Saving-Investment Nexus and International Capital Mobility: Evidence from SAARC Countries

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Abstract

The paper attempts to examine the validity of Feldstein-Horioka hypothesis for South Asian Association for Regional Cooperation (SAARC) countries for the period of 1980-2016. To accomplish the objective, the Granger causality test and auto regressive distributed lag (ARDL) bounds test of co-integration are applied. The significance of the business cycle shocks such as productivity, fiscal and terms of trade shocks is also tested. The results of co-integration test provide evidence in favor of low degree of capital mobility only for Bangladesh and India. So, FH puzzle does not exist for these countries. For rest of the countries, the domestic savings and investment are not correlated. The results of Granger causality test show that causality runs from savings to investment for Bangladesh and India. The results of business cycle shocks explain the high savings-investment correlation. The savings-retention coefficient remains well above zero even after controlling all three shocks.

***Keywords**: Feldstein-Horioka Hypothesis, Investment, Savings, Co-integration, Causality, Business cycle shocks: productivity, fiscal and terms of trade*

1. Introduction

The savings and investment (S-I) association has long been an object of interest for analysts. It is well known that one of the important aspects of achieving sustainable development is to preserve macroeconomic stability which is closely related to the extent of capital mobility. Although there is strong positive S-I relationship in a closed economy and existence of international capital flows makes it more complex to analyze. The degree of international capital mobility influences global resource allocation, economic policy and responses to external shocks. Various tests for capital mobility have been identified in the literature. One of the tests is proposed by Feldstein and Horoika (FH hereafter) in 1980. It states that relationship between national saving and investment does not exist under perfect capital mobility. However FH analyzed the corresponding relationships across sixteen OECD countries for the period of 1960–74. Contrary to their presumption, they found that national savings and investment were highly correlated under perfect capital mobility. This result was named as "FH puzzle" in the literature. Feldstein (1982) extended the work of FH (1980) by addressing econometric problems in the 1980's paper. The results showed that high capital mobility was not present in the OECD countries in the long-run.

FH's results are due to large-country bias instead of low capital movement [Harberger (1980) and Murphy (1984)]. The relationship between savings and investment is due to government practices of monetary and fiscal policy to achieve the current account balance [Bayoumi (1989)]. Many other theoretical justifications have been forwarded to rationalize greater and significant coefficient when investment is regressed on savings. Obstfeld (1986) opines that low capital mobility is the consequence of information restraints and nonexistence of enforceability of agreements at international level. He also mentions that S-I correlation may be due to other factors such as "productivity shocks". All these studies analyze the impact of

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S-I relationship on capital mobility across multiple countries, however, individual countries, especially the SAARC countries which are socially, politically and economically similar in nature, have mostly been ignored. This paper examines the S-I correlation and analyzes its impact on degree of capital mobility and direction of causality between these two variables for SAARC countries at country level. An attempt is also made to investigate the S-I relationship that correctly reflects the degree of capital mobility before and after controlling business cycle shocks such as productivity, fiscal and TOT shocks on S-I correlation. The paper contributes in the literature regarding degree of capital mobility and business cycle shocks for SAARC countries using S-I correlation approach proposed by FH (1980).

The rest of the paper is structured as follows. Section 2 reviews the literature relevant to the issue. Data sources and variables are given in section 3. Section 4 describes econometric methodology. Section 5 discusses the results. Finally section 6 presents the conclusions and policy implications.

2. Literature Review

A huge volume of literature concerning the FH hypothesis is available and has been taking the response of economists from all over the world. In this section, we reviewed the existing theoretical and empirical literature related to Feldstein-Horioka hypothesis. There are basically two main strands of literature that compact with this hypothesis. The first strand support FH hypothesis and claims that higher S-I correlation implies greater international capital immobility. Feldstein (1982), Penati and Dooley (1984), Dooley et al. (1987) and Vos (1988), using cross section framework, submit that domestic savings and investment are closely related to each other. In time series framework, the literature shows that there is dynamic relationship between savings and investment over the time and through different exchange rates and capital control systems (Miller, 1988; De Vita and Abbott, 2002; Ozman and Parmaksiz, 2003; Narayan, 2005).

