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ΘΕΜΑ

THE FELDSTEIN-HORIOKA PUZZLE: REVISITED

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Contents

Section1
Introduction

The high association between national savings and investment rates across OECD countries is one of the best-established facts in international economics. The basis for this fact was Feldstein and Horioka's cross section study in 1980. Feldstein and Horioka found that saving and investment in OECD countries were highly correlated. They interpreted this result as perfect capital immobility. They further stated that with perfect capital mobility "there should be no relation between domestic savings and domestic investment: saving in each country responds to the worldwide opportunities for investment while investment in that country is financed by the worldwide pool of capital". There is no a priori reason to expect saving and investment to be correlated across countries, as investment rates depend on the expected real rates of return, while saving rates depend upon demographic and cultural elements and on the distribution of income.

The Feldstein-Horioka interpretation was controversial since it appeared. It was widely accepted that the financial markets were integrated. The active Eurocurrency markets and the existence of covered interest parity across countries contributed to it. The speed with which the stock market crash of 1987 was transmitted internationally, the large flows of portfolio and direct investment to the rapidly growing markets of East Asia and the ease with which large balance of payments deficits could be financed provided more evidence towards the opposite direction.

Moreover, since the 1980s, we have witnessed the widespread deregulation of the financial markets due to the removal of impediments to cross-border trading of financial investment. Information and communication technology advances have facilitated the 24-hour trading and the easy international transfer of capital.

As a result, economists responded to the FH paradox with questioning both the economic basis of the FH model and the econometric results. Thus, the "puzzle" itself has been replicated in a number of subsequent studies mainly using cross-section and time-series data. Most of these studies produced evidence on the savings-investment association. Given this apparent robust association, attention has focused on reconciling it with perfect capital mobility. In this view, theoretical models that could simultaneously accommodate perfect capital mobility and a high savings-investment association were constructed.

Section 2
General literature review

In 1980, Feldstein and Horioka tested the relationship between savings and investment by running the following regression on a cross-section of 16 industrialised countries:

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

where I = gross domestic investment, S= gross domestic saving, GDP = gross domestic product and I is the country index. The ratios of savings and investment to GDP were averaged over the period of 14 years (1960-1974). The sample period was also split into the intervals 1960-1964, 1965-1969 and 1970-1974 and the regression is repeated for each of the subsamples. In each of these tests the coefficient (b) on savings was found to be in the range 0,85-0,95, insignificantly different from unity. They concluded that 85-95% of national savings was invested in the country of origin and rejected the hypothesis of perfect capital mobility.

They also conducted a number of tests in order to check whether this relationship varied with the degree of openness of the economy, the size of the economy or depended on possible simultaneous equation bias. Overall, they found little support for the hypothesis that savings and investment rates are independent. In 1983, Feldstein himself found that this correlation had not weakened over time. Tobin, commenting on Feldstein's study, argued that if government policies tried to balance the current account on average, and "if these policies continued when saving was increased and full employment were maintained, the extra saving would raise domestic investment", thus domestic saving and investment would be correlated.

In 1981 and 1983, Sachs proposed a modification of the FH model by introducing the current account in the balance of payments. He believed that the current account is an indicator of capital mobility, so he examined the fluctuations in the current account balances of LDC and OECD countries since 1960. He regressed the current account on the national savings and domestic investments and found that investment is more closely correlated with changes in the current account than is savings. The regressions also established that there is a negative correlation between investment and the balance on current account.

Both Feldstein – Horioka's and Sachs' studies encouraged other researchers to try and find the existing relationships between saving, investment and the current account.

In 1984, Penati and Dooley replicated the Feldstein-Horioka and Sachs' regressions using the same time periods, but extending the sample of countries. They confirmed FH results, but found Sachs' regressions to be heavily dependent on one or two outlying observations and the coefficients to be sensitive to the choice of time period. Their regression was based on cross-section data of 19 industrialized countries. They finally reaffirmed that "the data clearly lead one to reject the hypothesis that changes in net foreign assets have become more sensitive to yield differentials".

