Pakistan Economic and Social Review
Volume 57, No. 2 (Winter 2019), pp. 117-141

BUDGET SPILLOVERS AND SPATIAL INTERDEPENDENCE AT THE SUB-NATIONAL LEVEL: EVIDENCE FROM PAKISTAN

UMAIMA ARIF, FARZANA NAHEED KHAN AND ASMA ARIF*

Abstract. In this study we investigate the notion that provincial governments, in making their choices of public spending, consider the policy choices of neighboring province. The study is based on annual data of all the four provinces of Pakistan over the period of 1981 to 2018. The empirical evidence shows that expenditure choices of provincial governments are influenced by the level of expenditures of its neighboring province. Moreover, provincial spending on law and order, health and education are also influenced by the spending of neighboring province. Further, the results show that variation in interprovincial spillover effects may necessitate a different structure of federal grants to provinces that, along with the standard criteria, also consider uncompensated spillover benefits to neighboring regions as an indicator for the distribution of financial resources.

Keywords: Public policy, budget spillovers, fiscal interactions, seemingly unrelated regression

JEL Classification: H7, H4, H5

---

*The authors are respectively Assistant Professors at School of Economics, Quaid-i-Azam University, Islamabad – Pakistan and Ph.D. student at School of Economics and Management, China University of Geosciences, Beijing - China.
Corresponding author's e-mail: farzanakhan@qau.edu.pk

I. INTRODUCTION

Expenditure spillovers and public policy interdependence among the sub-national governments has attained considerable importance in theoretical and empirical literature related to public finance. Interdependence in provincial and local fiscal policies arises if public choices in nearby region have an essential role in the public decisions of domestic region. Fiscal policy interdependence among provincial or local governments can be provoked by positive or negative spillover effects that influence consumption of residents in neighboring region. Therefore, positive or negative interdependence among neighbor's public expenditure may be observed depending upon the complementarity or substitutability with neighbor's expenditure. Public policy interdependence may also arise for fiscal competition between regions to attract residents/businesses and for cooperation and coordination between provincial and local governments. Further, interdependence can be due to yardstick competition as voters if imperfectly informed evaluate the performance of their government by taking the policies of neighboring region as yardstick. Imperfectly informed provincial or local authorities also tend to follow policies of neighboring region.

In recent times, fiscal policy interdependence was usually investigated for taxation policy and tax competition (Allers & Elhorst, 2005; Hayashi & Robin, 2001; Revelli, 2002; Sol´e-Oll´e, 2007; Bordignon et al., 2003). In developing countries provincial and local governments are not properly equipped with tax competencies. Consequently, the literature has been widened to public expenditure since lower levels of government interact mainly through public expenditures (Foucalt et al., 2008; Sol´e-Oll´e, 2006; Revelli, 2005; Lundberg, 2006; Brueckner, 1998; Case et al., 1993).

Generally, the empirical literature on fiscal interdependence among the sub-national governments is comprised of three groups involving benefit spillovers, yardstick competition and tax competition. The literature on benefit spillovers examines whether public spending of a region creates negative or positive effects on the welfare of citizens in neighboring regions.

The models of yardstick competition are generally considered within the framework of benefit spillover where voters with asymmetric

information use neighboring regions' public policies to evaluate the performance of their own government (Salmon, 1987). The tax-competition literature explores the strategic imposition of taxes by the governments on a mobile tax base along with the strategic policy choices of sub-national governments concerning welfare benefits. All the above categories of literature investigate whether decisions of a sub-national government are determined by the policies choice elsewhere.

There is both theoretical and empirical work that explores whether or not sub-national governments take their decisions about spending by considering the spending decisions of their neighboring jurisdiction. In this conceptual framework, expenditure decisions would depend not only on the economic, social, political, demographic and geographical characteristics of sub-national government but also on the spending decisions of neighboring sub-national governments. Most of the empirical studies investigate fiscal interactions for the tax side of the sub-national budget and only few studies focus on public expenditures (Foucault et al., 2008; Revelli, 2002b, 2003; Baicker, 2005, Costa et al., 2015; Case et al., 1993; Figlio, Kolpin, & Reid, 1999). However, in existing literature we cannot find any study that investigates policy interactions by using comprehensive dataset on the provinces of Pakistan. In the current study, we attempt to fill up this gap by exploring the presence of spatial effects that influence provincial spending decisions.

The current study is based on annual data for the 4 provinces of Pakistan over the period 1981-2018. We investigate the notion that provincial governments, in making their choices of public spending, consider the policy choices of neighboring province by employing spatial lag/durbin model within seemingly unrelated regression framework. Further, four alternative criteria to determine neighborliness is used to test the robustness of results. The study contributes to the empirical literature based on budget spillover as the objective of study is to investigate whether or not provincial public expenditure is affected by the expenditures in neighboring provinces. The study investigates the prevalence of spatial interdependence in provincial public spending by using annual data on the four provinces of Pakistan. We focus on total spending and also on different categories of public spending including law and order, education and health.

Generally, the study is based on budget spillovers and policy interdependence and attempts to explore whether or not the decisions of provincial governments' spending affect each other. This issue is important to comprehend the allocation of expenditures across provinces along with the effects of decentralized policies on expenditure side. The decentralization reforms that Pakistan is pursuing, after the 18th amendment 2010 and 7th National Finance Commission (NFC) Award, renders further importance to this issue. The 18th Amendment to the constitution assigned greater fiscal autonomy to the provincial governments by eliminating the concurrent list along with other associated provisions. Further, for the distribution of financial resources among the provinces, multiple indicators have been incorporated as the criterion in 7th NFC Award 2010. The 7th NFC Award revised the ratio of division of revenues to the federating units which is a major step towards fiscal federalism as it broadened the criterion for the NFC Award, reduced the share of Punjab and almost doubles the share of Baluchistan.

