

FOREIGN DIRECT INVESTMENT, WORKERS' REMITTANCES AND PRIVATE SAVING IN PAKISTAN: AN ARDL BOUND TESTING APPROACH

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Abstract. The objective of this study is to investigate the impact of foreign direct investment (FDI) and workers' remittances on private savings of Pakistan. This study employs ARDL bound testing co-integration approach, rolling window analysis, Granger causality test, Toda and Yamamoto Modified Wald causality test and variance decomposition test. Results indicate the significant positive impact of FDI and workers' remittances on private savings in the long and short run. Causality analyses confirm the bidirectional causal relationship of FDI and workers' remittances with private savings. It is recommended that policy makers should form friendly policies to attract more FDI and workers' remittances in the country which leads to increase private savings in Pakistan. This leads to increase more fund for financial intermediaries to increase domestic investment opportunities in the country. This paper makes a unique contribution to the literature with reference to Pakistan, being a pioneering attempt to investigate the impact of FDI and workers' remittances on private savings of Pakistan by using the long annual time series data and applying more rigorous econometric techniques.

Keywords: foreign direct investment, remittances, savings, time series, ARDL co-integration, Pakistan.

JEL Classification: F21, F24, E2.

Introduction

The term savings describe the unconsumed disposable income which is kept with the intention of stabilizing consumption in some future time. Saving is the key factor which increases future consumption. Private savings contribute in overall growth of any country and economists consider it as a gauge to economic health. When people start to rely on debts either than they saved cash much more pressure is found on the financial institutions which reduce the strength of any nation. We can see a high rate of inflation and imposed taxes throughout the world which is a big threat for the amount to save by an individual and which further reduces the investment to be made in the upcoming future.

People do saving in the good times so that they have enough funds in their account for the rainy days which are more likely to come in a very frequent pace in develop-

ing countries like Pakistan. This issue of insufficient funds leads any country towards poverty which is a big threat for all emerging markets, which are trying to become prosperous and want to be counted as a developed nation of this impulsive world. Pakistan, which is on its developing stage, is facing a very low saving rate since very long this is because of many factors influencing the private saving behavior of the country.

Domestic saving and domestic investment gap are considered as a major hurdle to enhance economic growth in developing countries. Foreign capital inflows become an important source to bridge this gap (Chenery, Strout 1966). Foreign direct investment (FDI) and workers' remittances are proved to be an important source of capital inflow in developing countries. FDI plays as an essential part of economic growth of any country. FDI-Growth nexus based on exogenous growth theory and endogenous theory have been discussed heavily in empirically studies¹. According to the exogenous growth theory FDI can affect the economic growth by providing the technological development in the host country. On the other hand, endogenous growth theory argues that FDI can affect economic growth by providing the positive and significant spillover effects in human capital and gross domestic production.

Workers' remittances play an important role to increase the disposable income. Workers' remittances have become an increasingly important source of income for the economic growth of countries. For the last two decades, the workers' remittances have grown rapidly in a positive direction. In the last five years, foreign direct investment has fallen sharply due to economic recession in Pakistan whereas, workers' remittances are continuously increasing. Workers' remittances provide an external source of income and play a part to increase in the minimum wage level in developing countries, which leads to increase private savings².

From Table 1 it is clear that private savings, foreign direct investment and remittances are increasing over the period of time. On the other hand, from Figures 1 and 2 do not show any clear sign about the relationship between the growth of private saving with foreign direct investment and remittances. From above scatter diagram analysis and the review of summary statistics, we are not coming up to a concrete conclusion about the effects of foreign direct investment and workers' remittances on private savings in Pakistan.

After reviewing the previous empirical studies, it is found that most of the studies have analyzed the impact of foreign capital inflow on domestic saving or national savings in Pakistan. There is only one recent time study has been found on the impact of foreign capital inflow on private saving in Pakistan conducted by Azam and Shakeel (2012). The basic problem with their study is that their analysis is based on assumption that the data that are being used are stationary. Nowadays, there is convincing evidence that many macroeconomic variables are having non-stationary properties. These types of non-stationary variables may provide spurious results in OLS estimations.

¹ Borensztein *et al.* (1998), Lyroudi *et al.* (2004), and Pradhan (2010).

² Raza and Jawaid (2012).

Table 1. Summary statistics

Variables	1970's	1980's	1990's	2000's
PS	12.55	61.42	216.96	1081.56
FDI	0.15	1.49	16.23	145.65
REM	5.6	32.36	47.91	304.59

Note: All figures are in billion rupees (PK).

