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Saving Investment Correlation in South Asia- A Panel Approach

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Abstract

Using Fixed Effect, Random Effect and between or CS models, we find that there is low correlation between saving and investment in Bangladesh, India, Pakistan, Srilanka and Nepal. However this result does not necessarily imply high capital mobility in these countries as capital mobility is influenced by other factors also such as the economic size, differences in financial structure across countries, fiscal policy coordination etc.

Keywords: Saving-investment correlation, panel data, F-H puzzle.
JEL Classification Codes: F21, F32, F41

1. Introduction

Understanding the saving-investment link is important for two reasons. First, it may hold the key to the positive correlation between saving and growth and second, if capital accumulation is important for growth, the interaction between saving and investment is crucial for assessing the validity of the view that raising savings is the surest way to increase growth.

Keynes' well-known "paradox of thrift" according to which, an ex-ante increase in saving may lead via multiplier to an ex-post decline in real output, investment and saving itself insists that policies to encourage savings by raising investment and growth might in fact prove to be futile. Nevertheless, in closed economy, national savings and domestic investment must be identical ex post but in an open economy that facilitates unrestricted capital mobility between countries, capital will flow where it may yield the highest return from. An increase in saving would be reflected in current account rather than in higher domestic investment and growth.

Since the ground-breaking seminal work of Fledstein and Horioka in 1980 on the relationship between saving and investment on 16 OECD countries where they found high saving investment correlation and explained it as an evidence of low capital mobility, several researchers investigated this relationship. Some of the researchers supported this puzzle while others disagreed on the ground that it is not the high saving-investment correlation that determines capital mobility between nations rather there are some other factors such as the economic size, international financial linkages fiscal policy coordination etc that may substantially explain capital mobility.

The objective of this paper is to examine correlation between saving and investment in some developing countries namely Bangladesh, Pakistan, India, Nepal and Srilanka to see whether the findings match the common results of earlier studies on other developing countries. To the best of our

knowledge, no study has so far been undertaken to examine saving investment correlation in these countries.

The rest of the paper is structured as follows; Section 2 discusses literature review followed by discussion on data and methodology in section 3. Section 4 reports the results. Section 5 offers summary and conclusions.

2. Literature Review

Since the ground breaking work of Feldstein and Horioka in 1980, several researchers investigated the relationship between saving and investment. Although most research works focused on advanced economies, a few studies paid attention to developing countries.

Feldstein(1983) found that the high correlation between saving and investment had not weakened over time. Sachs(1981) proposed a modification of the F-H model by introducing the current account as an indicator of capital mobility and found that investment is more closely correlated with changes in the current account than in savings and that the correlation is negative. Caprio and Howard (1984) on the other hand, found a strong association between savings and the current account.

Other models showed that saving-investment correlation is not the result of market imperfections only, it may be due to other exogenous disturbances. For example, Obstfeld's (1986a) life cycle model demonstrates that shocks to productivity generate co movements in saving and investment. In Finn's (1990) model the, co movements stem from positively autocorrelated domestic and foreign technology processes. McClure(1994) also explained the S-I association mainly in terms of the variance covariance structure of exogenous shocks.

The empirical literature on F-H puzzle includes both cross-section and time series investigations. Dooley, Frankel and Mathieson (1987) are the first examples whose findings supported F-H puzzle. They examined 62 countries out of which 48 were developing countries and 14 were OECD countries. They found that saving investment correlation is higher in OECD countries than in developing countries. They split the sample into two sub-periods, the fixed exchange rate period and the floating exchange rate period. Their findings also suggested that saving-investment correlation is higher during floating exchange rate period for both OECD and developing countries. Bayoumi (1990) found evidence of progressive liberalization of domestic financial markets and the dismantling of capital controls. Wong (1990) showed that the size of non-traded sector can explain the high saving investment correlation. Mamingi (1994) investigated the F-H regression using time series estimation for 58 developing countries. He also found that saving investment correlation is much weaker for developing countries than for OECD countries. He argued that developing countries are usually small open economies where fiscal policy used for demand management purposes will be unable to crowd out private sector investment. Sinn(1996) insisted that using decade averages leads to high saving-investment correlation. Krol (1996) argued that the F-H puzzle is related to estimation technique and reported that lower estimates are obtained by using fixed effect panel regression. Vamvakidis and Wacziarg (1998) found that the correlation between saving and investment is lower or close to zero in a sample of developing countries. Isaksson (2001) explain this finding by foreign aid. Ho (2002) insisted that the power of estimation technique matters as he found in a study on 20 OECD countries where he applied DOLS and FMOLS.