It is expected that the multiple criteria used in 7th NFC award will play a key role in tackling the problem of regional disparities and fiscal equalization. It is expected that the ordinary citizens in federating units would gain from the reassignment of the resources from the federal to the provincial government as the provinces would now be able to spend most of their money on education, health, infrastructural facilities, drinking water, energy, agriculture and irrigation.

Now federal government is not the only influential force for fiscal affairs as legislation autonomy has also been transferred to the provinces. The share of provinces in the divisible pool of funds has risen from 47 percent to 57.5 percent that can be further increased with grants, straight transfers and development loans, etc. Accordingly, sound fiscal policy with prudent management of public expenditure is essential for synchronization of revenue receipts and expenditures to avoid high deficits. The current study based on budget spillovers and policy interdependence attempts to explore whether or not the decisions of provincial governments' spending affect each other. It is imperative to attain fresh insights into the decisions of public policy, at the sub-national level, for greater fiscal consolidation.

The rest of the study is arranged as follows. Section II discusses empirical literature on benefit spillover and interdependence of public policy whereas methodology and data/sample are presented in section III. The empirical findings are discussed in section IV and the study is concluded in the last section.

II. REVIEW OF LITERATURE

Strategic interaction among the sub-national governments is a well debated issue in the literature of regional science and public finance. The presence of strategic interactions among sub-national governments is theoretically expressed by a number of models like spillover effects, yardstick competition, political trends, welfare and tax competition. In the yardstick competition model, voters compare taxes and expenditures in their jurisdiction with taxes and expenditures in neighboring jurisdictions (Salmon, 1987) and therefore, voters penalize the serving politician if spending/tax decisions do not match with their neighbors.

Starting with the work of Besley and Case (1995), several studies in literature have empirically tested yardstick competition (e.g., Revelli, 2002a; Bordignon, Cerniglia, & Revelli, 2003; Solé-Ollé, 2003; Padovano & Petrarca, 2014; Allers & Elhrost, 2005). Another source of policy interaction arises due to tax competition where mobile tax base depends on its own and neighbors' tax policies that results in tax competition (Kanbur & Keen, 1993; Rizzo, 2008; Devereux, Lockwood, & Redoano, 2008; Rizzo, 2010).

In the spillover model, public spending of a jurisdiction may lead to positive/negative spillover effects that influence the welfare of citizens in neighboring jurisdiction. Therefore, sub-national governments may decide their own spending strategically by considering the spending decision of their neighbors (Case et al., 1993; Revelli, 2003, 2002b; Baicker, 2005; Solé-Ollé, 2006; Werck, Heyndels, & Geys, 2008; Costa, Veiga, & Portela, 2015).

The empirical research on the interdependence of public spending was originated with the pioneering work of Case et al. (1993), who empirically explored the interaction in public spending of the 48 states in the US and provided evidence that states' spending is affected by the

public spending of neighboring states. Brueckner (1998) analyzes the municipalities of California with growth-control measures and explored the evidence of strategic interaction of policies.

Hanes (2002) analyzes local rescue services for the Swedish economy and finds negative response of municipalities to spillover benefits from neighboring region. Neighborhood influence in the provision of social services for the UK local governments has been investigated for spatial interdependence and results confirm that spatial autocorrelation in social expenditures is endogenous and determined by neighboring regions (Revelli, 2002b).

The case of Spanish local government has also been analyzed by estimating the expenditure reaction function for interaction between local government and the results reveal that spillovers are more pronounced in urban areas relative to the rest of the country (Sol´e-Oll´e, 2005). Expenditure spillover effects are also analyzed for the states of the US via exogenous shocks to medical outlays and empirical findings supports the hypothesis that state spending are mostly effected by the states to which the domestic residents are expected to move (Baicker, 2005).

The cultural and recreational spending by Swedish municipalities has also been tested for spatial interdependence and the empirical findings depict that municipalities with similar outlays are geographically clumped (Lundberg, 2006). Further, positive interdependence has been observed, in German communities, for the public spending that create facilitating environment for business development and general administration (Borck et al., 2006).

For Italian jurisdictions, Ermini and Santolini (2007) examined public spending interdependence and get considerable spatial interaction among the regions for aggregate and different categories of spending. Werck et al. (2008) finds for Flemish municipalities that their cultural expenditures are absolutely influenced by the cultural spending of neighboring municipality. Redoano (2007) investigated fiscal policy interdependence, involving both taxes and expenditures for European countries. Foucalt et al. (2008) examined public policy interactions among French municipalities regarding different categories of local public spending. Ermini and Santolini (2010) finds spatial

interdependence in local councils' spending in Italy, hence suggested that local council spending may possibly be impelled by spillover effects.

The empirical literature on interdependence of public policy shows that public spending in neighboring region can positively/negatively affect the welfare of citizens in nearby regions that leads to policy interdependence at the sub-national level. With reference to developing countries, particularly Pakistan, we cannot find any relevant theoretical or empirical literature for budget spillovers and spatial interdependence at the sub-national level. Hence, it necessitates probing this matter for fresh insights on expenditure policy and prudent fiscal management at the sub-national in Pakistan.

III. EMPIRICAL MODEL, DATA AND ESTIMATION PROCEDURE

EMPIRICAL MODEL

Our theoretical framework implies that province *i* spending in year *t*, E_{it}, depends on the spending of its neighbor, E_{jt}, and its own attributes (Z_{it}). Following Elhorst (2014), Baicker (2005) and Case et al. (1993), our estimation equation with only one neighbor is given by

$$E_{it} = \lambda Z_{it} + \gamma E_{jt} + u_{it} \qquad (1)$$

where E_{it} is province *i* spending in year *t*, E_{jt} is province *j* spending in year *t*, Z_{it} is a vector of control variables λ and γ are the parameters and u_{it} is a random error term.

