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An Empirical Investigation on the Determinants of the Saving-Investment Interaction

Summary: This study aims to shed light on the Feldstein-Horioka (F-H) puzzle, making use of the potential explanations put forward in the related literature. To this end, the study takes a distinct empirical route, combining a cointegration technique and regression analysis. In the first step, we obtain three definitions for the dependent variable that represent the degree of the interaction between domestic saving and investment (S-I), employing a cointegration analysis for 86 countries in the sample. In the second step, each definition of the dependent variable is regressed on potential explanations for the co-movement of the S-I such as openness, country size, productivity shocks, and real interest rate differentials. After examining a number of potential variables for their explanatory power on this puzzle, however, none of the posited variables are found to be statistically significant determinants of the S-I interaction. The results indicate that the size of the economy, productivity shocks or interest rate differentials have almost no role in explaining the S-I behavior. Further, the findings show that openness has no influence on the S-I interaction, suggesting that it is not plausible to view the S-I correlation as an indicator of international capital mobility as F-H did.

Key words: Feldstein-Horioka puzzle, Saving-Investment relations, International capital mobility, Cointegration.

JEL: E20, C32.

There are several approaches in the literature of international finance to examining whether an economy is open to international capital mobility such as the validity of interest rate parity or real interest rate equalization. Martin Feldstein and Charles Horioka (1980, F-H hereafter), however, proposed another approach to test the degree of international financial integration based on the correlation between domestic saving and investment (S-I hereafter). The rationale behind this notion is quite simple although theoretically powerful. Domestic investment has to be financed solely by domestic saving in a closed economy. Therefore, the S-I is expected to be highly correlated in closed economies. On the contrary, saving can flow in and out of an open economy depending on the relative returns, and hence domestic investment can be financed by both domestic and international savings. As a result, the S-I should not, in theory, be highly correlated in an open economy. In order to test their hypothesis, F-H defined a cross section regression of domestic investment on domestic saving, the slope of which is called the "saving retention coefficient". Employing the data

from 16 OECD countries, they documented that the S-I were highly correlated with a saving retention coefficient close to one. Contrary to expectations, this finding suggested that there was imperfect capital mobility across these relatively industrialized and "supposedly open" economies. This is a rather surprising result, known as the F-H puzzle, and thus attracted the interest of many economists over three decades.

Since then, there has been a great deal of studies in the international finance literature raising concerns and criticisms about the F-H study on several grounds. One line of studies, in particular, attempt to theoretically explain that a close relationship between domestic saving and investment is feasible even for the economies with highly internationally integrated financial markets (Maurice Obstfeld 1986; Emanuel Cardia 1992; Marianne Baxter and Mario Crucini 1993; Allan W. Gregory and Allen C. Head 1997; Jacques Miniane 2004). These studies provide several conceptual explanations such as country size, productivity shocks or interest rate parity differentials as to why the S-I can be closely linked even under perfect capital mobility. As a result, these studies reach the conclusion that it is not plausible to interpret a high correlation between the S-I as an indicator of international financial openness as the F-H did. Accordingly, the S-I relationship cannot be used as a test for the degree of international capital mobility. Nevertheless, there are few studies empirically investigating the roles of country size (Tsung-wu Ho 2002; Ho and Ho-chuan Huang 2006; Lutfi Erden and Ibrahim Ozkan 2007), productivity shocks (Henry S. Kim 2001; Soyoung Kim, Sunyung H. Kim, and Yunjong Wang 2007; Erden, Ozkan, and Burak Gunalp 2009) and openness (Mohsen Bahmani-Oskooee and Avik Chakrabarti 2005) on the link between the S-I. A recent study by Nicholas Apergis and Chris Tsoumas (2009) provides an excellent survey on the F-H puzzle, pointing to the significance of the studies empirically examining the possible channels that move the S-I together.

