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Causality between Tax Revenue and Expenditure in case of Pakistan through Toda Yamamoto Methodology

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Abstract*: The study investigates the actual causal partnership between federal expenditure and federal revenue inside Pakistan by employing Toda-Yamamoto methodology for the period, 1972 to 2014. This statistical methodology opens an additional channel for causation between the government total revenues (LFTR) and expenditures (LFEXP). The empirical upshots reveal the existence of unidirectional causality running from (LFEXP) expenditures to (LFTR) revenues ("spend–revenue" hypothesis). It is suggested to concern authorities the preference of controlling or reducing expenditures.*

Keywords: Tax revenue, Expenditure, Granger Causality, Toda-Yamamoto Model.

1.Introduction

Since the early eighties, the economists and policy-makers regarding the inter-temporal connection between taxation and government spending have been discussing. This kind of debate is vital since it corroborates how big government, budget deficit along with the composition involving taxation and spending themselves. Pakistan started journey of budget deficit with six percent of GDP in 1990 experiencing ups and downs through the time to 8.5% of GDP in 2012(SBP,1990-2012). Due to the budget deficit, it is has been borrowing to fill the gap domestically and internationally.

In Pakistan, higher level of fiscal deficit is supported to a major extent by government. She borrows it and leads to increase the taxes in future. There has been ample research on the consequence of budget deficit instead of the causes. Examining the relation between taxes and expenditures may be a crucial step in understanding the sources, the implications, the longer term methods of budget deficit, and notice the suitable solutions for control and reduction it. The link between revenue (tax) and expenditure gets importance for policy makers and economists alike. This study is more crucial and pertinent since budget deficit has been increasing in the governments of both under developed and developing countries. The fiscal policy becomes an effective with the knowledge of nexus between revenue and expenditure. The nexus between tax revenues and government expenditures can be classified in four public finance models.

First, the revenue (tax)-spending hypothesis, in which it is stated that variations in revenues lead alteration in expenditures, but not reversely. This hypothesis poses that by spending all her revenues implies that a rise in government revenue clears way for higher government spending. The empirical findings of this hypothesis would show unidirectional causality from revenue (tax) to spending for the government.

Second, the spending-revenue (tax) hypothesis takes totally opposite direction of first one. It suggests that government will nurture the funds for the coverage of its spending, and therefore a rise in government expenditures will be responsible for rise in government revenues. The practical outcomes of this hypothesis will demonstrate unidirectional causality from spending to revenue (tax) for the government.

Third, the hypothesis of fiscal synchronization topic suggests that jointly decisions are performed for revenue (tax) and expenditure. It slates that governments select the spending programs' amount along with the revenues (tax) necessary to endowment such amount. According to this hypothesis, there is a bi-directional causality between the revenue (tax) and spending in the budgetary process.

Finally, the institutional separation hypothesis states that there is no dependency between government revenue (tax) and expenditure judgments of government due to institutional separation. In this fourth hypothesis, there is no evidence of causality between revenue (tax) and spending variables, and henceforth they are causally independent of one another.

Although the causality between revenue (tax) and spending of government, it is essential to investigate the way to highlight fiscal imbalances. Empirical findings on this main issue are limited, especially in developing and under-developed countries. Hence, this acquires to explore the causality between revenues (tax) and government spending using Toda-Yamamoto methodology in Pakistan.The remaining study takes an organized form as follows: Literature review follows, data and modal, results and conclusion in the next

coming sections.

2. Literature Review

A very limited study has been conducted on the question of linkage between revenue (tax) and government spending. It is still problematic to settle this issue for all the economies of the world whether they may be developed, developing or under-developing. Wong and Lim (2005) applied Granger causality in Malaysia for the period 1965-2002 using cointegration with ECM approach. The results support the existence of revenue (tax) – spend hypothesis with unidirectional granger causality from the revenue (tax) to spending in Malaysia.

Eita and Mbazima (2008) explored causality between revenue (tax) and spending in Namibia for the period 1977-2007 using vector autoregressive (VAR) Methodology and found unidirectional causality between revenue (tax) and expenditure supporting tax-spend hypothesis for Namibia.

Payne (1997) observed unidirectional causality between the revenue (tax) and government spending including GDP variable in Canada. The ECM technique was followed and findings supported the spend-tax hypothesis in this paper.

