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Determinants of GDP Fluctuations in Selected South Asian Countries: A Macro-Panel Study

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Now a days, the issue of volatility in GDP is becoming a fundamental development concern due to the undeniable connections between volatility and lack of development. In addition, the recognition of the negative link between short-term fluctuations and long-term growth not only signifies the importance of exploring this link but also stresses the importance of studying the determinants of the GDP fluctuations so that the efforts to manage these fluctuations can be made. Therefore, keeping in view, the importance of studying the factor causing fluctuations in GDP, the present study aims at exploring the determinants of GDP fluctuations using macro panel approach in a panel of five selected South Asian countries (SSAC) including Bangladesh, India, Nepal, Pakistan and Sri Lanka over the period of 1980-2010. For this purpose, modern non-stationary panel techniques such as cross section dependence test, second generation unit root test under cross sectional dependence, panel cointegration and Group Mean Fully Modified OLS (GM-FMOLS) estimation are applied.

The results of the group mean FMOLS estimates show that aid dependence (AIDGDP), trade openness (OPEN), volatility in the price level (PRIVOL), reliance on agriculture (AGRGDP) and political stability (POLSTB) are the significant determinants of the GDP fluctuations. Thus, it is suggested that these determinants may be managed to reduce the volatility in GDP growth rate.

JEL Classification: E32, F44, N15

Keywords: Determinants of GDP Fluctuations, Determinants of GDP Volatility, South Asia, Group Mean FMOLS, Panel Cointegration, Macro Panel, Business Cycle Fluctuations

1. INTRODUCTION

GDP fluctuations and volatility has large welfare costs, particularly, in developing countries. According to World Bank (2007), the direct welfare costs of volatility are about 5 to 10 percent of annual consumption in some Latin American countries as compared to industrial countries where it is about less than one percent. Similarly, the fluctuation and volatility of GDP has an adverse impact on long-run output growth, especially in developing countries. This negative link between volatility and growth was found empirically in the seminal paper of Ramey and Ramey (1995) and then Fatás (2002), Acemoglu, *et al*. (2003), Hnatkovska and Loayza (2004) and many other studies further studied it and found similar results.

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Now the issue of volatility is becoming a fundamental development concern due to the undeniable connections between volatility and lack of development [World Bank (2007)]. In addition, the recognition of the negative link between short-term fluctuations and long-term growth not only signifies the importance of exploring this link, but also stresses the importance of studying the determinants of the GDP fluctuations, so that the efforts to manage these fluctuations can be made.

There are so many domestic and external factors such as fluctuating commodity prices (inflation volatility), level of financial development, trade openness, reliance on agriculture, political instability and reliance of foreign resources etc. that cause the fluctuations in GDP growth. Studying the determinants of GDP fluctuation being least explored topic has a lot of space and potential for further research in a special context of developing countries.

Most of existing literature on the determinants of GDP volatility is limited to large cross-sectional and micro-panel studies. There is a considerable space in existing literature for further time-series, macro-panel studies (with small N and large T), and country or region specific research on this topic. South Asian countries are also facing the issue of fluctuations in growth rate, such as, soon after a vibrant growth rate of 9.1 percent in 2010, South Asia's real GDP growth has decelerated to an projected growth rate of 6.6 percent in 2011 [World Bank (2012a)]. Consequently, there is a massive potential for research on analysing the underlying sources of GDP volatility in South Asia, so that an effective policy to manage these GDP fluctuations may be devised.

Therefore, the present study tries to identify the major determinants of GDP fluctuations using annual data of five SSAC for the period of 1980-2010. Thus, the present study applies modern macro-panel techniques for non-stationary data which also accounts for cross section dependence. The organisation of the rest of the paper is as follows. The next section reviews the existing available literature on the determinants of GDP fluctuations. Section 3 deals with the detailed description of econometric techniques and data description. Section 4 presents and discusses the estimated results. The last section concludes the paper by presenting a summary of findings and giving policy recommendations.