The possibility of multiple neighbors has been incorporated by replacing E_{jt} in equation (1) by

$$\sum_{j=1}^{n} w_{ij} E_{jt} \text{ for all } i \neq j. \qquad (2)$$

where $\sum_{j=1}^{n} w_{ij}$=1 and $w_{ij}$are the weights assigned to the neighbors.

We use four different weighting specifications to measure which provinces are close or distant neighbors. Each specification is used to generate composite values of neighbor's spending for each of the four provinces. In considering geographical proximity to measure

neighborliness, we make it both dichotomous and continuous variable. In specifying geographical proximity as a dichotomous variable, we denote $w_{ij} = \frac{\omega_{ij}}{\delta}$ where $\delta = \sum \omega_{ij}$. For each of the four provinces ω_{ij} is assigned a value of 1 if i^{th} and j^{th} province have a common border and equal to zero otherwise. We also specify geographic contiguity as a continuous variable by setting $\omega_{ij} = \frac{1}{d_{ij}}$, where d_{ij} is the distance connecting the capitals of i^{th} and j^{th} province, to calculate w_{ij} from ω_{ij} as mentioned above.

We also measure neighborliness for each province *i* to other provinces *j* on the basis of per capita income in each province by defining $\omega_{ij} = \frac{1}{|income_i - income_j|}$ where $|income_i - income_j|$ is the difference between the average income of province *i* and *j* to calculate w_{ij} from ω_{ij} as before.

Similarly, neighborliness is determined for each province *i* to other provinces *j* on the basis of population in each province as regions with analogous demographics might have significant mutual affect as their residents are expected to compete in domestic markets. So, we define $\omega_{ij} = \frac{1}{|population_i - population_j|}$, where $|population_i - population_j|$ is the difference between the average population of province *i* and *j* over the sample, to calculate w_{ij} from ω_{ij} as before.

DATA

For the measurement of government outlays in province *i* in year *t*, we take aggregate expenditure of each province and convert it into per capita terms. The vector Z_{it} in equation 1 consists of per capita income, per capita federal grants to province, population density and population over 60 years.

The resources available for provincial spending are measured by the federal grants to the provinces and income. Demographic variables are included to capture the disparity in demands for public goods by different age categories whereas population density captures the possibility of scale economies in the provision of public services.

Data on aggregate expenditure of each province and federal grants to the provinces is collected from *Pakistan Statistical Year Book* and data on demographic variables is collected from *Pakistan Bureau of Statistics.* The data on different categories of spending which include expenditure on health, education and law and order is also collected from *Pakistan Statistical Year Book*. The data on provincial GDP is extracted and extended to date by following the methodology of the Arby (2008) due to unavailability of official published statistics on Gross Domestic Product (GDP) at the provincial level. The descriptive statistics of the variables are given below in Table 1.

TABLE 1

Descriptive Statistics of Variables

Variables	**Descriptive Statistics**			
	Mean	**Standard Deviation**	**Maximum value**	**Minimum value**
Punjab				
Per Capita Expenditures	7.1	1.1	8.98	5.1
Per capita Output	10.4	0.67	11.8	9.8
Per capita Grants	6.6	1.32	8.78	4.6
Population Density	374	87	527	233
Population 60+	15.35	0.25	16.01	14.9
Sind				
Per Capita Expenditures	7.40	1.2	9.3	5.24
Per capita Output	10.7	0.66	12.1	10.2
Per capita Grants	5.9	1.67	9.1	4.26
Population Density	225	52	317	140
Population 60+	14.1	0.25	14.5	13.7
Baluchistan				
Per Capita Expenditures	7.9	1.18	9.8	5.79
Per capita Output	10.6	0.58	11.8	10.06
Per capita Grants	7.2	1.60	9.6	4.33
Population Density	19	4	27	12
Population 60+	12	0.25	13.0	12.2
KPK				
Per Capita Expenditures	7.4	1.10	9.34	5.53

Variables	Descriptive Statistics			
	Mean	**Standard Deviation**	**Maximum value**	**Minimum value**
Per capita Output	10.3	0.63	11.6	9.73
Per capita Grants	6.68	1.45	9.19	4.58
Population Density	248	58	350	154
Population 60+	13.5	0.25	14	13.1

After collecting data on the above mentioned variables from various sources, we end up with an annual data for the 4 provinces of Pakistan over the period 1981-2018. We estimate our model of provincial spending by using four alternative criteria to determine neighborliness.

ESTIMATION PROCEDURE

In the context of more general space-time modeling, spatial SUR model was introduced by Anselin (1988) which "*consists of an equation for each time period which is estimated for a cross-section of spatial units*" (Anselin, 1988).

As the time dimension of our sample is longer than the cross-sectional dimension, model specification depends on the time dimension (Mur and Lopez, 2010). Fewer cross sectional units allow developing an equation for each unit along with the interaction mechanism. This approach has been followed by White and Hewings (1982), Hordijk (1979), Arora and Brown (1977), and Hordijk and Nijkamp (1977). We will have a separate equation for each spatial unit (province) to investigate whether variables observed in one unit affect the other units, which give a kind of spatial lag/durbin model within seemingly unrelated regression framework. Therefore, a set of four seemingly unrelated expenditure equations can be written in compact form as

$$E_{it} = X_{it}\beta + u_{it} \qquad t = 1\ldots, \text{n and } i = 1,\ldots, \qquad (3)$$

$$E(u_{it}) = 0 \text{ , for all } t \text{ and } i$$

$$E\left(u_{it}u_{it}^{'}\right) = \sigma^2{}_i \mathrm{I} \text{ , for all } t$$

