Sectoral Volatility, Development, and Governance: A Case Study of Pakistan

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I. INTRODUCTION

Development of overall economy of any country largely depends upon the characteristics of different prominent sectors such as agriculture, industry, services, etc. Sharp structural change in prominent sectors are experienced by the Pakistan's economy during the last four decades, in which industrial and service sector have exhibited an extra ordinary rate of growth, while the agricultural sector did not shown that rate of growth which was experienced during the time of green revolution. Due to these structural changes in the prominent sectors volatility of growth rate has been experienced by the economy.

To the extent that most of the recent volatility in growth rate of GDP can be attributed to the increasing share of the some volatility of the some prominent sectors, the analysis of their volatility can be useful in providing some enlightenment on the factors behind this phenomenon and its implications for the formulation of the policy in the future.

The main objective of this study is to use a time series analysis to analyse the actual cause of the volatility in the output/growth rate of output of the Pakistan's economy. The technical characteristics of the volatility of the different sectors will be analysed and then an effort will be made to estimate the impact of sectoral volatility on the volatility of the growth rate of the Pakistan's economy. Specific questions which will be addressed in the course of study will include: What are the main characteristics of the structure of the Pakistan's economy? What is the nature of volatility of the different economic sectors? Does sectoral volatility explains relative changes in the growth rate? In other words, is sectoral volatility biased or neutral? How the volatility in the different sectors of Pakistan's economy is correlated with each other? To what extent do volatility in growth rate is associated with the Volatility of the growth rates of the sectors under analysis? What are the main implications of the volatility parameters for the Pakistan's policy problem, and for the achievement of stable growth rate? Does instability in political structure affect volatility of growth rate of output?

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This will represent the first attempt to analyse quantitatively the relationship between the volatility and development. The study is organised in the following manner. Following the section of Introduction Section II presents the literature review while Section III presents methodology and estimations of impact of sectoral volatility on the performance of Pakistan's economy. Section IV discusses data and construction of variables and results and there discussion will be presented in Section V. whereas last section presents the summary and conclusion along with some policy suggestions.

II. LITERATURE RIVIEW

In the economic literature, a number of efforts can be seen discussing the impact of volatility on the economic performance of different countries especially the developing countries, e.g., Koren and Tenreyro (2005) explained that despite the number of steps have been taken by most of the developing countries towards the stability of their economies, still one can easily observe the volatility in most of their macroeconomic variables. The concern with volatility in most of the developing countries arises day by day. Most of the studies are concerned with this question: why GDP growth is so much volatile in poor countries than in rich one? Generally experts identified the four possible reasons:

(a) Poor countries specialise in more volatile sectors;

(b) Poor countries specialise in fewer sectors;

(c) Poor countries experience more frequent and more severe aggregate shocks (e.g. from macroeconomic policy);

(d) Poor countries' macroeconomic fluctuations are more highly correlated with the shocks of the sectors they specialise in.

This is the requirement of the time that how to decompose volatility into these four sources, quantify their contribution to aggregate volatility, and study how they relate to the stage of development.

However, a number of studies can be seen in the literature discussing the phenomenon of volatility and its impact on the performance of the economy, It is well recognised that volatility of different sectors has negative impact on the performance of the economy. Especially in the literature, it has been observed that volatility of those sectors in which the economy is specialised has a significant effect on the production and trade of the developing as well as the developed economies. For example, macro economic impact of volatility discussed by Koren and Tenreyro (2005), Lucas (1988), Acemoglu and Zilibotti (1997), Obstfeld (1994), Saint-Paul (1992), Greenwood and Jovanovic (1990), Imbs and Wacziarg (2003), Stockman (1988), Scheinkman and Xiong (2003), Cheema (2004), Perotti (1996), Atkinson (1996 1997), Gottschalk and Smeeding (1997), Bourguignon and Morrissson (1998), Li, *et al.* (1998), Betancourt (1996) Mobarak (2001), Pritchett (2000), Jalan and Ravallion (1999) and Morduch (1995), Lucas (1987), Pallage, *et al.* (2003), Wolfers (2003), Barlevy (2002), Barro and Sala-I-Martin (1995) and many others. Whereas determinants of Volatility are discussed by Levine and Renelt (1992), Acemoglu and Zilibotti (1997), Rodrik (1999) and Ramey and Valerie (1995). Relationship between

democracy and volatility explained by Henisz (2000), Nooruddin (2003), Chandra (1998) and Quinn and Woolley (2001).

In spite of the crucial importance attributed to growth rate of GDP in Pakistan like other developing countries, no empirical quantitative research has however, been conducted to examine the volatility of that sector in which economy is specialising, and its impact on the volatility of growth rate in Pakistan. The present study focuses on this issue. In the first step a general overview regarding the historical patron of economic volatility in Pakistan is given in the following section.[1]

II.I. Patron of Economic Volatility in Pakistan

Since independence the economy of Pakistan has undergone dramatic structural changes and economic growth. Pakistan has tried to change its economic structure as the other underdeveloped countries from an agricultural economy to an industrial export-oriented economy, in which the manufacturing sector constitutes today the dominant form of economic activity. This dominance resulted from a development strategy based on tax exemption schemes, in addition to other incentives, which the Pakistan's government implemented in the past five decades. The main objective of different schemes was to alleviate the historically high level of unemployment and at the same time, promote the economic and social welfare of the population.

During the last five decades the manufacturing sector itself has experienced a series of changes in its internal structure. The structure is based towards the capital intensive techniques instead of labour-intensive one. This however, created the problem of unemployment, balance of payments (most of the intermediate and final inputs are imported). The high technology is also attracted by the government and main industrial groups in Pakistan. One of the main reasons for the attraction has been the necessity to maintain or improve the international competitiveness of Pakistan's manufacturing sector. The imported technology used by these industries and the associated technical changes have also affected the utilisation of layout and has contributed towards increase in labour productivity. It has induced changes in the organisation and composition of the work force, and affected skill requirements and management of labour. Despite all of this, still agriculture plays a significant role in the development of Pakistan's economy.

The pattern of economic volatility in Pakistan is complex. At the macroeconomic level the very high volatility recorded in real growth rates, price inflation, and private investment per capita, government revenues per capita, terms of trade and real exchange rate. But patterns of volatility vary among sectors. In terms of GDP the most volatile sectors are agricultural, industrial and service; while the least volatile are distribution, transport, and communications. On government expenditure current expenditures (there are three major components of current expenditure, namely, interest payments, defense and expenditure on civil administration) are highest than the development expenditures while public expenditure as percentage share of GDP has been relatively stable.

Tax and debt funded public spending as the driving force of the Pakistan's economy. Fiscal policy and budget management constitute the pivot of macro-economic policy. Major problems include: excessive centralisation of resources and powers, to the

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[1]In this most of Views regarding the patron of economic volatility in Pakistan are based on author's personal observation and experience of research work.

detriment of sub-national units of government; prevalence of fiscal imbalances both vertically horizontally; and frequent overlapping and non-coordination of expenditure responsibilities among different levels of government. There is need to evaluate and restructure present fiscal set-up, to ensure fiscal discipline at all levels, as well as to secure greater understanding and cooperation across the different tiers of government.

Exchange rate policy is a key factor in economic management. In an elusive search for a real exchange rate to maintain both internal and external balance, Pakistan has experimented with a succession of exchange rate regimes. The latest experiment is based on managed floating rate of exchange.