The main objective of this study is to examine the relationship between FDI, workers' remittances and private saving in Pakistan. This paper makes a unique contribution to the literature with reference to Pakistan, being a pioneering attempt to investigate the impact of FDI and workers' remittances on private savings of Pakistan by using the long annual time series data for 39 years from 1973 to 2011 and by applying more rigorous econometric techniques.

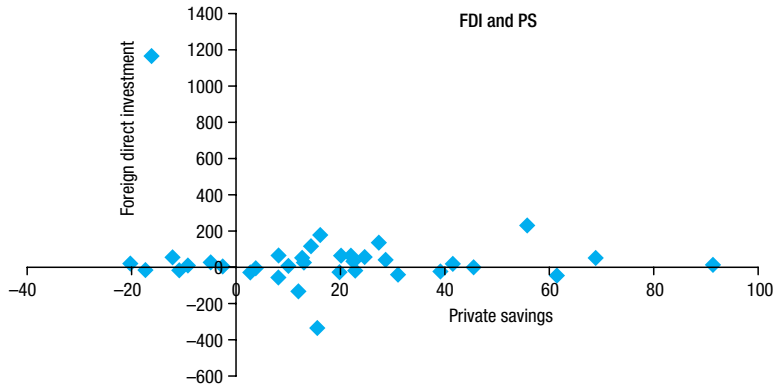


Fig. 1. Foreign direct investment and private savings

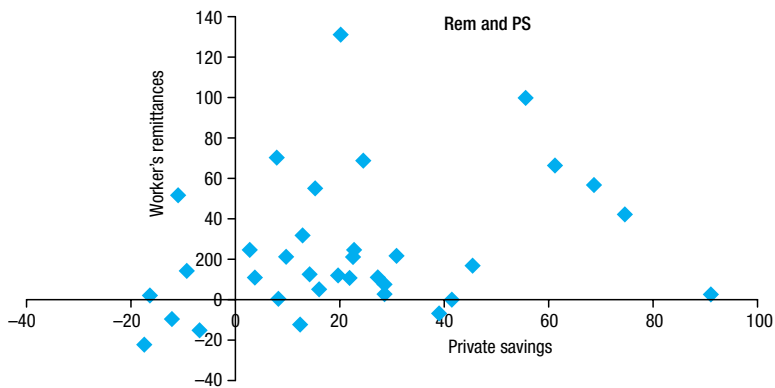


Fig. 2. Worker's remittances and private savings

The rest of the paper is organized as follows: Section 1 reviews the empirical literature on the relationship between FDI, workers' remittances and private saving. Section 2 discusses the modeling framework; estimations and the results have been discussed in sections 3, 4, 5 and 6, and the final section concludes the study and provides some policy implications.

1. Review of literature

Becker's (1974) argue that workers' remittances flow was not profit driven, instead compensatory. Gilani *et al.* (1981) conclude that most of the workers' remittances in Pakistan are spent on consumption followed by residential investment. Russel (1986) argues that workers' remittances is a main source of savings and investments and also raise the standard of living. Edwards (1996) concludes that workers' remittances contribute positively the saving capacity of household savings. On the other hand, Sofranko and Idris (1999) argue that workers' remittances cannot play a major part in savings because workers' remittances are mainly used for the daily consumption purpose. Adams (1998) concludes that workers' remittances helps to increase the investment by raising the marginal propensity to invest for migrant households in Pakistan.

Kapur and McHale (2003) conclude that workers' remittances may create idleness among recipients because of its compensatory nature. Khan and Hye (2010) identify the impact of financial liberalization on household saving in Pakistan by using the time series data from the period of 1988 to 2008. Autoregressive distributed lag approach has been used. Results indicate the significant positive impact of workers' remittance on household saving in the long run while the results in short run indicate the positive but insignificant relationship between workers' remittances and household saving. Jawaid and Raza (2012) analyze the structure of workers' remittances in China and Korea and conclude that workers' remittances may create voluntary unemployment in the recipients' families which leads to decrease in productivity, growth and savings in the host country.

FDI brings advantages for the enhancement of the standard of living and prospects for economic growth of the host country (see Kindleberger 1969; Dunning 1997; Borensztein *et al.* 1998; Nair-Reichert, Weinhold 2001; Zhang 2001; Hachicha 2003). Blomstrom and Kokko (1998) analyze the different spillover effects of foreign firms in the economy of the host country. They conclude FDI has a strong spillover effect on the economy of the host country, but the magnitude of spillover effects vary between industries and countries. Edwards (1995) analyzes the panel data of 36 countries from the period of 1972 to 1992 and concludes that domestic saving does not respond with the changes in the foreign capital inflows.