$$E(u_{it}u_{i't}) = \sigma_{ii'}\mathrm{I} \text{, for all } t, \text{ where } i \neq i'$$

where t and i shows time dimension and cross sectional dimension respectively. E_{it} and u_{it} are tx1 vectors of provincial expenditure and error terms respectively, X_{it} are t x k matrix of k independent variables that includes expenditures in neighboring (E_{jt}) province and other control variables (Z_{it}) that includes per capita income, per capita federal grants to provincial government, population density and population above 60 years of age. $\sigma_{ii'}$ is the covariance across equations i and i'. The covariance matrix of u in case of four regions is given by

$$(uu') = \begin{bmatrix} \sigma^{ii}I & \sigma^{ij}I & \sigma^{ik}I & \sigma^{il}I \\ \sigma^{ji}I & \sigma^{jj}I & \sigma^{jk}I & \sigma^{jl}I \\ \sigma^{ki}I & \sigma^{kj}I & \sigma^{kk}I & \sigma^{kl}I \\ \sigma^{li}I & \sigma^{lj}I & \sigma^{lk}I & \sigma^{kk}I \end{bmatrix} = \begin{bmatrix} \sigma^{11} & \sigma^{12} & \sigma^{13} & \sigma^{14} \\ \sigma^{21} & \sigma^{22} & \sigma^{23} & \sigma^{24} \\ \sigma^{31} & \sigma^{32} & \sigma^{33} & \sigma^{34} \\ \sigma^{41} & \sigma^{42} & \sigma^{43} & \sigma^{44} \end{bmatrix} \otimes I$$

$$= \Omega \otimes I$$

where the diagonal terms are variances of u_i and u_j and off diagonal terms are the covariance between u_i and u_j. So the interactions between the spatial units also come into the model through Ω matrix in generalized least square method. The estimated coefficient matrix $\hat{\beta}$ is given by

$$\hat{\beta} = [\mathrm{X}'(\Omega \otimes I)\mathrm{X}]^{-1}\mathrm{X}'(\Omega \otimes I)\mathrm{E}$$

If Ω is unknown, it can be replaced by the matrix of mean squares and product of least square residuals. For the most circumstances, the estimated coefficient is more efficient than the ordinary least square estimator for each equation.

We estimate our spatial SUR model with four alternative criteria to determine neighborliness that includes provincial income (W_Y), provincial population (W_P), distance based geographic proximity

(W_D) and geographic proximity based on common border (W_B). Our basic model within the SUR framework is also estimated for different categories of provincial spending to explore the policy interdependence. The categories considered include expenditure on health, education and law and order.

IV. RESULTS AND DISCUSSION

Table 2 to 5 present the estimation results for spatial seemingly unrelated regression equation for the four provinces of Pakistan over the period of 1981-2018. We test the notion that provincial public spending is influenced by the spending of the neighboring provinces which indicates fiscal interdependence at the sub-national level.

We start with the analysis of total provincial spending however we also analyze different categories of provincial spending to explore fiscal policy interdependence. The empirical outcome in Table 3 to 5 shows different spatial patterns of provincial spending on health, education and law and order respectively.

Table 2 shows the results on the basis of four alternative weighting specifications to determine neighborliness that involves geographic proximity based on common border (W_B), distance based geographic proximity (W_D), per capita income (W_Y) and population (W_P) respectively. The analysis of all these specifications shows that spatial interdependence seems to prevail in spending decisions of all the provinces which implies that provincial governments do not compose their spending choices in isolation. The empirical findings of several other studies confirms the spillover hypothesis and spatial interdependence in spending decisions of sub-national governments [For example, Foucalt *et al*. (2008), Sol´e-Oll´e (2006), Revelli (2006), Lundberg (2006), Brueckner (1998), Case *et al*. (1993), Arnott and Grieson (1981) and Gordon (1983)].

The estimated SUR model, for aggregate public expenditure, presented in Table 2 shows positive and highly significant spatial interdependence for the province of Punjab, Sind, Baluchistan and KPK which postulates that higher aggregate public expenditures in neighboring province may influence the provincial governments to increase their spending. The interdependence in provincial spending

postulates that an increase in spending, by the neighbors of i^{th} province, leads to an increase in public expenditure of province *i*. The result shows a very high degree of spatial spillover in provincial public spending. All the weighting specifications indicate that neighborliness matters for spending decisions. We can reject the null hypothesis, that the spatial effects are zero, for almost all weighting specifications (W_B, W_D, W_Y, and W _P) [1].

The estimated coefficients of the control variables mostly accord with theoretical expectations. The coefficient of per capita federal grants has expected positive effect on provincial public spending for Baluchistan and KPK, however, it negatively affects per capita spending in Punjab and Sind.

TABLE 2

The Neighborhood Effect and Aggregate Spending Interdependence

		W_B	**W_D**	**W_Y**	**W_P**
Punjab	Spatial lag	0.90 (0.13)***	0.99 (0.14)*	0.93 (0.13)***	0.93 (0.13)***
	Population Density	-0.02 (0.43)	-0.38 (0.4)	0.33 (0.41)	0.19 (0.42)
	Income per Capita	0.13 (0.06)**	0.17 (0.06)***	0.09 (0.06)*	0.12 (0.06)**
	Grants	-0.28 (0.06)***	-0.27 (0.06)***	-0.24 (0.06)***	-0.26 (0.06)***
	Pop 60+	0.72 (0.83)	0.68 (0.89)	0.87 (0.6)*	0.89 (0.57)*
	LM test P-Value	0.01	0.01	0.01	0.01
Sindh	Spatial lag	0.89 (0.12)***	0.82 (0.14)***	0.84 (0.15)***	0.82 (0.16)***
	Population Density	-0.69 0.42*	-0.98 0.47**	-0.78 0.13***	-0.49 0.16***
	Income per Capita	0.26 (0.10)**	0.33 (0.12)**	0.37 (0.12)***	0.39 (0.12)***
	Grants	-0.02 (0.03)	-0.04 (0.03)	-0.05 (0.03)*	-0.06 (0.04)*

[1]The hypothesis is examined by using LM test.