Since its beginning in 1947 national development planning in Pakistan has suffered from lack of systematic, integrated and target oriented approach, each plan being essentially a laundry list of projects, some rolled over from the over from the previous ones. Lack of clear vision, transparency and functional cooperation at the political levels, marginalisation of civil society in the planning process, and lack of rigor at the bureaucratic level have severely compromised the quality of the planning. At all levels, of government technical expertise as well as technology and information management systems are very deficient.

The review of policy options considers short-middle term as well as long term prospects. It focuses on monetary policies, prices and exchange rate management, revenue stabilisation, diversification and growth, public expenditure management and the constitutional and operational problems of fiscal federalism. The main determinant of the stock of money, in Pakistan, has been the consolidated fiscal balance of all levels of government, federal, state and local, which has been in deficit for most of the time since 1947. The money supply growth has contributed to the relative growth of the service sector and the relative decline of the agricultural sector of the economy, contributing to considerable GDP volatility. The federal government and most state governments have embarked on programs to improve public expenditure management by downsizing, rightsizing and restructuring the public services and privatising public enterprises the stabilisation of public expenditure is constrained by the lack of harmonisation and coordination of expenditure management by the various tiers of government

Public revenue in Pakistan is inadequate and unstable. The major cause of revenue volatility is a combination of two factors: the large and unpredictable fluctuations in agricultural sector because the whole economic activity is based on agriculture and ad hoc policies as well as inefficient structure of the central board of revenue. In the short run efforts should be made to raise more revenue through more effective harvesting of existing sources and more imaginative investigation and development of new ones. In the long run steps should be taken to promote and support increased production and productivity in the various sectors of the economy. The low level of social development and social security is a major constraint to sustainable growth. There is need to enlarge the revenue base through social security taxation in order to provide adequately for the necessary investment in social service delivery.

Most studies on the volatility structure and development have been undertaken for developed and developing countries as will be reviewed in the study. Only a very limited number of studies deal with these issues in less developed countries (LDCs). Still no serious attempt has been seen covering the area of development and sectoral volatility.

This is the first systematic quantitative study on the measurement of volatility and development. In addition, it is the first attempt to provide a quarterly time series data set covering the period 1971-72 to 2002-2003, which capture the different shocks of the Pakistan's economy and adjustments associated with the different economic and political crises. The analysis of the relationship between the sectoral volatility and growth rates in Pakistan makes it a unique study in views of future policy options.

III. DATA AND METHODOLOGY

III.I. Methodological Issues

The study takes advantage of the developments in the theory of unit root test, Vector Auto Regressive Model (VAR), Co-integration Test and Impulse Response Functions (IRFs). To measure the time varying measure of volatility of output, economists construct a rolling (moving) variance of the series. However, the rolling variance is a naïve derivation of uncertainty because economic agents are not necessarily exploiting patterns in the data when making forecasts of uncertainty through measures of fluctuations but not of uncertainty. The choice stands for a measure of uncertainty measure obtained through the ARCH-GARCH process. Auto-regressive Conditional Heteroscedasticity (ARCH) models were introduced by Engel (1982) and generalised auto-regressive models (GARCH) by Bollerslev (1986).

(1) Autoregressive describe a feedback mechanism that incorporates past observations into the present.
(2) Conditional implies a dependence on implies a dependence on the observations of immediate past.
(3) Heteroscedasticity represents a time-varying variance (i.e. volatility).

Therefore ARCH models allow the error term to have a time varying variance i.e. to be conditional on the past behaviour of the series. In the present study volatility of all the variables is calculated using rolling (moving) standard deviations of the series and ARCH-GARCH process. Under the rolling (moving) standard deviation as the measure of volatility 4-quarter moving standard deviation and 8-quarter moving standard deviation are used for analysis.

A dummy variable is used to check the impact of political stability on the volatility of output in growth and level form. Value of dummy variable is one for the periods of election campaign (one quarter before, during and after the government change) and zero otherwise. It is expected that political instability lead to high volatility in output in growth and level form.

III.II. Data and Variables Notations

The study uses data of output (GDP), value added of agriculture, value added of Finance and Insurance, value added of services, value added of industry and value added of whole sale and retail. The secondary quarterly data covering the time period 1971-72 to 2002-2003 is used that has been taken from Kemal and Arby (2004).[2]

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[2]This is the only data source that provides quarterly data on GDP of Pakistan from 1971 to 2003 however State Bank of Pakistan also starts reporting quarterly figures on GDP since 1998 but that is not considered in the present study.

To differentiate among different types volatility variables that are calculated using moving standard deviations of the series and ARCH-GARCH process following notations are used:

4 quarter moving Standard deviation	= VOL
8 quarter moving standard deviation	= VOLL
Volatility based on ARCH-GARCH	= VOLT

Variables

Output (GDP)	= Y
Value added of agriculture	= VAG
Value added of Finance and Insurance	= VFIN
Value added of Services	= VSER
Value added of Industry	= VIN
Value added of Whole sale and retail	= VWH

Growth Rate of Variables

Growth rate of output	= GRY
Growth rate of value added of agriculture	= GR_VAG
Growth rate of value added of Finance and Insurance	= GR_VFIN
Growth rate of value added of Services	= GR_VSER
Growth rate of value added of Industry	= GR_VIN
Growth rate of value added of Whole sale and retail	= GR_VWH

Volatility based on 4 quarter moving standard deviation

Volatility of output	= VOL_Y
Volatility of value added of agriculture	= VOL_VAG
Volatility of value added of Finance and Insurance	= VOL_VFIN
Volatility of value added of Services	= VOL_VSER
Volatility of value added of Industry	= VOL_VIN
Volatility of value added of Whole sale and retail	= VOL_VWH

Volatility based on 8 quarter moving standard deviation

Volatility of output	= VOLL_Y
Volatility of value added of agriculture	= VOLL_VAG
Volatility of value added of Finance and Insurance	= VOLL_VFIN
Volatility of value added of Services	= VOLL_VSER
Volatility of value added of Industry	= VOLL_VIN
Volatility of value added of Whole sale and retail	= VOLL_VWH

Volatility based on ARCH-GARCH Process

Volatility of Growth rate of output	= VOLT_GRY
Volatility of Growth rate of value added of agriculture	= VOLT_GR_VAG
Volatility of Growth rate of value added of Finance and Insurance	= VOLT_GR_VFIN
Volatility of Growth rate of value added of Services	= VOLT_GR_VSER
Volatility of Growth rate of value added of Industry	= VOLT_GR_VIN
Volatility of Growth rate of value added of Whole sale and retail	= VOLT_GR_VWH

V. RESULTS AND DISCUSSION

The data for this study exhibits the regular characteristics associated with most of the macroeconomic variables. This conclusion derives by looking at various tests carried out on the variables used. Simple graphical comparisons of volatility variables obtained through the moving standard deviation (both 4-quarter and 8-quarter) indicate that volatility of output is the highest volatile sector followed by volatility of value added of

agriculture sector. Dispersion among the volatilities of other variables is relatively less. Important thing to note down is this that all the volatility variables whether based on 4-quarter or on 8-quarter moving standard deviation are increasing over the time period. This type of patron can be seen from Figure 1 and Figure 2.