2. REVIEW OF LITERATURE

The history of literature on the study of causes of business cycle is very old, but the study of the causes and sources of volatility and fluctuations in GDP growth rate has been started in late nineties and early twenties. Bergman (1996) found that both demand and supply shocks are important causes of business cycle fluctuations. Easterly, Islam and Stiglitz (2000) found that trade openness and price volatility (nominal volatility) are positively related to growth volatility (real volatility). Moreover, the relationship between financial deepening and growth volatility has a non-linear form.

Hoffmaister and Roldós (2001) examined found that domestic shocks are the main source of GDP fluctuations, while external shocks explain a small part of changes in output. Acemoglu, *et al.* (2003) found that countries inheriting the "extractive" institutions from their colonial past have more chances of having high volatility and economic crises during the post-war period. Furthermore, the study found that the distortionary macroeconomic policies are the indicators of underlying institutional

problems rather than the main causes of economic volatility. The findings of the study also suggested that the weak institutions cause volatility through a number of microeconomic, as well as macroeconomic, channels.

Ndlela and Nkala (2003) confirmed macroeconomic theory postulations about the nature of the relationship between each of the variables (real domestic product, terms of trade, inflation, government consumption, money supply, real exchange rate, and the world interest rate) and macroeconomic fluctuations in South Africa. Arreaza and Dorta (2004) found that domestic shocks seem to explain around 70 percent of the non-oil, output growth volatility. Particularly, supply shocks seem to be the main source of non-oil, output growth volatility. On the other hand, nominal shocks seem to account for over half of inflation variability.

Mobarak (2004) found that democracy, income and diversification lower the volatility, while volatility itself has a negative impact on growth. The author concluded that the democracy-stability link is strong, robust and sharper than democracy–growth relationship.

Spiliopoulos (2005) study found that the relationship between volatility and financial sophistication is not clearly negative as explained by many studies. Similarly, the oft quoted negative relationship between real GDP per capita and volatility turns out to be positive while no stable significant relationship between inflation and volatility is found. Mehrara and Oskoui (2007) found that the oil price shocks are the main source of output fluctuations in Saudi Arabia and Iran, but not in Kuwait and Indonesia.

Kunieda (2008) found that financial development has a hump-shaped effect on growth volatility. In the very early stages of financial development growth rate is less volatile. An economy becomes highly volatile as the financial sector develops. However, as the financial sector becomes mature and financial markets become perfect, the growth rates become less volatile again.

Ahmed and Suardi (2009) found strong evidence that trade liberalisation is associated with higher output and consumption growth volatility. On the contrary, financial liberalisation was found to increase the effectiveness of consumption smoothing and stabilise income and consumption growth. Balcilar and Tuna (2009) found that supply-side shocks are the main determinant of output fluctuations in the long-run and it explains almost half the variance of domestic output. On the other hand, most of the short-run fluctuation in domestic output was affected by relative demand shocks. Aggregate demand shocks did not seem to play any significant role in output volatility in the long-run.

Jalil (2009) found that a higher level of financial development reduces the volatility of real per capita GDP in China for the period under study. Perry (2009) found that during 1970-2005 about 44 percent of excess volatility in developing countries is associated with higher exposure to external shocks, about 38 percent is associated with volatile macroeconomic policies and the rest of (18 percent) is associated with insufficient development of domestic capital markets, financial integration, and other factors. Özata and Özer (2010) found that the fluctuations in real output are mainly caused by the supply shocks both in the short- and long-runs. Furthermore, it was also found that the domestic supply shocks (defined as productivity shocks) are the most important factors in explaining output fluctuations.

The literature, reviewed above, highlights different factors causing volatility in GDP growth rates. Furthermore, most of existing literature on the determinants of GDP volatility is limited to large cross-sectional and micro-panel studies. Thus, signifying for a considerable space in existing literature for further time-series, macro-panel studies (with small N and large T), and country or region specific research on this topic. South Asia has never been studied in the literature. Consequently, this study focuses on analysing the underlying sources of GDP volatility in like South Asia.