The second strand of literature addresses alternate hypothesis to clarify high S-I relationship. It claims that high S-I relationship has no effect on the degree of capital mobility but there are other factors such as productivity shocks [Obstfeld (1986), current account [Summers (1988), Artis and Bayoumi (1992)], size of country [Baxter and Crucini (1993)], current account solvency [Coakley et al. (1996)] and financial crisis [Kasuga, (2004)] which may affect degree of capital mobility. The impact of free capital mobility on S-I relationship has been a matter of a significant debate. From a theoretical perspective, in the presence of perfect capital mobility among the nations, national savings respond to worldwide investment opportunities and national investment should be financed from worldwide pool of capital. Hence S-I may not be related. However Feldstein-Horioka (1980) found high association between savings and investment, as FH assessed that at global level capital flows was low and also had not expanded in current time period. FH (1980) use average cross-sectional sample of sixteen OECD economies for period of 1960-1974. Their result shows significant association between the savings and investment and almost 90% of domestic savings stay within a nation that fund the domestic investment which implies low capital mobility across countries.

Literature review is divided into three sub- sections keeping in view correlation between savings and investment; and degree of capital mobility. Sub-Section 2.1 appraises those studies which assert perfect capital mobility when savings and investment are not correlated. The studies which suggest low capital mobility when correlation between savings and investment exists are discussed in sub- section 2.2. Sub-section 2.3 reviews those studies which claim that capital mobility has nothing to do with savings and investment correlation.

2.1 Review of studies which observe perfect capital mobility when there is no correlation between savings and investment

Yamori (1995) finds that savings and investment are not correlated with each other for Japan which suggests perfect capital mobility. Palley (1996) finds the relationship between savings and investment which contradicts the FH puzzle. Vamvakidis et al (2002) explains the co-integration of domestic savings and investment which decreases over time that suggest higher integration in the capital market. Kim *et al*. (2005), Adedeji and Thornton (2006), Afzal (2007), Tang and Lean (2008), Narayan and Narayan (2010) and Saeed and Khan (2012) test the FH hypothesis and conclude that there is free capital mobility among the countries. The presence of perfect capital mobility justifies non-existence of savings and investment relationship among selected countries.

2.2. Review of studies which observe low capital mobility when S-I are correlated

Hussein (1998), Ozmen and Parmaksiz (2003), Pelgrin and Schich (2008), Kollias *et al.* (2008), Wahid *et al*. (2009), Mishra *et al*. (2010), Onafowara *et al.* (2011),Adebola and Dahalan (2012) test the FH hypothesis by using different techniques for different countries and evidence that international capital mobility is very low. Narayan (2005), Ang (2007) and Singh (2008) apply causality test and ARDL model for Japan, Malaysia and India respectively. They conclude that savings and investment are co-integrated which also confirm that there is a low capital mobility. Shahbaz *et al*. (2010) and Nasiru and Usman (2013) explore the long run and short run S-I association for Pakistan and Nigeria respectively. The strong evidence is found for S-I relationship in Nigeria whereas weak correlation turns out for Pakistan.

2.3. Review of studies which suggest savings and investment correlation has no impact on capital mobility

Obstfeld and Rogoff (1986) highlight the possible instruments to clarify the co-movement of savings and investment. They opine that savings and investment are significant elements of the business cycle and there is a reason to trust the real shocks such as "total productivity shocks" can bring about a high relation within the savings and investment. Cyrille (2010) draws the conclusion that S-I nexus is low and relationship between capital inflow and outflow is insignificant for fifteen African countries. Ketenci (2012) demonstrates the evidence of validity of co-integration for twenty three nations of European Union for period of 1995-2009 except for Portugal and Estonia. He disputes the FH hypothesis. Low level of savings-retention coefficient measure high capital flows in most of the countries.

Literature review made above reveals that most of the existing studies estimate FH hypothesis for cross countries mostly for OECD and European Union and African countries but no study has been conducted for SAARC countries, especially for country-by-country analysis although these countries are socially, politically and economically similar in nature. This paper is an attempt to fill this literature gap.

3. Data Source and Variables

Annual data for SAARC countries is used for the period of 1980-2016. The data set for this paper is retrieved from International Financial Statistics (IFS) and World Development Indicators (WDI). Savings, investment, share of labor, labor output, labor input, GDP growth rate**,** net government debt**,** growth rate of government spending, export price and import price are variables used in the analysis. The detail description and construction of variables is discussed in the appendix.