Janicki and Wunnava (2004) analyzed the determinants of FDI in EU countries and conclude that FDI is a major source for rapid economic growth and to increase the living standards of economies in transition. Lipsey and Sjöholm (2004) analyze the relationship between FDI and wages spillover in Indonesian manufacturing industries. They conclude that the presence of foreign entities in Indonesian manufacturing industries

raises the general wage level in a province and industry. Bowles (1987) analyzes the causal relationship between foreign capital inflows and savings of 20 developing countries from the period of 1960 to 1981. Results indicate the significant causal relationship in 10 countries. He concludes that causal relationships are not universal and it depends on the proportion of the foreign capital inflows.

Ahmad and Ahmed (2002) investigate the impact of foreign capital inflows on domestic saving in Pakistan by using the annual time series data from the period of 1972 to 2000. Johansen and Jeuselius' cointegration and error correction model techniques have been used. Results indicate that the foreign capital inflows may play a part as a substitute for domestic saving. Katircioglu and Naraliyeva (2006) investigate the causal relationship between private saving and FDI in Kazakhstan by using the quarterly data from the 1st quarter of 1993 to fourth quarter of 2002. Results of granger causality test confirm the no causal relationship between FDI and private saving.

Bashier and Bataineh (2007) investigate the relationship between FDI and domestic saving in Jordan by using the annual time series data from the period of 1971 to 2005. Johansen and Jeuselius cointegration, error correction model and granger causality test have been performed. Results indicate the significant positive impact of FDI on domestic saving. Results of granger causality test confirm the unidirectional causal relationship run from FDI to domestic savings. Shahbaz *et al.* (2008) investigate the causal relationship between FDI and domestic saving in Pakistan by using the annual time series data from the period of 1972 to 2007. Results of causality test based on Toda and Yamamoto procedure, confirm the bidirectional causal relationship between FDI and domestic saving. It is concluded that FDI and domestic saving are connected in a complementary way.

Salahuddin *et al.* (2010) analyze the impact of FDI on domestic saving in Bangladesh by using the annual time series data from the period of 1985 to 2007. Johansen and Jeuselius cointegration, error correction method and innovation accounting approach have been used. Results indicate the positive and significant relationship between FDI and domestic saving. Results suggest the complementary effect between FDI and domestic saving in Bangladesh. Results of variance decomposition methods indicate the bidirectional causality between FDI and domestic saving.

Oladipo (2010) analyze the causal relationship between FDI and savings in Nigeria by using the annual time series data from the period of 1970 to 2006. The causality test base on Toda and Yamamoto procedure has been used. Results indicate the unidirectional causal relationship between FDI and savings in Nigeria runs from FDI to savings. Azam and Shakeel (2012) investigate the impact of foreign capital inflow on household savings in Pakistan by using the annual time series data from the period of 1981 to 2010. The results of multiple regression technique indicate the positive and significant impact of workers' remittances and FDI in household savings.

Faridi and Arif (2012) analyze the relationship between workers' remittances and gross saving in Pakistan during the period of 1972–2010. Results indicate the positive and significant influence of workers; remittances on gross savings in Pakistan. Bayar (2014)

analyzes the relationship between FDI and domestic savings in emerging Asian economies during the period of 1982–2012. The results of vector error correction methods confirm the significant influence of FDI on domestic savings in emerging Asian economies.

2. Empirical framework

In this study, 39 years long annual time series data of Pakistan has been used from 1973 to 2011. Data on private savings, foreign direct investment and remittances are gathered from several issues of economic survey of Pakistan³. All variables are used in logarithmic form. The present study employs the Autoregressive Distributed Lag (ARDL) technique⁴ that has not been used previously to analyze the relationship of FDI and workers' remittances with private savings in Pakistan.

The Auto Regressive Distributed Lag (ARDL) method of cointegration developed by Pesaran M. H. and Pesaran B. (1997), Pesaran and Shin (1999), Pesaran *et al.* (2000, 2001) has been used with the help of unrestricted vector error correction model to investigate the long run relationship between FDI, workers' remittances and private savings. The ARDL approach has several advantages upon other cointegration methods. ARDL approach may apply irrespective of the of whether underlying variables are purely $I(0)$, $I(1)$ or mutually co-integrated⁵. ARDL approach has estimated better small sample properties⁶. In ARDL procedure the estimations of the results are even possible if the explanatory variable is endogenous⁷. The following ARDL model is developed for estimation:

$$\Delta PS_t = \psi_0 + \psi_1 \sum_{i=1}^p \Delta PS_{t-i} + \psi_2 \sum_{i=1}^p \Delta FDI_{t-i} + \psi_3 \sum_{i=1}^p \Delta REM_{t-i} + \gamma_1 PS_{t-1} + \gamma_2 FDI_{t-1} + \gamma_3 REM_{t-1} + \mu_t, \quad (1)$$

