SCHOOL OF ECONOMICS

Discussion Paper 2005-11

An Extended Feldstein-Horioka Test for the Degree of Capital Mobility

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ISSN 1443-8593
ISBN 1 86295 293 0

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Abstract

The paper proposes a test for degrees of capital mobility utilising an extended Feldstein-Horioka condition. In applying the extended condition, we find that high international capital mobility was not strongly correlated with development and only small open economies displayed results consistent with perfect capital mobility.

JEL Classification:
F36, F41, F21

Keywords:

International Capital Mobility, Feldstein-Horioka Condition,
Savings-Investment Ratio

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1. Introduction

The purpose of the paper is to test the hypothesis that the degree of capital mobility will vary with stages of economic development and financial crises utilising an extended version of the Feldstein-Horioka condition. Capital mobility has been identified as an important issue for development and welfare. Relatively free capital mobility is assumed to enhance welfare by enabling capital resources to be deployed more efficiently where they will generate the highest return. Developing nations are assumed to be capital poor with higher marginal returns on capital, and therefore improved access to capital markets may assist in increasing the rate of growth and development of developing countries, with higher returns on investment for capital from developed nations. More recently, international capital mobility has been identified as a source of development risk, with rapid capital movements being a strong factor in explaining the Asian crisis of 1997-1998.

The paper tests the extended version of the Feldstein-Horioka (FH) model by creating six country panels representing different stages of economic development. The larger developed countries are represented by the G7, while the smaller developed nations outside the G7 are labelled the 'small open' economies. In addition, a Newly Industrialised Group is distinguished from Developing Asia and Latin American groupings. Fifty five countries are included in six country panels, so panel estimation methods are applied to assess the degree of capital mobility in each panel. The analysis begins with a modification of the original FH Condition to allow both foreign and domestic savings to finance domestic investment.

2. Extended Version of the Felstein-Horioka Condition

We develop a model which takes into account both domestic (S) and foreign savings (S*) as funding sources for domestic investment. To achieve this we identify four conditions from the capital market integration literature as follows:

Financial Autarky: $$\frac{I}{Y} = \frac{S}{Y} \quad (1)$$

Investment Rules: $$\frac{I}{Y} = \alpha_0 - \alpha_1 \cdot r \quad (2)$$

$$\frac{I^*}{Y^*} = \alpha_0{}^* - \alpha_1{}^* \cdot r^* \quad (3)$$

Real Interest Rate (Restricted Capital Mobility) $$r_\theta = \theta \cdot (r_a - r^*) + r^* \quad (4)$$

Expression (1) represents financial isolation (autarky) where all of the investment in domestic capital is funded from domestic savings as defined by Feldstein and Horioka (1980). The linear investment demand functions are rationalized in Frankel (1992) and by Dooley, Frankel and Mathieson (1987) while the domestic real rate of interest is given by (4) where $\theta \cdot (r_a - r^*)$ measures the differential yield required between domestic and international capital. This is graphically illustrated in Figure 1.

θ includes all forms of flow restrictions or biases such as taxes, capital controls, information costs, portfolio preferences, home bias or risk differentials, effectively representing all factors influencing perceptions of the *after tax returns* following Dooley and Isard (1987). The effective home bias premium is $\theta \cdot (r_a - r^*)$. A domestic investor internalises this cost for international investment. The premium is assumed to be proportional to the difference between the rate of interest that would exist under autarchy and the world rate of interest. The normal expectation is that θ lies in the range $0 \le \theta \le 1$. Negative values of θ represent

negative home bias, where the preference is for savings to be invested abroad rather than domestically. Negative home bias is consistent with lifetime wealth portfolio diversification given a high proportion of non-internationally diversifiable human capital, Baxter and Jerman, (1997). Values of θ in excess of 1 imply some form of dysfunctionality in capital markets.

The value of θ determines the real borrowing rate imposed upon the borrowing country. For example, if $\theta = 0$, there is perfect capital mobility and $r_\theta = r*$. The price of a loan is the foreign (global) rate $r*$. If $\theta = 1$, the real rate on loans is the domestic financial autarky rate r_a. In between 0<θ<1, we have a rate payable on international loans which is the weighted sum of the autarkic rate r_a and the foreign rate $r*$. These building blocks (1) to (4) may be used to derive a domestic investment ratio function when capital flows are restricted $\left(I_\theta / Y \right)$. The derivation is the subject of the following theorem:

Theorem:

The investment ratio in the case of restricted capital flows I_θ / Y is the weighted sum of domestic S/Y and foreign savings ratios $S*/Y*$:

Proof:

Note from (2) and (3) above that

$$r = \frac{\alpha_0}{\alpha_1} - \frac{S/Y}{\alpha_1} \qquad \text{(T-1)}$$

$$r* = \frac{\alpha_0 *}{\alpha_1 *} - \frac{S*/Y*}{\alpha_1 *} \qquad \text{(T-2)}$$