Fig. 1. Volatility in Income and Its Determinants (Based on 4-Quarter Moving Standard Deviation)
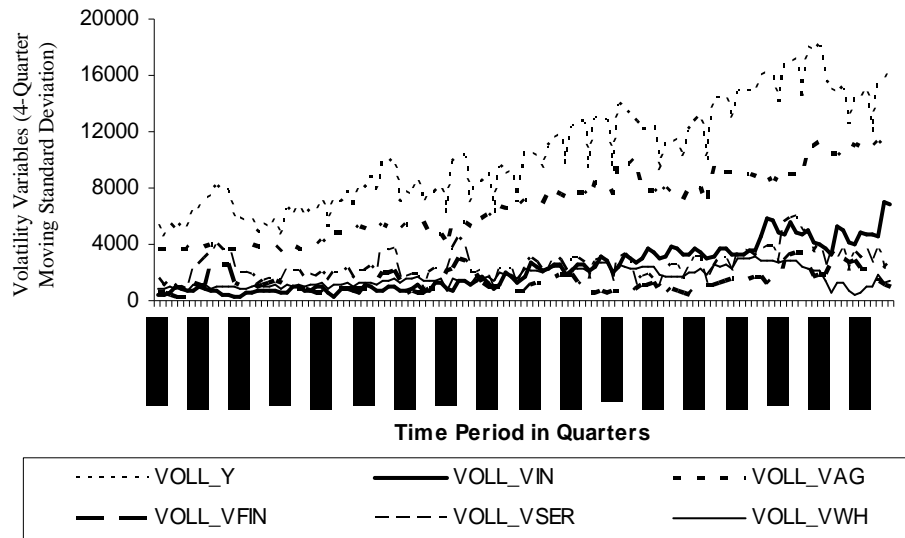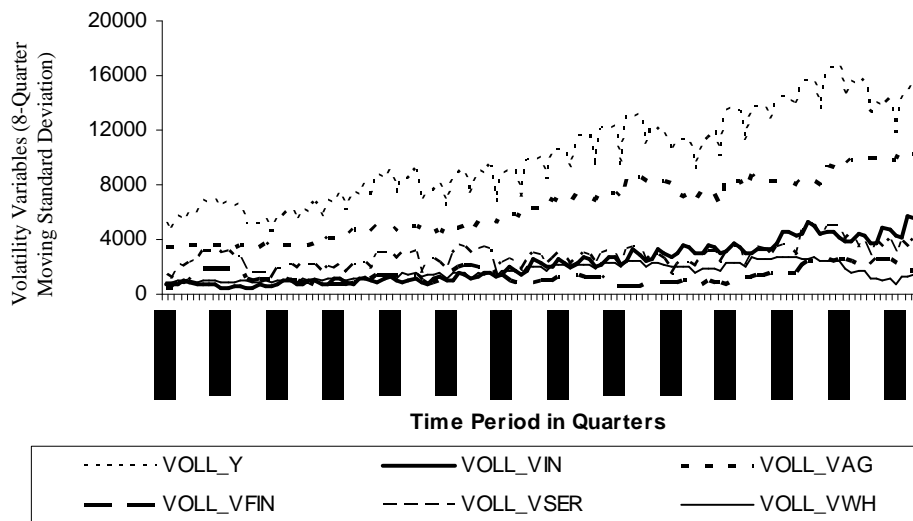

Fig. 2. Volatility in Income and Its Determinants (Based on 8-Quarter Moving Standard Deviation)

Volatility of growth rate of value added of finance and insurance is observed to be most volatile when observing the volatility variables through ARCH-GARCH process[3]. Volatility of other growth variables are less volatile and lie within ± 2. Here the important thing is that volatility variables obtain through ARCH-GARCH process can have negative values.

Now moving towards more sophisticated techniques of analysis in section V.I results of unit root tests are reported, this is necessary because the co-integration tests can be applied only to variables that are non-stationary in levels (contain unit root). In section V.II error correction model and regression analysis are presented to check the short run or long run relationship between volatility of growth rate of output and variables under analysis and in section V.III Impulse Response Functions (IRF) will be presented.

V.I. Unit Root Tests

Checking stationary is necessary because during building models for time series, the underlying stochastic process that generated the series must be invariant with respect to time. If the characteristics of the stochastic process change over time, i.e., if the process is non-stationary, it will often be difficult to represent the time series over past and future intervals of time by a simple algebraic model. This leads to misleading result. On the other hand, if the stochastic process is fixed in time, i.e., if it is stationary, then one can model the process via an equation with fixed coefficients that can be estimated from past data.

We report the results for the Augmented Dickey Fuller (ADF) test that has been initially developed by Dickey and Fuller (1979) because it has an Over-riding advantage on other tests, as ADF automatically controls for higher order correlations by assuming that the coefficient of the series follows an AR (p) process and automatically adjusts the test methodology. Results of unit root tests on variables are reported in Table 1.

Results of ADF tests shows that all the variables of the model are integrated of order one that is I (1) if test is applied with intercept, suggesting the need for differencing of the variables. Results of the unit root tests based on with trend and intercept or with none showed mixed level of integration that is variables are not integrated of same order. All the growth rate variables are integrated of order zero whether based on with intercept, with trend and intercept or with none.

Our prime objective is to check the impact of volatility of different sectors on the volatility of output. In this regard we applied unit root tests on the volatility of different variables that are calculated by 4-quarter moving standard deviation, 8-quarter moving standard deviation and by ARCH-GARCH process. Here the results of ADF test indicate that all the volatility variables of growth rate variables based on ARCH-GARCH process are integrated of order zero. Volatility variables based on moving standard deviation showed mixed results. Volatility variables based on 4-quarter moving standard deviation and 8-quarter moving standard deviation are integrated of order one except volatility of value added of finance and insurance and volatility of value added of services when test applied with intercept. Volatility of value added of services based on moving standard deviation (both 4-qaurter and 8-quarter) is integrated of order zero when ADF test

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[3]Data of the Volatility variables obtained by ARCH-GARCH process is given in Appendix A.

