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THE IMPACT OF FOREIGN CAPITAL INFLOWS ON ECONOMIC GROWTH: POOLED MEAN GROUP ANALYSIS FOR DEVELOPING COUNTRIES

SHAFIQ UR REHMAN AND HAFIZ KHALIL AHMAD*

Abstract. This study attempts to include all foreign capital inflow variables to analyze their impact on economic growth of 21 developing countries for the period of 1990 to 2013. Modern econometric techniques are applied for data analysis including panel unit root test and pooled mean group (PMG) estimation for short-run and long-run analysis. The results indicate that inflows including net external debt and net official development assistance have significantly negative impact on economic growth of developing countries, while net foreign direct investment and net remittances have positive and significant impact on economic growth in the long-run. The negative sign of error correction term shows the convergence of the variables towards equilibrium in the long-run. The study highlights the need of allocation of foreign resources effectively and efficiently.

Keywords: Capital inflows, Panel Unit Root test, PMG

JEL classification: C23, F21

I. INTRODUCTION

Foreign capital inflows stimulate the process of economic development and lead towards a healthy economy. Inflows enhance the capacity of production

*The authors are, respectively, Ph.D. Scholar and Assistant Professor at the Department of Economics, University of the Punjab, Lahore-54590 (Pakistan).
Corresponding author e-mail: shafiq@pakaims.edu.pk

and reduce unemployment with effective allocation of resources. The role of capital inflows is eminent in developing countries because they are deficient in capital, skilled labour and modern technology. The rising trend of capital inflows has been studied by earlier researchers who found mixed results.

Kentor (1998) found negative impact of foreign capital penetration on economic growth in the long-run but revealed positive in the short-run. Chowdhury (2001), Pattillo *et al.* (2002), Cordella *et al.* (2005) and Ekanayake and Chatrna (2010) supported the negative effect on economic growth. Capital inflows have also positive impact on economic growth as analyzed by earlier researchers like Berument and Dincer (2004), Tan (2009), Ndambendia and Njoupouognigni (2010) and Karamelikli and Bayar (2015).

Most of the studies have analyzed inflow variables in isolation and found numerous results. With regard to foreign direct investment de Mello (1999), Ciftcioglu *et al.* (2002), Frimpong and Oteng-Abayie (2006), Akbas (2013) and Dogan (2014) found positive influence of foreign direct investment on economic growth. Ekanayake and Chatrna (2010) analyzed foreign aid spanning the period of 1980 to 2007 for low, middle and upper middle income countries applying GMM and OLS techniques and found negative results with regard to economic growth. On the contrary, Tan (2009) found positive impact of foreign aid on economic growth using pooled mean group estimation technique for 46 developing countries.

As far as remittances, which is a major tool for promoting economic growth, are concerned, positive effect on economic growth are found in existing literature like Paul *et al.* (2011), Bayar (2015) and Karamelikli and Bayar (2015).

External debt is a tool which is used to bridge the gap between government expenditures and government revenues. It is not only used for budgetary support but also promotes investment in recipient countries. In literature, it is strongly recommended that external debt has a negative effect on economic growth (Chowdhury, 2001; Pattilo *et al.*, 2002; Cordella *et al.*, 2005) due to poor allocation of resources and mismanagement of the governments.

Most of the studies have one point in common that they have not used all the inflow factors in a regression model which may have created the problem of omitted variable bias and inconsistency of parameters.

Fambon (2013) analyzed foreign aid and foreign direct investment and captured their impact on economic growth of Cameroon using autoregressive

distributed lag model. He found significant effect of foreign direct investment on economic growth of Cameroon but foreign aid had positive but insignificant impact. Nwaogu and Ryan (2015) applied mix of the inflow variables including FDI, remittances and foreign aid of 53 African and 34 Latin American and Caribbean countries using GMM technique for analysis to observe their relationship with economic growth. The writer found that remittances had no significant impact while FDI and foreign aid had positive and significant impact on economic growth.

