Table 10, the AMG estimates differ from PMG in several respects. Expenditure shows a negative coefficient under AMG, contrasting with the positive and significant effect found in PMG. Transfers and economic growth remain negative and significant, consistent with the PMG results. The political alignment dummy is marginally positive and significant under AMG, while it was insignificant in PMG. This suggests that controlling for unobserved common factors and cross-sectional dependence can reveal subtle political alignment effects, particularly in states subject to discretionary federal decisions. Revenue is not significant in either model. These differences indicate that controlling for unobserved common factors and cross-sectional dependence can affect both the magnitude and sign of estimated coefficients. Despite these variations, the negative effects of transfers and economic growth on debt are robust across estimators, suggesting that these relationships are relatively stable in the long run.

Table 10. Robustness checks (AMG estimator).

Variables	Coefficient	Std. err.	p-value
ln(Rev)	0.006	0.007	0.404
ln(Exp)	-0.013*	0.008	0.091
ln(Tra)	-0.175**	0.073	0.017
ln(Gro)	-0.043**	0.018	0.014
Ali	0.001**	0.000	0.050
Cons	1.835	0.583	0.002

Note: *, ** denote statistical significance at the 10%, 5% levels, respectively.

6. CONCLUSION AND POLICY RECOMMENDATIONS

This study examines subnational debt sustainability in Malaysia under fiscal centralization, focusing on thirteen states from 2004 to 2023. Using the PMG estimator and robustness checks via the AMG approach, the results indicate that long-run debt is significantly reduced by federal transfers and sustained economic growth, while short-run debt fluctuations are primarily driven by growth shocks. The effects of own-source revenue, expenditure pressures, and

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political alignment are not statistically robust and therefore cannot be confirmed as systematic determinants of debt outcomes. Less fiscally capable states, including Perlis, Kedah, Kelantan, Terengganu, Sabah, and Sarawak, converge more slowly toward long-run equilibrium, reflecting institutional constraints, weak fiscal autonomy, and strong dependence on federal support. These findings highlight that in Malaysia's highly centralized fiscal system, state-level fiscal outcomes are heavily shaped by macroeconomic conditions, federal policy, and institutional frameworks, rather than by individual state revenue initiatives or political alignment.

The study underscores the importance of predictable federal transfers and macroeconomic growth as central levers for sustaining subnational debt. While political alignment may influence the timing of short-term fiscal adjustments, its long-term effect on debt sustainability is limited due to formal approval procedures, the National Finance Council's oversight, and centralized borrowing rules.

6.1. Policy Recommendations

1. Ensure predictable, formula-based federal transfers and royalties. States highly dependent on resource revenues, such as Sabah, Sarawak, Kelantan, and Terengganu, should receive timely, transparent allocations. Implementing clear reporting standards and disbursement schedules will reduce fiscal uncertainty and enable better budget planning.
2. Strengthen state revenue autonomy and fiscal capacity- Expanding own-source revenue collection through land taxes, excise duties, resource management fees, or other locally feasible instruments would reduce excessive dependence on federal support and improve fiscal resilience, particularly during economic shocks.
3. Enhance intergovernmental fiscal coordination, establishing joint budgeting frameworks, monitoring systems, and expenditure reporting mechanisms between federal and state governments, which can improve transparency, reduce arrears, and support smoother debt management.
4. Promote fairness, transparency, and rule-based fiscal allocations—transfers, borrowing approvals, and royalties should be guided by objective fiscal need and policy criteria rather than political considerations. Such mechanisms can mitigate disparities between politically aligned and opposition-led states, supporting equitable and sustainable development.
5. Support capacity-building in less fiscally capable states, technical assistance, advisory services, and training programs can strengthen state debt management, improve long-term fiscal planning, and facilitate compliance with national fiscal rules.
6. Encourage sustainable expenditure management - States should adopt medium-term expenditure frameworks and prioritize development projects based on cost-effectiveness and economic impact, while remaining within available fiscal space.

By addressing structural, institutional, and coordination challenges, Malaysia can enhance subnational fiscal discipline, reduce vulnerability to debt accumulation, and promote sustainable development across all states, particularly those highly dependent on federal transfers or resource revenues. This study contributes to a better understanding of how macroeconomic growth, fiscal centralization, and institutional design jointly shape state-level debt outcomes in a quasi-federal developing economy.

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