4. Econometric Methodology

The main objective of this paper is to check the validity of Feldstein-Horioka hypothesis for SAARC countries. This section is divided into two sub-sections. Sub-section 4.1 discusses unit root, co-integration and causality tests and sub-section 4.2 explains the ARDL approach.

4.1 Unit Root Test

In co-integration and causality analysis, we attempt to determine long- run relationship between a set of various variables and analyze the patterns of effect of one variable on another. But before testing the co-integration and applying causality test, it is essential to check time series properties of each variable because if a variable(s) is non- stationary and the regression analysis, done in a conventional way, will produce spurious results[3]. So the unit root tests are conducted to examine the time series properties of the variables. A variable is said to be stationary if its mean and variance are not limited and autonomous of time, while the covariance is limited and free of time[4]. If a variable which is integrated of order one or more than one then the variables is called non-stationary at level. A number of tests are available in the literature to check unit root. We applied augmented Dickey Fuller test in this paper. A test developed by Dickey and Fuller (1976) is known as Dickey-Fuller test[5] and it is based on simple auto regression:

$$y_t = \mu + \alpha y_{t-1} + \varepsilon_t \quad (4.1)$$

If the error term ε_t in equation (4.1) is consecutively correlated then this can be removed by changing the Dickey-Fuller as the augmented Dickey-Fuller (ADF) test which can be specified $\Delta y_t = \mu + \delta y_{t-1} + \sum_{i=1}^{k} \beta \, \Delta y_{t-1} + \varepsilon_t$

(4.2)

Where $\delta = \alpha - 1$

'k' is chosen such that ε_t is white noise error term

H_0: $\delta \geq 0$ Unit Root H_1: $\delta < 0$ Stationary

The rejection of null means that variable is stationary.

4.2 Co-Integration and Auto Regressive Distributed Lag Approach

ARDL approach can easily handle variables having different optimal number of lags which is not possible under other approaches of co integration. So, in view of the above advantages, we used the bounds test approach to co integration within an ARDL framework[6] and the Granger causality test. These tests are relatively more efficient for finite sample [(Narayan and Narayan (2005), Narayan and Smyth (2006)].

In this paper ARDL technique is applied to examine the effect of S-I relationship on capital mobility. To derive our preferred model, we follow the assumptions made by Pesaran *et al.* (2001). ARDL representations of the respective function can be stated as follows.

$$\Delta lnI_t = \alpha + \varphi lnI_{t-1} + \gamma lnS_{t-1} + \sum_{i=1}^{p} \delta_i \, \Delta lnI_{t-i} + \sum_{i=0}^{p} \beta_i \, \Delta lnS_{t-i} + e_t$$

(4.3)

Where Δ is the first difference operator, *'ln'* is the natural log of the variable. I_t and S_t denote investment and domestic savings as a share of GDP at time t respectively, α is drift component and e_t are white noise errors. The first part of the equation with φ and γ represents the long-run dynamics of the model. The second part of the equation represents the short-run dynamics of the model. The optimal lag length is determined by using minimum Akaike's information criteria (AIC). There are two steps involved in this procedure. The first step involves conducting F-test for co-integration, while the second step involves estimation of

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[3]. Shrestha (2005)

[4]. It does not vary systematically over time.

[3]. The difference among these tests is that the DF test assumes that the error term ε is independently and identically distributed, the ADF test care of the possible serial correlation in the error term by adding the lagged difference terms of the regressand.

[6] Such models are also named as *dynamic linear regression models.*

relationship. The bounds test for co-integration is based on F-test of the following null hypothesis.

H_o: $\varphi = \gamma = 0$ there is no co-integration between the variables.

H_1: $\varphi \neq \gamma \neq 0$ there is co-integration between the variables.

The ARDL bounds test is based on the Wald-test (F-statistics). Pesaran *et al* (2001) give two critical values for the co-integration test. The lower critical bounds assume that all the regressors are I (0), while the upper critical value assumes that they are I (1). Therefore, if the computed F-statistics is greater than the upper bounds critical value, then H_o will be rejected and we conclude that savings and investment have long-run relationship. If the F-statistics is below the lower bounds critical value, then H_o will not be rejected regardless of the orders of integration of the variables and we conclude that savings and investment do not have a long-run relationship. The presence of co-integration suggests that capital is at least internationally immobile, while the lack of co-integration suggests perfect capital mobility [Miller (1988)]. When computed F-statistics fall between the lower and upper bounds, then the results are inconclusive unless we know the order of integration of the underlying variables.