where ψ_0 is constant, μ_t is a white noise error term, PS is private savings, FDI is foreign direct investment and REM is workers' remittances. The error correction dynamics are denoted by the summation sign while the second part of the equation corresponds to the long run relationship. Schwarz Bayesian Criteria (*SBC*) has been used to identify the optimum lag of model and each series. The *SBC* is slightly superior to the *AIC* (Pesaran, Shin 1999). Besides, *SBC* is parsimonious as it uses minimum acceptable lag while selecting the lag length and avoid unnecessary loss of degrees of freedom. Therefore, *SBC* criterion has been used, as a criterion for the optimal lag selection, in all cointegration estimations.

In ARDL model we first estimate the F -statistics value by using the appropriate ARDL models. Secondly, the Wald (F -statistics) test is used to investigate the long run rela-

³ The web link is: www.finance.gov.pk

⁴ See Pesaran M. H. and Pesaran B. (1997), Pesaran and Shin (1999), and Pesaran *et al.* (2000, 2001).

⁵ Pesaran and Shin (1999).

⁶ Haug (2002).

⁷ Pesaran, Shin (1999) and Pesaran *et al.* (2001).

tionship between the series. The null hypothesis of no cointegration is rejected if the calculated F -test statistics exceeds the upper critical bound (UCB) value. The results are said to be inconclusive if the F -test statistics falls between the upper and lower critical bound. Lastly, the null hypothesis of no cointegration is accepted if the F -statistic is below the lower critical bound. If the long run relationship between foreign direct investment, workers' remittances and private savings is found, then we estimate the long run coefficients. The following model will be used to estimate the long run coefficients:

$$PS_t = \zeta_0 + \zeta_1 \sum_{i=1}^p PS_{t-i} + \zeta_2 \sum_{i=1}^p FDI_{t-i} + \zeta_3 \sum_{i=1}^p REM_{t-i} + \mu_t. \quad (2)$$

If we find evidence of long run relationship between foreign capital inflows and private savings, then we estimate the short run coefficients by employing the following model:

$$\Delta PS_t = \varphi_0 + \varphi_1 \sum_{i=1}^p \Delta PS_{t-i} + \varphi_2 \sum_{i=1}^p \Delta FDI_{t-i} + \varphi_3 \sum_{i=1}^p \Delta REM_{t-i} + nECM_{t-1} + \mu_t. \quad (3)$$

The error correction model shows the speed of adjustment needed to restore the long run equilibrium following a short run shock. The n is the coefficient of the error correction term in the model that indicates the speed of adjustment.

3. Estimations and results

Augmented Dickey Fuller (ADF)⁸ and Phillip Perron (PP)⁹ unit root test are used to examine the stationary properties for long run relationship of time series variables. Augmented Dickey Fuller (ADF) test is based on the equation given below:

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{j=1}^k d_j \Delta Y_{t-j} + \varepsilon_t, \quad (4)$$

where ε_t is pure white noise error term, Δ is a first difference operator, Y_t is a time series, α_0 is the constant and k is the optimum numbers of lags of the dependent variable. Augmented Dickey Fuller (ADF) test determines whether the estimates of coefficients are equal to zero. The ADF test provides cumulative distribution of ADF statistics. The variable is said to stationary, if the value of the coefficient δ is less than the critical values from fuller table. Phillip and Perron (PP) unit root test equation is given below:

$$\Delta Y_t = \alpha + \rho^* Y_{t-1} + \varepsilon_t. \quad (5)$$

The Phillip and Perron unit root test is also based on t-statistics that is associated with estimated coefficients of ρ^* . Table 2 represents the results of stationary tests. First, these tests are applied on level of variables, then on their first difference.

Results of Table 2 show that all variables are stationary and integrated at first difference. This implies that the series of variables may exhibit a valid long run relationship.

⁸ See Dickey and Fuller (1979).

⁹ See Phillips and Perron (1988).

Autoregressive distributed lag method for cointegration is used to estimate the long run relationship between foreign capital inflows and private savings. The first step is to determine the optimal lag length of the model. The order of optimal lag length is decided by using the Schwarz Bayesian Criterion. Table 3 shows the results of *the ARDL cointegration method*.

The *ARDL* results suggest the rejection of the null hypothesis of no cointegration in model because the value of the *F*- statistic is greater than upper bound critical value at 5% level of significance in favor of alternative hypothesis that the valid long run relationship is exist between FDI, workers’ remittances and private savings in Pakistan. Now we estimate the lag length order of the all variables through unrestricted vector auto regression method. The decision criterion is based on the minimum value of Schwarz Bayesian Criterion.

