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Analysis of Fiscal Synchronization Hypothesis: Evidence From Pakistan

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Article Details

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ABSTRACT

This research intends to examine the relationship between tax revenue and government expenditure in Pakistan, with a focus on testing the fiscal synchronization hypothesis and assessing the indicators of future fiscal sustainability. This study aims to fill this gap by examining the dynamics of government revenue and expenditure in Pakistan and assessing the implications for future fiscal sustainability. It employed TSD from 1989 to 2024. The study employed the Augmented Dickey-Fuller Test, Granger causality test Engel Granger Co-integration test, and elasticity regression for analysis of the data. The results of Granger causality in million PKR suggest that the fiscal synchronization hypothesis exists in Pakistan, indicating a bidirectional causality between tax revenue and public expenditure. In contrast, when TR and PE are measured as a tax-to-GDP ratio, the results support the revenue-spend hypothesis, implying that changes in tax revenue lead to changes in public expenditure. The findings of Regression No.1, which measures tax revenue and public expenditure in units, provide evidence that these two fiscal variables are strongly interconnected. Conversely, Regression No.2, which examines the impact of GDP growth on tax revenue and public expenditure as a ratio of GDP, reveals an insignificant relationship, implying that GDP growth may not be a significant factor influencing changes in tax revenue and public expenditure. Results of TR elasticity with respect PE show that there is weak future fiscal sustainability in Pakistan. The study findings highlight the importance of effective expenditure management. Policymakers should prioritize expenditure allocation, ensure efficient use of resources, and reduce wasteful spending. The study findings can inform Pakistan's fiscal policy by highlighting the importance of coordinating tax revenue and public expenditure plans. The revenue-spend hypothesis suggests that tax reforms can be an effective way to improve tax revenue mobilization and finance public expenditure. To address the fiscal deficit and debt burden, it is essential to implement a fiscal consolidation strategy that focuses on increasing tax revenue and reducing public expenditure. One key approach to increase tax revenue is to broaden the tax base by reducing exemptions and concessions, thereby increasing the number of taxpayers and revenue generated Therefore, policymakers should prioritize tax revenue mobilization through reforms and efficient tax administration, while simultaneously reducing non-essential public expenditure. This approach can help control the fiscal deficit, reduce the debt burden, and ensure fiscal sustainability. Strengthening tax administration through automation, digitization, and capacity building can also improve tax collection efficiency.

Introduction

The relationship between Government revenue and expenditure has been a subject of ongoing debate among economists and policymakers. Theoretically, a change in tax revenue can influence Government expenditure and vice versa. . Fiscal neutrality implies that the economy is unaffected by the method of financing Government expenditures and taxation. This hypothesis is rooted in the Ricardian Equivalence Theorem, which posits that the timing and method of taxation does influence public expenditures or vice versa and economic activity, while fiscal neutrality hypothesis negates the Ricardian Equivalence Theorem.

The relationship between public expenditure and revenue is influenced by the prevailing economic paradigm and changes over time. Changes in the dominant economic paradigm influencing the direction of causality between government expenditure and TR (Magazzino & Dalena,2 010). Mehrara et al. (2011) suggested that fiscal policymakers in 40 Asian countries should set revenue and expenditure simultaneously to control the budget deficit. Government revenue and expenditure decisions are jointly made by the fiscal authority.

A feedback mechanism exists between revenue and expenditure, where higher tax levels are caused by higher spending levels and vice-versa (Ravinthirakumaran, 2011). Rezaei (2015) showed unidirectional causality running from Government revenue to Government expenditure and revealed a positive relationship between revenue and Government expenditure in both the long and short run. Previous fiscal period's tax revenue caused and determined current Government expenditure in Pakistan (Suhani et al., 2012). Tiwari and Mutascu (2016) confirmed co-integration between Government revenue and expenditure, with bidirectional causality in the short run and asymmetric adjustment in the long run.

In Turkey, there was unidirectional causality running from Government expenditure to Government revenue and supported the spending-led revenue hypothesis (Dogan, 2013).