3. DATA AND METHODOLOGY

3.1. Data Description

The volatility in GDP is already measured using five-years moving standard deviation of per capita GDP from trend. This study, on the basis of literature review, have selected the price volatility, level of financial development, the share of foreign aid in GDP, share of agriculture in GDP, trade liberalisation (openness) and political stability as the significant sources (determinants) of GDP fluctuations. The data of the GDP per capita and all the determinants including reliance on foreign aid (AIDGDP), aid volatility (AIDVOL), financial development (FINDEV), price volatility (PRIVOL) except Political Stability (POLSTB) is taken from the world development indicators 2012 [World Bank (2012b)]. While the data of political stability, proxied by the Polity2 series, is taken from Polity IV project by Marshall and Jaggers (2011). Some missing values in data of inflation for Bangladesh are taken from Triami Media (2012).[1] Detailed variable description along with data sources is given in Table A.1 of Appendix.

3.2. Econometric Methodology

The primary objective of this paper is to examine and explore the overall long-run relationship between GDP fluctuations and determinants in SSAC. Most of the existing studies have used micro-panels for studying GDP fluctuations. These studies calculated standard deviation of GDP per capita growth rate for time-period under study as a proxy of volatility. While, some of panel-data studies used the country-averages for the sub-periods (by dividing the time-period into decades or even smaller sub-periods). Since the present study is also interested in testing the consistency of relationship between GDP fluctuations, and its determinants over time and this method of country-averages is not suitable in case of this study due to small country-sample. Therefore, the current study uses five-years moving standard deviation of per capita GDP growth rate from trend.[2]

[1]The missing period of 1980-86 in the WDI dataset of inflation rate for Bangladesh is filled with the Triami Media (2012).

[2]The five-year moving standard deviation from trend (SDFT) is calculated through taking the five-years moving standard deviation of cyclical component of the GDP per capita growth. The series of GDP per capita growth rate of each country, individually, has been decomposed into trend and cyclical components using the Hodrick-Prescott (HP) filter [Hodrick and Prescott (1997)] with a smoothing parameter set at 6.25 [as suggested by Ravn and Uhlig (2002) for annual data]. Then the five years moving standard deviation of cyclical component has been calculated to get the SDFT. Hodrick and Prescott (1997) originally found that the value of smoothing parameter (λ) as 1600 for US quarterly data. Rand and Tarp (2002) find that business cycles in developing countries are significantly shorter in duration than cycles in developed countries. Therefore, the present study uses the choice of λ=6.25 suggested by Ravn and Uhlig (2002) for annual data.

In a panel data having a small sample of countries (N) with a longer time-series (T), like present study, the existence of non-stationarity is more likely. Furthermore, this study also likes to explore the consistency of past cross-sectional studies over time. Therefore, this study employs the panel cointegration framework to estimate the equation 4.1. But, before continuing to the cointegration analysis first to check the order of integration by applying the unit root tests is needed. Along with the unit root analysis another recently developed concept of the cross sectional dependence is also gaining lot of attraction in the current non-stationary panel literature. Therefore, the current study employs the Cross Sectional Dependence (CD) test by Pesaran (2004) before applying panel unit root test.

3.2.1. *Cross Sectional Dependence Test*

Pesaran (2004) suggests a simple test for testing cross-sectional dependence (CD) which can be applied to a variety of panel-data models including stationary and non-stationary dynamic heterogeneous panels. This CD test is based upon the average of pair-wise correlation coefficients of OLS residuals from the individual regressions in the panel rather than their squares like the Breusch–Pagan LM test [Baltagi (2005), p. 247]:

$$CD = \sqrt{\frac{2T}{N(N-1)}}\left(\sum_{i=1}^{N-1}\sum_{j=i+1}^{N}\hat{\rho}_{ij}\right) \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (1)$$

3.2.2. *Panel Unit Root Tests*

The first step in determining a potential cointegrated relationship is to test whether the variables of interest are stationary or non-stationary. There are many tests available for testing unit root in panel data like Breitung (2000), Hadri (2000), Levin, Lin and Chu (2002) test (known as LLC test) and Im, Pesaran and Shin (2003) test (known as *IPS* test) etc. but these all test assumes cross sectional independence. As mentioned earlier that it is more likely that our data may have cross-sectional dependence, therefore, none of these above-mentioned tests can be used. Accordingly, the current study employs the Breitung and Das (2005) panel unit root test. The main advantage of the Breitung and Das (2005) is that it can also be applied in the presence of cross-sectional dependence. In case of cross-sectional dependence the robust value of lambda is calculated to account for the cross-sectional dependence otherwise in case cross-sectional independence the simple value of lambda is calculated.