Results of the Unit Root Tests

| | ADF Test Statistics | | | | | | | ADF Test Statistics | | |
| | Intercept | | Trend and Intercept | | None | | | Intercept | Trend and Intercept | None |
Variables	Level	First Difference	Level	First Difference	Level	First Difference	Variables	Level	Level	Level
Y	2.868	–4.7467*	–2.447	–1.617*	6.3290	–1.6179	GRY	–5.3590*	–5.8624*	–1.9516*
VAG	0.736	–5.7559*	–2.4458	–5.8665*	3.7258	–4.4730*	GR_VAG	–6.2150*	–6.1882*	–4.5707*
VFIN	–1.156	–9.9411*	–4.5852*	–9.9046*	0.6380	–9.7911*	GR_VFIN	–4.7932*	–4.7726*	–4.4327*
VIN	2.516	–5.9679*	–2.3260	–6.5399*	7.3812	–2.8258*	GR_VIN	–5.4886*	–5.9445*	–2.4740*
VSER	5.148	–5.5177*	–0.8968	–7.4847*	9.5974	–1.8768	GR_VSER	–6.7988*	–7.0784*	–2.8983*
VWH	1.465	–5.1124*	–2.1241	–5.3080*	6.0821	–2.7513*	GR_VWH	–4.7395*	–5.0803*	–2.5758*
VOL_Y	–1.0489	–4.6774*	–3.4010	–4.6507*	0.9928	–4.4712*	VOLT_GRY	–4.2038*	–4.2333*	–4.1701*
VOL_VAG	–0.2862	–6.0048*	–3.4605*	–6.0116*	1.6703	–5.5789*	VOLT_GR_VAG	–4.8655*	–5.2690*	–4.8831*
VOL_VFIN	–3.1330*	–6.0889*	–3.2373	–6.0790*	–1.0052	–6.1098*	VOLT_GR_VFIN	–4.7931*	–4.7726*	–4.6654*
VOL_VIN	0.0999	–6.0792*	–3.6675*	–6.2316*	1.2246	–5.7942*	VOLT_GR_VIN	–4.4653*	–4.8847*	–4.4841*
VOL_VSER	–4.9313*	–6.1285*	–5.8330*	–6.1230*	–1.1751	–6.1443*	VOLT_GR_VSER	–5.2493*	–5.2392*	–5.2708*
VOL_VWH	–2.0712	–4.0367*	–2.1027	–4.0977*	–0.5229	–4.0490*	VOLT_GR_VWH	–4.4865*	–4.4477*	–4.5006*
VOLL_Y	–0.8132	–3.9776*	–4.4250*	–3.9310*	–0.9980	–3.7275*				
VOLL_VAG	–0.1096	–3.9744*	–3.3707	–4.0038*	1.8916	–3.4342*				
VOLL_VFIN	–2.9116*	–5.5337*	–3.1435	–5.3472*	–0.8253	–5.4076*				
VOLL_VIN	0.4487	–3.9141*	–3.7840*	–4.1450*	1.6402	–3.3896*				
VOLL_VSER	–3.5416*	–4.3628*	–5.5585*	–4.3340*	–0.6511	–4.3873*				
VOLL_VWH	–2.3334	–2.8587*	–3.6414*	–3.8153*	–0.4726	–2.8647*				

*Series is stationary at 5 percent level of significance.

applied with intercept or with trend and intercept while integrated of first order when test was applied with none. Volatility of value added of finance and insurance based on moving standard deviation (4-quarter moving and 8-quarter) is integrated of order zero when test was applied with intercept otherwise integrated of order one. According to Angel-Granger Approach if any of the variables is integrated of order zero then co-integration test cannot be applied. So there is no co-integration among volatility of growth rate of output and volatility of growth rates of value added by different sectors under analysis, all there exist is the short run relationship.

V.II. Error Correction Analysis and Regression Analysis

In this section analysis has been performed in two steps in the first step volatility of growth rate of value added of each variable is regressed over the volatility of growth rate of output. In the second step all the variables of volatility of growth rates of value added of different variables used to check the impact on volatility of growth rate of output at once. Another attempt is made to test the hypothesis based on the volatility derived from moving standard deviations. Dependent variable is volatility of the output (based on 4-quarter and 8quarter moving standard deviation) and independent variables are volatility of (based on 4-quarter and 8-quarter moving standard deviation) value added of different sectors under analysis. Results are provided in Table 2.

Results are very much in the same direction as was expected. From the regression results it has been observed that volatility of growth rate of selected sectors have significant impact on the volatility of growth rate of the income when regressed combined or separately. Similar results were observed in case of volatility variables obtained through moving standard deviations except of volatility of finance and insurance. Volatility of finance and insurance obtained through moving standard deviation has significant impact on the volatility of output when regressed separately while indicate negative but insignificant impact on the volatility of output when combined with other variables in regression.

In magnitude form volatility of growth rate value added of services contribute highest and volatility of growth rate of value added of finance and insurance contribute lowest to volatility of growth rate of output when regressed separately or combined with other variables. Results of volatility variables based on moving standard deviations (based on both 4-quarter and 8-quarter) indicate that volatility of value added of whole sale and retail contribute highest volatility of value added of agriculture contribute lowest to the volatility of output when regressed separately. When combined with other variables indicate that volatility of value added of services contributes highest and volatility of value added of industry contributes lowest to the volatility of output.

At the end dummy variable constructed for the political instability used as another independent variable. Results indicate that political instability has insignificant effect on the volatility of output in growth and level forms. As it is observed that volatility of financial sector do not have significant impact on the on the volatility of output. So a new regression is estimated without this variable and included the same dummy. However, the similar results were obtained that is political instability have no significant effect on the volatility of output.

Table 2

Regression Results Based on Different Volatility Variables

Dependent Variable	Constant	VOLT_GR_VAG	VOLT_GR_VFIN	VOLT_GR_VIN	VOLT_GR_VSER	VOLT_GR_VWH	DUMMY	R-squared	Adjusted R-squared	F-statistic
VOLT_GR_Y	−0.001(0.497)	0.154(0.001)						0.10089	0.09290	12.679(0.0005)
VOLT_GR_Y	−0.002(0.385)		0.001(0.016)					0.05069	0.04228	6.033(0.0156)
VOLT_GR_Y	−0.001(0.580)			2.286(0.000)				0.08862	0.08055	10.987(0.0012)
VOLT_GR_Y	−0.002(0.383)				0.300(0.000)			0.21125	0.20427	30.265(0.0000)
VOLT_GR_Y	−0.001(0.619)					0.249(0.000)		0.18274	0.17550	25.266(0.0000)
VOLT_GR_Y	−0.002(0.215)	0.154(0.000)	0.001(0.006)	0.131(0.006)	0.299(0.000)	0.120(0.000)		0.50677	0.48415	22.399(0.0000)
VOLT_GR_Y	−0.003(0.162)	0.155(0.000)	0.001(0.006)	0.137(0.005)	0.304(0.000)	0.119(0.011)	0.002(0.506)	0.50880	0.48152	18.645(0.0000)
VOL_Y	716.586(0.045)	1.418(0.000)						0.87175	0.87071	836.079(0.0000)
VOL_Y	7585.577(0.000)		2.000(0.000)					0.18360	0.17696	27.662(0.0000)
VOL_Y	5803.860(0.000)			2.049(0.000)				0.76510	0.76319	400.624(0.0000)
VOL_Y	4070.161(0.079)				2.454(0.000)			0.47266	0.46837	110.245(0.0000)
VOL_Y	4110.778(0.000)					3.703(0.000)		0.44667	0.44217	99.289(0.0000)
VOL_Y	−290.189(0.187)	0.823(0.000)	−0.031(0.784)	0.455(0.000)	1.040(0.000)	0.845(0.000)		0.97582	0.97480	960.460(0.0000)
VOL_Y	−282.798(0.196)	0.877(0.000)	0.825(0.000)	0.001(0.995)	0.461(0.000)	1.008(0.000)	−192.99(0.133)	0.97628	0.97507	809.442(0.0000)
VOL_Y	−282.737(0.193)	0.825(0.000)		0.461(0.000)	1.008(0.000)	0.877(0.000)	−192.860(0.125)	0.97628	0.97528	979.562(0.0000)
VOLL_Y	788.324(0.007)	1.458(0.000)						0.90629	0.90550	1150.813(0000)
VOLL_Y	6495.665(0.000)		2.561(0.000)					0.21282	0.20620	32.172(0.0000)
VOLL_Y	4977.266(0.000)			2.286(0.000)				0.86371	0.86257	754.152(0.0000)
VOLL_Y	1114.281(0.079)				3.181(0.000)			0.64651	0.64354	217.643(0.0000)
VOLL_Y	2744.127(0.000)					4.392(0.000)		0.57882	0.57528	163.537(0.0000)
VOLL_Y	−478.659(0.007)	0.759(0.000)	−0.082(0.415)	0.416(0.000)	1.190(0.000)	0.945(0.000)		0.98840	0.98790	1959.675(0.0000)
VOLL_Y	−473.827(0.008)	0.754(0.000)	−0.092(0.366)	0.418(0.000)	1.203(0.000)	0.933(0.000)	70.466(0.387)	0.98848	0.98787	1629.704(0.0000)
VOLL_Y	−491.984(0.005)	0.748(0.000)		0.420(0.000)	1.145(0.000)	0.987(0.000)	62.319(0.441)	0.98839	0.98789	1958.453(0.0000)

Values within parenthesis are P–values.