The second step in the analysis is to estimate the coefficients of the long-run relationship. Once an evidence of co integration is found between the variables, a long-run model of the following form is estimated:

$$lnI_t = \alpha + \sum_{i=1}^{p} \eta_i ln\, I_{t-i} + \sum_{i=0}^{p} \beta_i\, lnS_{t-i} + e_t \quad (4.4)$$

Optimal lag length is determined by least values of the Akaike information criteria (AIC) which is more preferable to others due to their tendency to define more parsimonious specifications [Pesaran and Shin (1998)].

A General (Short- Run) Error Correction Representation

After estimating the long-run model, the short run coefficients are estimated by Error Correction Model (ECM). It explains changes in the dependent variable in term of changes in the explanatory variables as well as deviations from the long run relationship between the variables and its determinants. The short-run model is of the following form:

$$\Delta lnI_t = \alpha + \sum_{i=1}^{m} \gamma_i\, \Delta lnI_{t-i} + \sum_{i=0}^{n} \delta_i\, \Delta lnS_{t-i} + \lambda ECM_{t-1} + \varepsilon_t \quad (4.5)$$

The coefficient of error correction term indicates the speed of adjustment back to the long-run equilibrium after a short-run shock in dynamic model which is represented by λ. The sign of λ should be negative and its statistical significance is interpreted as further evidence of co-integration.

Granger Causality Test

To determine the direction of causality we employed bi-variate Granger causality test. The bounds test assumes that the dependent variable to be I (1) and the regressors to be either I (0) or I (1). The procedure cannot be applied if the dependent variable of interest is I (0) and would crash in the presence of I(2) variable. To complement the bounds test approach and derive inference regarding the direction of causality between savings and investment, we use Granger causality test proposed by Granger (1969).

$$\ln I_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} \ln I_{t-i} + \sum_{i=1}^{k} \beta_{1i} \ln S_{t-i} + e_{1t} \quad (4.6)$$

$$\ln S_t = \emptyset_0 + \sum_{i=1}^{k} \emptyset_{1i} \ln S_{t-i} + \sum_{i=1}^{k} \delta_{1i} \ln I_{t-i} + e_{2t} \quad (4.7)$$

Where lnI_t and lnS_t shows the log of investment and savings at time t respectively and k represents the number of lags.

Hypothesis for Granger Causality Test

There are two set of hypothesis. The first null hypothesis shows that savings does not cause investment and its alternative is that savings cause investment. The second null hypothesis

shows that investment does not cause savings and its alternative is that investment causes savings. These hypotheses are formulated as follows:

H_o: $\beta_1=\beta_2=\ldots..=\beta_k=0$, against H_A: $\beta_1\neq\beta_2\neq\ldots..\neq\beta_k\neq0$

H_o: $\delta_1=\delta_2=\ldots\ldots=\delta_k=0$, against H_A: $\delta_1\neq\delta_2\neq\ldots\ldots\neq\delta_k\neq0$

In both cases, a rejection of the null hypothesis implies that there is Granger causality. Equation (4.6) and (4.7) is estimated and a Wald test is carried out to test the hypothesis.

Business Cycle Shocks

In order to control the effect of business cycle shocks, we run the separate regressions for ΔS and ΔI on each shock and use the residuals from these regressions to estimate the S-I correlation. We use the residuals from the following time-series regression for savings and investment for all countries:

$$\Delta S_{it}\,(\Delta I_{it}) = \propto_i + \beta_o shocks_{it} + \beta_1 shocks_{it-1} + \beta_2 shocks_{it-2} + residuals_{it}$$

(4.8)

Three shocks are considered in the regression: productivity, fiscal and TOT shock. We set the lag length up to 2 for shocks because the coefficients of third and above lags are insignificant in most cases [Soyoung *et al.* (2007)].

5. Results and Discussion

5.1.1 Results of ADF Test

The results of ADF reported in table 1 show that savings are stationary for Bangladesh, Bhutan and Nepal but non-stationary for India, Pakistan and Sri Lanka at level. Savings for India, Pakistan and Sri Lanka; and investment for all countries become stationary at their first difference. It means that savings for Bangladesh, Bhutan and Nepal is I(0), whereas it is I(1) for remaining three countries. Investment is I(1) for all countries.