Motivated by these considerations, this study takes another look at issue, empirically investigating the impacts on the S-I link of the arguments raised in the related literature such as country size, productivity shocks, interest rate differentials and openness measure. The central objective of this study, therefore, is to shed light on the Feldstein-Horioka puzzle. In doing so, the paper adopts a distinct empirical approach based on a combination of a cointegration technique and regression analyses. The novelty of this empirical method is that, unlike the methods in the previous work, it allows us to examine the effects on the S-I link of a large set of the arguments at once. Our empirical analysis consists of two steps. In the first step we describe the dynamics of the link between the S-I, performing cointegration tests and estimating the saving retention coefficients for each of 86 countries over the 1970-2008 periods. As is well known, cointegration tests check if the S-I form a meaningful and stable relationship while the saving retention coefficient shows the direction and the magnitude of the S-I interaction. This enables us to define three dependent variables viewed as representing the dynamics of the relationship between the S-I, two of which is obtained from the cointegration analysis and the other is the saving retention coefficients for each country in the sample. In the second step, we model the regression equations in which the three definitions are used one at a time as the dependent variable and the potential explanations for the S-I link are used as inde-

pendent variables. The findings in this paper show that there is almost no significant effects on the S-I interactions of country size, productivity shocks, interest rate differentials, including a measure of openness when considered all together.

The rest of the paper is organized as follows. The first section reviews the literature on the F-H puzzle and identifies the potential factors that lead to the S-I link. The second section describes the methodology for empirical implementation. The third section presents the data and the empirical results from the cointegration and regression analyses. The last section concludes.

1. Literature

There have been extensive amount of research, challenges and interpretations of the Feldstein-Horioka puzzle for the last three decades. It is also claimed to be one of the six major puzzles in the international finance literature by Obstfeld and Kenneth Rogoff (2000). In order to solve the puzzle and theoretically explain a high correlation between domestic saving and investment in relatively open economies, exogenous factors such as productivity shocks and domestic population growth rates as well as endogenous mechanisms such as the role of government policies, the size of the country and the effect of failure of real interest parity have been studied (for examples, Obstfeld 1986; Cardia 1992; Baxter and Crucini 1993; and Miniane 2004).

Productivity shocks have been viewed as one of the key variable to explain the F-H puzzle. The studies by Obstfeld (1986), Enrique G. Mendoza (1991, 1997), Baxter and Crucini (1993), Reuven Glick and Rogoff (1995), Gregory and Head (1999), and Miniane (2004) are some of the theoretical works focused on productivity shocks to explain the high correlation between domestic savings and investment. Each work reaches rather similar conclusions on the S-I link despite the different specifications about the type of productivity shocks, such as global or country specific, temporary or permanent and persistent or not. For instance, in the case of a positive global productivity shock, marginal productivity of capital increases, leading to more investment spending. At the same time, the favorable shock gives rise to household wealth, triggering both more consumption and saving. However, since the shock is global in nature, all economies will be affected in a symmetric way so that each country ends up financing the increases in domestic investment expenditure with domestic savings. In such a case, domestic investment and saving are expected to be closely tied to each other.

There are few studies in the literature emphasizing and empirically testing the effect of productivity shocks as a potential explanation for the F-H puzzle. Kim (2001), Julien Fouquau, Hurlin Christopher, and Isabella Rabaund (2007), Kim, Kim, and Wang (2007), and Erden, Ozkan, and Gunalp (2009) are some recent works focusing on the effect of productivity shocks on the S-I relation. Kim (2001) for OECD countries and Kim, Kim, and Wang (2007) for East Asian countries find that the saving retention coefficient declines only slightly after eliminating the productivity shocks from investment and saving. Hence, they conclude that productivity shocks are not responsible for the high S-I correlation. Fouquau, Christopher, and Rabaund (2007) employ a panel smooth-transition regression model in which output growth is used as a proxy for productivity shocks. They find that the saving retention coeffi-

cient remains statistically the same in response to productivity shocks. However, Erden, Ozkan, and Gunalp (2009) provide empirical evidence that productivity shocks can relate domestic investment to saving in OECD countries. They document that the saving retention coefficient gets larger for the countries subject to large productivity shocks.