Li (2001) for China, Raju (2008) for India established bidirectional causality between fiscal variables, (Miller and Russek,1990; Wahid, 2008)) proved unidirectional causality for US and Turkey respectively.Owoye, (1995) produced mix results of causality among G7 countries.Petanlar et'al. (2012) inspected the causal nexus between revenues (tax) and government spending in22 OECD countries, 11 European Union (EU) member states, and 11 non-EU and found mix resultsabout the countries under study.

In the context of Pakistan, little account of empirical literature review is created.(Aisha and Khatoon ,2009; Subhani et' al.,2012) produced unidirectional granger cause between expenditure and revenue (tax) confirming the "spend-tax" hypothesis. On other hand, (Sadiq (2010; Ali and Shah, 2012) reported the absence of causality between revenue and spending favouring the fourth hypothesis of institutional separation. The decree is still not settled out between government revenue (tax) and spending for the directional causality. So, this paper attempts to apply Toda Yamamoto Methodology to find directional causality between government revenue (Tax) and expenditure in case of Pakistan.

3. Materials and Methods

The paper employs time series annual data ranging from time period 1972 to 2014.Data is taken from website of State bank of Pakistan, various issues of Statistical year book and economic survey of Pakistan, and World Data Indicator,2014.The variablesare all in terms of logarithm. The GDP deflator is at 2006 base year and denoted by LP. The Federal Total Revenue is denoted by LFTR, whereas Federal Expenditure by LFEXP.

3.1 Toda-Yamamoto Methodology

Overcoming the shortcomings in Granger (1969), an efficient methodology Toda and Yamamoto (1995) has been introduced. It is relatively more efficient in dealing small sample size and disregarding order of integration for the relative variables (not known, not same or more than 2). Besides this, it does not believe in pre-testing the time series for the cointegration properties so long as integration order of the series does not cross the model's true lag length. Toda and Yamamoto (1995) is directly performed for Granger causality test, testing the coefficient of VAR at level. This methodology minimizes associated risk that was wrongly identified in the time series for order of integration and the existence of cointegration relationship (Mavrotas and Kelly, 2001).

Basically, Toda and Yamamoto (1995) augments the correct VAR (k) with d extra lags, where d is the maximum order of integration in the sampled system. As the optimal lag length in the VAR model is determined by Akaike Information Criteria (AIC) or Schwartz Information Criterion (SIC), say, k. In the third step, VAR (p) where (p=k+dmax) is estimated using Seemingly Unrelated Regression (SUR). At last, the no causality null hypothesis is tested by the Wald statistic (W). The Granger causality approach necessitates implementation of Toda and Yamamoto methodology linking three variables in the trivariate system as follow:

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_k Y_{t-k} + \mu_t \quad \ldots(1)$$

Where, $Y_t = \begin{bmatrix} Y_{1t} \\ Y_{2t} \\ Y_{3t} \end{bmatrix} = \begin{bmatrix} (LFTR)_t \\ (LP)_t \\ (LFEXP)_t \end{bmatrix}$, and A's are coefficient matrices of order 3; and $\mu_t \sim i.i.d\ N(0,\ \Sigma)$. LFTR stands for the Log of Federal Total Revenue, P is the GDP-Deflator on the base year 2006, and LFXP is the Log of Federal Expenditure.

The above equation (1) can be written as:

$$\begin{bmatrix} (LFTR)_t \\ (LP)_t \\ (LFEXP)_t \end{bmatrix} = A_0 + A_1 \begin{bmatrix} (LFTR)_{t-1} \\ (LP)_{t-1} \\ (LFEXP)_{t-1} \end{bmatrix} + A_2 \begin{bmatrix} (LFTR)_{t-2} \\ (LP)_{t-2} \\ (LFEXP)_{t-2} \end{bmatrix} + \ldots + A_k \begin{bmatrix} (LFTR)_{t-k} \\ (LP)_{t-k} \\ (LFEXP)_{t-k} \end{bmatrix} + \begin{bmatrix} \mu_{t(LFTR)} \\ \mu_{t(LP)} \\ \mu_{t(LFEXP)} \end{bmatrix} \quad \ldots(2)$$

The null hypothesis of no causality shall be tested estimating augmented levels VAR (p=k+d) in the following way.

$$Y_t = A_0 + A_1 Y_{t-1} + A_2 Y_{t-2} + \ldots + A_k Y_{t-p} + \mu_t \quad \ldots(3)$$

