Saving-Investment Correlation and Capital Mobility-Feldstein and Horioka Approach

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ABSTRACT

The purpose of this paper is to investigate the existence of capital mobility in 10 newly emerging economies by using a model presented first in Feldstein and Horioka (1980). In Feldstein Horioka paper, the beta coefficient (b value) is estimated to measure the relationship between domestic investment and savings. In their original work, Feldstein and Horioka estimated a beta coefficient of 0.87, close to 1, which indicates low capital mobility contrary to the standard economy theory of perfect capital mobility.

Using an annual data from 1997-2013 and panel data econometrics regression to test the relationship between savings and investment, we find results that are contradictory to that of Feldstein and Horioka puzzle. In this study, we got a relatively lower beta coefficient indicating there is some extent of capital mobility in the countries we sampled. We carried out further analysis by including the percentage GDP growth rate and inflation rate as control variables in the model since these variables are factors that influences a nation's domestic investment. Regardless, the saving retention coefficient from all the regression results in this paper is below 0.5, which is relatively far from 1, implying that there is a degree of capital mobility among the sampled countries.

Keywords: Saving, Investment, Correlation, Panel data, and Capital mobility.

ÖZ

Bu çalışmanın amacı sermaye hareketliliğini 10 tane gelişmekte olan ekonomi için Feldstein ve Horioka modeli baz alinarak ölçmektir. Çalışmanın öncüsü Feldstein Horioka (1980) makalesidir ve bu makalede sunulduğu gibi, yerel yatırımlarla tasarruflar arasındaki ilişki beta katsayısı ile ölçülmeye çalışılmıştır. Orijinal çalışmalarında bilim insanları bu katsayının 0.87 ile 1 arasında değişim gösterdiğini ölçmüşlerdir. Bu ölçüm sonuçları bilim insanlarına göre düşük sermaye hareketliliğini işaret etmektedir ve bu değerler standart ekonomi teorisinde yer alan tam sermaye hareketliliğinden daha düşük olarak karşımıza çıkmaktadırlar.

Bu çalışma da 1997 – 2013 yıllarını kapsayan panel veri seti kullanmış ve ekonometrik regresyonu eşliğinde tasarruflar ve yatırım arasındaki ilişkiyi ölçmüştür. Çalışma sonuçları Feldstein ve Horioka (1980) makalesinin aksine, görece düşük beta katsayısı bulmakta ve bu da sermaye hareketliliğini işaret etmektedir. Analiz daha da ileriye taşınarak, yerel yatırım üzerindeki etkileri de düşünülerek GSYİH'daki yüzde büyüme ve enflasyon oranı kontrol değişkeni olarak modele eklenmiştir. Buna rağmen tasarruf tutma katsayıları tüm regresyon sonuçları için 0,5'ten az olarak karşımıza çıkmıştır. Birden çok uzakta gözüken katsayılar bizlere sermaye hareketliliğinin örneklem olarak alınan ülkelerde düşük düzeylerde kalmadığını göstermiştir.

Anahtar Kelimeler: Tasarruf, Yatırım, Korelasyon, Panel veri, Sermaye hareketliliği

DEDICATION

To my parent

They both taught me that there is dignity in learning

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I give glory to the Almighty God for his mercies and faithfulness throughout my life. My sincere gratitude goes to my able supervisor Asst. Prof. Dr. Cagay Coskuner for his continuous support, constructive criticism, suggestion and guidance in the preparation and completion of this study. Without his invaluable supervision, all my efforts would have been short-sighted and so I am grateful to him. A special thank goes to all the Professors in Economics Department who in one way or the other contributed to this work and also to my friends who had always been around supporting me morally.

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LIST OF ABBREVIATIONS

OECD	Organization for Economic Development
FH	Feldstein Horioka
GDP	Gross Domestic Product
G7	Group of 7
PMG	Pool Mean Group
FMOLS	Fully Modified Ordinary Least Square
NICs	Newly Industrializing Countries

Chapter 1

INTRODUCTION

1.1 General Introduction

This paper attempts to test whether there is capital mobility in the sampled 10 emerging economies by building on a methodology originally used by Feldstein and Horioka.

F-H (1980) paper assed the extent of capital mobility in OECD countries by estimating the relationship between saving and investment. To this end, F.H regressed investment rate (measured as investment as proportion of GDP) on saving rate (measured as savings as proportion of GDP). A significant positive relationship especially with a coefficient estimate close to one would imply that domestic investment is characterized (shaped) by domestic savings. This then would imply low capital mobility. On the other hand, the lack of this positive relation between savings and investment would imply the existence of capital mobility.

F.H has used this test for 21 OECD countries for which they have expected high capital mobility. The study covered a time period between 1960 and 1974. The regression results produced a coefficient estimate for savings, close to unity, implying a lack or low capital mobility for the selected countries. This result was so surprising that Maurice Obstfeld and Kenneth Rogoff (2000) identify this as one of the six major puzzles in macro economics. Indeed, this theory seem to contradict

economic belief as traditional economic theory assume if investors can invest anywhere in the world implying capital mobility (free capital movement), they would invest in countries that yield the highest marginal rate of return with the most attractive investment opportunities and also savings of any country will flow to countries with higher yielding interest. As investors will prefer to borrow at the world rate with lower interest rate compared to the domestic market and savers will prefer invest and lend at world's rate with higher rate of return compared to the domestic market. We take note of the fact that different country group have different degree of capital mobility and so while traditional theory assumes general capital movement due to liberalization we expect the degree of extent of capital flow to differ between lower income countries and high income countries.