Table 1: Estimates of ADF test

	At level		At First difference	
Countries	**S**	**I**	**ΔS**	**ΔI**
Bangladesh	-3.106*(2)	-0.090 (0)	-5.537**(1)	-4.426** (0)
Bhutan	-3.462*(0)	-2.328 (1)	-5.627**(0)	-5.557**(1)
India	-1.492 (3)	-1.077 (1)	-7.487**(0)	-7.345**(1)
Nepal	-3.181*(0)	-0.936(0)	-5.429**(1)	-6.528**(0)
Pakistan	-1.895 (0)	-1.131(0)	-6.070**(0)	-5.457**(0)
Sri Lanka	-1.056 (2)	-2.488(1)	-6.444** (1)	-4.799**(1)

Note: *Savings and investment are in the form of log. The lag length (figures in parenthesis) is selected with the help of AIC criteria. *and ** indicate the rejection of the null hypothesis of non-stationary at 1% and 5% significance level respectively.*

Hence Johansen co integration test is not applicable to the variables which do not have same order of integration. Therefore we apply bound test.

5.2 Estimates of Bounds Test

The results of bound test are reported in table 2. The presence of long run relationship between savings and investment is checked by the significance of the coefficient of the lagged levels variables with the help of F-statistics. It is clear from table 2 that the computed F-statistics appears to be greater than the upper bounds critical values at 5% level of significance only for Bangladesh and India. So the null hypothesis of no co-integration is rejected for these two countries.

Table 2: Results of bounds test with dependent variable (I)

Countries	F-Statistics	Co- integration
Bangladesh	8.323**	Yes
Bhutan	4.324	No
India	5.851**	Yes
Nepal	1.305	No
Pakistan	0.767	No
Sri Lanka	2.437	No

Note: *** denotes the rejection of null hypothesis at 5% significance level. Critical values for F-statistics are taken from Pesaran et al (2001.p.300)*

Hence we can conclude that evidence of co-integration.is only found for Bangladesh and India. It implies low capital mobility in Bangladesh and India which supports FH hypothesis. For Bhutan, Nepal, Pakistan and Sri Lanka null hypothesis of no co-integration cannot be rejected because the computed F-values are less than the lower bounds critical value at 5% level of significance for these countries. It implies that there is perfect capital mobility in these countries.

Table 3: Estimates of Long-run Coefficient for Bangladesh

Dependent Variable: I, Method: Least Square				
Variables	**Coefficient**	**Std. Error**	**t-Statistics**	**Prob.**
I(-1)	0.9447	0.1213	7.79	0.0000
I(-2)	-0.0851	0.1046	-0.814	0.4225
Constant	0.2008	0.1106	1.82	0.0799
S(-1)	0.0911	0.0314	2.90	0.0072
R-Squared	0.9860	**Mean Dependent Var**		3.0378
Log-	75.329	**Durbin-Watson Stat**		2.15
F-statistics	660.8	**Prob (F-statistics)**		0.000

Note: *Savings and investment are in the form of log.*

Table 4: Estimates of Long-run Coefficient for India

Dependent Variable: I, Method: Least Square				
Variables	**Coefficient**	**Std. Error**	**t-Statistics**	**Prob.**
I(-1)	0.1419	0.3550	0.400	0.6923
I(-2)	0.3103	0.1658	1.87	0.0717
Constant	0.0046	0.2878	0.0160	0.9873
S(-1)	0.5651	0.2106	2.6832	0.0082
R-Squared	0.8531	**Mean Dependent Var**		3.2855
Log- likelihood	37.515	**Durbin-Watson Stat**		2.12
F-statistics	54.21	**Prob(F-statistics)**		0.000

The results for these countries are consistent with the results of Narayan and Narayan (2010). The overall findings of the bounds test reveal that S-I are co-integrated only for Bangladesh and India. The long run coefficients of Bangladesh and India are reported in table 3 and 4 respectively The long-run coefficient of savings for Bangladesh and India is 0.09 and 0.56 respectively and it has not only expected sign but also significant at 1% level of significance. It means that a 1% increase in savings results in 0.09% and 0.56% increase in investment in the long run in Bangladesh and India respectively.

5.3 Estimates of Granger Causality Test

From the above findings we can see that there is long-run relationship between savings and investment only for Bangladesh and India but for cross checking the findings we applied the

granger causality test for all countries. P-values of the Wald test are used to check the direction of causality between savings and investment. The results of the causality test are presented in Table 5.