Table 4 represents the results of the lag length order of all variables. Results of Schwarz Bayesian Criterion indicate that FDI and workers’ remittances should be include at 1st lag and private savings should be include at 2nd lag. After having the valid evidence of the long run relationship between foreign capital inflows and private savings. Now we applied the *ARDL* method to estimate the long run and short run coefficients.

Table 2. Stationary test results

Variables	Augmented Dickey-Fuller				Phillips-Perron			
	I(0)		I(1)		I(0)		I(1)	
	C	C&T	C	C&T	C	C&T	C	C&T
PS	-1.62	-2.75	-6.22	-6.83	-1.05	-2.21	-10.11	-10.38
FDI	-0.57	-3.02	-5.29	-5.15	-0.79	-2.94	-7.21	-7.10
REM	-1.70	-2.94	-3.44	-3.38	-1.32	-2.13	-4.15	-4.18

Note: The critical values for ADF and PP tests with constant (c) and with constant & trend (C&T) 1%, 5% and 10% level of significance are -3.711, -2.981, -2.629 and -4.394, -3.612, -3.243 respectively.

Table 3. Lag length selection & bound testing for cointegration

Lags order	AIC	HQ	SBC	F-test statistics
0	11.177	12.223	11.313	19.321
1	6.177	6.223	6.313	
2	2.681	2.865	2.226	
Critical values generated by Pesaran <i>et al.</i> (2001)				
Significance level	Lower bounds	Upper bounds		
1%	6.340	7.520		
5%	4.870	5.850		
10%	4.190	5.062		

Table 4. Lags defined through VAR of variables

Lag	0	1	2	Selected lags
	SBC	SBC	SBC	SBC
PS	3.795	-0.147	-0.218*	2
FDI	4.645	1.402*	1.591	1
REM	3.485	0.249*	0.313	1

Note: * indicate minimum SBC values.

The model for long run coefficients as follows:

$$\begin{aligned}
 PS_t = & \zeta_0 + \zeta_1 \sum_{i=1}^p PS_{t-1} + \zeta_2 \sum_{i=1}^p PS_{t-2} + \zeta_3 \sum_{i=1}^p FDI_t + \zeta_4 \sum_{i=1}^p FDI_{t-1} + \\
 & \zeta_5 \sum_{i=1}^p REM_t + \zeta_6 \sum_{i=1}^p REM_{t-1} + \mu_t.
 \end{aligned}
 \tag{6}$$

Table 5 shows the results of long run *ARDL* estimations. Results indicate the significant positive impact of FDI and workers' remittances on private savings in Pakistan. The coefficient of FDI showing the higher contribution in the private saving model, that's means that in the long run 1% increase in FDI causes the increases in the private savings by 0.53%. On the other hand, the coefficient of workers' remittances showing that the 1% increase in workers' remittances causes the increase in the private savings by 0.25%. It is concluded that FDI and workers' remittances both play an important part in the enhancement of private savings in Pakistan. FDI provides more opportunities of employment conversely, workers' remittances provide an external source of income. Both FDI and workers' remittances play a part to increase in the minimum wage level in developing countries, which leads to increase private savings. Following model is

Table 5. Long run results using ARDL approach

Variables	Coeff.	t-stats	Prob.
C	0.563	1.738	0.093
PS(-1)	0.509	3.472	0.002
PS(-2)	0.390	2.440	0.021
FDI	0.533	2.303	0.034
FDI(-1)	-0.661	-1.411	0.160
REM	0.250	1.909	0.066
REM(-1)	-0.249	-2.043	0.050
Adj. R ²		0.989	
D.W stats		2.312	
F-stats (Prob.)		584.829 (0.000)	

Table 6. Short run results using ARDL approach

Variables	Coeff.	t-stats	Prob.
C	-0.004	-0.033	0.974
$\Delta PS(-1)$	0.788	1.245	0.223
$\Delta PS(-2)$	0.327	1.035	0.310
ΔFDI	0.354	3.502	0.002
$\Delta FDI(-1)$	-0.321	-0.576	0.569
ΔREM	0.358	2.985	0.006
$\Delta REM(-1)$	-0.454	-2.235	0.034
ECM(-1)	-0.484	-2.271	0.031
Adj. R ²		0.541	
D.W stats		2.105	
F-stats (Prob.)		5.491 (0.001)	

used to check the short run relationship among the considered variables with the different lag length.