Now the restricted capital flow investment ratio is written:

$$\frac{I_\theta}{Y} = \alpha_0 - \alpha_1 \cdot r_\theta \tag{T-3}$$

Substitute (4) into (T-3), expand and then simplify:

$$\frac{I_\theta}{Y} = \beta_0 + \beta_1 S/Y + \beta_2 S^*/Y^* \tag{T-4}$$

where

$$\beta_0 = \alpha_0(1-\theta) - \alpha_1(1-\theta)\frac{\alpha_0^*}{\alpha_1^*} \tag{T-5}$$

$$\beta_1 = \theta$$

$$\beta_2 = \frac{\alpha_1(1-\theta)}{\alpha_1^*} \tag{T-7}$$

Q.E.D

We can see all of the special cases in (T-4) above. In particular if $\theta = 1,\ \beta_0 = 0,\ \beta_1 = 1$ and $\beta_2 = 0$; and $I_\theta/Y = S/Y$. This is defined as complete immobility and financial autarky as defined by FH. At the other extreme, if $\theta = 0$ then $\beta_1 = 0$ and $\beta_2 = \alpha_1/\alpha_1^*$ so that all of the investment loans required are secured internationally at the rate r^*, and, $I_\theta/Y = \beta_2 S^*/Y^*$. This represents perfect capital mobility in this extended framework.

We now proceed to test the extended version of the model utilising panel estimation methods.

3. Data

Data on Gross Investment, Gross Savings and Gross Domestic Product is taken from the IMF *International Financial Statistics* Database. Table 1 indicates the countries in each panel. Unit Root Tests indicated the likely presence of non-stationarity in the data in levels, but not in first-difference form for many of the 55 countries included in panels.

4. Results

Equation (T-4) is run in first difference form so that the issue of non-stationarity does not arise.

$$\left(\frac{I_t}{Y_t} - \frac{I_{t-1}}{Y_{t-1}}\right) = \beta_0 + \beta_1 \cdot \left(\frac{S_t}{Y_t} - \frac{S_{t-1}}{Y_{t-1}}\right) + \beta_2 \cdot \left(\frac{S*_t}{Y*_t} - \frac{S*_{t-1}}{Y*_{t-1}}\right) \quad (5)$$

Equation (5) is tested using six country panels: the G7, Newly Industrialised, Small Open economies, Transition economies, Developing Asia and Latin America. Panels were estimated utilising Pooled Least Squares. Results for the Pooled Least Squares for the panels are reported in Table 2. Developing Asia and Latin America are tested over two periods firstly 1993-2002 and secondly 1981 to 1997 to examine the possible effects of financial crises over the 1997-1998 period.

The Panels were tested for fixed and random effects including the Hausman test and alternative parameter estimates made utilising Pooled Least Squares assuming fixed effects and Pooled Generalised Least Squares assuming random effects. In all cases and tests, parameter estimates of β_1 and β_2 were not impacted by the potential for cross-sectional fixed or random effects. [1]

The estimated value of β_1 are always significant in equation (5) except for the Transition, Developing Asia 1993-2002 and Latin America 1993-2002 which included the 1997-1998

[1] Panel Data results were generated utilising Eviews-5. Panel Data results for the Pooled Least Squares (assuming neither fixed nor random effects) are shown in Table 2. Results of Redundant Fixed Effects Likelihood Ratio tests and Hausmann Tests are available from the Authors. Additional panel data results for the Pooled Least Squares assuming fixed effects and Panel Data results for the Pooled Least Squares assuming random effects are available from the Authors.

emerging market financial crises. The largest value of β_1 is 0.5 for the Newly Industrialized Group, its smallest value (-0.157) relates to the Small Open Economies group reflecting a non-home biased portfolio preference.

If a country's domestic investment is not financed by domestic savings, then it implies that its investment is financed by foreign savings, S^*/Y^*. In this case, the parameter β_2 should take a value equal to α_1/α^*_1. The coefficients on the Δ(S*/Y*) ratio are significant for determining the Δ(I/Y) ratio for all countries and periods except the Transition group, Developing Asia 1993-2002 and Latin America 1993-2002. For the Newly Industrialised countries, small open economies and Latin America 1981-1997 groups, the coefficient on the S^*/Y^* is not significantly different from one, supporting the hypothesis that domestic investment is strongly influenced by foreign savings.

Negative β_2 coefficients occurred in three of the panels, Transition, Latin America 1993-2002 and Developing Asia 1981-1997. Only the latter was statistically significant. It is intriguing to consider whether this statistical signal of 'dysfunctionality' was a harbinger of the financial crisis to come.