One can also find the short run one by constructing an error correction mechanism (ECM). A pre-condition of the ECM is this that all the variables should be integrated of same order and no variable should be integrated of order zero. If any variable is integrated of order zero or integrated of different orders then there do not exist long run relationship so no adjustment process. This again put another brick in the wall of analysis that there exist short run relationship among the volatility of sectors under analysis and volatility of growth rate.

V.III. Impulse Response Functions (IRF)

The findings of Impulse Response functions are not very much promising. It has been observed from Figure 3 to Figure 7 that volatility of sectoral growth has not significant impact on the performance of the economy in the long-run. Figure 3 presents the impulse response function of volatility of growth rate of value added of agricultural sector to one standard deviation shock to volatility of growth rate of income and the IRFs indicate that impact is temporary. The volatility of growth rate of income gradually returns to the converging point. Previous literature does not suggest any a priori explanation of this behaviour. The effects of volatility of growth rate of finance and insurance sector are presented in Figure 4. Same phenomenon has been occurred as observed in case of volatility of growth rate of value added of agriculture. Short run fluctuations can be seen whereas long run effects are not appeared. Currently it is well known fact that increases in the volatility of finance and insurance sector has the impact in the performance of the economy but the impact is observed to be temporary. The impact of volatility of growth rate of industrial sector, volatility of growth rate of service sector and volatility of growth rate of whole sale and retail sector are not significantly different from zero.

Fig. 3. Impulse Response Function between the Volatility of Growth Rate of Output and the Volatility of Growth Rate of Value-added of Agriculture

Response to One S.D. Innovations ± 2 S.E.
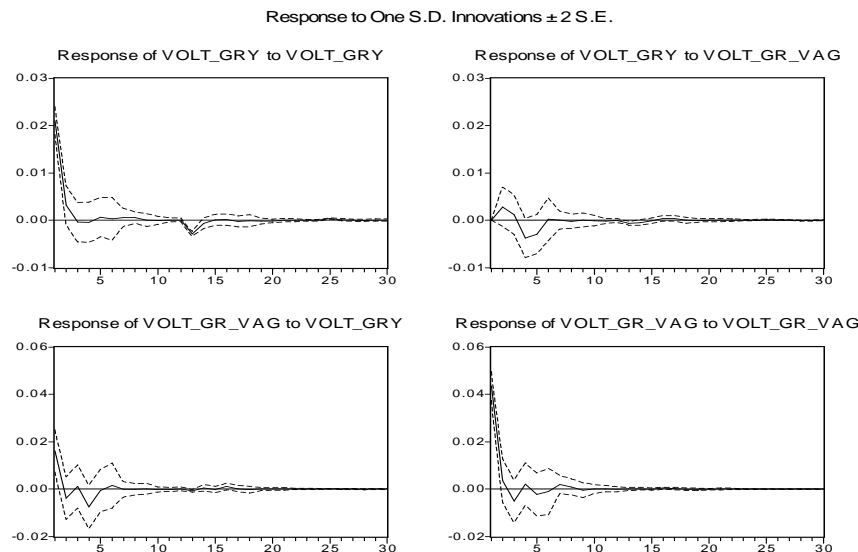
Fig. 4. Impulse Response Function between the Volatility of Growth Rate of Output and the Volatility of Growth Rate of Value-added of Finance and Insurance

Response to One S.D. Innovations ± 2 S.E.

Fig. 5. Impulse Response Function between the Volatility of Growth Rate of Output and the Volatility of Growth Rate of Value-added of Industry

Response to One S.D. Innovations ± 2 S.E.

Fig. 6. Impulse Response Function between the Volatility of Growth Rate of Output and the Volatility of Growth Rate of Value-added of Services

Response to One S.D. Innovations ± 2 S.E.