$$\Delta PS_t = \varphi_0 + \varphi_1 \sum_{i=1}^p \Delta PS_{t-1} + \varphi_2 \sum_{i=1}^p \Delta PS_{t-2} + \varphi_3 \sum_{i=1}^p \Delta FDI_t + \varphi_4 \sum_{i=1}^p \Delta FDI_{t-1} + \varphi_5 \sum_{i=1}^p \Delta REM_t + \varphi_6 \sum_{i=1}^p \Delta REM_{t-1} + nECM_{t-1} + \mu_t. \tag{7}$$

Table 6 represents the short run relationship between foreign capital inflows and private savings. Results indicate the lagged error correction term for the estimated private savings equation is both negative and statistically significant. This confirms a valid short run relationship between foreign capital inflows and private savings in Pakistan. The coefficient of the error term is -0.48 suggest that about 48% of disequilibrium is corrected in the current year. Results indicate the significant positive short run relationship of FDI and workers’ remittances with private savings. The short run coefficient of workers’ remittances showing the higher contribution in the short run model of private savings, that’s means that in short run 1% increase in REM causes the increases in the private savings by 0.45%. On the other hand, the coefficient of FDI showing that the 1% increase in FDI causes the increase in the private savings by 0.25% in the short run. The results of both long run and short run conclude that FDI is contributing more in the long run as compare to short run in increasing of private savings in Pakistan. Conversely, workers’ remittances is contributing more in short run as compare to long run in the enhancement of private savings in Pakistan.

4. Stability of long run model: a rolling window analysis

The stability of long run coefficients of the model in the sample size is evaluated by using the rolling window estimation method. This technique also helps to identify the behavior of considered variables throughout the sample period (Raza *et al.* 2015). Figures 3 and 4 represent the results of coefficients of FDI and workers' remittances respectively:

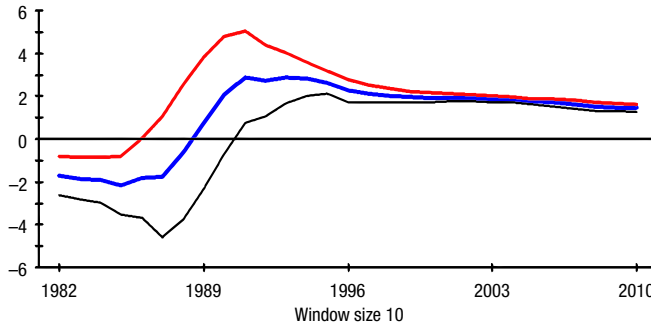


Fig. 3. Coefficient of FDI and its two S.E. bands based on rolling OLS (Dependent Variable: PS)

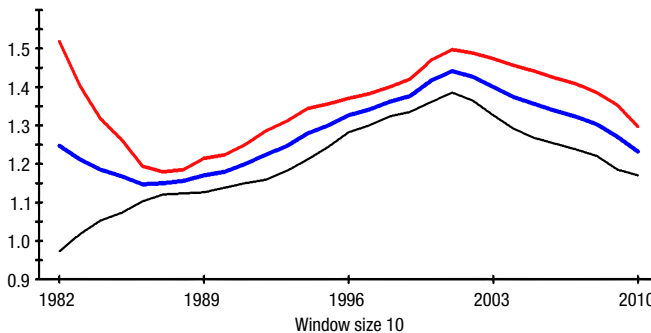


Fig. 4. Coefficient of REM and its two S.E. bands based on rolling OLS (Dependent Variable: PS)

Two standard deviation bands show the upper and lower bounds. Results of Figure 3 indicate that the coefficient of considered variable FDI remains negative from 1982 to 1988. But from 1988 to 2010 the coefficient of FDI remains positive. Results of Figure 4 shows that the coefficient of workers' remittances having positive coefficients throughout the sample period. The coefficient of workers' remittances is continuously increasing from 1986 to 2001. But from 2001 to 2010 the coefficient of workers' remittance is continuously decreasing.

5. Stability of short run model

The stability of the short run model in the sample size is evaluated by using the cumulative sum (CUSUM) and CUSUM of square test on the recursive residuals. CUSUM test detects systematic changes from the coefficients of regression, while, CUSUM of

square test is able to detect the sudden changes from constancy of regression coefficients (Brown *et al.* 1975).

Figure 5 and 6 represents the results of the CUSUM and CUSUM of square tests respectively. Results indicate that the statistics of both CUSUM and CUSUM of square test are lying within the interval bands at 5% confidence interval. Results suggest that there is no structural instability in the residuals of equation of private savings.