Later, several authors have tried to solve FH puzzle, different researchers have tested the relationship between investments and savings with different results: Cooray and Sinha (2005) found a low relationship between savings and investment which signifies that these countries investment is based on foreign savings. They carried out their research on 20 different African countries. Baxter and Crucini (1993) just like Feldstein and Horioka re-examined saving and investment correlation among similar industrializing countries and find close relationship between them.

As many papers on the subject have produced mixed results, the puzzle remains to be unsolved. This paper also attempts to continue on this literature by examining saving-investment correlation for 10 rapidly emerging economies. These countries have been selected as they are very well known for their rapidly emerging economies, which have also been very successful in attracting foreign direct

investment and international portfolio investment. In fact, some of these countries have also been major exporters of FDI and international portfolio investment. Therefore, these countries have been selected on the expectations that they are successfully integrated to global economy and international finance markets.

Saving and investment are very important in macro economics. They are key requirements for growth and development. Investment enhances economic growth as the accumulation of physical capital is expected to lead to an increase in productivity and overall production which will have a positive impact on aggregate demand, and employment opportunities. This in turn, leads to increase in the general welfare of a nation. Furthermore, saving supply adequate funds together with resources necessary for investment and consist of private saving (the difference between disposable income and consumption of a house hold) and public saving (difference between taxes gotten by the government and government expenditure). Private savings is done by individuals and households who allocate their disposable income not spent on consumption to saving. The real rate of return or real interest rate banks pay individuals for their savings deposit will influence savings as with higher interest returns consumer tend to save more. In addition, investment will be influenced by interest rate. As the interest rates imply cost of borrowing a higher interest rate will trigger low investment and vise versa.

In analyzing the behavior of capital flow, Feldstein Horioka (1980) used savings and investment as indicators to evaluate the extent of capital mobility between countries. Mobility of capital implies the ability to move capital across national boundaries in pursuit of higher returns. The benefits of capital mobility in an economy cannot be

overlooked. This includes reallocating capital as countries with relatively large interest rate and high investment opportunities can easily borrow from abroad and in turn, high saving countries can lend to these countries with promising investment opportunities there. As a result, both countries are better off. Standard economic approach expect that when there is free movement of capital, capital will flow from countries which are relatively capital abundant to low income and capital scarce countries. This is because more capital is needed in the relatively capital scarce countries and so, the marginal rate of returns for these capital investments will be higher taking into account the risk involved relative to high income or capital abundant countries. Consequently, free movement of capital allows individuals in an economy to have more efficient allocation of their savings as it enables resources to be redirected towards its most productive use. Hence, the flow of funds from capital abundant to relatively capital scarce country in the long run could increase the economy of a country. Capital mobility also improves the consumption or welfare of countries experiencing negative economic shocks in the sense that capital mobility makes it possible for countries with negative shock to borrow from other countries this is not majorly important but it is still one of the perks of free movement of capital between countries.

In a closed economy, investment is financed by domestic saving and as such saving and investment are strongly correlated in such an economy. In other words savings is identical to investment in a closed economy. However, in an open economy domestic investments is not necessarily financed by domestic savings as capital is mobile hence, it can be financed by other countries' saving (foreign saving). This type of investments includes foreign direct investment, portfolio and other investment

derivates. As a result, in an open economy, saving and investment are uncorrelated with no relationship. We see that Feldstein and Horioka in their original work in their original work in 1980 and subsequent work by Feldstein in 1983 observed highly correlated saving and investment among their sample countries. This result have caused major speculation on the part of different authors and research study that disagree with it since a major capital mobility is expected among these countries as result of the world's integration in both trade and the capital market that occurred over the years.

1.2 Objectives

This paper will focus on saving and investment as the major coefficient when testing capital mobility. Feldstein and Horioka's paper using OECD countries was replicated by many authors basing their research on developed countries or different OECD countries this paper will be a different from the others in the sense that it will focus on testing the regression on investment and saving and their impact in movement of capital among newly industrializing countries. This paper using econometrics will make an empirical contribution to the existing extensive research on the relationship between these variable. Understanding the casual correlation between them is very important because, as we explained earlier, the capital mobility, saving and investment are all contributors to economic growth. The importance of this topic in international economics hasn't been emphasized enough so we will shed more light on it using Feldstein Horioka (1980) paper as a framework. The difference is that this paper uses emerging economies as the sample countries rather the industrializing countries as used in F.H paper.

Chapter 2

LITERATURE REVIEW

The aim of this chapter is to perfectly understand the Feldstein Horioka theory on saving, investment and capital mobility and its importance in macroeconomics as a whole. Also, to relate the findings by other researchers supporting or criticizing Feldstein Horioka analysis, the variables included in these authors research, the countries they based their research, their model and their various results.

Basic theory analyze that under perfect capital mobility that is easy movement of capital between countries with no or low transaction cost, investors can easily invest anywhere in the world therefore capital will flow into country which tend to have the highest yield on capital investment. As a result of this, savings and domestic investment will be uncorrelated as individuals save in one country and invest in another.. This standard theory is supported and backed upon by many economists. These three words savings, investment and capital mobility are very important terms in macroeconomics so to have a perfect understanding of Feldstein and Horioka's (1980) let's have a look on what savings, investment and capital mobility means and then form a relationship between.

Saving is basically income not spent done by individuals and household. Saving is an economy action undertaking by both individuals in an economy and the government, it occurs over time with makes it a flow variable and consist of gross

domestic product(GDP) and therefore increase the availability of capital which is necessary for economic growth. Savings involves not consuming all of one's present income and setting this income in a current or saving account.