In the same year, Caprio and Howard focused on the medium run – on the period from one business cycle to the next- and concluded that "only half of any change in domestic savings is matched by changes in domestic investment in the medium run". Contrary to Sachs' results, they reported that " fluctuations in savings were more systematically associated with current account developments than were variations in domestic interest rates".

In 1985, researchers shifted from explaining the savings-investment correlation as a result of imperfect markets to developing models that produce the correlation in response to exogenous disturbances.

Obstfeld was the first to develop such a model. He used a small open-economy framework with an infinitely-lived representative agent to demonstrate that underlying shocks to productivity may generate co-movements in saving and investment. In the life-cycle model he constructed the saving-investment rates are correlated while capital is perfectly mobile. A simulated regression using the data generated by the model yielded estimates quite similar to those found by Feldstein & Horioka.

In 1990, Finn constructed a stochastic overlapping generations, two-country model of savings and investment under conditions of perfect capital mobility. The focus of her analysis was on the relationship between saving and investment dynamics in a small open economy in response to stochastic variations in domestic and foreign production technologies. She found that significantly positive S-I relationships stemmed from positively-autocorrelated domestic and foreign technology processes.

In 1993, Baxter & Crucini developed a two-country, one-good model, a version of the neoclassical model. They found that "positive correlations between saving and investment are a robust prediction of the quantitatively restricted model and that the model correctly predicts that these correlations are higher for larger countries. It also predicts the negative regression coefficient between the current account to GNP ratio and the investment to GNP ratio."

In 1994, McClure investigated the high correlations between saving and investment within an IS-LM framework. He showed how the predicted variability of both the current account and income depends upon the variance-covariance structure of exogenous shocks as well as the degree of capital mobility. He concluded that "if there is no covariance among these shocks, then the only way this model can explain a F-H puzzle is an assertion of zero capital mobility."

Similar models – based on macroeconomic theory to explain the S-I correlation and capital mobility - were developed by Prescott (1986), Dooley(1988), Engel & Kletzer (1989), Wong (1990), Gordon & Bovenberg (1994 & 1996), Feldstein (1994), Sachs & Warner (1995), Barro, Mankiw & Sala-I-Martin (1995), Taylor & Sarno (1997), Moosa (1997).

Apart from the macroeconomic approaches to the F-H paradox, numerous econometric studies appeared since the 1980s. These studies can be broadly divided into two categories: the one using cross-section data and the other time-series data.

In this section, we will review literature concerning the cross-section data studies, while the time-series studies will be extensively analyzed in section 3 –specific literature review-.

Dooley, Frankel & Mathieson (1987) tried to cope with the endogeneity problem, the fact that both national saving and investment ratios are endogenous variables. They conducted an empirical analysis of this problem using a sample of 14 industrial countries and 50 developing countries in 1960-1984 employing both OLS estimation and Instrumental Variable technique. The results were in line with those of F-H in 1980. The positive correlations between levels and changes in national saving and investment rates were apparent both for industrial countries and developing countries and had been higher for recent years compared with earlier periods. The only data that were an exception to this rule includes developing countries that depend primarily on aid to finance their current account imbalances.

Further, in 1990, Bayoumi estimated the FH equation for 10 industrial countries using annual observations for the period 1965-1986. The regressions were run using averages for the whole 21-year period, for the four 5-year subperiods and for the two 10-year subperiods. His results coincided with those of F-H when regressing total saving on total investment, but when regressing private saving on private fixed investment, the estimate of b fell to 0,58 and declines all the time. This fall was consistent with the progressive liberalization of domestic financial markets and the dismantling of capital controls. He also used instrumental variable estimation and the bootstrap technique, but the results remained more or less the same. The time-series analysis that he conducted will be analyzed in section 4.

Tesar (1991) tested the correlation between savings and investment using a sample of 23 OECD countries and concluded that this correlation is both a short and a very long-run phenomenon and is not restricted to a particular sample of countries. Nevertheless, she questioned the fact that this correlation provides evidence on low capital mobility.