Aminu and Raifu (2018) found that the revenue-spending hypothesis prevailed over the fiscal synchronization hypothesis when the nonlinear causality approach was applied to aggregated and disaggregated data. Phiri (2019) found there existed bidirectional causality between revenues and expenditures and justifies the Fiscal synchronization hypothesis.

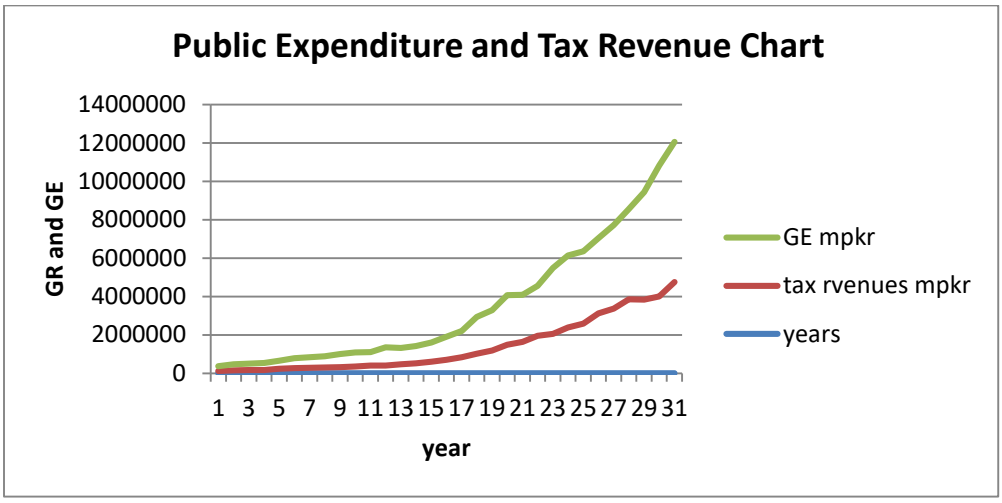
Febriani and Rambe (2022) results of the study showed five experienced bidirectional causalities between tax revenues and local Government spending out of the six regions. Babarinde (2022) tested the validity of the fiscal neutrality hypothesis in the Nigerian Local Government and confirmed no causality between revenue and expenditure in the Nigerian local Government. Solikin and Nizar's (2023) results of their study provide supported evidence for the revenue and expenditure for the Indonesian Government budget.

Omoshoro-Jones (2020) results of the causal analyses show a bidirectional causality between Government revenues and expenditures in both the long run and short run, supporting the fiscal synchronization hypothesis. Khan et al. (2021) analysis revealed a unidirectional relationship between two fiscal variables, i.e., expenditure and revenue. Kaya and Arslan (2020) empirical results proved that there is bidirectional causality between total revenues and Government expenditures in the Turkish economy so fiscal synchronization hypothesis is valid for the Turkish economy.

Al-Zeaud (2015) study suggested that exists bidirectional causality between Government expenditures and revenues. Government revenue has a positive and significant impact on Government expenditure (Aregbeyen & Ibrahim, 2012). A long-run causality exists between Government spending and Government revenue in Lao PDR. This causality was unidirectional from spending to revenue, which supports the spend-and-tax hypothesis (Saysombath & Kyophilavong (2013). Yinusa and Adedokun (2017) found unidirectional causality running from revenue to expenditure and disaffirmed the spend revenue hypothesis.

Pakistan's fiscal deficit has been a longstanding issue. Pakistan recorded a Government budget deficit equal to 1.2 percent of the country's GDP in the first half of fiscal year 2024-25(SBP).To predict the fiscal

deficit, it is necessary to calculate the direction of causality between revenue and expenditure. This study analyzes the tax-spend nexus in Pakistan, examining the relationship between government revenue and expenditure to determine the validity of fiscal neutrality and its implications for economic policy and stability.



The hypothesis of Tax-Spend Nexus:

The relationship between Government revenue and expenditure has been a subject of ongoing debate among economists and policymakers. Four major hypotheses explain this relationship: the revenue-spend hypothesis, the spend-revenue hypothesis, the fiscal synchronization hypothesis, and the fiscal neutrality hypothesis.