		W_B	W_D	W_Y	W_P
	pop 60+	-0.12 (0.76)	-0.06 (0.9)	-0.36 (1.0)	-0.39 (1.1)
	LM test P-Value	0.06	0.05	0.04	0.13
Baluchistan	Spatial lag	0.71 0.08***	0.78 0.13***	0.49 0.16***	0.5 0.15***
	population Density	-0.32 (0.34)	-0.14 (0.02)***	-0.64 (0.13)***	-0.7 (0.13)***
	income per capita	-0.01 (0.06)	0.05 (0.07)	0.15 (0.08)**	0.12 (0.083)*
	Grants	0.16 (0.02)***	0.14 (0.02)***	0.16 (0.03)***	0.57 (0.15)***
	pop 60+	0.09 (0.54)	-0.7 (0.77)	0.34 (0.92)	0.02 (0.02)
	LM test P-Value	0.15	0.07	0.06	0.19
KPK	Spatial lag	0.68 (0.12)***	0.73 (0.13)***	0.64 (0.13)***	0.7 (0.13)***
	Population Density	0.24 (0.06)***	0.25 (0.06)***	0.84 (0.53)*	0.87 (0.52)*
	Income per Capita	-0.28 (0.09)***	-0.17 (0.09)*	-0.15 (0.09)*	-0.16 (0.09)*
	Grants	0.24 (0.06)***	0.06 (0.06)	0.03 (0.06)	0.02 (0.06)
	Pop 60+	0.15 (0.07)**	0.82 (0.42)**	0.4 (0.2)**	0.15 (0.07)**
	LM test P-Value	0.25	0.07	0.3	0.01

The figures in parenthesis are standard Errors. *, **, *** denote significance at 10, 5, 1 percent respectively.

W_B, W_D, W_Y, W_P are the weighting specifications based on Geographic Contiguity (common border), Geographic Contiguity (distance Km), Income and population respectively.

In Pakistan expenditure decentralization has outpaced the revenue decentralization, therefore provincial governments have to rely on federal grants to finance their expenditures. The provincial governments receive these federal grants without accountability to tax payers, which promotes fiscal indiscipline and inefficiency/corruption in resource allocation.

Further, per capita income has expected positive effect on provincial public spending in Punjab, Sind and Baluchistan but it is negatively related to per capita spending in KPK. This result is surprising for the

province of KPK as it indicates under-utilization of available resources which implies that public spending follows counter cyclical variation, rising when the economy is slow down and decreasing when the economy grows faster.

The effect of population density on aggregate spending is negative implying that with increase in population density, provincial spending would fall. Moreover, an increase in old age population tends to increase provincial spending as provincial governments may have to manage their old age pensions and social security.

The pattern of spending interdependence may vary for different categories of spending. The magnitude and sign of response coefficient might be positive or negative for different expenditures categories as some spending may show substitutability and others may have complementarily. We also estimate the SUR model separately for spending on law and order, health and education. We keep on analyzing spending on per capita basis. The results are presented in Tables 3 to 5.

The LM test statistics for the significance of spatial response coefficient, γ, is given at the bottom row of the tables for each weighting specification to define neighborliness. For each category of spending, we reject the null hypothesis that provincial public spending is spatially independent across provinces.

Table 3 reports neighborhood effect and spending interdependence for public expenditure on health.

TABLE 3

The Neighborhood Effect and Spending Interdependence (Health)

		W_B	**W_D**	**W_Y**	**W_P**
Punjab	Spatial lag	0.38 (0.24)*	0.21 (0.23)	0.37 (0.22)*	0.48 (0.28)*
	Income per capita	-0.23 (0.32)	-0.31 (0.33)	-0.23 (0.33)	-0.16 (0.33)
	Grants	0.9 (0.38)**	0.92 (0.37)**	0.79 (0.40)**	0.75 (0.41)**
	Pop 60+	0.21 (0.23)	0.37 (0.41)	0.27 (0.45)	0.33 (0.24)
	LM test P-Value	0.05	0.16	0.06	0.2

		W_B	**W_D**	**W_Y**	**W_P**
Sindh	Spatial lag	0.81 (0.31)**	0.92 (0.35)**	0.43 (0.38)	0.75 (0.40)**
	Income per capita	0.44 (0.72)	0.19 (0.8)	-0.14 (0.87)	0.05 (0.83)
	Grants	-0.39 (0.20)**	-0.35 (0.23)*	-0.33 (0.24)	-0.35 (0.23)*
	Pop 60+	0.09 (0.54)	0.7 (0.77)	0.34 (0.92)	0.02 (0.02)
	LM test P-Value	0.01	0.03	0.06	0.14
Baluchistan	Spatial lag	0.42 (0.20)**	0.62 (0.40)*	0.29 (0.31)	0.39 (0.25)*
	Income per capita	-0.3 (0.36)	-0.37 (0.41)	-0.59 (0.4)*	-0.6 (0.39)*
	Grants	0.49 (0.19)**	0.46 (0.23)**	0.52 (0.21)**	0.54 (0.20)**
	Pop 60+	0.8 (0.38)**	0.9 (0.37)**	0.48 (0.3)*	0.5 (0.3)*
	LM test P-Value	0.16	0.08	0.09	0.15
KPK	Spatial lag	0.1 (0.14)	0.3 (0.17)*	0.4 (0.15)**	0.3 (0.14)**
	Income per capita	0.46 (0.23)**	0.73 (0.40)*	0.93 (0.35)**	0.52 (0.21)**
	Grants	0.39 (0.25)*	0.39 (0.26)*	0.4 (0.26)*	0.4 (0.25)*
	Pop 60+	0.1 (0.14)	0.41 (0.20)**	0.61 (0.40)*	0.5 (0.3)*
	LM test P-Value	0.35	0.09	0.08	0.56

The figures in parenthesis are standard Errors. "*", "**", "***" denote significance at 10, 5, 1 percent respectively.
W_B, W_D, W_Y, W_P are the weighting specifications based on Geographic Contiguity (common border), Geographic Contiguity (distance Km), Income and population respectively.