3.2.3. *Panel Cointegration Tests*

After confirmation about the order of integration of variables of interest, and if the variables are non-stationary, the next step is to check for cointegration because the use of traditional OLS may give the spurious results in the presence of a unit root. Although taking the first difference of the data is a useful transformation to prevent the spurious regression problem but it also causes to lose the long term information. Therefore, the current study uses the panel cointegration technique. For the panel cointegration test, the current study employs Pedroni (1997, 1999 and 2004a) panel cointegration tests. The main advantage of using Pedroni panel cointegration test is that it accounts for cross-section dependence if common

time dummies added as Banerjee and Lluís (2006) pointed out that most panel data tests (including Pedroni) assume cross-section independence, except for common time effects. Therefore, the addition of common time effects (common time dummies) may account for the problem of cross-sectional dependence.

Pedroni Panel Cointegration Test: Pedroni Panel cointegration test is a significant improvement over the conventional cointegration tests applied on a single series. The panel regression model to analyse the long-run co-integrating relationship between growth and GDP fluctuations, using Pedroni panel co-integration test, can be represented as under:

$$FLUC_{i,t} = a_i + \delta_t + \sum_{m=1}^{M} \beta_{mi} X_{mi,t} + e_{i,t} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

Where,
X = Set of Determinants of GDP Fluctuations (including volatility of the price level (PRIVOL), level of financial development (FINDEV), reliance on the foreign aid (AIDGDP), political stability (POLSTB), Share of Agriculture (AGRGDP) and Trade liberalisation / openness (OPEN)) FLUC = GDP fluctuations

Using the above equation, the null of no cointegration is tested through seven test statistics developed by Pedroni (1999). The first four statistics (Panel-v, Panel-rho and Panel-t (PP and ADF)) are based on pooling the residuals along the within dimension of the panel. The rest of three statistics (Group-rho and Group-t (PP and ADF)) are based on pooling the residuals along the between dimension of the panel. Under the alternative hypothesis, Panel-v statistic diverges to positive infinity. It is a one sided test therefore, where large positive values reject the null of no cointegration. The remaining statistics diverge to negative infinity, which means that large negative values reject the null of no cointegration.

3.2.4. *Panel Estimation using FMOLS Approach*

These panel cointegration tests, just give the information about the long-run equilibrium relationship among the variables, these tests don't estimate the co-integrating vectors. For this purpose, the present study uses Group Mean Fully Modified Ordinary Least Squares (GM-FMOLS) developed by Pedroni (2001a, 2001b, 2004b) which is an extension of time-series Fully Modified OLS (FMOLS) by Phillips and Hansen (1990). The main advantage of using GM-FMOLS estimator is that it not only gives consistent estimates of the β parameters in relatively small samples, but it also controls for the likely endogeneity of the regressors and serial correlation [Ramirez (2010); Al Yousef (2013)]. This technique also control for the likely cross-sectional dependence by including common time dummies in the model [Pedroni (2001a); Lee (2007)]. Another method which allow estimation in the presence of cross-sectional dependence is the Pesaran (2006) CCEMG estimator. But Pesaran (2006) is the extension of Pesaran and Smith (1995) MG and Pesaran, shin and Smith (1999) PMG estimator. Tsangarides, Saxegaard, and Roudet (2007) pointed out that GM-FMOLS estimators have satisfactory size and power properties even for small panels, as long as T is larger than N and in the presence of homogeneous co-integrating vector mean-group estimators have better small sample performance than within group estimators. Tsangarides, *et al.* (2007) further highlighted the PMG estimator imposes long-run homogeneity, it can also produce inconsistent estimates of the average values of the parameters if the assumption of homogeneity is

violated in practice. Therefore, the present study employs GM-FMOLS with common time dummies to estimate the long-run cointegrating vector.