According to the tax-and-spend hypothesis, it's understood that Government spending is driven by the amount of tax revenue collected. Friedman (1978, 2003) suggested that when governments raise taxes to reduce budget deficits, it often leads to even more spending. This is because politicians and bureaucrats tend to use all available funds to serve their political goals. So, he concluded that there is a positive link where tax revenue drives government spending.

On the other hand, Buchanan and Wagner (1977) also agreed that tax revenue influences spending, but they saw the relationship as negative. They explained that when governments rely heavily on direct taxes to fund their activities, it creates a "fiscal illusion." In simple terms, people feel like public services are more expensive than they are. As a result, public demand for these services goes down, which can lead to reduced government spending.

The second perspective on the relationship between government spending and tax revenue is known as the spend-and-tax hypothesis. Barro (1979) argued that because of the concept of Ricardian equivalence, households don't mind whether government spending is funded through taxes or borrowing. They understand that if the government borrows today, it will likely raise taxes in the future to repay that debt. Based on this reasoning, Barro believed that government spending tends to lead to tax revenue.

In a similar way, Roberts (1978) and Peacock and Wiseman (1979) suggested that public spending often rises in response to extraordinary events like wars or natural disasters. When such events occur, governments typically ramp up their expenditures first and then increase taxes afterward to cover the additional costs. Their work also supports the idea that spending drives tax collection, indicating a one-way relationship between expenditure to revenue.

Another theory on this issue is called fiscal synchronization. According to scholars like Musgrave

(1996) and Meltzer and Richard (1981), governments often make decisions about spending and taxation together, at the same time. Because of this, there's a mutual relationship between the two—each one influencing the other—resulting in a two-way link.

The institutional separation hypothesis takes a different view. It suggests that decisions about government spending and tax policy are made independently by different departments. Because these decisions are not coordinated, there's no expected relationship between how much a government spends and how much it collects in taxes (Baghestani & McNown, 1994; Wildavsky, 1988).

Fiscal sustainability refers to a government's ability to manage its finances in a way that allows it to meet its current and future obligations without defaulting on its debt or compromising its long-term stability. This concept encompasses not only the government's ability to service its debt but also its capacity to maintain current policies while remaining solvent, and even to optimize its policies for long-term prosperity. In essence, fiscal sustainability is about ensuring that a government's financial decisions are responsible, feasible, and sustainable over time. Countries with high debt or negative net worth need to focus on reducing debt or building up their net worth to achieve fiscal stability. This might involve making tough decisions like cutting spending or increasing revenue.

Countries with low debt or significant net worth have more room to maneuver. They might be able to take on more debt or reduce their net worth without putting their fiscal stability at risk. This could allow them to invest in key areas, stimulate economic growth, or respond to economic challenges.

1.2. Empirical Evidence of Fiscal Policy Hypotheses in Practice:

The relationship between government revenue and expenditure is a crucial aspect of fiscal policy, with different hypotheses explaining how these two variables interact. This section explores the practical implications of four fiscal hypotheses in different countries: the revenue-spend hypothesis in the USA, the fiscal neutrality hypothesis in Brazil, the spend-revenue hypothesis in Germany, and the fiscal synchronization hypothesis in Australia.

Revenue-Spend Hypothesis in the USA:

In the United States, the revenue-spend hypothesis suggests that changes in tax revenue lead to changes in government spending. Historical data supports this hypothesis, with periods of strong economic growth and rising tax revenues often accompanied by increases in government expenditure. For instance, during the post-WWII period, federal receipts and outlays as a percentage of GDP generally trended upwards together. According to the Congressional Budget Office (CBO), the US government's tax revenue increased by 12 percent between 2018 and 2019, which was accompanied by a corresponding increase in government spending.

Policies that demonstrate the application of this hypothesis include arguments for tax cuts to limit spending, such as the "starve the beast" strategy. The Economic Recovery Tax Act of 1981 and the tax cuts under the Bush administration in the early 2000s are examples where policymakers argued that reducing tax revenue would force spending restraint.