The size of an economy is thought of as another major explanation for the S-I relationship in the literature. According to Obstfeld (1986) and Baxter and Crucini (1993), it is natural to expect a close tie between domestic savings and investment for large economies through their dominant impact on the world interest rate. In such cases, the S-I can be highly correlated regardless of international financial openness. The studies by Robert G. Murphy (1984), Ho (2002), Ho and Huang (2006), Erden and Ozkan (2008), and Ozkan, Erden, and Burhan Turksen (2009) empirically investigate the question of whether the country-size argument provides an explanation for the F-H puzzle. To do so, these studies look at whether the saving retention coefficient is responsive to the country size. Murphy (1984) divides 17 OECD countries into two small and large categories with respect to their GDPs and finds a higher correlation between the S-I for large countries. Ho (2002) attempts to measure the affect of country size in S-I relations using panel data for 23 OECD countries. Employing a panel threshold regression that divides the sample into three groups based on relative GDP shares, Ho finds that the saving-retention coefficient is highly related with the country size. As country size increases, the saving retention coefficient gets closer to one. Ho and Huang (2006) for 14 developed countries, using a semi-parametric technique, find evidence that the size relates the S-I positively but nonlinearly. Erden and Ozkan (2007) and Ozkan, Erden, and Turksen (2009), grouping 21 OECD countries with applications of K-means and Fuzzy-c-means clustering techniques respectively, provide some support for the size as an explanation of the puzzle.

The real interest rate differential is also considered to be an explanation for the puzzle. Using a standard open-economy model with perfect international capital mobility, Cardia (1992) shows that the failure of the real interest parity provides an endogenous mechanism through which changes in monetary and fiscal policy influence both domestic investment and national saving. For instance, when the central bank increases money supply, there might be less need for bond-financing the government deficit and a reduction in taxes on labor income. This might spur consumption both in the short and long run, which results in lower levels of saving. As a result of a large increase in consumption spending, the prices of foreign goods decline relative to those of domestic goods to equilibrate the domestic goods market, which in turn increases the domestic real interest rate above the world real interest rate. Thus, domestic investment declines. Clearly, both saving and investment move together in this scenario under an open economy. To the best of our knowledge, there is no empirical study considering the effect of interest rate parity on the S-I correlation.

Finally, the degree of openness to international financial markets can be another reason for a high or low correlation between the S-I. For instance, the correlation coefficient is expected to be very high if the economy is relatively closed to international capital movement because domestic investments are mostly financed by domestic savings. In the case of an open economy with perfect capital mobility,

however, domestic investment spending is not necessarily financed by domestic saving due to an in-and-out flow of foreign capital depending on the relative return rates. This might break down the link between domestic saving and investment. As already mentioned, F-H interprets the interaction between the S-I as reflecting the degree of international capital mobility. If this interpretation is correct, then one would expect that the S-I interaction depends on the degree of international financial openness. In a recent empirical study by Bahmani-Oskooee and Chakrabarti (2005) using a large panel of countries, the saving retention coefficient is found to be lower for more open economies.

2. Empirical Methodology

Unlike the previous empirical works that focus on only one of these potential explanations for the S-I relationship, this work develops an empirical methodology that allows to test the significance of the explanatory factors all at once. The methodology of this study consists of basically two steps: i) obtain dependent variables aiming to represent the dynamics of the relationship between domestic saving and investment by employing a cointegration analysis and estimating the saving retention coefficients for each country in the sample, and ii) investigate the impacts of the potential factors on the S-I co-movement (dependent variables) with an application of regression analysis. Thus we experiment with different definitions that aims to capture the nature and the extent of the S-I link and then use them as dependent variables one at a time against the arguments that might lead the S-I interaction.

2.1 Cointegration Analysis

One natural way to look at the existence of a relationship between the variables (like S-I) that contain stochastic trends is to perform cointegration analyses. The studies on the cointegration test by Soren Johansen and Bent G. Nielsen (1993), Gregory and Bruce E. Hansen (1996), Julia Campos, Nail R. Ericsson, and David F. Hendry (1996), and Johansen, Rocco Mosconi, and Nielsen (2000) point to the significance of testing for cointegration in the presence of structural shifts. These works consider both single and systems cointegration tests with a known break date. Helmut Lutkepohl, Pentti Saikkonen, and Trenkler Carsten (2004) suggested a new approach for cointegration testing with an assumption that there is a simple shift in the mean with unknown break date. Since the data covers the time span of 1970 to 2008, one should take into account of possible shifts in the dynamics of the S-I interaction during these periods. To this end, in this study, the Lutkepohl, Saikkonen, and Carsten (2004)'s cointegration test is employed[1]. At this point, it is worth presenting a brief technical note on the Lutkepohl's test.