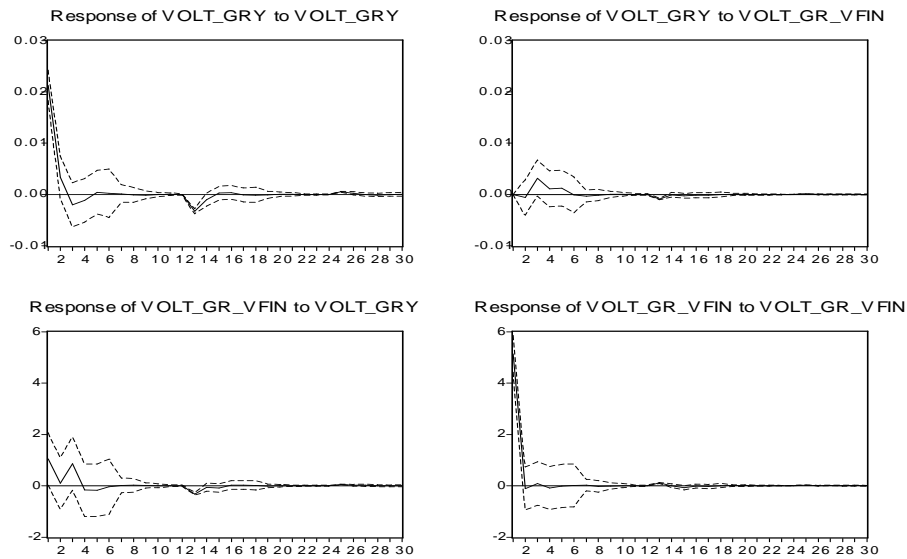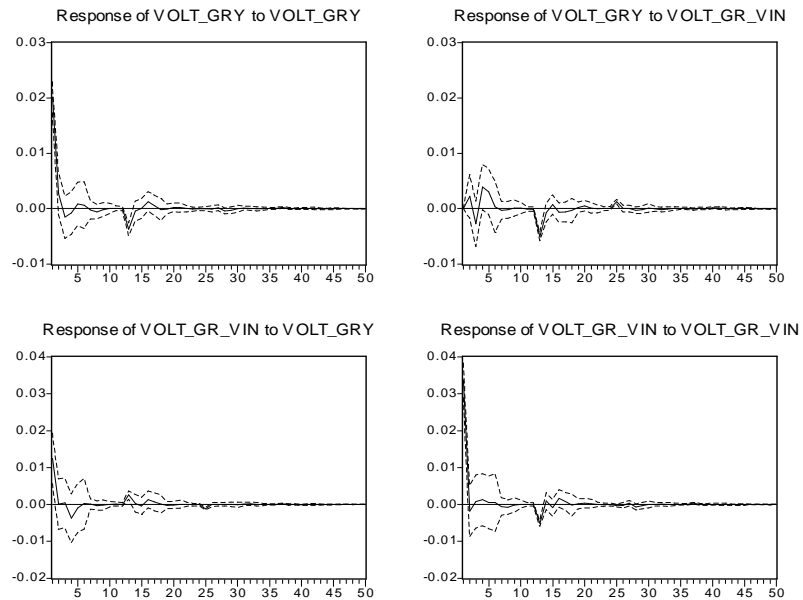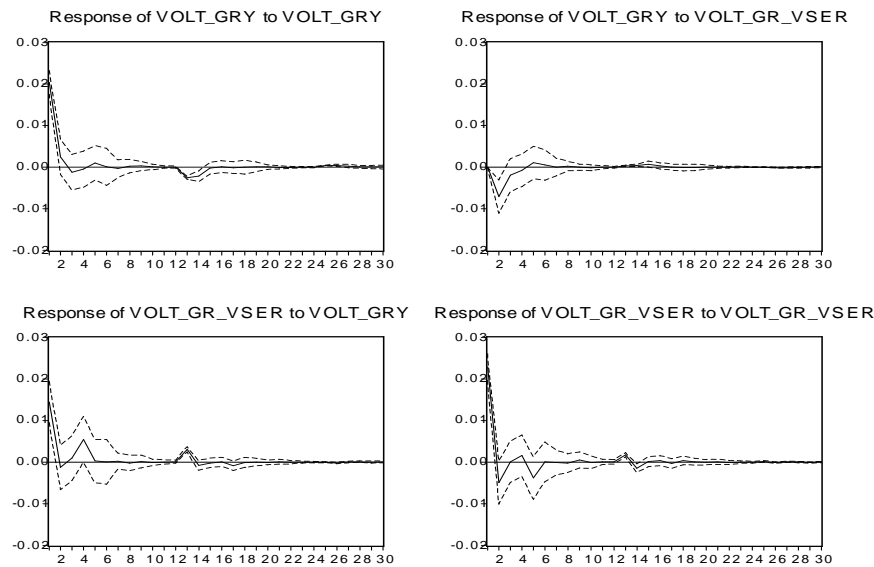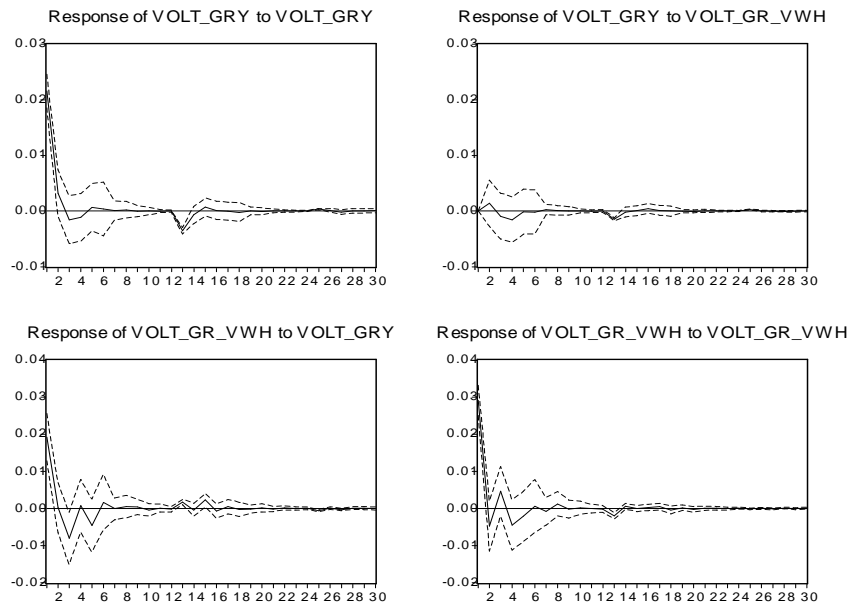**Fig.7. Impulse Response Function between the Volatility of Growth Rate of Output and the Volatility of Growth Rate of Value-added of Wholesale and Retail**

Response to One S.D. Innovations ± 2 S.E.

VI. CONCLUSIONS

From this study it has been observed that in Pakistan every policy is based on short-run whereas it requires the introduction of a long term planning and expenditure framework for Pakistan. This requires an appropriate policy and institutional framework which addresses the long-term goals of the nation as determined through a transparent process involving all the legitimate stakeholders, and should be based on a clear strategy and an integrated program of action. The National Economic Council has a central role to play in this task.

However, for this study it is also observed that volatility of different sectors have impact on the volatility of growth rates in the short-run while volatility of value added of finance and insurance indicate insignificant impact. Volatility of value added of services contributed highest to the volatility of growth rate of output and volatility of finance and insurance contributed lowest to the volatility of growth rate of output.

Dynamic changes in political structure have insignificant impact on the growth rate of the economy. Currently the insignificant impact might be due to the dummy variable used for the political instability. So there is a need to estimate the impact of political instability on the volatility of the growth rate by considering and developing comprehensive measures of political instability.

The problem of inadequate, untimely and unreliable data has adversely affected development planning and management. Although there are several institutions at the federal level charged with the production of statistical and survey reports, their performance has been uneven and irregular. The system lacks the capacity to harvest and use the information available at the various agencies and centres of action.

There is need to re-think and restructure fiscal federalism in Pakistan. Under prolonged military rule the principles and practice of fiscal federalism were eroded. Efforts are now being made to re-build the system. Such efforts should include the establishment of mechanisms for coordination and cooperation between Federal Government of Pakistan and provincial governments in such a way as to make it possible to agree on economy-wide macroeconomic objectives and targets, and ways of achieving same. The Constitution itself should be drastically reviewed and refashioned in the light of the needs and expressed wishes of the people.