Table 5: Estimates of Granger causality Test

Countries Countries	Lag length Length (k)	S_t causes I_t		I_t causes S_t		Direction of ccaCausality
		Wald stat	p-value	Wald stat	p-value	
Bangladesh	1	3.808**	0.042	0.017	0.796	*S→I*
Bhutan	1	0.361	0.594	0.833	0.803	No
India	1	5.727**	0.022	0.583	0.651	*S→I*
Nepal	1	0.226	0.939	0.703	0.494	No
Pakistan	1	1.148	0.219	1.351	0.678	No
Sri Lanka	1	1.339	0.973	1.108	0.210	No

Note: *** denotes the rejection of null hypothesis at 5% significance level.*

The p-values of Wald statistics show that null of savings do not cause investment is rejected for Bangladesh and India. Hence there is evidence of unidirectional causality running from savings to investment for these two countries. It means that the savings should be given a greater priority to boost investment. For the rest of the countries, no evidence of causality is found between savings and investment.

5.4 Estimates of Error Correction Model (ECT_{t-1})

The value of coefficient of ECT_{t-1} should be negative and statistically significant. Before proceeding to error correction model we must check stationarity of the residuals from the regressions of investment on savings. If it is stationary at level then we can proceed for ECM.

Estimates of Augmented Dickey-Fuller (ADF) test on residuals	
Countries	**At Level**
Bangladesh	-4.833**
India	-5.729**

Note*: ** denotes the rejection of null hypothesis of non- stationary at 5% significance level.*

The presence of unit root in residuals at level obtained from S-I regression is rejected at 5% significance level for both countries. This shows that co-integration exist between the residual of savings and investment for Bangladesh and India so we can proceed to estimate ECM. The results of the model for Bangladesh and India are presented in table 6.

Table 6: Short-Run Estimates of Investment for

Variables	Bangladesh				India			
	Coef	S. E	t-Stat	Prob.	Coef	S. E	t-Stat	Prob.
ΔI_{-1}	1.1338	0.3453	3.28	0.0029	0.4024	0.9369	0.430	0.6711
ΔI_{-2}	-0.3676	0.1068	-3.44	0.0020	-0.0804	0.1818	-0.443	0.6617
Constant	0.0108	0.0059	1.84	0.0775	0.0195	0.0156	1.25	0.2236
ΔS_{-1}	-0.2324	0.0827	-2.81	0.0093	-0.7365	0.9752	-0.755	0.4569
ECT_{-1}	-0.0402	0.0198	-2.02	0.0253	-0.0686	0.0391	-1.75	0.0313

Note: *Savings and investment are in log form.*

The estimated coefficients of ECT_{-1} are significant for both countries which imply that there is long-run relationship between savings and investment in these countries. It also shows that 4% and 6.8% of the errors from the lags are absorbed in the next period for Bangladesh and India respectively. Though the speed of adjustment is very low but it is significant at 5% level for both countries. The estimated value of savings coefficient is negative for both

countries which show capital mobility in these countries but it is statistically significant only for Bangladesh. The results of savings retention coefficients are reported in table 7. Five models are estimated. Model 0 shows savings retention coefficients[7] before controlling shocks. Model 1, 2, 3 and 4 shows the savings-retention coefficients after controlling the productivity, fiscal, TOT[8] and all three shocks respectively.

Table 7: Estimates of Savings-Retention Coefficients

Countries	Model 0	Model 1 (Productivity	Model 2 (Fiscal)	Model 3 (TOT	Model 4 (All Three)
Bangladesh	0.42* (0.01)	0.01 (0.05)	0.01 (0.05)	0.06 (0.05)	0.37* (0.05)
Bhutan	0.13* (0.04)	-0.18** (0.09)	0.09 (0.09)	0.16 (0.27)	0.01 (0.09)
India	0.95* (0.06)	0.23 (0.28)	0.16 (0.27)	0.49 (0.33)	0.18** (0.41)
Nepal	0.31* (0.07)	0.25* (0.08)	0.20** (0.08)	0.16 (0.09)	1.49* (0.09)
Pakistan	0.19* (0.05)	0.15*** (0.08)	0.10 (0.08)	0.10 (0.09)	0.23** (0.10)
Sri Lanka	0.01 (0.09)	0.31* (0.12)	0.03 (0.15)	0.02 (0.15)	0.007 (0.14)