For the estimation of GM-FMOLS estimation the following model is considered:

$$FLUC_{i,t} = \alpha_i + \beta_i X_{i,t} + \varepsilon_{i,t} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

Where, $FLUC_{i,t}$ is the dependent variable of the country i at time t, $X_{i,t}$ is vector of determinants of GDP Fluctuations (of a country i at time t) including volatility of the price level (PRIVOL), level of financial development (FINDEV), reliance on the foreign aid (AIDGDP), political stability (POLSTB), Share of Agriculture (AGRGDP) and Trade liberalisation/openness (OPEN). and $\varepsilon_{i,t}$ is the error-term. $X_{,t}$ and $FLUC_{i,t}$ are cointegrated with coefficient β_i, which may or may not be homogenous across i.

All the idiosyncratic (individual country) coefficients ($\hat{\beta}^*_{FM,i}$) and associated t-statistic for each country (i) are estimated using above Equation (3) and then the Group Mean (Between-Dimension) panel estimates ($\hat{\beta}^*_{GFM}$) can be calculated using the following formula given by Pedroni (2004b).

$$\hat{\beta}_{GFM} = N^{-1}\sum_{t-1}^{N}\left(\sum_{t-1}^{R}(P_{it}-\overline{P}_i)\right)^{-1}\times\left(\sum_{t-1}^{T}(P_{it}-\overline{P}_i)S^*_{it}-T\hat{\gamma}_i\right) \quad \ldots \quad \ldots \quad (4)$$

Where,

$$s^*_{it} = \left(S_{it}-\overline{S}_i\right)-\frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}}\Delta p_{it}$$

$$\hat{\gamma}_i = \hat{\Gamma}_{21i}+\hat{\Omega}^{\circ}_{21i}-\frac{\hat{\Omega}_{21i}}{\hat{\Omega}_{22i}}\left(\hat{\Gamma}_{21i}+\hat{\Omega}^{\circ}_{21i}\right)$$

In the above equation (4), the expression after the summation over i is similar to the conventional idiosyncratic time-series estimator ($\hat{\beta}^*_{FM,i}$) therefore the between dimension panel estimator ($\hat{\beta}^*_{GFM}$) can be constructed simply by,

$$\hat{\beta}^*_{GFM} = N^{-1}\sum_{t-1}^{N}\hat{\beta}^*_{FM,i} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (5)$$

Where, $\hat{\beta}^*_{FM,i}$ is the conventional time-series (individual country) FMOLS estimator of *ith* member of panel. Similarly, related t-statistic for the between dimension panel estimator can be measured by the following formula by Pedroni (2004b).

$$t_{\hat{\beta}^*_{GFM}} = N^{-1/2}\sum_{t-1}^{N} t_{\beta^*_{FM,i}} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (6)$$

Where, $t_{\hat{\beta}^*_{FM,i}}$ is the conventional time-series (individual country, i) t-statistic, of ith member of panel, associated with related $\widehat{\beta}^*_{FM,i}$. The formula of $t_{\hat{\beta}^*_{FM,i}}$ is given as,

$$t_{\hat{\beta}^*_{FM,i}} = \left(\hat{\beta}^*_{FM,i}-\beta_o\right)\left(\hat{\Omega}^{-1}_{11i}\sum_{t-1}^{T}(P_{it}-\overline{P}_i)^2\right)^{1/2} \quad \ldots \quad \ldots \quad \ldots \quad \ldots \quad (7)$$

4. RESULTS AND DISCUSSION

4.1. Cross Sectional Dependence Test

The results of CD Test by Pesaran (2004) are given in the Table 1 which shows that except GDP fluctuations (FLUC) and Price Volatility (PRIVOL) the null of no cross-sectional independence can be rejected i.e. all the variables except the FLUC and PRIVOL are found as cross-sectionally dependent variables.