Investment on the other hand is an accumulation of newly acquired physical resources, such as companies, machinery, buildings, and other inventories this is more of an economic definition of investment. Investment can be defined as any economic undertaking either by private individuals, firm and other business sector with the sole aim of making profit. Standard investment equation is I=GDP-C-G-NX and so investment is anything that remains of the national income(GDP) after subtracting it from government spending, consumption and net exports. However, increased saving does not necessarily means an increase in investment. This applies because savings in cash not deposited into any deposit or financial account cannot be used as investment for any business organization, individual or other financial institution with this saving may increase without an increase in investment. According to traditionally economy, if savings fall below investment in the short run, it facilitates an increase in demand and expands the economy. Consequently, if saving falls below investment for a long period of time, it ultimately decreases investment and diminishes future growth. According to Keynesian perspective, saving is what remains after consumers disposable income is spent on consumption, while investment is income used to finance goods that are not consumable but are expected to make profit for more consumption.

Feldstein Horioka argued in their seminar paper (1980) that in an economy where perfect capital mobility exists, investment-saving should be uncorrelated. This is

because investors can borrow from international market and savers can also invest in international capital markets and in countries with the highest marginal rate of returns on capital. This theory seems very logical therefore we except statistically data with low correlation between domestic savings and investment. Adversely, FH empirical result gives an opposite of what was estimated. The high level of saving-investment correlation reported signifies no capital mobility which made it a puzzle. Feldstein Horioka in their 1980 paper correlated savings and investment shares to measure the extent of capital mobility.

Further work by Feldstein (1983) alongside Bachetta (1989) confirmed the Feldstein and Horioka findings. Strzala (2005) interpretation of these result states that 90% of individual savings in these OECD countries are used to finance it domestic investment. Maddison (1991) used an invariant data set for 10countries to review the distant future relationship between saving and investment and concluded that savings and investments are co integrated in many countries. Maddison (1991) result suggests that consumption demand and supply shocks explain much of time invariant between total saving and investment. Bayoumi (1989) got a similar result as that of FH during the post war era and attributed this high saving-investment correlation to government policy, stating that government policies to improve the economy in the post war period have great effect in the relationship between saving and investment. Sb kim (1993) also backed Bayoumi (1989) theory that government interferences had a impact on correlation between saving and investment; countries with relatively high saving-investment tended to have government that countered widening current account imbalances with fiscal policy and countries without these government actions have relatively lower saving-investment correlation. Roubini (1988) studied

saving-investment correlation in relation to current account and budget deficit using a model that could explain Feldstein Horioka puzzle. Using an empirical test of the model for a sample of 18 OECD countries present robust affirmation the non segregation present in the international capital markets are widely integrated and that Feldstein Horioka puzzle might be explained by the essential role fiscal deficits play in determining a country's current account saving behavior. Caprio, Howard (1984) also examined Feldstein Horioka proposition stating that over medium run variation in a country's domestic saving rate are reflected almost exclusively in offsetting movement in domestic investment rather than in country's current account. Using a data set of 23 OECD for their analysis within a time frame of 18years, Caprio and Howard (1984) found evidence against Feldstein Horioka work stating that if government policies is taken into account and included in the model a relatively low saving coefficient will be observed. Telator, Telator and Bolatoglu (2007) using data from European countries and applying Markov-switching model with heteroskedastic disturbance, they found that the correlation coefficient between saving and investment are unstable due to policy regime. Eichegreen (1990) also studied this theory basing his research within the time period of 1902-1913 and came up with an estimate of saving and investment correlation of (0.5-0.7) , Eichegreen supported that high capital mobility may be as a result of government policy which discouraged overseas lending and their intervention in the capital market.

The estimation technique used in regression this relationship is important. Obstfeld (1995) based their analyses on cross section regressions following Feldstein and Horioka and observed a saving coefficient fairly lower than that of FH. However, authors like Kim(2001), Kim and Wang(2007) based their analysis using time series

which appear to give us a vast divergence of saving and investment as real interest rate is an essential variable when ascertaining saving-investment relationship using a time series approach which is not really used in the cross sectional approach applied by Feldstein and Horioka.

Zevin (1992) selecting his data set with a sample of 8 countries with the inclusion of price and quantity as criteria for measuring financial openness in the nineteenth and twentieth century and came up with the conclusion that saving and investment coefficient to be 0.51 and so the absence of a one to one relationship. However, we keep in mind that the sample country sizes are not the same. Sinn (1992) regressed the variables using a panel data approach included productivity, terms of trade, global shocks and county specification were used as factors and established a positive correlation between saving and investment. This policy regime is usually controlled by the government..

Georgopoulos & Hejazi (2005) came up with the finding that larger economies are more dependent on on domestic source of investment. Pelgrin and Schich (2008) used panel data approach with a sample of 20 OECD within the period of 1960-1999 and got robust Investment-Saving interrelation. Miller (1988) looked at investment-saving connection as well, and found that the variables are only correlated when the central back controls the exchange rate regime but not when exchange rate is determined by demand and supply of foreign currency, he used exchange rate as a factor in determining capital mobility. Grier (2009) studied how close the variables are interrelated within USA from (1947-2007) and found a positive relationship in the short run. However, this relationship has weakened over time. Rossini and

Zangheiri (1993) investigated Feldstein Horioka proposition using mostly European countries and also introduced investment variable after netting out foreign direct investment (FDI). Their result found a decrease in Feldstein Horioka coefficient during the 1980's and an increase in the coefficient over 1990's. Schmidt (2003) states that movements and changes in consumers propensity to save have a major impact in increasing the variables correlation. This statement supports the fact that while domestic saving rate respond endogenously, domestic rate does not. Mamingi (1997) tested saving and investment relation using a sample of 58countries and time period between (1970-1990) and found that saving and investment correlation is higher for low income countries compared to those of higher income countries.