Keeping in view the literature, it is found that there is no single study which has incorporated all the inflow variables to dig out their effect on economic growth. In order to achieve objectives, researchers applied different designs of the study, time period and analysis techniques to observe the impact of inflows on economic growth but still there were other discrepancies like spurious regression, heterogeneity, use of stock and flow variables and reliable data (Waheed, 2004).

This paper has significant contribution in economic growth studies in three important ways. Firstly, this study includes all capital inflow variables including net foreign direct investment, net official development assistance, net remittances and net external debt to analyze their impact on economic growth along with their individual significance. Secondly, this study contributes by using latest econometric techniques including panel unit root test and pooled mean group estimation approach, which is also known as panel autoregressive distributed lag (ARDL) model for balanced dataset. A pooled mean group (PMG) estimation technique provides homogeneity of the coefficients in dynamic panel data analysis across the cross sections and allows heterogeneous dynamics in the short-run (Pesaran *et al.*, 1999). Thirdly, the study highlights the convergence of the variables in short-run using error correction term.

This study analyzes selected developing countries including Argentina, Armenia, Belarus, Bolivia, Bulgaria, Brazil, China, Colombia, Costa Rica, Dominic Republic, Ecuador, El. Salvador, Honduras, India, Moldova, Pakistan, Philippines, Panama, Peru, Paraguay, and Kyrgyzstan. Pooled mean group estimation technique is applied in this study to observe long-run impacts of inflow variables on economic growth for the period of 1990 to 2013. The main objective of this study is to evaluate the impact of capital inflows on economic growth and highlight the inflow variables which are more effective to attain economic growth.

II. DATA AND ECONOMETRIC METHODOLOGY

DATA

Annual dataset comprising of 21 developing countries for the period of 1990 to 2013 is used for analysis. The data is collected from *World Economic Indicators* of World Bank. Net remittances, net external debt, net official development assistance, net foreign direct investment, employed labour force and gross fixed capital are used as explanatory variables while real GDP per capita is used as the dependent variable.

TABLE 1

Variables Used for Analysis along with their Symbols

Variables	Symbols	Data Sources
Net Remittances	NRMT	Word Economic Indicators
Net External Debt	NEXD	Word Economic Indicators
Net Official Development Assistance	NODA	Word Economic Indicators
Net Foreign Direct Investment	NFDI	Word Economic Indicators
Employed Labour Force	ELF	Word Economic Indicators
Gross Fixed Capital	GFC	Word Economic Indicators
Real GDP Per Capita	RGDPPC	Word Economic Indicators

Source: Prepared by the authors.

ECONOMETRIC METHODOLOGY

In prior studies, traditional methods, *e.g.* ordinary least square method, fixed effect, random effect or generalized method of moments (GMM) are applied for panel data analysis to observe the impact of capital inflows on economic growth. However, these models do not capture long-run effects of the variables with homogeneous coefficients. Since most of macroeconomic data have certain trends or presence of unit roots which create the problem when simple linear regression model is applied, the resulting regression would become spurious (Asteriou, 2007).

Frank and Blackburne (2007) have highlighted the problem of fixed effect and mean group estimator for nonstationary heterogeneous panel data analysis, where intercepts and slope coefficients differ across the groups. Pesaran *et al.* (1999) remark that when number of cross sections becomes

greater than number of time periods then assumption of homogeneity of slope coefficient becomes inconsistent. In mean group method, a separate model is estimated for each group and average of slope coefficients is calculated. As a result, the error variances, slope coefficients and intercepts become invariant across the groups.

A latest approach to handle all the above problems is pooled mean group estimator or panel ARDL model. In this approach, the slope coefficients may differ in short-run but homogeneous in the long-run. So homogeneity of slope coefficient in the long-run across each group is the main findings of this study.

Panel Unit Root Test

First step towards data analysis is to observe the presence of unit root which means that data is non stationary. Im, Pesaran and Shin test is applied for observing the presence of unit root.