Table 1

Cross Sectional Dependence Test

Variable	CD-test	p-value	Corr	abs(corr)
AGRIGDP	14.82	0.000	0.902	0.902
FINDEV	9.86	0.000	0.600	0.600
POLSTB	3.22	0.001	0.196	0.266
AIDGDP	12.12	0.000	0.738	0.738
OPEN	4.74	0.000	0.289	0.375
FLUC	0.71	0.479	0.044	0.226
PRIVOL	0.60	0.547	0.037	0.250

Source: Author's Own Calculation.
Notes: Under the null hypothesis of cross-section independence CD ~ N(0,1).

While, GDP fluctuations (FLUC) and Price Volatility (PRIVOL) are found as cross-sectionally independent variables.

4.2. Panel Unit Root Testing under Cross Sectional Dependence

Table 2 depicts the results of Breitung and Das (2005) panel unit root test at level. The value of lambda (λ) statistic shows that at level all the variables are non-stationary at 5 percent level of significance. The robust values of lambda (λ) are given to account for cross-sectional dependence except the FLUC and PRIVOL which are the cross-sectionally independent variables.[3]

Table 2

Breitung and Das (2005) Panel Unit Root Test (at Level)

Lambda Statistic (Probability in Parenthesis)						
AIDGDP	AGRGDP	FINDEV	FLUC	OPEN	PRIVOL	POLSTB
With Intercept Only						
-0.4234	2.5911	3.2224	-0.4644	1.3295	-0.6573	-1.5266
(0.3660)	(0.9952)	(0.9994)	(0.3212)	(0.9082)	(0.255)	(0.0634)
With Intercept and Trend						
1.5011	-0.8978	3.0679	-1.4907	1.7235	0.7886	0.7896
(0.0667)	(0.1846)	(0.9989)	(0.0680)	(0.9576)	(0.7848)	(0.7851)

* and ** represent the rejection of null hypothesis of no unit root at 1 percent and 5 percent level of significance respectively.

[3]Pesaran (2004) CD Test implemented using XTCD Stata Module by Eberhardt (2011).

The results of Breitung and Das (2005) panel unit root test at first difference are given in Table 3. The table shows that all the variables become stationary at first difference. The results of Breitung and Das (2005) panel unit root test shows that all the variables are integrated of order one i.e. I(1).

Table 3

Breitung and Das (2005) Panel Unit Root Test (at 1st Difference)

Lambda Statistic (Probability in Parenthesis)						
AIDGDP	AGRGDP	FINDEV	FLUC	OPEN	PRIVOL	POLSTB
With Intercept Only						
-7.3115*	-5.2441*	-4.9692*	-7.4447*	-4.1148*	-5.6063*	-8.0366*
(0.000)	(0.000)	(0.000)	(0.000)	(0.0000)	(0.000)	(0.0000)
With Intercept and Trend						
-8.6522*	-4.7455*	-1.6883**	-6.7141*	-3.4999*	-4.0954*	-5.5024*
(0.000)	(0.000)	(0.0457)	(0.000)	(0.0002)	(0.000)	(0.0000)

* and ** represent the rejection of null hypothesis of no unit root at 1 percent and 5 percent level of significance respectively.

4.3. Panel Cointegration Test

After the conformation of the order of integration of the variables, the results of the Pedroni test are shown in Table 4. The Pedroni's seven panel test statistics are given in the table.

Table 4

Pedroni Panel Cointegration Test Results (Determinants of GDP Fluctuations)

	With Intercept and No Trend+		With Intercept and Trend+	
Test Statistics	Un-weighted	Weighted++	Un-weighted	Weighted++
panel v-stat	0.304925	-0.12296	0.021222	-0.58023
panel rho-stat	0.564599	0.923547	1.31596	1.693967***
panel pp-stat	-2.7994*	-1.73298**	-2.4967*	-1.36056***
panel adf-stat	-2.55554*	-1.35939***	-1.58484***	-0.04979
group rho-stat	1.695304	-	2.398424	-
group pp-stat	-1.95884**	-	-1.33352**	-
group adf-stat	-1.93784**	-	0.28011	-

Null hypothesis: no cointegration, + common time dummy included to account for cross sectional dependence. ++ Panel stats are weighted by long run variances. *, ** and ** represent the rejection of null hypothesis of no unit root at 1 percent, 5 percent & 10 percent level of significance respectively

The Group PP-Statistic and Group ADF-Statistic show the existence of long-run equilibrium relationship between GDP Fluctuations and its determinants (AIDGDP, AGRGDP, FINDEV, PRIVOL, OPEN, POLSTB) in both cases of Pedroni panel cointegration tests (i.e. model with intercept and no trend and model with intercept and trend). According to the panel statistics, Panel PP-Statistic and Panel ADF-Statistic also show the existence of a co-integrating relationship between GDP Fluctuations and its

determinants. Therefore, it may be concluded that the results of Pedroni cointegration test show the presence of long run equilibrium relationship among the variables.