In 1992, Sinn argued, based on current account theory, that the current account balance tends to move over time from deficit to surplus and vice versa in order to satisfy some sort of intertemporal budget constraint. As a result, estimation using decade averages would lead to an upward bias in the estimated coefficient, so he used annual data from 1960-1988 for 23 OECD countries. In this way, he found much lower correlation coefficients, which varied substantially from year to year. The S-I link became looser after 1973, but broadly the evidence was in line with the FH results.

In 1998, Hogendorn tested capital mobility in a historical perspective for ten industrial countries from 1865-1992 covering four periods with different characteristics: the gold-standard period with little government intervention (1870-1913), the interwar years with higher formal capital barriers (1919-1939), the Bretton-Woods period during which government intervention was still fairly common (1945-1969), and the period from 1970-1992 that countries have progressively opened their borders to capital movements. The methodology used was the one proposed by F-H and his conclusions regarding the four mentioned periods were as follows:

- ✓ 1st period: the savings retention coefficient was considerably low at 0,553, while it did not denote complete capital mobility.
- ✓ 2nd & 3rd period: the savings retention coefficient was found to be close to one, a fact that showed that the countries in the sample were closed economies, and
- ✓ 4th period: a reversal of the trend was apparent, the estimate of b dropped to 0,804, which was nearly significantly different from 1.

Similar models – based on cross-section regressions to explain the S-I correlation and capital mobility - were developed by Dooley & Penati (1984), Montiel (1994), Lemmen & Eijfinger (1995), Vamvakidis & Wacziarg (1998).

Section 3
Specific literature review

This section will attempt to revise the existing literature on the Feldstein –Horioka puzzle based on time-series analysis of data.

The first one to employ time-series analysis in a study for the Feldstein-Horioka puzzle was Obstfeld in 1986, along with presenting a life-cycle model in which countries' savings and investment rates are correlated though capital is perfectly mobile. The simulated regression using data generated by the model yielded estimates quite similar to those found by Feldstein and Horioka.

He then presented estimates of the time-series correlation between quarterly changes in saving rates and in investment rates for 7 OECD countries. The estimated correlation coefficients turned out to be highest for economies which are either very large (the United States) or have had extensive capital controls over the sample perod (Japan). In all cases, but those of US and Japan, the estimated Saving- Investment correlation over the entire sample period considered (1958-1984), differed significantly from the value of 1 that would be obtained under complete capital mobility.

In 1988, Miller tested the Feldstein Horioka puzzle only in the United States using cointegration techniques. He found that National Saving and Domestic Investment appeared to be cointegrated before 1971, but appeared not to be cointegrated after 1971. He employed seasonally adjusted quarterly series from 1946Q1 to 1987Q3. The series included gross private domestic investment and gross national saving both divided by GNP. In addition, he examined two sub-samples of roughly fixed 1946Q1 to 1971Q2 and flexible 1971Q3 to 1987Q3 exchange rates. Augmented Dickey Fuller tests for stationarity of each series over each sub-sample implied that all series were first-differenced stationary. The results for the two sub-samples implied cointegration during the fixed exchange rates, but no cointegration during the flexible exchange rates. The full sample results presented mixed signals.

Miller's study was severely criticised by Gulley (1992), by arguing that Miller did not take into account the fact that both the saving and investment rates series have non-zero means. He also found that the levels of saving and investment are not cointegrated during either the fixed or flexible exchange rate regime. He included a constant in the equation because the mean of the series is not zero. When he estimated the equation (using the ADF method), both rates were found to be stationary. Moreover, he examined the levels of Saving and Investment for a cointegrating relationship and concluded that both series are first-differenced stationary for all three time periods. A cointegrating regression was then estimated, but no evidence was found for a long run relationship between the two series for any period. No change in the relationship between Saving and Investment during different exchange rate regimes was detected.