Appendix A

Data of the Volatility Variables Obtained from the ARCH-GARCH Process

Year	Volatility in Growth Rate (VOLT_GR) of						Year	Volatility in Growth Rate (VOLT_GR) of					
	VAG	VFIN	VSER	VIN	VWH	Y		VAG	VFIN	VSER	VIN	VWH	Y
1971-72-Q1							1979-80-Q1	0.0068	−1.2684	−0.0313	0.0817	0.0365	0.0165
1971-72-Q2		3.9916					1979-80-Q2	0.0670	6.5516	0.0148	−0.0147	−0.0025	0.0241
1971-72-Q3		−1.2284					1979-80-Q3	−0.0585	−0.7484	0.0125	0.0192	−0.0284	0.0084
1971-72-Q4		1.2416					1979-80-Q4	−0.0275	−0.2884	0.0219	0.0112	0.0189	0.0181
1972-73-Q1		0.0916					1980-81-Q1	−0.0375	−1.2784	−0.0181	0.0098	−0.0104	−0.0151
1972-73-Q2		−0.5484		0.0171	−0.0010		1980-81-Q2	0.0480	6.5416	0.0061	0.0418	0.0213	0.0029
1972-73-Q3		−0.9184		0.0742	0.0100		1980-81-Q3	0.0303	−0.8484	0.0027	0.0358	0.0101	0.0053
1972-73-Q4		0.2716		0.0200	0.0003		1980-81-Q4	0.0049	0.0416	0.0150	−0.0126	−0.0182	−0.0111
1973-74-Q1		−1.0384		−0.0014	0.0158		1981-82-Q1	−0.0093	−1.8884	−0.0479	0.0443	−0.0004	−0.0377
1973-74-Q2		6.9516		−0.0293	0.0252		1981-82-Q2	0.0419	−6.3684	0.0982	0.0241	0.0511	0.0325
1973-74-Q3		−0.8484		0.0276	0.0651		1981-82-Q3	0.0136	−0.9084	0.0276	−0.0038	0.0112	−0.0005
1973-74-Q4		−0.0884		0.0219	0.0342		1981-82-Q4	−0.0518	−0.9584	−0.0164	0.0732	0.0321	−0.0261
1974-75-Q1		−2.4784		0.0199	−0.0504		1982-83-Q1	0.0262	0.3916	0.0835	−0.0265	0.0228	0.0063
1974-75-Q2	−0.0060	−2.7784	0.0966	−0.0218	−0.0128	0.0215	1982-83-Q2	0.0171	−0.5584	−0.0446	−0.0122	0.0201	−0.0504
1974-75-Q3	−0.0022	−1.0184	0.1487	−0.0888	−0.0556	0.0335	1982-83-Q3	−0.0244	0.2616	0.0272	−0.0276	−0.0057	0.0072
1974-75-Q4	−0.0249	0.2716	0.0179	−0.0356	−0.0352	−0.0034	1982-83-Q4	−0.0511	−0.9484	0.0146	0.0211	0.0204	0.0058
1975-76-Q1	−0.0058	−1.2684	0.0313	0.0553	−0.0244	0.0255	1983-84-Q1	−0.0355	0.2216	0.0154	−0.0111	−0.0330	−0.0145
1975-76-Q2	0.0007	5.4616	−0.0642	−0.0541	−0.0729	−0.0401	1983-84-Q2	−0.0926	0.0716	0.0320	0.0064	−0.0547	−0.0356
1975-76-Q3	0.0480	−0.8184	−0.0311	0.0216	−0.0124	0.0401	1983-84-Q3	0.0340	−0.4784	0.0339	0.0275	0.0691	0.0072
1975-76-Q4	0.0587	−1.3084	−0.1132	−0.0306	−0.0009	0.0021	1983-84-Q4	−0.0083	−1.3784	−0.0520	−0.0139	−0.0154	−0.0344
1976-77-Q1	−0.0452	9.2316	0.0251	−0.0682	−0.1356	0.0004	1984-85-Q1	0.1004	−7.4484	−0.0544	0.0314	0.0775	0.0116
1976-77-Q2	−0.0461	0.0116	−0.0326	−0.0135	−0.0398	−0.0265	1984-85-Q2	0.0495	−5.2884	0.0375	0.0340	0.0748	0.0272
1976-77-Q3	0.0875	−1.3184	−0.0461	−0.0004	0.0043	−0.0024	1984-85-Q3	−0.0856	−0.0884	0.0574	0.0315	−0.0253	0.0178
1976-77-Q4	0.0172	−1.3784	−0.0450	0.0070	−0.0291	0.0033	1984-85-Q4	0.0034	−1.2884	−0.0178	−0.0929	−0.0208	−0.0285
1977-78-Q1	0.0345	41.4016	0.0158	0.0017	0.0348	0.0443	1985-86-Q1	0.0725	1.6416	0.0338	0.0341	0.0113	0.0129
1977-78-Q2	0.0118	2.1616	0.0282	0.0499	0.0418	−0.0010	1985-86-Q2	0.0077	−0.6884	−0.0525	0.0470	0.0284	0.0061
1977-78-Q3	0.0098	−1.1284	0.0421	0.0367	−0.0056	0.0119	1985-86-Q3	−0.0412	0.8016	−0.0430	−0.0071	−0.0363	−0.0088
1977-78-Q4	−0.0277	1.0616	0.0700	0.0041	−0.0184	0.0171	1985-86-Q4	0.1109	−1.0184	0.0144	0.0089	0.0500	0.0068
1978-79-Q1	−0.0105	−0.9884	−0.0119	0.0015	−0.0332	−0.0221	1986-87-Q1	0.0656	−0.1784	−0.0212	0.0167	−0.0061	0.0086
1978-79-Q2	0.0188	1.1616	−0.0135	−0.0196	0.0071	−0.0034	1986-87-Q2	0.0230	−0.1484	0.0154	−0.0070	0.0225	0.0298
1978-79-Q3	0.0116	−0.7384	0.0194	0.0083	0.0114	−0.0075	1986-87-Q3	−0.0463	−0.0884	−0.0171	0.0526	0.0080	−0.0303
1978-79-Q4	0.0409	−0.1884	0.0283	0.0420	0.0316	0.0302	1986-87-Q4	−0.0211	−0.9384	−0.0150	0.0116	−0.0385	−0.0316

Continued—

Appendix A—(*Continued*)