Authors' contribution in FH work provides empirical evidence that the model used for the analyses of saving and investment correlation is also an important factor along with the variables included in the model. R.Wacziarg (1988) paper showed that high saving retention is discovered only among OECD and saving-investment variables are not correlation in other countries (for example less developed and developing countries) are considered. A. Vamvakidis (1998) paper present new empirical results of Feldstein and Horioka points using an extended sample of countries and he find that correlation coefficient in a regression of the rate of domestic investment on the rate of domestic saving is statistically insignificant over time and predominantly less than 0.3 for sample countries other than the OECD countries.

Feileke (1982) did his research using 87countries within the time period of 1968-1977 and got a saving-investment correlation of 0.662. Frankel and Mathieson

(1987) based their results on 48 developing countries within the time period of 1974-1984 and got a saving-investment correlation of 0.455 and got a coefficient of 0.610 for the period of 1974-1984. Sinn (1992) also recognized that in the absence of measurement error, business cycle effects cause an upward bias in saving and investment coefficient, this is because they cause positive co movements in saving and investments rate. Ketenci (2010) paper investigated investment and saving relationship within the time period of 1970-2008 using countries grouped according to their boarder, size and economy growth such as OECD, EU15, G7 and NAFTA and came up with the empirical finding that reveal exists only in panel of G7 countries where the saving and investment coefficient is estimated at the level of 0.754 and 0.864 for the full sample of G7 countries and other stable countries. Kumar and Rao (2011) recent paper estimated the Feldstein Horioka equation from 1960-2007 with a sample of 13 OECD countries using panel regression and found that Feldstein Horioka puzzle exists in weaker form with a smaller saving retention coefficient. We bear in mind that Feldstein and Horioka based on work using cross section regression. Hence, the estimated regression used in the analysis could have influence on the saving retention correlation.

After listing FH original work as a macro economics puzzle, Obstfeld Rogoff (2000) using 8 OECD countries estimated a coefficient of 0.60. Obstfeld noted the durability of Feldstein and Horioka puzzle as the fundamental analysis simply explains in a compendious manner the point that OECD countries current accounts appear to be remarkably small relative to overall saving and investment, this is more pronounced when the mean is taken over time. It is a record that developing countries have continuous problem in financing their debt, so it is not quite shocking that creditors

and global financial institution like the international monetary fund (IMF) try to use policies to prevent them from incurring large budget deficits. Consequently, for OECD countries it is not quite easy to obtain default risk at gross international flows of financial assets are much bigger than net international flows. Later empirical work by Obstfeld, Kollias, Mylondias and Paleologou (2008) using 15 European Union members analyzed the relation between savings and investment using ADRL approach and panel regression. Their regression yields a saving investment correlation of (0.148-0.157) implying capital mobility in these European countries. Fouquau, Hurlin and Rabaud (2008) looked at factor such as the degree of a country's openness, size and current accounts on the relationship between saving and investment using panel data model, and a sample of 24 OECD countries for 40years and they concluded with the results that investment and saving are indeed influenced by these factors. Also, Naryan and Narayan (2010) in their recent study used Gregory and Hansen Residual based structural break for co integration for G7 countries over the period 1997-2002 with the result that capital is highly mobile in these countries and there is no significant evidence of correlation between saving and investment. Telatar (2007) carried out his test using 10 different European countries between 1970-2002 making their work quite different they drew their sample from large countries and relatively smaller European countries and found low correlation between savings and investment in Belgium, Denmark, France, Finland, Italy and Sweden. Whereas, reported no relation at all for the other countries of their study.

Chapter 3

EMPIRICAL SPECIFICATION

Feldstein and Horioka (1980) work have brought about much speculation regarding the high saving coefficient. In examining the relationship between national saving and investment, Feldstein and Horioka (1980) found empirical evidence against the capital mobility. The relation between these variables implies low capital mobility. They used a cross sectional regression of 21 OECD countries regressing fraction of investment and saving on GDP with the regression equation:

$$(I/Y)i = a + \boldsymbol{B}(S/Y)i + Ei$$

Where I=Investment, S=Saving Y= Total national income or National Gross Domestic Product(GDP) (I/Y)=share of investment on GDP (S/Y)=share of saving on GDP. The estimated coefficient was assessed as the saving retention coefficient and it was argued that the value of B determines the degree of capital mobility; a B value close to unity(one) indicate the strong correlation between saving and investment which clearly implies that domestic investment is largely determined by the national savings. On the other hand a B value close to zero(0) indicate the presence of capital mobility which signifies that domestic investment can be financed by foreign savings and domestic savings can finance international foreign investment. The basic data for their analyses includes investment shares to GDP and savings to GDP of the evaluated countries. With the equation outcome:

$$(I/Y)i = 0.035(0.018) + 0.887(S/Y)I \quad R2=0.91$$

We observed based on Feldstein and Horioka result that the value of B coefficient is 0.887 with a standard error of 0.074 is very close to one. Therefore, there is not just a correlation between saving and investment; instead, there is almost a one to one relation.

Several authors have also investigated Feldstein-Horioka paper using panel specifications or other panel integrated techniques such as pool mean group (PMG) and fully modified OLS(FMOLS) with the empirical findings and reports that savings and investment are non stationary and co integrated series Gundlach and Sinn (1992) .