In 1990, Bayoumi explored the time-series correlations between saving and investment for 10 industrial countries – US, Japan, Germany, UK, France, Canada, Norway, Belgium, Finland and Greece- covering the period from 1961-1986. He estimated the following equation:

$\Delta(I/Y)_t = \alpha + \beta\, \Delta(S/Y)_t + e_t$,where Δ is the first-difference operator. The method of estimation used was Ordinary Least Squares and the results confirmed the strong correlation between Savings and Investment. He also conducted a number of tests based on the same equation, using total fixed investment, private fixed investment and government fixed investment. The results of these tests broke the link between investment and saving and led him to the conclusion that a large part of the correlation reflects endogenous inventory investment behaviour.

In 1991, Leachmann conducted a time-series study of capital mobility among OECD countries. She implemented various tests for the Saving- Investment relationship, which suggested that capital was more mobile. She studied 24 out of 25 OECD countries (Yugoslavia was excluded due to data problems) for the period 1960-1984. Her approach was strictly stationary because as she stated: «Time-series removes the covariation between S & I rates generated by common causal factors». She used net values of Saving and Investment.

In order to detect the presence of a long-run equilibrium relationship between the saving and investment rates series, she conducted the following tests.

She tested for unit roots in the series using the methodology by Engle & Granger (1987). The result of this test (ADF test) was that each series possesssed a unit root except for the German Investment rates. Then, she tested for cointegration between the two series. She regressed the level of the investment rate on the level of the saving rates for each country and then examined the residuals for stationarity. She concluded that an equilibrium relationship does not exist between S & I in any OECD country, which implied that capital markets were not closed.

Then, she regressed the first difference of the investment rate on the first difference of the saving rate. In 12 of the 24 countries sampled, estimates of b differed significantly from one. The average of the estimated b values was 0,712, lower than Feldstein's estimate. This equation was also estimated for two sub –periods in each country: 1960-1973 and 1974-1984. For 13 out of the 24 countries samples, estimates of b declined in the second period indicating increasing capital mobility. In order to solve the problem of serial correlation in the series, she applied the White's correction procedure. In all regressions that it was appropriate, the variance-covariance matrix was adjusted for inefficiencies due to autocorrelation of the errors and the standard errors were recalculated.

She also regressed the investment rate deviations from trend on saving rate deviations from trend for each country, because the use of a trend variable could allow for factors which change over time but cannot be measured or specified. The results of this regression indicated that in 16 of 24 countries estimates of b differed significantly from one. When breaking the sample period into two subperiods, results indicated that in only 9 of the 24 countries, estimates of b fell in the later period.

She, finally, concluded that national capital markets are more open than the cross-sectional studies implied and that over time these national markets were becoming more integrated to the world pool of capital.

De Haan & Siermann (1994) commented on Leachmann's study. They used a long-run data set for 10 countries to examine the long-run relationship between Saving and Investment. In contrast to the finding of Leachmann, they concluded that Saving & Investment are cointegrated in many countries. They employed cointegration tests to examine the long-run relationship between Saving and Investment. ADF tests with a trend variable included were used to examine the order of integration. They found that both the series are not stationary in levels, but the first differences of Saving and Investment are stationary. In 3 countries, a cointegration relationship existed.

When they changed the sample period and the sample size, the results were mixed, so they concluded that the differences between their findings and Leachmann's were due to both sample size and sample period.

In 1992, Gundlach & Sinn approached the issue of capital mobility and thus financial integration by estimating the following equation:

$$CA/Y=-a+(1-b)S/Y-e,$$

where CA/Y is the current account surplus divided by GDP. They tested whether the current account is stationary or not (i.e. contains a unit root or not), given that the error term is an iid process. If CA ratio was found to be stationary ($b=1$), the country would be a closed economy. On the other hand, if CA ratio was found to be I(1) ($b \neq 1$), then this would indicate different reactions of saving and investment rates to different shocks.