4.4. GM-FMOLS Results and Discussions

The long-run GM-FMOLS i.e. Pedroni Panel (Group-Mean) FMOLS estimates are presented in Table 5.[4] The results of the group mean (panel) FMOLS estimates show that aid dependence (AIDGDP), trade openness (OPEN), volatility in the price level (PRIVOL), reliance on agriculture (AGRGDP) and political stability (POLSTB) are the significant determinants of the GDP fluctuations while the coefficient for financial development (FINDEV) has positive sign but insignificant.

Table 5

Group Mean Fully Modified OLS (GM-FMOLS) Results

Dependent Variable: GDP Fluctuations (FLUC)			
Variable	Coefficient	t - Statistics	
OPEN	0.008568	2.762835*	
POLSTB	-0.020820	-1.7627***	
AIDGDP	-0.095600	-5.57032*	
AGRGDP	0.043102	2.303267**	
FINDEV	0.004392	-0.44504	
PRIVOL	0.058576	2.001935**	
Constant	-0.132180	0.93368	
Diagnostic Testing			
Residual Stationarity	I(0)	CD Test for Residual	1.64 (0.110)
F Test	33.85434 (0.000)	RMSE	0.55030

*, ** and *** represents 1 percent , 5 percent and 10 percent significance level respectively.

The trade liberalisation (OPEN), volatility in the price level (PRIVOL) and reliance on agriculture (AGRGDP) have positive sign as expected showing a positive relationship of these variables with GDP fluctuations. Political stability is also found as a significant determinant of GDP fluctuations in the SSAC and have expected sign (i.e. negative). Political stability has a negative impact on the GDP fluctuations i.e. a stable political environment help in maintaining the stable growth rate of GDP (i.e. reducing fluctuations and volatility in GDP) on the other hand it may be said that political instability has positive relationship with GDP fluctuations. The reliance on foreign aid (AIDGDP) also has a negative relationship with GDP fluctuations, which shows that foreign aid helps in maintaining stability and smoothing out the volatility and instability.

The post estimation diagnostic tests are also shown in Table 4.6. These test shows that the F-test is significant and residuals are stationery. CD Test for residuals shows that the residuals are cross-sectionally independent which shows that the adding common time dummies resolve the issue of cross section dependence.

[4]The GM-FMOLS model is estimated using RATS code (*PANELFM*) by Doan (2012).

5. CONCLUSION AND RECOMMENDATIONS

The paper studies the determinants of GDP fluctuations in SSAC using macro panel approach in a panel of five selected South Asian countries (SSAC) including Bangladesh, India, Nepal, Pakistan and Sri Lanka over the period of 1980-2010. For this purpose, modern non-stationary panel techniques such as cross section dependence test, second generation unit root test under cross sectional dependence, panel cointegration and Group Mean Fully Modified OLS (GM-FMOLS) estimation are applied. Due to small sample size, study could not cover all of the determinants. Especially, non-economic factors like conflicts/ wars, atomic explosion, climatic condition/ natural disaster, floods and famine etc. may also be the determinants of the fluctuations/ volatility in GDP in South Asia. However, non-availability of reliable data, small sample size and degrees of freedom restrict the paper to the variables used in the study. However, impact of some non-economic aspects have been tried to be covered in the 'political stability' and impact of weather, natural disasters (floods etc.) have been proxied in dependence on agriculture. Despite these limitations, this study tries to contribute to limited literature on GDP fluctuations in South Asia.