The results in Table 3 show positive and significant spatial interdependence for expenditure on health. This category of spending may result in large spillovers with high substitutability of health facilities across provinces. Domestic residents may be indifferent to avail these facilities in domestic or neighboring province. Due to spillover effects, benefits of health facilities can reach to the neighboring province and the

absence of these services in domestic province may become a source of discontent when neighboring provinces make these services available. Baicker (2005) has examined expenditure spillover effects for the US States via exogenous shocks to medical outlays and empirical outcome endorse the hypothesis that state spending is generally affected by the states to which the domestic residents are expected to move. Hence, higher spending on health facilities in neighboring province may influence the domestic government to raise spending on these facilities.

For spending on education, the empirical results in Table 4 show negative coefficient for spatial interdependence in Punjab, Baluchistan and KPK, hence supporting the spillover hypothesis. The advantage of public services provisions in neighboring province spillover to the domestic province. This spillover benefit allows the domestic region to reallocate its budgetary expenditures to other provincial policies. Our empirical findings for health and education are also supported by the findings of Revelli (2002b) which confirm that spatial autocorrelation in social expenditures are endogenous and determined by neighboring regions.

Concerning expenditure on education, provincial governments have a tendency to free ride upon neighboring expenditures. The results verify the spillover hypothesis by showing negative interdependence for expenditures on the provision of education as the benefit of these public services provision in neighboring province spillover to the domestic province. Spillover benefits allow the provincial government to substitute its public spending in education with the public spending of neighboring province in these categories and reallocate its budgetary expenditures to other provincial policies that may be ranked high in priority.

TABLE 4

The Neighborhood Effect and Spending Interdependence (Education)

		W_B	**W_D**	**W_Y**	**W_P**
Punjab	Spatial lag	-0.44 (0.25)*	-0.53 (0.2)**	0.02 (0.3)	-0.362 (0.29)
	Income per Capita	-0.8 (0.38)**	-0.9 (0.37)***	-0.76 (0.40)**	-0.73 (0.41)*
	Grants	0.74 (0.45)*	1.8 (0.62)***	0.56 (0.5)	0.79 (0.5)*

		W_B	**W_D**	**W_Y**	**W_P**
	LM test P-Value	0.02	0.04	0.36	0.35
Sindh	Spatial lag	0.62 (0.17)***	0.29 (0.14)**	-0.32 (0.21)*	-0.496 (0.17)***
	Income per Capita	1.1 (0.7)*	0.36 (0.12)***	-0.24 (0.82)	-0.62 (0.77)
	Grants	-0.12 (0.16)	-0.01 (0.18)	-0.09 (0.15)	-0.056 (0.15)
	LM test P-Value	0.012	0.04	0.63	0.055
Baluchistan	Spatial lag	0.36 (0.12)***	-0.15 (0.2)	-0.11 (0.12)	-0.16 (0.14)
	income per capita	-0.88 (0.47)*	-1.16 (0.58)**	-1.33 (0.57)**	-1.38 (0.56)**
	Grants	0.72 (0.21)***	0.96 (0.26)***	0.9 (0.23)***	0.86 (0.22)***
	LM test P-Value	0.01	0.13	0.11	0.09
KPK	Spatial lag	-0.67 (0.18)***	-0.55 (0.33)*	-0.03 (0.31)	-0.357 (0.33)
	Income per Capita	-0.36 (0.12)***	-0.38 (0.11)***	-0.32 (0.21)*	-0.496 (0.17)***
	Grants	0.9 (0.50)*	0.44 (0.25)*	0.53 (0.2)**	1.536 (0.89)*
	LM test P-Value	0.01	0.07	0.12	0.13

The figures in parenthesis are standard Errors. "*", "**", "***" denote significance at 10, 5, 1 percent respectively.

W_B, W_D, W_Y, W_P are the weighting specifications based on Geographic Contiguity (common border), Geographic Contiguity (distance Km), Income and population respectively.

The results in Table 5 show positive coefficient of spatial correlation for expenditure on the maintenance of law and order as the provision of these services by the government in domestic province may be ranked high in priority when the neighboring province is providing those services. Hence, higher spending to maintain law and order in neighboring province may also influence the domestic government to rise spending for the provision of these facilities.