Assume that the data generation process consists of a constant, linear trend and the level shift terms given as: $y_t = \mu_0 + \mu_1 t + \delta d_{t\tau} + x_t$ where $t = 1,2,...$, step

[1] In addition to Lutkepohl cointegration test, we have performed the bounds test for cointegration. However, no meaningful differences have been detected. Therefore only Lutkepohl's cointegration test results are presented in the empirical analysis.

dummy, $d_{t\tau}=1$ for $t \geq \tau$ otherwise it is zero, $\mu_1 = 0$. If a linear trend is not present, the process x_t is assumed to have VAR(p) representation, $x_t = A_1 x_{t-1} + A_2 x_{t-2} + ... + A_p x_{t-p} + \varepsilon_t$ where, $\varepsilon_t \sim i.i.d$ with zero mean and Ω covariance matrix. Hence, the vector error correction form (VECM) of x_t is given by $\Delta x_t = \Pi x_{t-1} + \sum_{j=1}^{p-1} \Gamma_j \Delta x_{t-j} + \varepsilon_t$ and coefficients, $\Pi = -(I_n - A_1 - .... - A_p)$ and $\Gamma_j = -(A_{j+1} + ... + A_p) \quad j = 1,..., p-1$. Calculating the trace test statistics from this coefficient matrix, they test the null hypothesis of no cointegration; $H_0(r_0) : rk(\Pi) = r_0$ against the presence of cointegration $H_1(r_0) : rk(\Pi) > r_0$.

In what follows, we explain how the results from the cointegration analysis in this first step will be incorporated into the regression analysis.

2.2 Regression Analysis

In the second step, we perform regression analyses where the explanatory variables are identified with reference to the related literature such as productivity shock, size, interest rate differentials and a measure of international openness.

As for the dependent variable, we experiment with three definitions intended to represent the dynamics of the relationship between the S-I. The first definition (Model 1) is based on whether or not the S-I are cointegrated for each country in the sample, which is therefore a dichotomous variable that takes a value of one if the S-I are cointegrated for a given country and a value of zero otherwise. The decision on the presence of the cointegrating relationship between the S-I is made on the basis of the test statistics for each country being greater than the critical value at 5% level of significance. It is, however, obvious that the higher the value of the test statistics is, the more likely that the S-I are cointegrated. Therefore, depending on a threshold (5% critical value) to group the countries where the S-I are cointegrated might limit the information exploited from the cointegration analysis. To address such a possible shortcoming of the first definition, we use the cointegration test statistics itself as the second definition (Model 2) of the dependent variable. The third definition (Model 3) is based on the saving retention coefficients for each country as they provide the nature of the link between the S-I pointing to the degree of international capital mobility according to the F-H. As mentioned before, the F-H originally looked at whether this coefficient is close to one, in order to test for international financial openness. The deviation of this coefficient from unitary means that the S-I are loosely related or not related at all indicating a higher degree of international capital mobility. To estimate these coefficients for the countries in the sample, as in the F-H' study, we run a regression of domestic investment-GDP ratio on domestic saving-GDP ratio for each country. Hence, the third definition is the absolute deviations of these coefficients from one for each country.

In light of all that, a general form of a regression model can be specified as the following,

$$Y_i = \beta_0 + \beta_1 Size_i + \beta_2 Parity_i + \beta_3 \Pr od_i + \beta_4 Open_i + \varepsilon_i \quad (1)$$

where $i = 1,...,n$, showing the number of the countries in the sample. Y_i is a vector of three definitions for the dependent variable, each of which is employed one at a time in the empirical analysis. Since the first definition of the dependent variable is a dichotomous variable, we use the logistic estimation technique (Logit). As for the other definitions, we use the ordinary least squares method (OLS) to estimate regression (1).