Policy Example: The rhetoric surrounding the Reagan tax cuts (Economic Recovery Tax Act of 1981) or the George W. Bush tax cuts (EGTRRA 2001, JGTRRA 2003) included arguments that lower revenues would force spending restraint, even if the primary goal was economic stimulus. While the actual impact on spending

is debated, the underlying assumption aligns with the hypothesis. Following the 2001 and 2003 tax cuts, federal revenue as a percentage of GDP declined (from 20.6 percent in 2000 to 16.3 percent in 2004.

Spend-Revenue Hypothesis in Germany

Germany's public finances are a prime example of the spend-revenue nexus, where a large government and extensive welfare state drive significant spending commitments that require correspondingly high levels of revenue. With government spending standing at 3.7 percentage points higher than the median for advanced economies, Germany's revenue is also 5.2 percentage points higher. This dynamic is largely driven by the country's social programs, with spending on social benefits reaching 24 percent of GDP 8.5 percentage points above the median for peer countries. To finance this spending, Germany collects substantial social contributions, which amount to 16.9 percent of GDP 5.9 percentage points higher than the median.

An analysis of Germany's revenue structure reveals areas that could be reformed to meet rising costs. While overall revenue is high, tax revenue is 1.2 percentage points lower than the median advanced economy. To create a fiscal room, the government could explore policy options on both the expenditure and revenue sides. Eliminating environmentally harmful subsidies could save over 1 percent of GDP annually while closing loopholes in inheritance and gift taxes could generate up to 10 billion euros per year. These concrete policy choices can help Germany manage the tight linkage between spending needs and revenue generation (IMF, 2024). According to the German Federal Ministry of Finance, government spending on infrastructure and education has contributed to Germany's economic growth and increased tax revenue

Fact Example: Germany introduced extensive spending packages, including short-time work schemes (Kurzarbeit), direct aid to businesses, and healthcare spending. The federal budget deficit widened significantly from a surplus in 2019 to deficits of 4.3 percent of GDP in 2020 and 3.7 percent in 2021. The "debt brake" was suspended. The decision to spend heavily was made first, followed by borrowing (increasing public debt to 66.4 percent of GDP by 2021) to finance it. While some tax revenues increased with recovery, the immediate response was spending-led.

Fiscal Neutrality Hypothesis in Brazil

Brazil's adoption of International Financial Reporting Standards (IFRS) in 2010, preceded by Law 11,638/2007, is a key example of the fiscal neutrality hypothesis in action. This law aimed to detach financial reporting from tax rules, improving the quality and comparability of financial reporting. Studies have shown that post-IFRS adoption, Brazilian companies' financial reporting became more aligned with international best practices, reducing unconditional conservatism driven by tax incentives.

The Transitional Tax Regime (RTT) allowed companies to adopt IFRS for financial reporting without affecting their tax calculations, embodying the principle of fiscal neutrality. This separation between accounting profit and taxable profit has been crucial in improving the relevance and reliability of financial reporting in Brazil. According to the World Bank, Brazil's fiscal deficit decreased from 10.3 percent of GDP in 2016 to 7.4 percent of GDP in 2018, indicating a commitment to fiscal discipline

Fiscal Synchronization Hypothesis in Australia

Australia's fiscal strategy emphasizes balancing the budget over the economic cycle, implying a synchronized relationship between government expenditure and revenue. During periods of economic growth, the government aims to restrain spending growth or bank increased revenue to achieve surplus goals. Conversely, during downturns, both spending and revenue adjust accordingly.

The use of automatic stabilizers, such as increased social security payments during economic

slowdowns and decreased tax revenues, further illustrates the synchronized movement of expenditure and revenue. Australia's fiscal policy framework, including regular budget updates and fiscal strategy statements, demonstrates a coordinated approach to managing both sides of the budget. According to the Australian Government Budget Papers, the government's tax revenue and expenditure policies are designed to support economic growth and fiscal sustainability. Observation: During the period from 1996-97 to 2007-08, Australia recorded sustained budget surpluses (before the Global Financial Crisis). This was achieved through a combination of strong economic growth (boosting revenue) and fiscal discipline (managing expenditure), demonstrating a synchronized effort to improve the fiscal position.