The results of the current study show that the reliance on agriculture (AGRGDP) is a significant determinant of the GDP fluctuations in the *SSAC* and has a positive effect on GDP fluctuations (FLUC). This shows that the dependence on agriculture make a country more vulnerable because agricultural production is vulnerable and dependent upon the weather and climatic conditions. Similarly, price volatility (PRIVOL) is also found as a significant and positive determinant of the GDP fluctuations in the SSAC. Easterly, Islam and Stiglitz (2000) also find that nominal volatility (price volatility) is positively related to growth volatility (real volatility). The financial development (FINDEV) is also a positive but insignificant determinant of the GDP fluctuations. Kunieda (2008) also found that the financial development level, for the countries having fully developed financial markets and developed financial system, expected to have negative impact on GDP fluctuations. However, for less developed countries like the SSAC, where the financial system is not fully developed and in the middle stages of development, FINDEV has a positive impact on the GDP fluctuations. Similarly, Easterly, Islam and Stiglitz (2000) also find financial deepening (proxied by domestic credit to GDP ratio) and growth volatility has a non-linear form. Political stability (POLSTB) is also found as a significant determinant of GDP fluctuations in the SSAC and has expected negative sign. Political stability has a negative impact on the GDP fluctuations i.e. a stable political environment help in maintaining the stable growth rate of GDP and on the other hand political instability may result in increasing the volatility and fluctuations in growth rate of GDP. Mobarak (2004) also found that democracy has positive link with stability i.e. the democracy (political stability) lower the volatility.

The trade liberalisation or openness (OPEN) has positive and significant sign as expected showing a positive relationship of these variables with GDP fluctuations. Easterly, Islam and Stiglitz (2000) also find that trade openness is positively related to growth volatility. This shows when less developed countries become more open they become more vulnerable to external shocks resulting in more volatility. The reliance on foreign aid (AIDGDP) has a negative and significant relationship with GDP fluctuations, which shows that foreign aid helps in maintaining stability and smoothing out the volatility and instability.

The results, presented above, have the serious policy implications. These results suggest that the price volatility should be reduced and be controlled for reducing the GDP fluctuations and maintaining stability. Furthermore, financial development under less developed financial market and financial system is causing the fluctuation (volatility) in output (GDP) growth rates. Therefore, a developed financial system may help in maintaining economic stability. The political stability can also help in achieving the goal of economic stability. The study finds that the democracy and political stability helps in lowering the volatility in growth which suggests that a stable and democratic political environment may help in achieving the economic stability. The dependence on agriculture is also a major source of fluctuations in GDP growth rates, the structural transformation of economy by shifting the reliance from agriculture to other sectors (manufacturing etc.) may help in achieving stable growth rates. The study also suggests that the foreign aid in productive sectors can also be helpful in gaining economic stability and reducing growth volatility through supplementing the shortage of domestic resources (and by filling in the twin deficits i.e. current account deficit and fiscal deficit).

APPENDIX

Table A.1

Definitions and Sources of Variables

Variable Acronym	Variable Description	Source
FLUC	GDP Fluctuations, GDP fluctuations are measured by the five-years moving standard deviation (SD) of Per Capita GDP growth from trend (five-years moving SD of cyclical component, decomposed by HP filter).	Researcher Calculation based on WDI data on GDP per capita growth
FINDEV	Financial Development, Financial Development is proxied by domestic private credit to GDP ratio (%).	WDI 2012, Online
PRIVOL	Price volatility, measured by volatility index (GARCH Variance Series) generated by GARCH (1,1) model of CPI inflation.	Researcher Calculation based on WDI data on CPI inflation
POLSTB	Political Stability, proxied by Polity2 series of Polity IV project.	Polity IV Project by Marshall, and Jaggers. (2011).
AGRGDP	Reliance on Agriculture proxied by the share of Agricultural value added in GDP (as a percentage of GDP).	WDI 2012, Online
AIDGDP	Reliance on Foreign Capital, proxied by Foreign Aid as percentage of GDP	WDI 2012, Online
OPEN	Trade Liberalisation / Openness, proxied by the volume of exports + Imports as a share of GDP (%)	WDI 2012, Online

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