This paper contributes to the original work of Feldstein Horioka by using a panel data of 10 emerging economies for the time period between 1997 and 2013. To this end, a regression equation similar to that of Feldstein and Horioka will be used. Therefore we use the following panel regression with the equation:

Model (1) $(I/GDP)_{it} = a_{it} + B_{it}(S/GDP)_{it} + e_{it}$

Where I is our investment as share of GDP for country i in time t, a our constant coefficient in country i time t, B the saving retention which is going to determine the degree of capital mobility, S savings as share of GDP in country i time period t.

We made saving a major explanatory variable as we try to test the correlation between savings and investments by focusing on the saving coefficient beta (b value). However, we will look at other factors that affect investment such as GDP growth rate and inflation rate.

3.1 GDP Growth Rate

A country's Gross Domestic Product is the total output and income or the total amount of goods and services produced in a country within in year. GDP growth rate measures the difference between the previous year's national output and that of the current year to analysis how fast an economy is growing. GDP growth rate has a positive relationship with investment and affects it significantly. An positive GDP growth rate means the economy is growing, business is booming and companies are making profit this will increase consumers confident and give prospective investors greater incentive to invest(private investment) which will cause a further increase in the GDP. While a negative growth rate signifies a bad economy sometimes recession, consumer loss their business confident, businesses and company loss and so private investment decreases as investor do not have incentive to invest which in turn leads to a further decrease in the economy.

3.2 Inflation rate

Inflation rate measures the persistent increase in the general price level by taking the difference between the present year's inflation and that of the previous year. A country's inflation rate affects its domestic investment. However, the effect of inflation on investment depends on the type of investment. Investing in Treasury inflation protected securities and bonds will provide an investor protection over an increase in the inflation rate as the investor's earnings moves with the inflation rate. However, for other non inflation protected investment such as inventories, retirement and other fixed income. Generally, a higher inflation rate each year causes uncertainty in the economy, distortions and causes a high risk associated with investment. Here, inflation will be measured both in term of consumer prices and GDP deflator.

Since GDP growth rate and Inflation rate affect investment we believe Inclusion of the variables could have an impact in the saving coefficient. Therefore the model equation:

Model (2) (I/Y)i= a + ***B1***(S/Y)it+ ***B2***(GDP growth rate)it+ ***B3***(Inflation Rate) it+ Eit

B1 the saving coefficient is still our major focus of this study as it measures investment and saving relationship.

Chapter 4

DATA

This paper using Feldstein and Horioka approach try to regressed investment on saving to analyze their correlation with an example of ten (10) newly industrializing countries within the time period of 1997-2013. The newly industrializing countries include: Brazil, China, India, Indonesia, Malaysia, Mexico, Russia, South Africa, Thailand. These countries have been selected mainly because of their rapidly developing economies which have also been very well integrated to global markets in terms of international trade and finance. Indeed most of these countries have been major recipient of international investment (both FDI and portfolio investment). Therefore, we expect a capital inflows and outflows to and from these countries. Capital may not be completely mobile, that is, there may not be perfect capital mobility however we expect some degree of capital inflows and outflows in these countries.

Using Feldstein and Horioka regression approach, we need two basic variables: The Saving rates and Investment rates of the sample country expressed as percentage of GDP. These data have been collected for the countries named above for a time period between 1997 to 2013 by using the database of World Bank. Below, in Table 1 and Table 2 we present the descriptive statistics for these variables

Table 1: Descriptive statistics on share of Investment on Gross domestic product

Countries	**Mean**	**max**	**min**	**Standard deviation**
Brazil	17.73	20.69	15,77	1.53
China	42.30	49.29	35.12	5.06
India	30.93	38.03	23.51	5.46
Indonesia	26.09	34.74	11.37	6.98
Malaysia	24.72	42.97	17.84	6.51
Mexico	22.15	24.41	19.58	1.37
Russia	21.10	25.5	14.83	3.32
South Africa	18.23	22.71	15.29	2.24
Thailand	26.19	33.66	20.45	4.11
Turkey	20.03	25.11	14.94	2.97

Source: Author's Computation, using Microsoft Excel, 2007

Table 1 presents the descriptive statistics for investment rates in the selected countries. The investment rate has been obtained as gross fixed capital formation as percentage of GDP by using World Bank as database. The average investment rate ranges from a low of 18% of GDP in Brazil to a high of 42% of GDP in china.

Table 2: Descriptive statistics on share of saving on Gross domestic product

Countries	mean	Maximum	Minimum	Standard deviation
Brazil	17.85	20.99	14.97	2.15
China	46.37	52.65	37,53	5.63
India	27.91	34.02	21.88	4.07
Indonesia	30.31	34.31	19.45	4.26
Malaysia	42.52	48.67	35.45	3.85
Mexico	21.08	22.19	18.53	1.07
Russia	31.37	38.72	21.63	4.75
South Africa	18.38	19.71	15.93	1.20
Thailand	32.28	36.33	30.32	1.89
Turkey	17.06	23.27	13.83	2.79

Source: Author's Computation, using Microsoft Excel, 2007

Similarly, Table 2 presents descriptive statistics for saving rates, measured as percentage of GDP. These data are also directly from World Bank. The yearly average saving rates range from a low of 17% of GDP in Turkey to a high of 47% of GDP in China. Looking at our average saving and investment data measured as (% of GDP) we see that the mean saving and investment are almost the same. While saving rate is higher than the investment rates in Brazil, China, Indonesia, Malaysia, Russia, South Africa and Thailand, the opposite is true for Turkey, India and Mexico. Also, China has the maximum saving ratio while Turkey and Brazil have the minimum saving rate of 13.83% and 14.97% over the period of our study 1997-2013.