Objectives

1. To quantify spend and revenue hypothesis
2. To explore revenue and spend hypothesis
3. To analyze fiscal synchronization hypothesis
4. To identify fiscal neutrality hypothesis
5. To estimate the future fiscal sustainability in Pakistan

Significance of the Study

This research investigates the hypothesis of spend and revenue and determinants of tax revenue to contribute to the ongoing debate on the effectiveness of fiscal policy in influencing economic activity. The significance of this study lies in the following ways:

First, it will help fiscal authorities to raise Government revenue and reduce Government expenditure in order to control budget deficit.

Secondly study on Government revenue and expenditure helps to evaluate the impact of fiscal policy on the economy, informing policymakers about the potential outcomes of their decision. The findings of this research can inform budget planning and resource allocation, enabling Governments to make more informed decisions. Indeed, this relationship is critical in understanding the causes, outcomes, and future directions of Government budget deficit and hence drawing the optimal policy framework for both deficit control and deficit reduction.

Fiscal sustainability is important for long-term economic stability because it ensures that a government can meet its financial commitments, prevents economic crises, supports economic growth, and influences a country's credit rating. Therefore, maintaining fiscal sustainability should be a key priority for policymakers.

This study will be a useful document for further studies on the relationship between Government revenue and expenditure in Pakistan and anywhere in the world.

Literature Reviews

Ullah (2016) tested the relationship between Government revenue and Government expenditure in Malaysia from the period of 2002 – 2013. Their study will also look at the GDP growth in Malaysia and its relationship with revenue and expenditure. The aim of their study is to find out the theoretical relationship between revenue and expenditure in Malaysia. They found that the relationship between Malaysian Government revenue and expenditure follows the spend-and-revenue hypothesis.

Samal (2017) empirically examined the causal nexus between Government expenditure and Government revenue in India during the period 1980-2016. The methodology used in their study was the Unit Root Test and ARDL Bound Test to Cointegration. Their study confirmed the long-run relationship among Government revenue, economic growth, public debt, and Government expenditure. The result showed that Government expenditure had a positive and significant impact on Government revenue which indicates that a 1 percent increase in Government expenditure leads to a 0.94 percent increase in Government revenue in the long run while findings suggested that economic growth and public debt had a positive impact on Government revenue but insignificant. Thus empirical result supports the fiscal synchronization hypothesis.

Kiminyei FK (2018) examined the nexus between tax revenue and Government expenditure in Kenya. Data was collected from Kenya economic surveys from 1960-2012. They used Augmented Dickey-Fuller and Philips Perron unit root tests and the Johansen and Juselius co-integration techniques. The importance of their study depends on first the size of Government, the level of public deficits, and the pattern of taxation and expenditure. The outcomes of the study proved that between tax revenue and Government expenditure, there was evidence of a unidirectional flow running from Government expenditure to tax revenue at a 1 percent level of significance.

Akram and Rath (2019) examined the Government revenue and Government expenditure nexus using a panel of 26 Indian states from 1980–1981 to 2014–2015. The main objective of their study is to investigate the issue of causality between revenue and expenditure by emphasizing Indian state Governments. The methodology applied in their study was two structural breaks unit root test, OLS regression, and Dumitrescu–Hurlin (2012) panel causality Dumitrescu–Hurlin panel causality revealed the support for the 'fiscal synchronization' hypothesis of Indian states.

Mele et al. (2019) assessed the relationship between Government spending and Government revenue in Malaysia. And use annual data for the period between 1985 and 2016 from the Bank Negara Malaysia (BNM). The main variable of their investigation was Government revenue and Government spending. Use the Granger causality test to investigate the causal relationship between the expenditure and revenue of the Government in the case of Malaysia. The results sustain the spend-and-tax hypothesis that an increase in Government spending would therefore raise taxes.

Phiri (2019) examined the relationship between Government revenues and expenditures in South Africa, and to determine whether the tax-and-spend hypothesis or the spend-and-tax hypothesis held true for the country. Variables of the study were Government Revenues (GR) and Government Expenditures (GE). Results revealed that there existed bidirectional causality between revenues and expenditures, supporting the fiscal synchronization hypothesis. The findings suggested that increasing tax revenue helped reduce fiscal deficits in Nigeria. The Government's efforts to increase tax revenue and prevent fiscal leakages were successful in promoting economic growth.