TABLE 5

The Neighborhood Effect and Spending Interdependence
(Law and Order)

		W_B	**W_D**	**W_Y**	**W_P**
Punjab	Spatial lag	0.23 (0.10)**	0.2 (0.10)**	0.18 (0.09)**	0.17 (0.10)*
	Population density	-0.7 (0.35)**	-0.95 (0.60)*	-0.9 (0.51)*	-0.97 (0.61)*
	Income per Capita	0.9 (0.13)***	0.84 (0.12)***	0.87 (0.13)***	0.85 (0.13)***
	Grants	-0.28 (0.14)**	-0.19 (0.12)*	-0.17 (0.1)*	-0.16 (0.1)*
	Pop 60+	0.79 (1.25)	0.2 (0.10)**	0.18 (0.09)**	0.51 (0.24)**
	LM test P-Value	0.07	0.06	0.06	0.059
Sindh	Spatial lag	0.7 (0.35)**	0.99 (0.27)***	0.98 (0.27)***	0.79 (0.21)***
	Population density	0.27 (1.63)	0.08 (1.58)	0.83 (1.44)	0.89 (0.54)
	Income per capita	-0.61 (0.35)*	-0.57 (0.34)*	-0.78 (0.32)**	-0.74 (0.32)**
	Grants	-0.15 (0.09)*	-0.16 (0.09)*	-0.15 (0.09)*	-0.16 (0.09)*
	LM test P-Value	0.01	0.01	0.01	0.01
Baluchistan	Spatial lag	0.9 (0.27)***	0.96 (0.17)***	0.72 (0.12)***	0.71 (0.13)***
	Population	-0.62 (0.17)***	-0.29 (0.14)**	-0.32 (0.21)*	-0.496 (0.17)**
	Income per Capita	-0.82 (0.22)***	-0.71 (0.20)***	-0.79 (0.20)***	-0.71 (0.20)***
	Grants	0.32 (0.10)***	0.21 (0.09)**	0.19 (0.09)**	0.17 (0.09)**
	LM test P-Value	0.01	0.012	0.01	0.01
KPK	Spatial lag	0.8 (0.4)**	0.9 (0.46)**	0.7 (0.23)***	0.72 (0.29)**
	Population density	0.6 (2.7)	-0.5 (0.3)*	-0.4 (0.23)*	-0.2 (0.12)*

		W_B	W_D	W_Y	W_P
	Income per Capita	0.16 (0.06)**	0.75 (0.43)*	0.3 (0.15)**	0.47 (0.29)*
	Grants	0.06 (0.034)*	0.44 (0.29)*	0.23 (0.29)	0.23 (0.27)
	LM test P-Value	0.11	0.01	0.01	0.01

The figures in parenthesis are standard Errors. *, **, ***denote significance at 10, 5, 1 percent respectively.
W_B, W_D, W_Y, W_P are the weighting specifications based on Geographic Contiguity (common border), Geographic Contiguity (distance Km), Income and population respectively

Overall, the results explained above are robust to alternative weighting specifications to determine neighborliness that includes provincial income (W_Y), provincial population (W_P), distance based geographic proximity (W_D) and geographic proximity based on common border (W_B).

V. CONCLUSIONS

In this study, we test for the possible evidence of the interdependence in public expenditures of Pakistan's provinces over the period of 1981-2018. We investigate the notion that provincial governments, in making their choices of public spending, consider the choices of neighboring province while determining the overall size of provincial spending as well as its allocation to health, education and law and order.

We have estimated spatial lag/Durbin model by incorporating weighted average of neighboring expenditure within the framework of seemingly unrelated regression model. The results indicate that provincial governments are influenced by the policy choices of neighboring provinces and they use this information to make their domestic policy decisions. Fiscal policy interdependence among the provincial governments may arise for the reason of fiscal competition, complementarity or substitutability with neighbors' expenditures, yardstick competition or cooperation and coordination among provincial governments.

The result shows that provincial governments follow each other in health spending as well as in expenditures on the maintenance of law and

order. Positive interdependence for spending on health and law and order confirm fiscal competition among the provincial governments to catch the attention of residents and businesses.

Concerning expenditure on education, provincial governments have a tendency to free ride upon neighboring expenditures. The results verify the spillover hypothesis by showing negative interdependence for expenditures on the provision of education as the benefit of these public services provision in neighboring province spillover to the domestic province.

Spillover benefits allow the provincial government to substitute its public spending in education with the public spending of neighboring province in these categories and reallocate its budgetary expenditures to other provincial policies that may be ranked high in priority. Therefore, provincial governments may spend inefficiently small amounts for uncompensated spillover benefits in such areas.

The assessment of spending interdependence at the provincial level might be an imperative aspect of federal and provincial public policies. The policy guidelines that come out of this study areas follow:

- Spillover benefits allow the provincial government to substitute it's spending with the spending of neighboring province so provincial governments may spend inefficiently small amounts for uncompensated spillover benefits. To tackle the problem of inefficiency, the interprovincial spillover effects may necessitate a different structure of federal grants to provinces that, along with the standard criteria, also consider uncompensated spillover benefits to neighboring regions as an indicator for the distribution of financial resources.
- Further, positive interdependence of provincial spending with spending decisions of neighboring province confirms fiscal competition or complementarity with neighbors' expenditures. Therefore, Federal government may use different influential tools like special grants, project aid and program loans etc. to enhance provincial spending or to control unproductive spending that may arise for unnecessary fiscal and political competitions among the provincial governments.

REFERENCES

Allers, M. A., & Elhorst, J. P. (2005). Tax mimicking and yardstick competition among local governments in the Netherlands. International Tax and Public Finance, 12, 493-513.

Anselin, L. (1988). Spatial Econometrics: Methods and Models. Dordrecht: Kluwer.

Arnott, R., &Grieson, R.E. (1981). Optimal fiscal policy for a state or local government. Journal of Urban Economics, 9, 23-48.

Arora, S., & Brown, M. (1977). Alternative approaches to spatial autocorrelation: An improvement over current practice. International Regional Science Review, 2, 67-78.

Baicker, K. (2005). The spillover effects of state spending. Journal of Public Economics, 89, 529-544.

Besley, T., & Case, A. (1995). Does electoral accountability affect economic policy choices? Evidence from gubernatorial term limits. Quarterly Journal of Economics, 110, 769–798.

Bordignon, M., Cerniglia, F., & Revelli, F. (2003). In search of yardstick competition: A spatial analysis of Italian municipality property tax setting. Journal of Urban Economics, 54, 199–217.