There have been a number of studies that involved time series data. The first one is due to Obstfeld (1986a) who considered seven OECD countries and found that saving-investment correlation differed significantly from 1. A number of papers employed cointegration techniques. Saving-investment were found cointegrated in a study on the U.S.A. by Miller(1988), by De Hann and Siermann (1994) for some OECD countries. Bayoumi (1990) argued that to a large extent, the saving investment correlation reflects endogenous inventory investment behavior. Hoffmann(1998) stressed that in intertemporal optimization models of current account dynamics, the budget constraint will lead to high correlation and hence cointegration between saving and investment.

Malingi (1997) by using FMOLS found that S-I correlation is generally lower in developing countries as compared to OECD countries. Hussein(1998) showed that capital is highly mobile in 18 OECD countries while in 5 other countries, he found support for F-H puzzle.

Monte Carlo techniques were also used by some researchers. Jansen (1996) indicated that the effect of intertemporal budget constraint is strong enough to account for the F-H puzzle. Coakley et al. (1994, 1995ab and 1996) argued that it is simply a statistical artifact of cross section regression. Using panel data techniques, they strongly rejected the null of non-stationary current balances which implied that saving and investment cointegrate with a unit coefficient consistently with their time-series analysis. Sachsida and Caetano(2000) provided an alternative explanation of the F-H puzzle based on domestic and external savings substitutability.

Corbin(2001) recognized the importance of controlling for the heterogeneity of countries in a cross-section analysis of the S-I correlation for a group of countries using panel data. He concludes that high S-I correlation is more due to country specific effect than to the existence of common factors affecting all the countries in his sample.

Ho(2003) augmented the empirical literature by examining the threshold effect of country size and got supportive evidence. Vita and Abott (2001) found that there is high correlation between saving and investment in the U.S.A. by applying ARDL (Autoregressive Distributive Lag) bounds testing. This correlation however weakened during the more liberalized floating exchange rate period. Kasuga (2004) employed cross sectional analysis and concludes that the impact of domestic saving on investment depended on financial systems and their development. Usually in developing countries with bank-based and /or relatively inefficient financial sectors, the lower saving investment correlation is not unexpected. Narayan (2005) showed that low capital mobility also causes high saving investment correlation in a study on China during the period of restricted capital mobility as indicated by low foreign direct investment (FDI).

Therefore a number of factors have emerged empirically to explain the saving investment correlation in both developed and developing countries. The findings of this study will be limited to only saving investment correlation and is not intended to single out a factor that may substantially explain this correlation, be it high or low.

3. Data and Methodology

Data

This study includes panel data on investment and savings for five South Asian developing countries namely Bangladesh, Pakistan, India, Nepal and Srilanka over the period of 1973 to 2002 compiled from the World Development Indicator (WDI) Database 2004 CD-ROM. Since the sample size is small, to avoid the loss of degrees of freedom we considered yearly data for our study as has been the feature of many panel data studies these days. We calculated investment as a share of GDP (investment–GDP ratio) and domestic savings as a share of GDP (saving–GDP ratio) to estimate our models.