Im-Pesaran-Shin Test. Im, Pesaran and Shin test provides individual results of each cross section. IPS test is the extended form of Levin and Lin test where lagged dependent variables are used as regressors while allowing heterogeneity on the coefficient of lagged dependent variables. The ADF regression can be presented by

$$\Delta Y_{i,t} = \alpha_i + \beta_i Y_{i,t-1} + \delta_i t + \sum_{k=1}^{n} \theta_{ik^-} \Delta Y_{i,t-k^{--}} + \mu_{i,t}$$

The null hypothesis is that unit root exists

$$H_0: \ \beta_i = 0$$

The alternative hypothesis is that slope coefficients are less than zero, *i.e.* absence of unit root.

$$H_0: \ \beta_i < 0$$

Where β_i is the order of the ADF regression, and errors $\mu_{i,t}$ are independently distributed. IPS assumes to have a balanced panel so the time, T is assumed to be fixed for all cross sections to calculate test statistic (tau) which is nothing more than the average of individual test statistics (ADF test statistics).

$$\bar{t} = \frac{1}{N} \sum_{i=1}^{N} t_{\gamma,i}$$

where $t_{\gamma,i}$ converge to the statistic which is $iid \sim N(0, \sigma^2)$

IPS test statistic is presented in the following equation:

$$t_{IPS} = \frac{\sqrt{N\left[\bar{t} - \frac{1}{N}\sum_{i=1}^{N} E\left(t_{iT} \mid \gamma = 0\right)\right]}}{\sqrt{Var\left(t_{iT} \mid \gamma = 0\right)}}$$

Pooled Mean Group Estimation

After observing the stationarity of the data, the next step is to analyze the data by using suitable regression model. The selection of regression model is based on the type of data. This study has applied pooled mean group estimation technique or panel ARDL approach to observe the short-run and long-run effects of independent variables on dependent variable. The equation for panel ARDL is given below:

$$Y_{i,t} = \sum_{j=1}^{p} \delta_{i,j} Y_{i,t-j} + \sum_{j=0}^{q} \gamma_{i,j} X_{i,t-j} + \mu_i + \varepsilon_{it}$$

Where the dependent variable is real GDP per capita and its lagged values are used as regressors while $X_{i,t}$ variables include net foreign direct investment, net foreign debt, net remittances, net official development assistance, employed labour force and gross fixed capital formation.

The selection of the model is based on lag length, which is selected by Akaike Information Criterion (AIC). The lag length can be observed by taking maximum lags and then observe the value of AIC and choose the model where the value of AIC is the minimum. The second way of selecting lag length is automatic which is made by software itself (E-Views). For observing short-run and long-run effects, pooled mean group estimator provides the results separately. The value of error correction term is given to show the convergence of the variables in the long-run.

The specific model for Pooled Mean Group Estimator is given below:

$$\Delta y_{i,t} = \theta_i \left(EC_{i,t}\right) + \sum_{j=1}^{p-1} \alpha_{ij} \Delta y_{i,t-j} + \sum_{j=0}^{q-1} \varphi_{i,j} \Delta X_{i,t-j} + \varepsilon_{it}$$

Where

$$EC_{i,t} = y_{i,t-1} - X'_{i,t}\beta.$$

The first part of the equation on right hand side shows the error correction term which elaborates the convergence or divergence of the model in the long-run. The convergence or divergence depends on the sign of the

numerical value of error correction term. If the value becomes negative then we may say that there is long-run relationship among the variables. The second part of the equation shows that lagged dependent variables are used as regressors while lagged explanatory variables are used in the third part. The symbol θ is used as error correction term or adjustment coefficient while β shows long-run coefficient. The lag length of explanatory and independent variables are found by software (E-Views).

Lag Length

This study has applied Akaike Information Criterion (AIC) for selection of the model. The best model is considered having the lowest value of AIC as presented in Table 2 which is minimum at 2 lags, automatically selected by the software (E-Views).