Kaya and Arslan (2020) examined the asymmetric relationship between Government revenue and expenditures for the Turkish economy. Variables of the study are Total Expenditure, Total Revenue, and tax Revenue. Data of the study contain quarterly observations of the total expenditures, total revenues, and tax revenues based on sub-items over 2006: Q1-2019: Q3 time period from the Central Bank of the Republic of Turkey. Applied technique of Asymmetric Causality Test. Empirical results proved that there is bidirectional causality between total revenues and Government expenditures in the Turkish economy so the fiscal synchronization hypothesis is valid for the Turkish economy.

Solikin and Nizar (2023) investigated the hypotheses related to the direction of the relationship between Indonesian Government revenues and expenses. By utilizing quarterly time-series data in the period 1969:q2– 2020:q4. The dynamic and influential relationship between Government revenue and spending study was tested using a vector autoregressive (VAR) model. The test results showed that an increase in total Government revenue and tax revenue causes an increase in Government spending. The results of their study provide supporting evidence for the revenue-and-expenditure or tax-and-spending hypothesis for the Indonesian Government budget.

Variables of the Study

Table:1 Determinants of tax- spend nexus:

S/No	Variables	Abbreviation	Measurements	Expected Outcomes	Source of Data
01	Tax Revenue in units	TR in units	Million PKR	Positive	SBP
02	Public Expenditure in units	PE in units	Million PKR	Positive	SBP
03	Tax to GDP ratio	TR/GDP	Proportion of GDP	Positive	WDI
04	Public Expenditure to GDP ratio	PE/ GDP	Proportion of GDP	Positive	WDI

In this study, four key variables have been identified to examine the tax-spend relationship in Pakistan. These include Tax Revenue (TR), Public Expenditure (PE), Tax to GDP Ratio (TR/GDP), and Public Expenditure to GDP Ratio (PE/GDP). All variables have a positive relationship, assuming that higher tax revenue is associated with increased government spending and vice versa. This setup does not assume a single dependent variable, as the objective is to explore the direction of causality among the variables using the Granger Causality approach.

Econometric Technique and Research Methodology

This study employs a range of econometric techniques to investigate the relationship between tax revenue (TR) and public expenditure (PE). Firstly, the Augmented Dickey-Fuller (ADF) test is used to determine the stationarity of the variables. Next, the Granger causality test is applied to examine the causal relationship between TR and GE in levels. The test is represented by the following equations:

Equation 1: Government Expenditure as dependent variable:

$$GE = \alpha_0 + \sum (\alpha_{1i}.\ GE_{t-i}) + \sum (\beta_{1i}.TR_{t-i}) + \mu_{1t}$$

Equation 2: Tax Revenue as dependent variable:

$$TR_t = \gamma_0 + \sum (\gamma_{1i}\ .TR_{t-i}) + \sum(\delta_{1i}.\ GE_{t-i}) + \mu_{2t}$$

Furthermore, the Granger causality test is applied to the growth rates of TR and GE as a ratio of GDP.

The elasticity of TR with respect to GE is estimated to analyze the responsiveness of TR to changes in GE. The Engle-Granger test is employed to examine the long-run relationship between the variables. Additionally, elasticity regression is estimated.

The Engle-Granger two-step co-integration test is to determine if a long-run equilibrium relationship exists between two or more non-stationary time series variables. The test is conducted in two primary stages. The first step involves estimating a long-run relationship using an Ordinary Least Squares (OLS) regression.

The long-run co-integration equation would be:

$Log\ PE_t=\beta_0+\beta_1 log\ TR_t+\beta_2 Tax\ GDP\_Ratio_t+\beta_3 PE\ GDP\ Ratio_t+u_t$

The second and crucial step is to test whether the residuals (u^t) obtained from the long-run regression are stationary. This is done by performing a unit root test (typically the ADF test) on the residuals.

Data Sources

This research study used the TSD from 1989 to 2024. The Eviews 10 was used for the data analysis. The data was retrieved from the State Bank and World Development Indicator.