Note: *Figures in parenthesis are standard error. *, **and *** show significant at 1 %, 5% and 10% significance level respectively.*

It is clear from table 7 that savings retention coefficients are different for all countries but statistically significant only for four countries (model 4). Savings retention coefficients for all countries decrease after controlling all the three shocks except for Nepal and Pakistan (compare model 4 with model 0). It implies that there is high positive correlation between savings and investment for Bangladesh, Bhutan, Sri Lanka and India after controlling all shocks. Specifically after controlling all three shocks the savings retention coefficients decrease for four countries out of six countries than without shocks

Table 8 reports the estimates of ΔI and ΔS and savings retention coefficient at different lags after controlling the business cycle shocks. These savings-retention coefficients are derived from the regression of the residuals of ΔI on the residuals of ΔS. The residuals are obtained from the regressions of ΔI and ΔS on each shock at 0, 1 and 2 lags. The values of β under productivity shocks show that productivity shocks positively affect savings and investment. Increase in productivity has positive and significant effect on savings and investment but these effects decline over time. A decline in the savings-retention coefficient after controlling a certain shock indicates that this shock is adept to explain the positive relationship between savings and investment. After controlling the productivity shocks in the data of savings and investment, the savings-retention coefficient decreases for Bangladesh and India. The savings-retention coefficient of investment increases for Bhutan and Sri Lanka but coefficient of savings decreases. The investment decreases in Pakistan and Nepal, while the savings increases in case of Pakistan but decreases in case of Nepal. All the countries except Bhutan and Sri Lanka face the positive productivity shocks which mean that in these countries consumption is high but it is not as much as the increase in productivity and the households

[7]This regression coefficient measures the fraction of an exogenous increase in savings that remains at home. Feldstein and Bacchetta (1991) and Obstfeld (1995) used the same measure.

[8] For the use of these shocks in a model, see, for example, Obstfeld (1982), Svensson and Razin (1983)

save remaining output. Due to the positive productivity shocks the marginal product of capital increases which increases the investment in countries.

Fiscal shocks have less significant effect on the investment as compared to the productivity shocks. Fiscal shocks have initially negative effect on savings. It may be due to the increase in government spending. Investment initially increases but rapidly decreases over time. Theoretically the effects of fiscal shocks on savings and investment are ambiguous since the effects depend on the specification of the shocks. TOT shock decreases both savings and investment. Savings and investment initially increases but then decreases over time. Some points about the effect of shocks on saving and investment are noticeable. First, productivity shocks have the biggest impact on both variables among the three shocks which is consistent with the fact that productivity shocks are the most important source of business cycles in an economy. Second, the effects of lagged shocks are quite weak in the case of productivity shocks while fiscal and TOT shocks have prolonged effects.

Table 8: Estimates of Shocks on ΔI and ΔS

Countries	ΔZ	Coefficient	Productivity Shocks	Fiscal shocks	TOT shocks
Bangladesh	ΔI	βo	0.17**	0.06	0.07
		β1	0.06**	-0.1	0.02
		β2	-0.01**	0.01	0.06*
	ΔS	βo	0.78**	-0.95	1.06
		β1	0.11*	-0.66	-0.22
		β2	-0.15**	-0.18	0.41
Bhutan	ΔI	Bo	0.11**	0.10*	0.006
		β1	0.03**	-0.1	-0.08
		β2	0.12**	-0.09	-0.04
	ΔS	Bo	0.09**	0.6	0.18
		β1	0.01*	0.41	0.04
		β2	0.02*	0.64	-0.02
India	ΔI	Bo	0.95	1.04	1.1
		β1	0.25	-0.35	0.09
		β2	0.37	0.02	-0.64
	ΔS	Bo	0.84	0.82	0.81**
		β1	-0.04	-0.03	0.38
		β2	0.3	0.5	0.49
Nepal	ΔI	Bo	0.28**	0.13	-0.06
		β1	0.01	0.05	-0.01
		β2	-0.25**	-0.2	-0.05
	ΔS	Bo	1.34*	1.55	-0.09
		β1	-0.05	0.23	-0.13
		β2	0.06	0.12	0.02
Pakistan	ΔI	Bo	0.01	-0.04	-0.07**
		β1	-0.02	0.04	0.006
		β2	-0.08	0.04	0.07*
	ΔS	Bo	-0.13	0.35	-0.09
		β1	-0.12	0.24	0.08