Chapter 5

ESTIMATION TECHNIQUES

We saw that Feldstein and Horioka used cross sectional regression to test the degree of capital mobility in OECD countries and got a result of low capital mobility as their saving and investment. This section will review how I will test the degree of capital mobility using saving and investment rates. With a sample of 10 newly industrializing countries and a period of 17years, we expect some degree of capital mobility between these newly industrializing countries, and thus we expect a low relation or correlation between saving and investment. A high correlation will imply that capital is immobile (no capital movement) and so a country is investing whatever it saves.

The model used in the regression is:

$I/GDP = a + b(S/GDP)$

The dependent variable is I/GDP which represent the investment rate as a fraction of GDP. The independent variable is S/GDP which represents the saving rate as a fraction of GDP. Unlike F.H paper which uses a cross sectional data, we use a panel data for this study. Thus, here in this chapter, we review some of the econometric issues related to panel regressions.

5.1 Panel regression

In panel data the variables are a combination of cross sectional and time series as the cross sectional units are followed over time. A panel data test will be conducted for

my model I/GDP= a + b(S/GDP) to test the correlation between saving and investment, panel data produces very reliable results as it controls for unobserved heterogeneity, it reduces the collinearity among the explanatory variables(though these particular model includes just one explanatory variable), increases degree of freedom. Benefits of using panel data includes the large number of data point therefore it could be a reliable result, it controls for unobserved heterogeneity, it reduces the collinearity or multicollinearity among explanatory variables, panel data makes it possible to estimate dynamic equation for example the specification with lagged dependent variables on the right hand side and generally it improves the efficiency of econometrics estimates. A major problem with panel data includes missing/omitted data. However, we shouldn't encounter such problem as the variables have complete data. Hence, a panel study will be ideal for our study.

Hausman Test (Taylor Approach) conducted first will determine if a fixed effect or Random Effects should be used in running the regression. Hausman test result less than 0.5 indicates fixed effect should be used and above 0.5 means a random effect should be used. As a large and significant Hausman statistic means a large and significant differences, and so the null is rejected that the two methods are okay in favor of the alternative hypothesis that one is okay (fixed effect) and the other one is not (random effect).

5.2 Stationarity and Non stationarity

when a time series is stationary its properties and its temporal structure such as variance, mean and autocorrelation structure do not change over time in other words the mean, standard error, standard deviation and other descriptive prosperities are constant over time if not we have the problem of non stationarity. If a time series is

non stationary then the variables or parameters are changing over time. Time series becomes an upward trend, downward trend or a random walk, producing spurious regression results.

5.3 Cointegration

When two or more variables in an equation or model are stochastic they become integrated individually and so there is a long run relationship between them in a time series sense. Hence, this issue is mostly found in time series regression. Unit root test will test for stationary or non stationary. If the unit root test at value zero(0) will tell its non stationary taking the first difference to convert it to stationary which gives first difference stationarity. Cointegration could be tested using dickey fuller test as it tests the stationary in time series.

5.4 Fixed effect VS Random effect

With fixed effect, a single effect is expected to be common to every study or variables while a random effect estimates the mean of a distribution. A fixed effect assumption is that the individual specific effect is correlated with the independent variable and the explanatory variables are non random while a Random effect assumes individual specification effect to be uncorrelated with the independent variable. Fixed effect is the estimator of b (beta) and its derived from applying OLS to the within transformation whereas, Random effect is a weighted average of within and between estimator. In fixed effects, the unit specific effect can be correlated with the X's which is a form of endogeneity (correlation between the parameter, explanatory variable or error term) as a result of time invariant omitted variables on the other hand with Random effect the unit specific effect should not be correlated with the X's. The Hausman test is very relevant as it determines which of them to used in running a regression.

Chapter 6

ESTIMATION RESULT

This study used panel data on gross domestic savings and gross domestic investment as percentage/share of GDP of 10 newly industrializing countries including Brazil, China, India, Indonesia, Malaysia, Mexico, Russia, South Africa, Thailand and Turkey. Initially, the purpose is to test the saving and investment to determine capital mobility. A high saving retention or coefficient implies no capital mobility. Substantially, the study expects a the dependent and independent variables to be unassociated and so we expect a low saving coefficient since transfer of capital occur in these globalization years amongst these countries.

Before running the regression to test the correlation between our saving and investment variable, we take a unit root test to ensure that our data is stationary. After these tests, we corrected for the stationarity and both investment and saving variable became stationary at first difference. We run the test for the first difference for investment and saving for all the countries included using both fixed effect and random effect as they give us similar saving coefficient. The table below gives us the result with a saving coefficient of 0.507171, indicating there is no one to one relationship between saving and investment as Feldstein and Horioka paper. Instead, the result confirms the evidences that there is degree of capital mobility between these countries. With the Durbin Watson test of 1.606 which is fairly close to 2, we do not have an autocorrelation problem. The t-stat for the coefficient of saving rate is

large, indicating the significance of the variable in the model. However, the R2 is low indicating that the model is not complete in terms of explaining all fluctuation in investment rates. However, the main objective of this is not testing variables that influence investment so the R2 is not of major impact here, we just try to test saving and investment correlation

Table 3: Result 1

variables	**Correlation coefficient**	**T statistics**	**Probability (p value)**
dS_gdp	0.507177 (0.114172)	4.44216***	0.0000
C	0.005756 (0.246479)	0.023355	0.9614
		R2	0.133375
		Adjusted R2	0.075213
		S.E of regression	3.117508
		F-statistics	2.293143
		Durbin-Watson statistics	1.606973

*Source: Author's Computation, using Eviews7. ***indicates variables significant at 1%, 5% and 10%. **indicates variable is significant at 5% and 10%, *indicates variable significant at 10%*