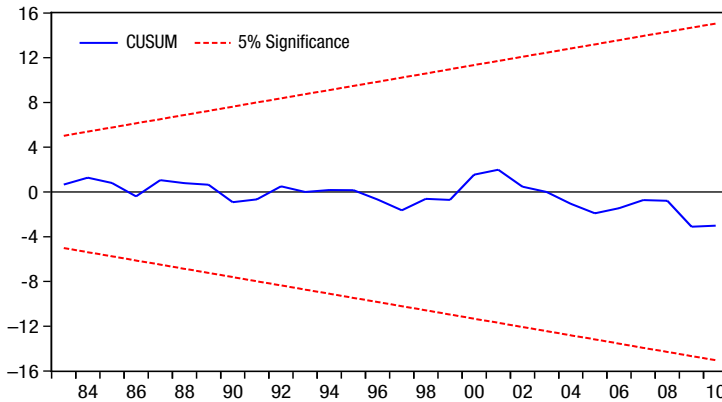


Fig. 5. Plot of cumulative sum of recursive residuals. The straight lines represent critical bounds at 5% significance level

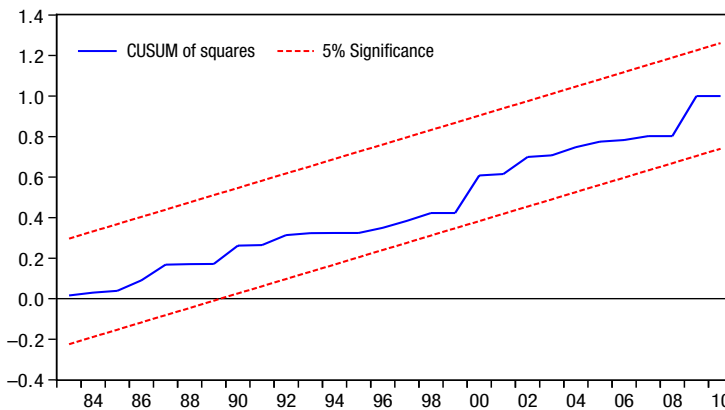


Fig. 6. Plot of cumulative sum of squares of recursive residuals. The straight lines represent critical bounds at 5% significance level

6. Causality analysis

In this section three different techniques of causal analysis, namely, Granger causality analysis¹⁰, Toda and Yamamoto modified Wald test causality analysis¹¹ and variance decomposition method¹² to analyze the robustness of causal relationship between foreign capital inflows and private savings.

6.1. Granger causality analysis

The direction of causality between dependent and independent variables is analyzed by Granger (1969) causality test. We determine the causality analysis of our private saving model on lag one. Jones (1989) favors the ad hoc selection method for lag length in the Granger causality test over some of other statistical method to determine the optimal lag. The equation of the Granger causality model is given below:

$$\begin{aligned}
 Y &= \sum_{i=1}^t \alpha_i X_{t-i} + \sum_{i=1}^t \beta_i Y_{t-i} + \mu; \\
 X &= \sum_{i=1}^t \lambda_i X_{t-i} + \sum_{i=1}^t \delta_i Y_{t-i} + \nu.
 \end{aligned}
 \tag{8}$$

It is assumed that μ and ν are uncorrelated. There are two variables and dealt with bi-lateral causality. Above equation states that Y is related to its lag values and X is related to its lag values.

Table 7. Results of Granger causality test

Variables	F-Statistic	Probability
PS does not Granger cause FDI	11.100	0.000
FDI does not Granger cause PS	3.284	0.035
PS does not Granger cause REM	4.178	0.049
REM does not Granger cause PS	3.426	0.073

Note: The lag length is 1.

The results of the Granger causality test are reported in Table 7. Results show the bi-directional causal relationship of FDI and workers' remittances with private savings.

6.2. Toda and Yamamoto modified Wald test causality analysis

The direction of causality between dependent and independent variables is analyzed by using the causality test based on Toda and Yamamoto (1995) procedure. This test uses a modified Wald (*MWALD*) test which can be applies irrespective of the of whether underlying variables are purely $I(0)$, $I(1)$ or mutually co-integrated. Toda and Yama-

¹⁰ See Granger (1969).

¹¹ See Toda and Yamamoto (1995).

¹² The variance decomposition method is estimated through VAR framework, it shows the proportion contribution in one variable caused by the shocks in other variables (Pesaran, Shin 1998).

moto (1995) augmented Granger causality test uses the Seemingly Unrelated Regression (*SUR*) technique through estimating a two equation system. The Wald test improves efficiency when *SUR* models are used in the estimation. So, the model can be specified as follows:

$$\begin{aligned}
 Y_t &= \alpha_1 + \sum_{i=1}^{k+d} \gamma_{1i} Y_{t-i} + \sum_{i=1}^{k+d} \gamma_{2i} X_{t-i} + \varepsilon_{yt}; \\
 X_t &= \alpha_2 + \sum_{i=1}^{k+d} \delta_{1i} Y_{t-i} + \sum_{i=1}^{k+d} \delta_{2i} X_{t-i} + \varepsilon_{xt},
 \end{aligned}
 \tag{9}$$

where *k* is the optimal lag order, *d* is the maximum order of integration of the series in the system, ε_{yt} and ε_{xt} are error terms that are assumed to be white noise. Usual Wald tests are then applied to the first *k* coefficient matrices using the standard χ^2 – statistics.