Bosch, N., &Sol´e-Oll´e, A. (2007). Yardstick competition and the political costs of raising taxes: An empirical analysis of Spanish municipalities. International Tax and Public Finance, 14, 71–92.

Borck, R., Caliendo, M., & Steiner, V. (2006). Fiscal Competition and the Composition of Public Spending: Theory and Evidence. Bonn. The Institute for the Study of Labor, (Discussion Paper No. 2428).

Brueckner, J. (1998). Testing for strategic interaction among local governments: The case of growth controls. Journal of Urban Economics, 44, 438-467.

Brueckner, J. (2003). Strategic interaction among governments: An overview of empirical studies. International Regional Science Review, 25, 175-188.

Case, A. C., Rosen H. S., & Hines J. R. (1993). Budget spillovers and fiscal policy interdependence: Evidence from the states. Journal of Public Economics, 52, 285-307.

Costa, H., Veiga, G., & Portela, M. (2015). Interactions in local governments' spending decisions: Evidence from Portugal. Regional Studies, 49(9), 1441–1456.

Devereux, M. P., Lockwood, B.,& Redoano, M. (2008). Do countries compete over corporate tax rates? Journal of Public Economics, 92(5–6), 1210–1235.

Elhorst, Paul. (2014).Spatial Econometrics: From Cross-sectional Data to Spatial Panels. Springer, Heidelberg New York Dordrecht London.

Ermini, B., Santolini, R. (2007). Horizontal interaction on local council's expenditures.Evidence from Italy. Presented in Amsterdam, First World Meeting of the Public Choice Society.

Ermini, B. and Santolini, R. (2010).Local expenditure interaction in Italian municipalities: do local partnerships make a difference?, Local Government Studies, 36(5), 655-677.

Figlio, D. K., Kolpin, V. W., & Reid, W. E. (1999). Do state play welfare games? Journal of Urban Economics, 46, 437–454.

Foucault, M., Madies T.,&Paty, S. (2008).Public spending interactions and local politics. Empirical evidence from French municipalities. Public Choice, 137(1), 57-80.

Gordon, R.H. (1983).An optimal taxation approach to fiscal federalism. Quarterly Journal of Economics,98, 567-587.

Hayashi, M., & Robin, B. (2001). An Empirical analysis of intergovernmental tax interaction: The case of business income taxes in Canada. Canadian Journal of Economics, 34(2), 481-503.

Hordijk, L. (1979). Problems in estimating econometric relations in space. Papers, Regional Science Association, 42, 99-115.

Hordijk, L., & Nijkamp, P. (1977).Dynamic models of spatial autocorrelation. Environment and Planning A,9, 505-519.

Hanes, N. (2002). Spatial spillover effects in the Swedish local rescue services.Regional Studies, 36, 531-539.

Kanbur, R., & Keen, M. (1993). Jeux sans frontieres: Tax competition and tax coordination when countries differ in size. American Economic Review, 83(4), 877–892.

Lundberg, J. (2006). Spatial interaction model of spillovers from locally provided public services. Regional Studies, 40(6), 631 – 644.

Mur, J., López, F., & Herrera, M. (2010).Testing for spatial effects in Seemingly Unrelated Regressions. Spatial Economic Analysis, 5 (4), 399-440.

Padovano, F., & Petrarca, I. (2014). Are the responsibility and yardstick competition hypotheses mutually consistent? European Journal of Political Economy, 34, 459–477.

Redoano, M. (2007). Fiscal interactions among European countries. Does the EU matter? CESIFO Working paper No. 1952, March.

Revelli, F. (2002a). Local taxes, national politics and spatial interactions in English district election results. European Journal of Political Economy, 18, 281–299.

Revelli, F. (2002b). Testing the tax mimicking versus expenditure spill-over hypotheses using English data. Applied Economics, 34(14), 1723–1731.

Revelli, F. (2003). Reaction or interaction? Spatial process identification in multi-tiered government structures. Journal of Urban Economics, 53, 29–53.

Revelli, F. (2002c). Neighborhood effects in social service provision: Competition or reflection?,Torino, Universit`a di Torino (Working Paper No. 6).

Revelli, F. (2006).Spatial Interactions among Governments, In Ahmad, E., Brosio, G.(eds.), Handbook of Fiscal Federalism. Cheltenham, Northampton, Edward Elgar, p.106–130.

Rizzo, L. (2008). Local government responsiveness to federal transfers: Theory and evidence. International Tax and Public Finance, 15, 316–337.

Rizzo, L. (2010). Interaction between federal taxation and horizontal tax competition: Theory and evidence from Canada. Public Choice, 144(1–2), 369–387.

Salmon, P. (1987).Decentralization as an Incentive Scheme. Oxford Review of Economic Policy, 3, 24-43.

Samuelson, Paul A. (1954).The theory of public expenditure. Review of Economics and Statistics, 36, 386-389.

Solé-Ollé, A. (2003). Electoral accountability and tax mimicking: The effects of electoral margins, coalition government, and ideology. European Journal of Political Economy, 19(4), 685–713.

Sol´e-Oll´e, A. (2005). Expenditure spillovers and fiscal interactions: Empirical evidence from local governments in Spain. Barcelona, Institutd'Economica de Barcelona.(Working paper No. 3).

Sole-Olle A. (2006).Expenditure spillovers and fiscal interactions: Empirical evidence from local governments in Spain. Journal of Urban Economics, 59, 32-53.

Werck, K., Heyndels, B., & Geys, B. (2008). The impact of central places on spatial spending patterns: Evidence from Flemish local government cultural expenditures. Journal of Cultural Economics, 23(1), 35–58.

White, E., & G. Hewings (1982). Space-time employment modeling: Some results usingseemingly unrelated regression estimators. Journal of Regional Science,22, 283-302.