Data Analysis and Interpretation:

Verification of the Direction of Relationship among the Tax Revenue and Public Expenditures: GRANGER CAUSALITY TEST

Table:2 Results of Granger Causality Test For PE and TR in units:

Null Hypothesis	bservations	-Statistic	robability
R	3	.	.
Edo	35	.700	.000

es not Granger Cause TR		92	4

Source: Author's estimation

Since both p-values are below 0.05, so reject both null hypotheses. This suggests that there is bidirectional Granger causality (fiscal synchronization) between TR and government expenditure and is statistically significant. The results of Phiri (2019) validate fiscal synchronization. It supports Keynesian economic theories that emphasize the role of fiscal policy in economic stabilization.

Table:3 Results of Granger Causality between growth rates For PE and TR as GDP ratio:

ull Hypothesis	bservations	-Statistic	robability
R	3		0.0450

E d o e s n o t G r a n g e r C a u s e T R	3 5	. 4 6 9 8 1	0.8833

Source: Author's own estimation

For the hypothesis "TR does not Granger Cause GE," the probability value is 0.0450, which is less than the typical significance level of 0.05. This means changes in Tax Revenue can help to predict changes in Government Expenditure.

The p-value for the hypothesis "GE does not Granger Cause TR" is 0.8033 which is much higher than 0.05. This means changes in Government Expenditure do not necessarily impact Tax Revenue. Results revealed that there is a unidirectional relationship running from TR to Government expenditure, Results of Solikin and Nizar (2023) validate the spend revenue hypothesis.

Augmented Dickey-Fuller Test

Table: 4 Results of ADF Tests

S.No	Name	ADF	Test value	Critical value	P-value	Results
01	TR in units	Level	2.892	-3.536	1.0000	***I(1)***
		1st difference	-3.610	-3.5484	0.0416	

02	PE in units	Level	- 2.279	-3.5155	0.4360	***I(1)***
		1st difference	-6.119	-3.5207	0.0000	
03	TR/GDP	Level	-2.124	-3.5207	0.5176	***I(1)***
		1st difference	-7.6793	-3.5207	0.0000	
04	PE/GDP	Level	-4.312	-3.5133	0.0632	***I(1)***
		1st difference	-5.543	-3.5510	0.0316	

ADF test is employed to assess the stationarity of the data to ascertain the type of econometric model to be employed on the data. The ADF test employs the tau statistic to assess the unit root. The null hypothesis of ADF is that data is non-stationary. If the tau calculated is more negative than the critical value tau rejects Ho otherwise accept Ho. Again if the p-value is less than 0.05 then reject Ho and the data will be stationary otherwise accept Ho and the data will be non-stationary.
The ADF test results showed that variables were integrated of order one **I(1)**, So we employ the Engel-Granger co-integration test to determine if there exists a long-run equilibrium relationship between TR and government expenditure.

Engel Granger Test

The Engel-Granger table presents the results of the co-integration analysis, which is divided into two parts: elasticity regression and propensities. The elasticity regression analysis examines the long-run relationship between tax revenue and public expenditure, while the propensities analysis assesses the impact of changes in tax revenue on public expenditure. The results of the Engel-Granger test indicate whether there is a long-run equilibrium relationship between the variables.

Table: 5 Results of Engel Granger Test:

S No	Regression	EG test value	EG critical value	EG P value	Remarks
1	Elasticity Regression	-6.12543	-3.5180	0.0000	The EG type of Co - integration Exists
2	Propensities	-2.8866	-1.9484	0.0049	The EG type of Co-integration Exists

Source: Author's own estimation

The Engel-Granger table results indicate that there is a long-run equilibrium relationship between the variables in both the Elasticity Regression and Propensities regressions. For the elasticity regression, the EG test is significantly lower than the critical value, and the p-value (0.0000) is highly significant, indicating a strong co-integrating relationship. This suggests that over time, tax revenue and public expenditure tend to move together, supporting the notion of long-term fiscal linkage.

Similarly, in the propensity model, the EG test value is also lower than its respective critical value, with a statistically significant p-value (0.0049), further confirming the existence of co-integration. These results imply that despite short-term fluctuations, the variables are linked in the long run, providing empirical

support for fiscal policy coordination in the economy.