Table 8. Results of Toda and Yamamoto causality test

Dependent variable	Modified Wald – statistics		
	PS	FDI	REM
PS	–	6.676 (0.018)	4.594 (0.019)
FDI	8.874 (0.006)	–	0.464 (0.709)
REM	3.324 (0.079)	0.425 (0.658)	–

Note: The lag length for *PS* is 2, *FDI* is 1 and *REM* is 1. As per SBC criteria.

The results of Toda and Yamamoto (1995) based causality test are reported in Table 8. Results indicate the bidirectional causal relationship of FDI and workers’ remittances with private savings.

6.3. Variance decomposition analysis

Generalized forecast error variance decomposition method under vector autoregressive (VAR) system has been used to analyze the strength of the causal relationship between FDI, workers’ remittances and private savings. The variance decomposition method provides the magnitude of the predicted error variance for a series accounted for by innovations from each of the independent variable over different time periods. Table 9 represents the results of variance decomposition analysis.

Results of Table 9 show that in the first round the change in private savings, explain completely by its own innovations. In the second period, 95.90% explain by own innovation, 2.27% by FDI innovation and 1.83% by workers’ remittances innovation. In period five, the shocks in private savings explain 76.80% by own innovation, 10.56% by innovations of FDI and 12.64% by innovations of workers’ remittances. In tenth period, the shocks in private savings explain 30.80% by own shocks, while 37.56% explain by innovations of FDI and 31.64% explain by innovations of workers’ remittances.

Table 9. Results of variance decomposition approach

Period	PS	FDI	REM
Variance decomposition of PS			
1	100.000	0.000	0.000
2	95.904	2.266	1.830
3	91.744	3.980	4.276
4	84.274	6.869	8.858
5	76.803	10.557	12.640
6	66.274	14.869	18.858
7	61.569	18.032	20.399
8	46.428	29.062	24.510
9	38.929	33.877	27.194
10	30.803	37.557	31.640
Variance decomposition of FDI			
1	0.026	99.974	0.000
2	0.061	99.939	0.001
3	5.004	94.940	0.057
4	8.557	91.315	0.128
5	13.975	85.901	0.124
6	18.182	81.641	0.177
7	22.245	77.277	0.479
8	25.353	73.555	1.092
9	27.942	70.131	1.927
10	29.949	67.211	2.840
Variance decomposition of REM			
1	12.488	2.394	85.118
2	8.357	2.171	89.472
3	10.967	2.501	86.532
4	13.475	2.803	83.722
5	16.795	2.853	80.352
6	19.326	2.773	77.902
7	21.146	2.749	76.105
8	22.157	2.905	74.938
9	22.776	3.222	74.002
10	23.216	3.620	73.164

The shocks in FDI explain 0.03%, 13.98% and 29.95% by innovation of private savings in the period 1, 5 and 10 respectively. The shocks in workers' remittances explain 12.49%, 16.76% and 23.22% by innovation of private savings in the period 1, 5 and 10 respectively. These findings suggest the bidirectional causal relationship of FDI and workers' remittances with private savings.

Conclusions

This paper makes a unique contribution to the literature with reference to Pakistan, being a pioneering attempt to investigate the impact of FDI and workers' remittances on private savings of Pakistan by using the long annual time series data for 39 years from 1973 to 2011 and by applying more rigorous econometric techniques. ARDL bound testing cointegration approach confirms the valid of a long run relationship between foreign capital inflows and private savings. Results indicate the significant positive impact of FDI and workers' remittances on private savings in the long run as well as in the short run. Results of Granger causality test, Toda and Yamamoto Modified Wald causality test and variance decomposition test confirm the bidirectional causal relationship of FDI and workers' remittances with private savings.

FDI, workers' remittances and private savings are connected in a complementary way in Pakistan. It is recommended that government and policy makers should form friendly policies to attract more FDI and workers' remittances in the country which leads to increase private savings and domestic investment opportunities in the country. One of the best destinations of inward FDI is the export processing zone (EPZ) in any country. EPZ benefits the host country by utilizing location specific assets. This inward FDI may enhance technological know-how, training of local workforce and this increase export competitiveness.

The comparative study with neighboring countries should be done in the near future to comparatively analyze the influence of FDI and remittances in the South Asian countries.

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