TABLE 2

Akaike Information Criteria

Model	AIC	Specification
4	12.441573	ARDL (2, 2, 2, 2, 2, 2, 2)
3	12.645133	ARDL (1, 2, 2, 2, 2, 2, 2)
2	12.871169	ARDL (2, 1, 1, 1, 1, 1, 1)
1	12.888900	ARDL (1, 1, 1, 1, 1, 1, 1)

Source: Generated by authors.

III. RESULTS

Since the first step towards panel data analysis is to observe the stationarity of data. This study has applied Im Pesaran and Shin test to evaluate the presence of unit root. The null hypothesis is the presence of unit root. When calculated value (tau) becomes greater than the critical value then we reject the null hypothesis, which means that data is stationary. Otherwise, we have to make the data stationary by differencing procedure.

RESULTS OF PANEL UNIT ROOT

Panel unit root test results are reported in Table 3 while observing data with intercept and with intercept and trend. At level, net official development assistance and real GDP per capita are stationary at 10% and 5%, respectively but the rest of the variables are non-stationary. All the variables

are stationary at first difference at both with intercept and with intercept and trend. The null hypothesis can be rejected at 5% level of significance. The values in parenthesis in Table 3 elaborate the 'p' value which is less than 5%, shows the significance. Since all the variables are stationary at first difference and no one is stationary at second difference.

TABLE 3

Panel Unit Root Test

Variable	At Level		At First Difference	
	With Intercept	With Intercept and Trend	With Intercept	With Intercept and Trend
ELF	–0.31926 (0.3748)	1.11649 (0.8679)	–8.07312* (0.0000)	–5.71150* (0.0000)
GFCF	10.6966 (1.0000)	6.43027 (1.0000)	–5.17339* (0.0000)	–5.60767* (0.0000)
NEXD	–0.39848 (0.3451)	0.54971 (0.7087)	–13.9511* (0.0000)	–11.6791* (0.0000)
NFDI	2.67527 (0.9963)	0.08096 (0.5323)	–11.6194* (0.0000)	–10.0004* (0.0000)
NODA	–0.54966 (0.2913)	–0.56042** (0.0593)	–13.9232* (0.0000)	–11.6241* (0.0000)
NRMT	7.69505 (1.0000)	2.14971 (0.9842)	–6.53869* (0.0000)	–5.46369* (0.0000)
RGDPPC	3.58117 (0.9998)	–2.51919* (0.0059)	–7.05346* (0.0000)	–5.06227* (0.0000)

NOTE: The signs * and ** indicate significance at 5% and 10% level, respectively.

Source: Generated by authors.

RESULTS OF POOLED MEAN GROUP ESTIMATION

Impact of capital inflows on economic growth is analyzed using pooled mean group estimation technique which provides short-run and long-run effects of the variables.

Long-Run Results (Pooled Mean Group Estimation)

The results are presented in Table 4 which show that net foreign direct investment, net remittances and employed labour force have significant, positive impact on economic growth while net official development assistance and net external debt have negative impact on economic growth at 5% level of significance. The most effective instrument of growth is net foreign direct investment. The slope coefficient of net FDI (0.82) reveals that 1% increase in investment will lead to real GDP per capita increase by 0.82% on average. The second significant inflow variable is net remittances which has positive impact on economic growth of developing countries. The coefficient of net remittances is 0.69 which shows that real GDP per capita increases by 0.69% as a result of 1% increase in net remittances. Net external debt and net official development assistance have negative effect on economic growth due to poor allocation of resources and rising of non-development expenditures. This result is supported by Pattillo *et al.* (2002) and Bornschier *et al.* (1978).