Panel data methods

Let I_{it} be the (domestic) investment–GDP ratio of a country *i* at time *t*, and S_{it} be the (domestic) saving–GDP ratio, then in an environment of free capital mobility, one would expect very poor correlation between these two variables in the following regression

$$I_{it} = \alpha + \beta S_{it} + u_{it}, \qquad u_{it} \sim iid(0, \sigma^2), \quad i = 1....., N, \;\; t = 1....., T \tag{1}$$

and the value of should approach zero. Equation 1 is the baseline model and known as the Pooled OLS (POLS). Estimation of pooled data using simple OLS technique is however, sometimes inadequate. This ignores any country specific effect that is unobservable. In other words, POLS imposes homogeneity on both the intercept and slope parameters. The fixed effect (FE) estimator, on the other

hand, allows heterogeneity in the intercept that accounts for country specific effect by introducing dummy variables[1] as in the following regression

$$I_{it} = \alpha_i + \beta S_{it} + u_{it}, \qquad u_{it} \sim iid(0, \sigma^2) \tag{2}$$

which is then estimated using OLS method. Another closely related method that allows time specific heterogeneity in addition to the country specific heterogeneity in the estimation, is known as the two–way fixed effect (2FE) and can be formulated as follows

$$I_{it} = \alpha_i + \alpha_t + \beta S_{it} + u_{it}, \qquad u_{it} \sim iid(0, \sigma^2) \tag{3}$$

This paper also makes use of the random effect (RE) model where the intercept represents the mean value of country specific intercepts as in the following regression

$$I_{it} = \alpha_i + \beta S_{it} + u_{it}, \qquad u_{it} \sim iid(0, \sigma^2) \tag{4}$$

where, $\alpha_i = \alpha + \eta_{\alpha i}$, where $\eta_{\alpha i} \sim iid(0, \sigma_\alpha^2)$. For this model to be appropriate, it is further assumed that the distribution of intercept parameters are independent of the regressor, S_{it} and the error term u_{it}.

A major problem that relates to estimation of panel data is the presence of cross–section dependence (CSD). This may arise due to effects of common unobservable and latent factors that affect all units of a panel. We employ two particular tests in order to detect the presence of CSD, these are Breusch and Pagan [BP] (1980) test and the Pesaran's (2004) (PCD) test (described below). Once the presence of CSD is detected in the data, it is desirable that the estimation procedure takes this into account. In this respect, we apply the between or the cross–section (CS) estimator[2]

$$\bar{I}_i = \alpha + \beta \bar{S}_i + u_i, \qquad u_i \sim iid(0, \sigma^2), \ i = 1.....N \tag{5}$$

Pesaran and Smith (1995) showed that the CS estimator remains consistent in the presence of CSD given that regressors and error loadings are mutually independent. There are other estimators, however, that account for CSD, for example, the common correlated effects mean group (CMG) developed in Pesaran (2006). But, this method is more appropriate for large heterogonous panel (with N =15 or more) rather than small panel as in our case.

Tests for cross – section dependence

Breusch and Pagan (1980) proposed a simple Lagrange Multiplier (LM) test to detect pair–wise correlation. The test statistic is obtained using the following formula

$$CD_{lm} = T \sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij}^2 \tag{6}$$

where $\hat{\rho}_{ij}$ is the sample pair-wise correlation of the residuals. BP show that under the null, the test statistic is asymptotically distributed as chi-squared with N (N–1) degrees of freedom. However, one important condition is that we must have sufficiently large T and small N. Another test which is due to Pesaran (2004) called PCD is conducted using the following formula

$$PCD = \sqrt{\frac{2T}{N(N-1)}} \left(\sum_{i=1}^{N-1} \sum_{j=i+1}^{N} \hat{\rho}_{ij} \right) \tag{7}$$

The PCD statistic asymptotically converges to the standard normal distribution under the null of zero correlation. The paper applies both of these two tests to check the presence of CSD (see appendix).

1 Also known as the Least Square Dummy Variable (LSDV) method. This particular approach is also equivalent to first de–meaning data and then applying OLS.

2 The original Feldstein–Horioka (1980) applied this method to reach their famous conclusion of low capital mobility in a panel of OECD countries.

4. Results

We report results of four models, panel OLS(POLS) model, fixed effect model, random effect model and between or CS in table 1. All these models show that there is statistically significant poor or low correlation between saving and investment in Bangladesh, Pakistan, India, Nepal and Srilanka. Estimation of CS offers more reliable results as cross sectional dependence in the data is taken into account.