Year	Volatility in Growth Rate (VOLT_GR) of						Year	Volatility in Growth Rate (VOLT_GR) of					
	VAG	VFIN	VSER	VIN	VWH	Y		VAG	VFIN	VSER	VIN	VWH	Y
1987-88-Q1	0.0267	–0.1684	0.0062	–0.0048	0.0205	0.0238	1995-96-Q1	0.0929	–0.0484	0.0002	–0.0006	–0.0248	–0.0078
1987-88-Q2	0.0321	–0.3684	–0.0030	0.0254	0.0532	0.0089	1995-96-Q2	0.0418	–0.5084	0.0123	0.0201	0.0277	0.0150
1987-88-Q3	–0.0249	0.5316	0.0144	0.0640	0.0444	0.0165	1995-96-Q3	0.0306	0.3016	0.0141	–0.0198	0.0237	–0.0131
1987-88-Q4	–0.1909	–1.1384	–0.0140	0.0034	–0.0027	–0.0161	1995-96-Q4	0.0028	–0.9984	–0.0041	–0.0463	–0.0152	–0.0163
1988-89-Q1	0.0651	0.7016	–0.0310	–0.0425	–0.0535	–0.0544	1996-97-Q1	–0.0011	–0.4484	–0.0222	–0.0162	–0.0230	–0.0230
1988-89-Q2	0.0686	–0.6184	–0.0126	–0.0393	0.0173	0.0105	1996-97-Q2	0.0022	0.2116	0.0157	–0.0380	0.0465	–0.0059
1988–89-Q3	–0.0215	0.9316	0.0076	0.0001	0.0436	0.0194	1996-97-Q3	0.0153	0.1216	–0.0153	–0.0352	–0.0682	–0.0270
1988-89-Q4	0.1018	–1.3584	–0.0344	0.0321	0.0045	0.0015	1996-97-Q4	–0.0087	–0.8984	–0.0299	–0.0819	–0.0810	–0.0502
1989-90-Q1	–0.0589	5.2416	–0.0227	0.0078	0.0046	–0.0470	1997-98-Q1	0.0080	–0.7384	–0.0427	–0.0282	–0.0222	–0.0306
1989-90-Q2	–0.0267	–0.2284	0.0039	0.0411	0.0052	–0.0078	1997-98-Q2	–0.0198	0.3216	–0.0082	0.0657	–0.0256	0.0071
1989-90-Q3	0.0057	–0.1684	–0.0247	–0.0155	–0.0296	–0.0023	1997-98-Q3	0.0428	–0.1284	–0.0285	0.0477	–0.0236	0.0096
1989-90-Q4	–0.0026	–0.8784	0.0137	–0.0575	–0.0077	–0.0099	1997-98-Q4	0.0193	–1.1384	–0.0345	–0.0478	–0.0055	–0.0182
1990-91-Q1	0.0416	–0.0884	–0.0137	0.0090	–0.0042	–0.0146	1998–99-Q1	–0.0667	–0.1584	–0.0225	0.0263	–0.0100	–0.0184
1990-91-Q2	0.0193	–0.4684	0.0150	0.0096	0.0462	–0.0096	1998-99-Q2	–0.0233	2.6016	0.0544	–0.0821	–0.0075	0.0237
1990-91-Q3	–0.0190	0.0316	–0.0071	0.0063	–0.0207	–0.0246	1998-99-Q3	0.0098	–1.4184	–0.0805	0.0210	–0.0166	0.0006
1990-91-Q4	0.0544	–0.8784	–0.0005	0.0015	–0.0241	–0.0009	1998-99-Q4	–0.0442	51.0916	0.0548	0.0189	0.0274	0.0489
1991-92-Q1	0.0432	–0.3584	0.0093	0.0318	0.0774	0.0494	1999-00-Q1	–0.0296	–1.1584	0.0008	–0.0248	0.0077	0.0036
1991-92-Q2	0.0510	–0.0684	0.0199	–0.0104	–0.0029	0.0356	1999-00-Q2	0.0532	1.6116	–0.0221	0.0005	–0.0542	0.0244
1991-92-Q3	–0.0274	–0.2684	–0.0012	0.0241	0.0100	–0.0051	1999-00-Q3	–0.0486	–0.8084	0.0319	–0.0885	0.0119	0.0047
1991-92-Q4	–0.0022	–0.6184	0.0088	–0.0242	–0.0118	–0.0019	1999-00-Q4	0.0652	0.6016	0.0083	–0.0141	–0.0553	0.0310
1992-93-Q1	–0.0681	0.3416	0.0222	–0.0257	–0.0403	–0.0162	2000-01-Q1	–0.0548	–1.1584	0.0098	–0.0105	0.0700	0.0042
1992-93-Q2	–0.1037	–1.0484	–0.0254	–0.0085	–0.0083	–0.0164	2000-01-Q2	–0.0531	3.3116	0.0006	–0.0996	–0.1106	–0.0511
1992-93-Q3	0.0238	0.2316	–0.0097	0.0146	0.0021	0.0119	2000-01-Q3	–0.0336	–1.2784	–0.0098	0.0758	0.0744	–0.0108
1992-93-Q4	–0.0049	–0.6884	–0.0015	–0.0052	0.0179	–0.0131	2000-01-Q4	–0.0732	3.9216	0.0216	0.0124	0.0275	–0.0043
1993-94-Q1	0.0280	–0.2984	–0.0144	–0.0248	0.0114	0.0103	2001-02-Q1	–0.0272	–0.8584	0.0137	0.0362	–0.0016	0.0022
1993-94-Q2	–0.0547	–0.2584	–0.0002	–0.0255	–0.0564	–0.0206	2001-02-Q2	0.0326	0.9116	–0.0047	–0.0627	–0.0213	–0.0341
1993-94-Q3	0.0140	0.0516	0.0107	0.0013	0.0004	–0.0049	2001-02-Q3	–0.0502	–1.0684	–0.0098	0.0175	–0.1111	–0.0317
1993-94-Q4	–0.0481	–0.6084	–0.0009	–0.0328	–0.0155	–0.0184	2001-02-Q4	–0.0687	0.6116	0.0065	–0.0173	0.0549	0.0012
1994-95-Q1	–0.0109	–0.3284	–0.0258	0.0061	–0.0320	–0.0409	2002–03-Q1	–0.0081	–0.8484	0.0139	–0.0344	–0.0106	0.0115
1994-95-Q2	–0.0372	–0.5584	0.0001	–0.0581	0.0177	–0.0204	2002-03-Q2	–0.0049	0.1616	–0.0050	–0.0307	0.0603	0.0015
1994-95-Q3	0.0440	0.1716	0.0147	0.0126	0.0019	0.0183	2002–03-Q3	0.0122	–0.7184	0.0203	0.0707	0.0384	0.0479
1994-95-Q4	0.0230	–0.9184	0.0086	0.0368	0.0710	0.0254	2002-03-Q4	0.0084	–0.0684	-0.0079	–0.0216	–0.0206	0.0153

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Comments

This paper examines the nature of volatility of GDP along with the volatility of different economic sectors of the economy, and focuses on the question as to what extent the volatility in the GDP growth rate is associated with the volatility of various sectors of the economy. The paper concludes that in a country like Pakistan, no long-run relationship exists between the volatility of GDP growth rate and the volatility of sectoral growth rates. However the relationship exists for the short run only.

As the title of the paper suggests, the authors were expected on the one hand to explain the microeconomic and macroeconomic determinants of sectoral volatility of GDP and on the other, to establish the linkages between sectoral volatility, economic development and governance. The contents of the paper, however, clearly show the failure of the authors to clearly diagnose the basic determinants of sectoral volatility and to establish the transmission mechanisms between sectoral volatility, development and governance. In fact, the discussion on these two critical aspects is almost non-existent in the paper.

The literature review in the paper refers to some important studies on the subject, however, the paper does not explain their findings and conclusions. The authors could develop a tabulated matrix to show the readers when each of these studies was conducted, what was the sample of the country data and what were the results. This would have significantly improved the contents of the paper.

The authors point out that this paper would answer a number of questions about the volatility of GDP growth rate etc. and then go on to pen down a few specific questions. However the answers to many of these questions are missing in the paper, which include the following:

(a) What are the main implications of the volatility parameters for Pakistan's policy problems?
(b) What are the main implications of the volatility parameters for the achievement of stable growth rate of real GDP?
(c) How is the volatility in different sectors of Pakistan's economy correlated with each other?
(d) What is the nature of volatility of different economic sectors?

The regression results presented in the paper need far greater explanation than is provided in the paper. Simply stating that the impact variables are insignificant is not sufficient analysis. The idea is not to show the regression results, but to explain them in the light of changes in the stock and flow of economic variables. This could make the discussion interesting as well as meaningful. At the same time, there is a need to incorporate other independent variables in the regression equations which can be proxies for development and governance. Simply regressing the volatility in the overall GDP with the volatility in sectoral GDP is an oversimplified exercise and does not provide any useful policy conclusions.

In the sub-section on Impulse Response Function (IRF), each figure (Figure 5 – 9) in the paper requires exclusive explanation. The results from the IRF suggest that the sectoral volatility has no significant impact on the overall performance of the economy. One needs a decomposition analysis to validate such a result. There are various decomposition techniques in the literature which the authors could utilise for improving their results.

The literature on the theory and usage of Unit-Root Test and Angel-Granger Approach is well-known by now. The rudimentary explanation of these tests should be placed the in an appendix. There is no need for these details to be placed as a sub-section in the main body of a paper explaining policy implications of sectoral volatility.

In the concluding part of the paper, a reference has been made about restructuring the fiscal federalism in Pakistan. This is an unwarranted addition as the fiscal policy and demand management policies have not been incorporated in the econometric tests conducted in the paper. The reader is unable to see how sectoral volatility of the economy can be linked with fiscal federalism.

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