5. Conclusion

The authors have attempted to extend the F-H model to include a role for both domestic and international savings in determining domestic investment and as a measure of degrees of capital mobility. The results show empirical support for the extended model as a test for capital mobility. The model performs poorly over periods of crisis and economic transition,

this is potentially indicative of the capacity of these factors to disrupt international capital flows and the effective operation of capital markets through capital flight.

The empirical analysis provided support for the hypothesis that the effective harnessing of domestic savings could be important for successful economic development. By this measure, the Newly Industrialised Group of countries performed well, while Latin America did not. High levels of international capital mobility were not consistently correlated with development.

A general conclusion is that capital mobility must be considered a question of degree rather than perfection. All groups displayed evidence of international capital mobility, with no group results consistent with autarchy. Only the 'small open economies' displayed results which are generally consistent with perfect capital mobility. The modified version of the F-H condition provides significant potential for further research on capital mobility and tests of the linkage between degrees of capital mobility and economic development.

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Table 1: Panel Group Countries

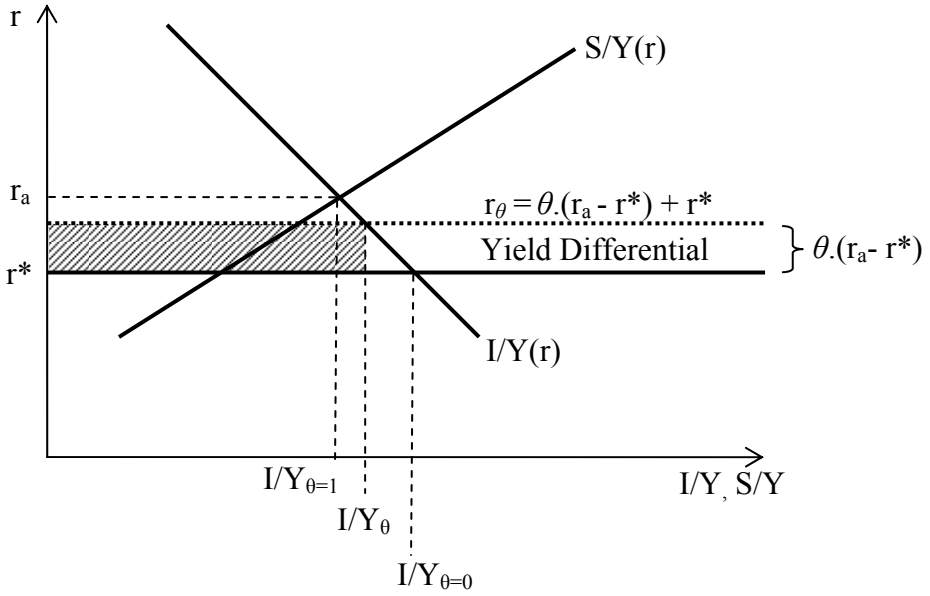
Panel Group	Countries
'G7'	United States, United Kingdom, France, Germany, Italy, Canada and Japan.
'Newly Industrialised'	Greece, Ireland, Portugal, Spain, Hong Kong, Korea, Singapore, and Taiwan.
'Transition'	Poland, Czech Republic, Slovenia, Estonia, Latvia, Lithuania, Slovakia, Russia, Bulgaria, Roumania, Ukraine Kazakhstan and Belarus
'Small Open'	Austria, Switzerland, Netherlands, Belgium, Sweden, Finland, Norway, Denmark and Australia
'Developing Asia'	Bangladesh, Myanmar, Sri Lanka, Pakistan, Vietnam, Indonesia, Malaysia, Philippines, Thailand, China and India.
'Developing Latin America'	Argentina, Brazil, Chile, Mexico, Colombia, Ecuador and Paraguay

Table 2: Results of Panel Estimation – Pooled Least Squares

Panel	Period	$\Delta S/\Delta Y$	$\Delta S^*/\Delta Y^*$	Constant	Adjusted R^2	DW Statistic
		β_1	β_2	β_0		
G7	1993-2002	0.283***	0.523***	-0.001	0.226	1.507
Newly Industrialised	1993-2002	0.512***	1.449**	0.002	0.184	2.346
Small Open Economies	1993-2002	-0.157**	1.030***	0.002	0.117	1.668
Transition	1993-2002	0.038	-0.413	0.000	-0.003	1.654
Developing Asia	1993-2002	0.211**	0.153	-0.003	0.023	1.612
	1981-1997	0.172***	-0.99***	0.001	0.081	1.400
Latin America	1993-2002	0.089	-0.031	-0.001	0.001	1.828
	1981-1997	0.108***	1.019**	-0.001	0.135	1.906

***, **, * Significant at the 1%, 5% and 10% probability levels respectively

Figure 1: Graphical Illustration Savings, Investment and Yield Differentials



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