Nevertheless, we could include other variables in our model that affects or influences investment in order to increase the R2. For example we try to include Gross domestic product growth rate and inflation rate into the model as these variables affect a country's domestic investment. An increase in GDP to an extent signifies an increase

in a country's economic growth. Therefore, it will have a positive impact in increasing the level of investment in a country. On the other hand, inflation rate should affect investment rates negatively as it creates uncertainty about the overall economy. Inclusion of an growth in Gross domestic product (measured as % GDP growth) and inflation (measured as Inflation rate- consumer price index) into our original model of

(1)) I/GDP= a + b(S/GDP)

Will produce the following regression model:

(2)) I/GDP= a + bi(S/GDP) + b2(% GDP growth rate) + b3(inflation rate)

Using fixed effects test we get result below as presented in Table 6.2 where our saving retention coefficient of 0.26 is lower and statistical significant, gdp growth is also very significant, autocorrelation is not an issue here as our Dublin Watson test of 1.73 very close to 2, R2 increases to 0.63 meaning about 63.2% of the variation in investment as share of GDP is jointly explained by saving and GDP growth.

Table 4: Result 2 for model 2

Variables	**Correlation coefficient**	**T statistics**	**Probability (p value)**
dS_gdp	0.256810	3.336583***	0.0000
	(0.076968)		
Gdp_annual_growth	0.647557	13.23208***	0.0000
	(0.048938)		
Inflation_consumer_price	-0.021711	-1.408528	0.1611
	(0.015414)		
C	-2.715430	-8.267388***	0.0000

	(0.328451)		
		R2	0.632168
		Adjusted R2	0.602141
		Durbin-Watson statistics	1.733220
		F statistics	21.05325

*Source: Author's Computation, using Eviews7. ***indicates variables significant at 1%, 5% and 10%. **indicates variable is significant at 5% and 10%, *indicates variable significant at 10%*

We see that inflation rate measured as consumer prices has a negative sign as expected, but it is statistically insignificant in our above model as so we drop it.

Nonetheless, we run the regression again using inflation rate measured as GDP deflator. However, we get very similar results as to when consumer prices were used to measure inflation as so inflation measured as GDP deflator is still not significant. This result is shown in Appendix B. providing us with evidence that the effect of inflation rate on investment is ambiguous. This is because a high inflation mostly affects non inflation protected investment such as inventories and retirement and other fixed incomes. On the other hand, investment such as securities and bonds earnings moves with inflation so a higher inflation rate does not have a great effect on this kind of investment.

Dropping the insignificant inflation variable, we get our third model:

(3)) I/GDP= a + bi(S/GDP) + b2(% GDP growth)

Running the test again after dropping for inflation using fixed effect with our main variables investment and saving as share of gdp both stationary at first difference with the inclusion of GDP growth rate gives the result below with a saving retention

of 0.25 indicating here is no one to one interrelationship among our major variables and hence there is capital mobility. GDP growth is still statistically significant, we have an R2 of 0.62 and autocorrelation is maintained as our durbin Watson stat is 1.72 close to 2. The fact that the results are not changing much from model 2 to model 3 indicates the robustness of the model.

Table 5: Results for model 3

Variables	Correlation coefficient	T statistics	Probability (p-value)
dS_gdp	0.257499 (0.077222)	3.334532**	0.0011
Gdp_annual_growth	0.665034 (0.047496)	14.00177***	0.0000
C	-2.984312 (0.268167)	-11.12856***	0.0000
		R2	0.627204
		Adjusted R2	0.599496
		S.E of regression	2.051588
		Durbin-Waston statistics	1.7283
		F-statistics	22.63632

*Source: Author's Computation, using Eviews7. ***indicates variables significant at 1%, 5% and 10%. **indicates variable is significant at 5% and 10%, *indicates variable significant at 10%*

The values in the parenthesis are the standard error and the values directly above them are the variables coefficient. With the inclusion of GDP annual growth we get the equation below with standard error in the parenthesis

(I/GDP)= -2.984+ 0.257(S/GDP) + 0.665(GDP_Annual_Growth)

s.e (0.268) (0.077) (0.047)

Using the non stationary of the variables s/gdp, i/gdp, growth rate and lagged investment without correcting for unit root, we get the equation below with the standard errors below in the parenthesis and result in Appendix A.

(I/GDP)= 0.455+ 0.198(S/GDP) + 0.560(GDP_Annual_Growth) + 0.6605(IGDP(-1)

s.e (1.431166) (0.062528) (0.046883) (0.046883)

In all the regression analysis conducted we get saving retention/coefficient of 0.57, 0.25 and 0.198 respectively this indicates that even though there is a degree of capital mobility among these countries and there is no one to one relation between investment and saving. Therefore, based on the standard economy theory if a country's saving rate increases the effect of these increase on investment will not a special effect in one country as these capital will spread all over the world to take advantage of higher interest rate. Thus an increase in a country's saving rate will not necessarily lead to an increased in the domestic investment by the exact same amount