We see (from table 1A in appendix) that average correlation is 0.369028** . Both BP and LM test score is 52.94617 and PCD test statistic is 6.391757 rejecting the null of zero correlation at all conventional levels of significance.

Table 1: Estimation Results

	POLS	**Fixed Effect**	**Random Effect**	**Between or CS**
Savings	0.524* (0.047)	0.603* (0.100)	0.594* (0.025)	0.455** (0.210)
t–stat ($\beta = 1$)	–10.128	–3.970	–16.240	–2.595
Constant	0.129* (0.007)	0.119* (0.016)	0.120 (0.095)	0.138* (0.028)
t–stat ($\alpha = 0$)	18.429	7.438	1.263	4.929
R^2	0.390	0.561	0.359	0.501
DW	0.425	0.508	0.492	1.616
Obs.	150	150	150	5

Notes: The Heteroscedasticity consistent standard errors in parentheses which are obtained using the White's procedure.*(**) indicate rejection of the null at 1% and 5% level of significance respectively.

5. Summary and Conclusions

Many theoretical and empirical papers have attempted to explain saving investment correlation in developing countries. In this paper, we find that there exists low positive correlation between domestic savings and investment in Bangladesh, Pakistan, India, Nepal and Srilanka The findings should partially disprove the Feldstein-Horioka puzzle. The poor saving investment correlation does not necessarily imply high capital mobility in these countries since it has been empirically proved that low saving investment correlation can be explained also by a number of other factors such as economic size(Baxter and Crucini, 1993) differences in financial structure across countries (Kasuga, 2003), foreign aid (Isaksson, 2001), the size of non-traded sector (Wong, 1990), poor fiscal policy (Mammingi, 1994), switching from fixed exchange rate to more liberalized flexible exchange rate period (Dooley et al.,1987) country specific effect (Corbin 2001). Some of the authors even hold power of estimation technique (Ho, 2003), data averaging method (Sinn, 1996) etc. responsible for high saving investment correlation coefficient. Finally we conclude that Feldstein- Horioka puzzle still remains a puzzle.

Appendix:

Table 1A: Test for CSD Results

Correlation among the disturbance terms from individual regressions (OLS).

	Ban	***Ind***	***Nep***	***Pak***	***Sri***
Ban	1				
Ind	0.535*	1			
Nep	0.131	0.056	1		
Pak	0.331	0.250	0.222	1	
Sri	0.648*	0.685*	0.394**	0.439**	1
Test Results					
Ave. Corr.	0.37**				
BP	52.95*				
PCD	6.40*				

* (**) rejects the null of no correlation at 1% and 10% level of significance. BP stands for the Breusch – Pagan test and PCD for the Pesaran's test for cross section dependence (CSD).

References

1] Baxter, M., & M. J. Crucini(1993), "Explaining Saving-Investment Correlations," **American Economic Review**, 83, 416-436.

2] Bayoumi, T., "Saving- Investment Correlations: Immobile Capital, Government Policy or Endogenous Behaviour?" **IMF Staff Papers**, 37 (1990), 360-87.

3] Breusch, T. S. and Pagan, A. R. (1980). "Spatial dependence in linear regression models with an introduction to spatial econometrics", in A. Ullah and D. E. A. Giles (Eds.), **Handbook of Applied Economic Statistics**, New York: Marcel Dekker. Caprio, G.A., Howard, D.H., (1984), "Domestic saving, current accounts and international capital mobility." Board of Governors of the Federal Reserve System, International Finance Discussion Paper No. 244.

4] Coakley, J., Kulasi, F. and Smith, R. (1998), "The Feldstein-Horioka Puzzle and Capital Mobility: A Review", **International Journal of Finance and Economics**, 3: 169-188.

5] Corbin, A. (2001), "Country Specific Effects in the Feldstein-Horioka paradox: A Panel Data Analysis, " **Economics Letters**, 72, 297-302.