The main null hypotheses of the study estimating augmented VAR system are described as follow:

H_{01}: Y_{t3} (LFEXP)does not cause Y_{t1} (LFTR),that is, $a_{31}^{1} = a_{31}^{2} = \ldots a_{31}^{p} = 0$

H_{02}: Y_{t1} (LFTR)does not cause Y_{t3} (LFEXP),that is, $a_{13}^{1} = a_{13}^{2} = \ldots a_{13}^{p} = 0$

The Wald test statistic is employed to test both null hypotheses. It follows asymptotic Chi-Squared distribution with k degrees of freedom. It ignores the d_{max} parameters of the auto regressive system in testing granger causality. It helps to overcome the problem of non-standard asymptotic properties associated with standard Wald test for integrated variables.

4. Results for Discussion

It is essential to establish stationarity among the variables to be estimated before the estimation of the VAR system. Thus, the KPSS is carried out for the level (with intercept and intercept and trend) and first differences (with intercept and intercept and trend) in the **Table01.**

Table01:Kwiatkowski-Phillips-Schmidt-Shin(KPSS) Unit Root Test (H_0: no unit root)

Variables	Level		First Difference	
	C	C+T	Ct	C+T
LFEXP	0.720***	0.129***	0.167	0.143
LP	0.712***	0.159***	0.182	0.061
LFTR	0.715***	0.083***	0.099	0.067

Source Authors' own Calculation(*shows reject at1%)**

The findings of the study are clearly depicted in **Table01**. The null hypothesis of stationary is rejected at level but cannot be rejected at the first difference.

Thus, all the series LFEXP, LP, and LFTR are stationary at first difference so they possess one order of integration I(1). After establishing the stationary properties of the series, an appropriate lag length is determined for the VAR model. The choice of the lag length may affect the inferences of the VAR for the Toda Yamamoto causality. The model can be mis-specified due to too small lag length while it wastes degrees of freedom due to too large lag length. Therefore, analysis is started with six lags for all the variables. Different criterions have been used to determine the optimal lag length such as Akaike Information Criterion (AIC), Bayesian Schwarz Information Criterion (BSIC) and Hannan- Quinn Criterion (HQ) for the models. As order of integration is one for all the series (i.e d(max)=1). So VAR (4=3+1) has been estimated to perform granger non causality through Toda-Yamamoto Methodology and results are presented in **Table02.**

The upshots from **Table02** show that unidirectional causality runs from LFEXP to LFTR between the federal government's total revenue and total expenditures in Pakistan. This is based on the significance of the null hypothesis with p-value (0.0114). These results provide evidence about "spending to taxes" hypothesis in Pakistan. The results suggest that higher government expenditures would lead to higher government expenditures. In other words, hypothesis of increases in expenditures would induce higher taxes in Pakistan cannot be rejected whereas opposite of it is rejected.

Tableo2: Toda and YamamotoCausality Test

H_0	$\chi^2_{(df)}$	Prob	Decision
$LFTR \nrightarrow LFEXP$	3.872(3)	0.2756	Do not Reject
$LFEXP \nrightarrow LFTR$	11.055(3)	0.0114	Reject

Source: Authors' own calculation

Conclusion

On the basis of empirical findings, the hypothesis of "spending-revenue (tax)" can be accepted. Besides this, empirical findings reveal evidence about the stability of long-run relationship between government revenue (tax) and expenditure with unidirectional causality running from spending to revenue (tax).

In conclusion, an increase in Pakistan's public expenditures, especially current expenditures, and the lack of foreign financial assistances - which are mainly assigned to cover up gap of the budget deficit which is regularly exacerbated. Automatically the government will finance its spending by borrowing internally and externally, and consequently indebtedness would be raised. The process of financing government expenditures is generally by means of tax revenues, internal or external borrowing, grants and foreign aids. If tax rate is kept constant for a specific time, additional rise in government spending would be funded either through internal or external borrowing or by the request for more grants and foreign aids. The foreign aids by which some budget expenditure is financed, depends upon the economic condition of the donor countries. The borrowing through internal and external sources by which expenditures are covered up, will move the arrow of interest rate upward for the loans and thereby make high the burden of indebtedness.

Therefore, it is necessary to cut government expenditures in level in order to place the budget deficit under control. Alternatively, government of Pakistan will experience high risk of budget instability and the burden of public debt would be increased in the long term.

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