At this point, a detailed explanation of the regressors is in order. Size represents the size of a country proxied by the GDP of the i[th] country relative to overall GDPs of the countries in the sample. Parity shows the deviations from the real interest rate parity. The departures of the domestic real interest rates in each country from the US real interest rates are computed to obtain this variable. Prod denotes the productivity shocks which are the annual changes in the productivity variable for each country. The first differences are taken to remove any trend in this variable to capture its shock component. Finally, open shows a measure of international openness that includes the degree of international capital controls provided by the Fraser Institute.

As equation (1) is a cross section regression, all explanatory variables are the overall mean values over the periods of 1980 to 2005. However, using the overall means of the explanatory variables is too restrictive as it compresses the variations in these variables and thus might limit their ability to explain the S-I relationship. As a result, we use 10 year averages of the variables, Size, Prod and Parity. Since the data on Open are measured in 5-year sequences, we use them as they are. This effort also enables us to check if the variables in question have a time-varying impact on the S-I relationship. To this end, equation (1) can be extended to define the following regression:

$$\begin{aligned} Y_i = {} & \beta_0 + \beta_1 Size80 + \beta_2 Size90 + \beta_3 Size2000 + \beta_4 Parity80 + \beta_5 Parity90 \\ & + \beta_6 Parity2000 + \beta_7 Open85 + \beta_8 Open90 + \beta_9 Open95 + \beta_{10} Open2000 \\ & + \beta_{11} Open2005 + \beta_{12} \Pr od80 + \beta_{13} \Pr od90 + \beta_{14} \Pr od2000 + \varepsilon_i . \end{aligned}$$

3. The Data and Results

The data used in this study come from two main sources: the World Bank and the Fraser Institute. The data on saving-GDP ratio, investment-GDP ratio, GDP, real interest rates, and productivity are obtained from World Bank's World Development Indicators. As a measure of openness, we use Freedom to Trade Internationally (Column 4), that includes International Capital Market Controls (Column 4E), obtained from the Fraser Institute's economic freedom data. We limit the sample of the countries in a way that at least 30 time series observations are available for each country over the periods of 1970 to 2008, in order for the cointegration analysis to be meaningful. This reduces the number of countries in the sample to 86.

To carry out the first step of the empirical analysis, we perform Lutkepohl's cointegration test for each country in the sample. Table 1 presents the results. Comparing the trace test statistics with the critical value at 5% significance level, we reject the null hypothesis of no cointegration for 57 the countries (in italic). Thus the S-I form a stable long-run relationship in 57 out of 86 countries. When we take a glance at these 57 countries, there seems to be no clear pattern pertaining to their sizes, degree of openness, or levels of development. Within 57 countries, there are large and developed countries in the EU or OECD as well as small and developing countries.

As for the second step, we check if the S-I relationship is influenced by country size, productivity shocks, interest parity differentials and an openness measure in a regression analysis. To do so, we obtain the first definition for the dependent variable which takes a value of one for the countries where the S-I are cointegrated and of zero otherwise. In such cases a logit estimation technique is more suitable since the dependent variable is binary. The first two columns of Table 2 show the results. As seen in the first column, none of the independent variables are statistically significant. To see if these variables have time-varying impacts on the probability of the S-I being cointegrated, we use ten year averages of the explanatory variables over the 1980 to 2008 periods. The second column reports the results. However, this effort does not improve the explanatory power of the regression. Thus one natural question to ask is whether dividing the countries into only two categories based on the existence of a cointegrating relationship limits the information extracted from the cointegration test and so reduces the ability of such a dependent variable to represent the S-I link. To address this issue, we use the trace test statistics for cointegration of each country as the second definition for the dependent variable. The results are presented in the third and fourth columns of Table 2 under Model 2. Nonetheless, there is no improvement in the results as all variables are still statistically insignificant. Taken as a whole, although we assess the incidents of the cointegration cases very well in order to represent the S-I link, there appears no significant impact of the factors on the relationship between the two variables.