6] de Haan, J. and Siermann, C. L. J.,(1994) "Saving Investment and Capital Mobility: A Comment on Leachman", Open Economies Review, 5 (1994), 5-17.

7] De Vita, G. & A. Abott, (2002), "Are Saving and Investment Cointegrated? An ARDL Bounds Testing Approach," **Economics Letters**, 77(2), 293-299.

8] Dooley, M., Frankel, J. and Mathison, D. J., "International Capital Mobility: What Do Saving-Investment Correlations Tell US? **IMF Staff Papers**, 34(1987), 503-29.

9] Feldstein, M.(1983), "Domestic saving and international capital movements in the long run and the short run", **European Economic Review**, 21, 129-151.

10] Finn, M.(1990), "On Saving and investment Dynamics in a Small Open Economy" **Journal of International Economics**, 29, 1-21.

11] Ho, T. W., (2002), "The Feldstein-Horioka puzzle Revisited," **Journal of International Money and Finance**, 21 555-564.

12] Ho, T. W., (2003), "The Saving-Retention Coefficient and Country-size: The Feldstein-Horioka puzzle Reconsidered," **Journal of Macroeconomics**, 25(4), 387-396.

13] Hussein K., (1998), "International Capital Mobility in OECD countries: The Feldstein- Horioka puzzle Revisited." **Economics Letters**, 59, 237-242.

14] Isaksson, A., (2001) Financial liberalization, foreign aid and capital mobility: evidence from 90 developing countries. **Journal of International Financial Markets, Institutions and Money** 11, 309-338

15] Jansen J., (1996), "Estimating saving-investment correlations : evidence for OECD Countries based on an error correction model", **Journal of International Money and Finance**, 15, 5, 749-781.

16] Kasuga H.,(2004) "Saving-Investment Correlations in Developing Countries," **Economics Letters**, 83(3), 371-376.

17] Krol, R. (1996), "International capital mobility: evidence from panel data", **Journal of International Money and Finance**, 15. 3. 467-474.

18] Mamingi, N., "Saving-Investment Correlations and Capital Mobility in Developing Countries", **The World Bank Policy Research Working Paper Number** 1211, 1994.

19] McClure, H.(1994), The Feldstein-Horioka puzzle: The IS-LM Model with Optimal Policy." **Open Economies Review** 5, 371-382.

20] Narayan, P.K., (2005), "The Saving and Investment Nexus for China: Evidence from Cointegration Tests, **Applied Economics**, 37(17), 1979-1990.

21] Obstfeld, M. (1986a), " Capital mobility in the World Economy: Theory and Measurement" **Carnegie Rochester Conference Series on Public Policy** 24, 55-104.

22] Obstfeld, M. (1986b), " How integrated are Capital Markets? Some new tests." **NBER Working paper** No. 2075.

23] Pesaran, M. H. (2004). "General diagnostic tests for cross section dependence in panels", **Cambridge Working Paper in Economics**, No. 0435. University of Cambridge.

24] Pesaran, M. H. (2006). "Estimation and inference in large heterogeneous panels with a multifactor error structure", ***Econometrica*** Vol. 74, No. 4, pp. 967–1012.

25] Pesaran, M. and Smith, R. (1995). "Estimating long-run relationships from dynamic heterogeneous panels", ***Journal of Econometrics***, Vol. 68, pp.79–113.

26] Sachs, J., (1981), " The Current Account and Macroeconomic Adjustment in the 1970s, ***Brookings papers on Economic Activity***, 1, 201-282.

27] Sachisida, A. and M. A-R Caetano (2000), "The Feldstein-Horioka puzzle Revisited." **Economics Letters**, 68, 85-88.

28] Vamvakidis, A., Wacziarg, R., (1998) Developing Countries and The Feldstein-Horiokla Puzzle. **IMF Working Paper**. IMF, Washington, DC Wong, D. Y., (1990) What do savings-investment relationships tell us about capital mobility? **Journal of International Money and Finance** 9, 60-74.