		β2	-0.02	0.52	0.37
Sri Lanka	ΔI	Bo	0.22*	0.16	-0.17
		β1	0.17**	-0.40**	0.28
		β2	0.31	-0.03	-0.02
	ΔS	Bo	1.23*	0.02	0.4
		β1	-0.85	0.26	0.21
		β2	0.06	0.08	0.13

Note: *ΔZ represent the saving-retention coefficients that are derived from the regression of the residuals of ΔI on the residuals of ΔS (Eq.4.8). *and ** show significant at 1 % and 5% significance level respectively.*

6. Conclusions and Policy Recommendations

The paper examines the validity of Feldstein-Horioka hypothesis in the presence of capital mobility for South Asian Association for Regional Cooperation (SAARC) countries for the period of 1980-2016. The results indicate that savings and investment are co-integrated only Bangladesh and India. It suggests that investment responses proportionately to change in savings. It implies low capital mobility in these two countries. The results also confirm non-existence of co-integration for Pakistan, Bhutan, Nepal and Sri Lanka. It means that domestic savings does not play effective role to support investment in these countries. It indicates perfect capital mobility, so domestic investment is supported through foreign investment instead of domestic savings. Causality test shows that there is unidirectional causality from savings to investment for Bangladesh and India. Based on these empirics, we conclude that savings drives investment in Bangladesh and India, so the policies that encourage savings in these countries can be helpful to increase domestic investment which can be important for growth and development. The results of error correction model suggest that the relationship between savings and investment not only holds but also statistically significant in the short run. In sum we can say that domestic investment is positively related to domestic savings in only two countries i.e. Bangladesh and India out of six countries. Bulk of the investment in other four countries is not being financed by domestic savings but by foreign savings. Business cycle shocks are also incorporated in the analysis to analyze how each shock explains the S-I correlation. The major findings of the paper indicate that business cycle shocks describe the high correlation between savings and investment. Even after controlling all three shocks, the coefficient of savings-retention remains well above zero.

Policy Recommendations

On the basis of empirical findings of the paper, the following policy recommendations can be made. In Bangladesh and India there should be efficient use of external aid and finance to promote growth, and savings should be the immediate priority in these countries and monetary policy may be effectively used for macroeconomic stability. Economic policies may be focused on the incitation of investment and the reduction of capital outflows in Bhutan, Nepal, Pakistan and Sri Lanka. In all these countries savings do not cause investment so policy emphasis should be shifted away from savings and concentrated in removing the impediments to investment. For this purpose a combined fiscal and monetary policy initiatives are needed to ensure the equilibrium between domestic resources and financing in the economy. Government budget targeting would minimize the resource gap and will bring equality between savings and investment. In Bhutan, Nepal, Pakistan and Sri Lanka savings and investment are not correlated so the governments of these countries should maintain a current account targeting policy so that current account would not fluctuate to the optimal level and in turn, savings and investment would be highly correlated even in the presence of perfect capital mobility.

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Appendix

Description of variables

Savings and Investment: The savings and investment represent gross domestic saving and gross capital formation respectively as a share of GDP.

Productivity Shocks : Productivity shocks are defined as annual percentage changes[9] in productivity. For productivity measure, we use Solow residuals derived from the Cobb-Douglas production function. If we assume fixed stock of capital, the Solow residual can be represented as follows: $A_t = Y_t/L_t^{\alpha}$ where A_t is Solow residuals, α is share of labor (assumed 0.6), Y_t is Industrial value added as a share of GDP, L_t is Labor input (Employment), Employment in industry (% of total employment)

Fiscal Shocks: Fiscal shocks are defined as percentage change in unexpected government spending. We run the country-by-country OLS regression of the growth rate of real government spending at time *t* on the real GDP growth rates and the total debt. We use the residuals of these regressions for the unexpected government spending data.

Terms of Trade (TOT) Shocks

Terms of trade (TOT) shocks are defined as the percentage changes in the TOT. ` Export price to Import price ratio (P_x/P_m). Export price is the unit values of exports (Index Number) and import price is the unit values of imports (Index Number).

[9] In order to correctly compare the coefficients of different shocks in the regression, we control the differences in units by defining shocks as percentage change instead of first differences.