Chapter 7

CONCLUSION

7.1 Conclusion

The preliminary objective of this paper is to investigate the relationship between saving and investment for 10 newly industrializing countries using the original Feldstein and Horioka(1980) approach. In contrast to Feldstein and Horioka that used OECD countries and cross sectional data, this paper instead used a country sample of 10 newly industrializing countries and panel data. Also, it contradicts Feldstein and Horioka findings of high positive correlation coefficient between saving and investment in their sample OECD countries, the present paper shows evident of a relatively capital mobility among the 10 newly industrializing countries, with a much lower saving retention number that is more closer to zero than one as found by the original authors among the OECD countries. After testing for unit root and correcting investment and saving as share of GDP they became stationary at first difference. In addition, a subsequent model was created which included % GDP growth rate and inflation rate (measured both in consumer prices and GDP deflator) as these variables determine an increase or decrease in investment. Also, the inclusion of the variable GDP Growth and inflation have an influenced saving coefficient as it gave a lower value, the single variable inflation appeared to be statistically insignificant and so dropped however GDP Growth have a great influence on the saving retention coefficient as including it decreased the saving coefficient. Taking the lagged value of investment influenced the saving retention coefficient as the value decreased when

the lagged value of investment was taken. Nonetheless, this show evidence of capital mobility among the 10 fast growing industrializing sample countries as in each case applied using only saving as a dependent variable, the addition of other dependent variables and also taking the lagged values of the variables we get nothing above 0.5 which is fairly far from 1 compared to Feldstein and Horioka saving coefficient of 0.89. Hence, with these new findings of this paper, we can now conclude that capital is not immobile among the 10 sample of NICs. Notwithstanding, the paper takes note of the fact that this low saving-investment correlation does not imply perfect capital mobility as there is no such thing as perfect capital mobility in today's integrated financial world. Thus, our findings suggest that there is to some extent a relatively high degree of capital mobility among the selected NICs of the study.

7.2 Contributions

Feldstein and Horioka used only saving ration as a dependent variable in their original paper and got a very high saving retention coefficient. In this paper other variables that influence investment was included that is the GDP annual growth rate and inflation rate and we observed a lower association linking the dependent and independent variable. Also, taking the lagged values of these variables lowers saving-investment relationship. With these addition variables influence and effect on the saving retention coefficient it supports authors discussions that other variables including country size could influence saving and investment correlation; Baxter and Crucini (1993) model is consistent with the fact that the size of a country have a large influence in determining correlation between saving and investment. As a large country will have a bigger saving and investment ratio hence the reason why high saving-investment relationship is observed in OECD countries compared to less developing countries. (Barro, Mankiw,and Sala-i-martin 1995) suggests high tax rate

can reduce both saving and investment and their correlation. (Obstfeld, 1986) also suggests that differences in investment and interest rate will affect saving coefficient this is because investment depends negatively on interest rate so a higher interest rate will trigger low investment and if there is a low interest rate investment will be high. Since interest rate affect investment directly, it will subsequently affect saving and investment correlation. Empirical research by other authors provided evidence Government policy can impact the correlation between these variables. Government and the central bank intervene in an economy to control or correct either trade deficit or a trade surplus. Bayoumi (1989) suggests countries with relatively high saving-investment tends to have government that countered widening current account imbalances with fiscal policy and countries without these government actions have relatively lower saving-investment correlation. All in all, a revisit to Feldstein and Horioka original paper with the inclusion of some of these variables could end the puzzle.

7.3 Implication for Further Study

Many researchers and authors have tried to understand the puzzle behind the high saving retention coefficient conducting their own different research. We seen more cases of one to one relationship among the variables in industrialized countries compared to less developed countries even when OECD countries were expected to have higher degree of capital mobility. Researchers main point of some factors that influence this correlation such as country size, interest rate, government policy, fixed or flexible exchange rate regimes, the extend of trade openness, how strict the tax system is in that given economy, how high the Economy Valve added tax (VAT) is as taxes influence disposable income and in turn affect consumers propensity to consume, save or investment. These factors could play an important role in the

correlation between saving and investment. And so, further research can be carried out with the inclusion of these variables as when they are taken into account they could reduce the almost one to one relationship gotten by Feldstein and Horioka.

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APPENDICES

Appendix A: Model Using Non Stationary Variables

To manipulate these variables, let us regress our non stationary investment and saving as share of GDP variables, the GDP growth rate and an inclusion of lagged investment variable, we get the result in the table below with our saving retention coefficient of 0.19 which is low implying that there is capital mobility between these countries a statistically significant GDP growth and lagged investment, a high R2 of 0.95 and durbin Watson of 1.63 still relatively close to 2.

Result 4

Variables	**Correlation coefficient**	**T statistics**	**Probability (p-valve)**
S_GDP	0.198379	3.172629**	0.0018
	(0.062528)		
Gdp_annual_growth	0.560627	11.95809***	0.0000
	(0.046883)		
I_GDP(-1)	0.660052	13.52479***	0.0000
	(0.048803)		
C	0.454599	0.317642	0.7512
	(1.431166)		
		R2	0.949810
		Adjusted R2	0.599496
		Dublin Watson stat	1.638183
		F statistic	**231.8225**

*Source: Author's Computation, using Eviews7. ***indicates variables significant at 1%, 5% and 10%. **indicates variable is significant at 5% and 10%, *indicates variable significant at 10%*

Appendix B: Model using inflation measured as GDP deflator

We try to regress investment on saving using inflation rate measured as GDP deflator our result below provides us with evidence that GDP deflator is insignificant in our model.

Result 5

Variables	Coefficient	Std Error	T statistics	P-Value
DS_GDP	0.302798	0.076838	3.940736***	0.0001
GDP_annual_growth	0.498176	0.041807	11.91597***	0.0000
Inflation_GDP_deflator	-0.014269	0.010969	-1.300839	0.1952
C	-2.094235	0.286352	-7.313502	0.0000
			R2	0.517980
			Adjusted R2	0.508711
			F statistic	55.87941
			Durbin Watson test	1.395658

*Source: Author's Computation, using Eviews7. ***indicates variables significant at 1%, 5% and 10%. **indicates variable is significant at 5% and 10%, *indicates variable significant at 10%*