TABLE 4

Long-Run Results

Variable	Coefficient	Std. Error	t-statistic	Probability
NRMT	0.69*	0.11	6.53	0.0000
NODA	–1.55*	0.54	–2.86	0.0048
NFDI	0.82*	0.12	6.62	0.0000
NEXD	–1.87*	0.21	–9.03	0.0000
GFCF	–0.07*	0.01	–6.3	0.0000
ELF	35.53*	14.88	2.39	0.0180

NOTE: The sign * indicates significance at 5% level.

Source: Generated by authors.

The negative sign of net external debt and net ODA shows that these inflow variables are a major hurdle in the way of macroeconomic stability. The slope coefficient of net external debt is –1.87 which depicts that real GDP falls by 1.87% as a result of 1% increase in external debt while coefficient of net ODA shows that 1% increase in net official development assistance decreases real GDP per capita by 1.54% on average. Since

employed labour force has reported in millions and real GDP per capital in dollars, the slope coefficient depicts that one million increase in employed labour force, would increase real GDP per capita by 35 dollar on average. Gross fixed capital formation has diminishing impact on economic growth in the long-run. The negative sign of coefficient reveals that 1% increase in capital will cause real GDP per capita to fall by 0.07% on average. All the results are highly significant and sign of the slope coefficients are based on theoretical grounds.

TABLE 5

Short-Run Results

Variable	Coefficient	Std. Error	t-statistic	Probability
ECM	–0.07**	0.04	–1.66	0.0993
D(RGD PPC(–1)	0.09	0.13	0.67	0.5022
D(NRMT)	0.38	0.24	1.62	0.1060
D(NRMT(–1))	–0.34	0.44	–0.76	0.4503
D(NODA)	0.52	0.40	1.33	0.1863
D(NODA(–1))	0.29	0.39	0.74	0.4585
D(NFDI)	–0.27	0.23	–1.17	0.2451
D(NFDI(–1))	–0.28	0.25	–1.12	0.2645
D(NEXD)	0.11	0.15	0.74	0.4578
D(NEXD(–1))	0.08	0.12	0.64	0.5224
D(GFCF)	0.13*	0.06	2.06	0.0409
D(GFCF(–1))	0.13	0.10	1.31	0.1911
D(ELF)	72.33	64.54	1.12	0.2639
D(ELF(–1))	–59.51	42.32	–1.41	0.1613
C	253.34**	152.67	1.66	0.0988

NOTE: The signs * and ** indicate significance at 5% and 10% levels, respectively.

Source: Generated by the authors.

Short-Run Results

Pooled mean group estimation technique provides short-run results as well. The negative sign of error correction term shows the convergence of the variables in the long-run. The coefficient of the ECM_{t-1} is equal to (–0.07) for short-run model which shows that deviation from short-run in real GDP per capita is corrected by 7% on each year in the long-run. The results are significant at 10% level. The coefficient of gross fixed capital is also significant at 5% and has positive impact in the short-run (Table 5).

IV. CONCLUSION

This study has examined the impact of net foreign capital inflows on economic growth for 21 developing countries using panel unit root test and pooled mean group estimation techniques during the period of 1990 to 2013. The results indicate that there is a long-run effect of net foreign direct investment, net external debt, net remittances and net official development assistance on economic growth. The major contribution of this study is to highlight inflow variables which are more effective to foster economic growth and strengthen the economy in the right direction.

The results show that foreign direct investment and remittances are effective tools for boosting economic growth since they have positive and significant impact on economic growth in the long-run while external debt and official development assistance have negative impact on real GDP per capita. The negative sign of error correction term shows the convergence of the dynamics towards equilibrium in the long-run. The value of error correction coefficient shows the speed of convergence towards equilibrium which is significant.

These results are helpful for policy analysis to form strategies for effective utilization of foreign capital inflows in the right direction and to minimize the negative impact of external debt and foreign assistance by sound macroeconomic policies including fiscal and monetary policies. In order to achieve sustainable economic growth, the countries should provide supportive environment to attract foreign inflows, particularly, FDI and remittances to enhance economic growth in the developing countries.

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