Finally, we use the third definition of the dependent variable. As mentioned previously, F-H's original test is based on whether the saving retention coefficient is close to one since it shows the direction and magnitude of the S-I relationship. To estimate these coefficients for the countries in the sample, we run a regression of domestic investment-GDP ratio on saving-GDP ratio for each country. These results are not presented to save the space. Using the absolute deviations of the saving retention coefficients from unitary as the dependent variable, we repeat the same regression analysis. The last two columns of Table 2 report the results obtained from Model 3. While the fitness of the regression is improved a little as shown by the adjusted R-squared, it is still too low to interpret that the explanatory variables play a major role in relating domestic investment to saving. Interestingly though, the results in the last column indicate that the coefficients of the productivity shocks during 1980s and 1990s carry a negative sign and are statistically significant. By reducing the deviations of the saving retention coefficients from one, productivity shocks seem to have a time varying impact on the S-I link. In addition, interest parity differentials

during the 1980s also have a significant role in explaining the S-I relationship. Nonetheless, this model as a whole is also insignificant as given by a p-value of 39%. Overall, our findings on the effects of country size contradict with the majority of previous empirical evidence while those on the productivity shocks are in line with them.

It is worth noting however, that the openness measure also enters the models insignificantly. If F-H's initial contention that the S-I correlation can be taken to indicate the degree of international financial integration is correct, one would expect any measure of openness to influence the S-I interactions. Surprisingly, our findings do not provide a supporting evidence for the insight that the more open the economies are, the weaker the S-I relationship or *vice versa*. These results imply that the S-I correlation should not be used to test for the extent to which economies are open to international financial markets. Thus there is no F-H puzzle after all.

4. Conclusion

The main purpose of this study is to contribute to the empirical literature on the F-H puzzle. To this end, we develop an empirical method based on a combination of cointegration and regression analyses, employing a large set of countries covering 86 countries over the periods of 1970 to 2008. The advantage of this method is that it enables us to investigate the impacts on the S-I link of all potential arguments at once. Our empirical approach follows two steps. As the first step, we obtain three dependent variables aiming to represent the S-I relation, two of which come from an application of the cointegration technique while the other one is the deviation of the saving retention coefficients from unitary. In the second step, each dependent variable is regressed on the explanatory variables identified in the related literature that are likely to affect the S-I interaction.

The results indicate that the size, productivity shocks or interest rate differentials have almost no meaningful role in explaining the S-I relationship. Further, the findings show that the openness measure has no influence on the S-I interaction. This is a "puzzling" result because if the S-I relation can be taken to indicate the degree of financial openness, one expects that the measure of openness have a significant impact on the S-I link. Taken as a whole, it seems that F-H's finding is not a puzzle *per se*, but their interpretation of the S-I correlation is misleading. In short, our results from a well-defined empirical framework suggest that it is not plausible to view the S-I correlation as an indicator of international capital mobility as F-H did. However, the question on the possible channels that moves the S-I remains unanswered. For future work, one might consider investigating the effect on the S-I interaction of governments' intervention on the balance of payment or their choice of policy strategies.

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Table 1 Cointegration Test Results