Elasticity regression in units with Granger causality technique

The elasticity regression analysis, conducted using the Granger causality technique, measures the responsiveness of public expenditure to changes in tax revenue.

Table: 6 Results of Elasticity regression in units with the Granger causality technique

Variable	Coefficient	T values	P values	R square
Log(TR)	0.938439	70.64743	0.0000	0.99

Source: Author's estimation

The Log(TR) variable represents the logarithm of Total Revenue. The coefficient of 0.93 indicates that a 1 percent change in Tax Revenue leads to an approximately 0.94 percent change in the PE. The high R-squared value of 0.99 model is the best fit. The significant P value and high T value confirm that Log (TR) is a significant predictor. The elasticity analysis implies that the PE is highly responsive to changes in TR. Results suggest that there exists a strong relationship between TR and the.

Elasticity Regression in GDP ratio:

Table: 7 Results of Elasticity Regression in GDP ratio:

Results of Regression No.1 Elasticity Regression				
S.No	Coefficients	T values	P values	Remarks
01	0.938439	70.64743	0.0000	
Results of Regression No.2 Results of effects of one percentage change in GDP to TR and PE				
02	0.147239	0.641605	0.5247	

Source: Author's own estimation

The table presents the results of two regression analyses, specifically Regression No.1 Elasticity Regression and Regression No.2 Results of effects one percentage change in GDP to TR and PE.

Regression 1 shows a coefficient of 0.9384, with a T-value of 70.647 and a P-value of 0.0000, indicating a strong and statistically significant relationship between tax revenue and public expenditure. This suggests that a 1 percent increase in public expenditure is associated with a 0.93 percent increase in tax revenue. Regression 1 supports the idea that tax revenue and public expenditure are strongly interlinked, reinforcing the tax-spend nexus in fiscal policy.

Regression 2 analyzes the impact of a 1 percent change in GDP on tax revenue (TR) and public expenditure (PE). It shows a coefficient of 0.1472, with a T-value of 0.641 and a P-value of 0.5247, which means the relationship is statistically insignificant. The insignificant relationship in the second regression analysis implies that GDP growth may not be a significant driver of changes in tax revenue and public expenditure, and therefore, policymakers may need to consider other factors when making decisions about fiscal policy.

Regression 2 also analyzes fiscal sustainability factor. If changes in GDP do not significantly impact TR and PE in a statistically robust way, it suggests that these fiscal components might not be acting as strong automatic stabilizers in response to economic fluctuations.

Conclusion and Recommendations

Conclusion

This study investigates the fiscal neutrality hypothesis in Pakistan using annual time series data from 1989 to 2024. Various econometric techniques were employed to analyze the relationship between tax revenue and public expenditure, including the Granger causality test, Augmented Dickey-Fuller test, elasticity regression, and Engel-Granger test. The results of Granger causality in million PKR suggest that the fiscal synchronization hypothesis exists in Pakistan, indicating a bidirectional causality between tax revenue and public expenditure. In contrast, when TR and PE are measured as a tax-to-GDP ratio, the results support the revenue-spend hypothesis, implying that changes in tax revenue lead to changes in public expenditure. These findings have significant implications for fiscal policy in Pakistan.

Recommendations

To address the fiscal deficit and debt burden, it is essential to implement a fiscal consolidation strategy that focuses on increasing tax revenue and reducing public expenditure. To increase tax revenue Govt should bring the informal sector into the tax net, reduce tax exemptions, and implement tax reforms to improve tax revenue mobilization. policymakers should prioritize tax revenue mobilization through reforms and efficient tax administration Additionally, prioritize expenditure allocation, ensure efficient use of resources, reduce wasteful spending, and cut non-essential public expenditure, with a particular focus on controlling non-development expenditures. To achieve fiscal sustainability, implement a fiscal consolidation strategy centered on increasing tax revenue and reducing public expenditure. Adopt fiscal policies that fulfill inter-temporal budget constraints, reduce dependence on a single revenue source to mitigate the impact of fluctuations in public expenditure, and coordinate tax revenue and public expenditure plans effectively

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