Countries	Test stat.	Countries	Test stat.	Countries	Test stat.
Algeria	12.52	Greece	14.06	*Nicaragua*	*22.52*
Argentina	*19.69*	*Guatemala*	*19.35*	*Norway*	*19.04*
Australia	*18.33*	*Guinea-Bissau*	*16.65*	Oman	12.34
Austria	15.64	*Guyana*	*33.12*	Pakistan	15.86
Barbados	15.75	*Honduras*	*19.14*	*Pap. New Guinea*	*29.08*
Belgium	*16.83*	*Hong Kong*	*20.80*	*Paraguay*	*19.02*
Bolivia	13.06	*Hungary*	*21.72*	*Peru*	*20.29*
Botswana	*23.95*	*Iceland*	*22.33*	*Philippines*	*22.80*
Brazil	15.56	*India*	*17.33*	*Portugal*	*21.13*
Burundi	15.96	Indonesia	11.65	*Rwanda*	*27.31*
Cameroon	*22.82*	*Iran*	*19.20*	Senegal	12.95
Canada	*19.24*	Ireland	10.70	*South Africa*	*23.54*
Central Afr. Rep.	*20.31*	*Israel*	*21.10*	*Spain*	*16.55*
Chile	*18.11*	*Italy*	*20.78*	*Sri Lanka*	*19.35*
China	*23.19*	Jamaica	11.69	*Sweden*	*20.09*
Colombia	*19.77*	*Japan*	*20.25*	*Switzerland*	*17.65*
Costa Rica	*20.46*	Jordan	9.22	*Syria*	*16.62*
Cote d'Ivoire	14.42	*Kenya*	*26.31*	Thailand	14.59
Denmark	*16.57*	*Korea, South*	*17.44*	*Tunisia*	*17.44*
Dominican Rep.	*24.29*	Kuwait	15.81	Turkey	12.45
Ecuador	*23.97*	*Luxembourg*	*20.17*	*Uganda*	*20.51*
Egypt	*20.91*	*Madagascar*	*19.00*	Unit. Arab Em.	10.45
El Salvador	*20.73*	Malawi	11.08	*United Kingdom*	*18.52*
Fiji	*21.49*	*Malaysia*	*16.57*	*United States*	*19.56*
Finland	*17.89*	*Mali*	*18.96*	*Uruguay*	*24.23*
France	14.12	Malta	13.50	*Venezuela*	*21.37*
Gabon	13.73	Mauritius	15.25	Zambia	13.24
Germany	13.77	*Mexico*	*17.26*	Zimbabwe	14.11
Ghana	*18.96*	*New Zealand*	*27.08*		

Note: The critical value at 5% significance level is 15.83. The countries in italic are those where the S-I cointegrated at 5% level of significance.

Source: Authors' estimations.

Table 2 Potential Determinants of the S-I relationship

	Dependent variables					
	Binary (logit) (Model 1)		Trace test stat. (Model 2)		Saving retention coefficients (Model 3)	
	1	2	3	4	5	6
constant	1.002 (1.37)	2.62 (2.47)	16.57 (2.31)*	19.87 (4.94)*	0.88 (0.23)*	1.33 (0.48)*
Open	-0.077 (0.203)		0.176 (0.35)		-0.028 (0.03)	
Open85		-0.58 (0.47)		-0.13 (0.89)		0.027 (0.05)
Open90		0.47 (0.49)		0.12 (0.96)		0.028 (0.07)
Open95		0.058 (0.52)		0.55 (1.13)		0.009 (0.11)
Open2000		0.63 (0.81)		-0.13 (1.39)		-0.08 (0.12)
Open2005		-0.92 (0.66)		-0.67 (1.14)		-0.07 (0.11)
Parity	0.006 (0.054)		0.077 (0.08)		-0.0004 (0.006)	
Parity80		0.008 (0.027)		0.005 (0.008)		-0.001 (0.0006)**
Parity90		0.003 (0.08)		0.065 (0.12)		0.001 (0.005)
Parity2000		-0.07 (0.08)		-0.105 (0.15)		-0.012 (0.008)
Prod	18.03 (17.84)		8.12 (30.6)		-0.74 (2.74)	
Prod80		-5.76 (18.44)		-14.6 (45.8)		-5.41 (3.13)***
Prod90		6.73 (23.2)		-13.2 (46.8)		-8.42 (3.56)**
Prod2000		9.96 (31.68)		35.2 (53.8)		-0.38 (6.14)
Size	6.419 (6.354)		3.08 (4.97)		-1.04 (1.28)	
Size80		-103.3 (371)		-144.6 (373)		27.9 (37.1)
Size90		-27.3 (410)		128.4 (424)		-36.04 (41.1)
Size2000		160.5 (152)		22.7 (89.4)		7.33 (9.31)
Adj-R^2	0.018	0.119	0.015	0.08	0.03	0.24
Model (p-value)	0.76	0.85	0.87	0.99	0.63	0.39
D-W stat.	1.87	1.93	2.07	1.74	2.09	1.84

Note: The numbers in parentheses are White's heteroskedasticity consistent standard errors. The asterisks *, **, and *** indicate 1%, 5% and 10% significance levels respectively.

Source: Authors' estimations.

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