They used the methodologies developed by Dickey & Fuller, Said & Dickey, Phillips and Phillips & Perron to test for unit roots the CA ratio using a sample of 23 OECD countries for the period 1950-1988. Their results showed that at least Germany, Japan, and the US are part of the international capital market. Moreover, by breaking the time period into two sub-periods before and after the breakdown of the Bretton Woods systenm (1972), they showed that there was a considerable increase in capital mobility after 1972.

In 1994, Montiel conducted time-series analysis for a sample of 62 developing countries for the period 1970-1990 using the FH equation. The methods of estimation used were OLS and Instrumental Variables. Both methods were employed for estimation of the equation at levels, first differences and Error correction. The results produced by the different methodologies employed were conflicting, due to various econometric problems. Montiel preferred the estimates produced by the error correction instrumental variables that pointed to high capital mobility of developing countries. He concluded: "taken at face value, the Feldstein-Horioka methodology indicates that developing countries tend to differ substantially among themselves with respect to their degree of financial integration with world capital markets. For a substantial majority of developing countries, however the data are consistent with a substantial degree of financial openness."

Another study applying time-series analysis to developing countries is the one by Mamingi in 1997. She estimated the saving-investment correlations for 58 developing countries (from 1970-1990) in order to assess the degree of capital mobility in the FH sense for these countries. The technique used was Fully Modified Ordinary Least Squares (Phillips & Hansen – 1990) that simultaneously correct for serial correlation, endogeneity, and sample bias. This study found that the savings-investment correlations of many developing countries are lower than those for OECD countries.

In 1994 and 1995, the capital mobility in the European Community was tested.

The first one was by Argimon & Roldan who used co-integration to measure the relationship between saving and investment, both public and private, for the EC countries (excluding Luxembourg, Portugal and Greece) for the period 1960 to 1988 and to explain the reasons for their occurrence. They used the Johansen methodology to analyse and test for cointegrating relationships and they determined the long-run causality through the specification of an Error Correction Mechanism. Cointegration relationships between national saving and investment were found in five countries: Spain, France, Italy, Denmark and Belgium. For Germany, UK and Netherlands, it was not possible to reject the hypothesis of no cointegration. In the case of Ireland, the results pointed to the non-existence of unit roots in the series. Further tests were conducted in order to determine the causality direction from the public gap (Sg-Ig) to the private gap (Sp-Ip) and from saving to investment.

They concluded that the countries studied could be divided into two groups. The first one made up of Germany, the Netherlands and the UK, which are characterised by a high degree of international capital mobility. The second one made up of Spain, France, Italy, Denmark, Belgium and

Ireland, which are characterised by a low degree of capital mobility during the sample period. For these countries saving has been a constraint on investment and the public sector has crowded out the private sector. This result is consistent with open economies where capital controls have been used to target the external balance or to solve external debt-sustainability problems.

The second study concerning the European community was carried out by Lemmen & Eijfinger in 1995. They employed time-series analysis on the concept of cointegration in order to examine the degree of financial integration in the European Community (12 countries). In this respect, they performed ADF tests with a constant term included because Saving and Investment ratios have non-zero means. They used annual data (1967-1990) and quarterly (1970-1990), where available.

They rejected non-stationarity of one or both series only for Italy, Ireland and Portugal. Then they considered three tests for cointegration. The first benchmark was the Durbin- Watson statistic from the cointegrating regression D.W developed by Sargan & Bhargava (1983) and Bhargava (1986). The second was to apply an ADF test to the residuals from the cointegrating regression (OLS and save the residuals). The last test they applied was the one developed by Johansen (1988). They split the sample period in the pre-1979 period and the post –1979 period. In the pre-1979 period Saving and Investment rates were cointegrated in the UK, France, Denmark and Greece. For the post-1979 period the ADF test only finds cointegration for Portugal.

They concluded that the degree of capital mobility has increased since 1979. The empirical results seemed consistent with an increasing degree of capital mobility in the 1980s.

In 1996, Jansen argued that Saving-Investment correlations are best estimated by an Error Correction Model, because an ECM is consistent with intertemporal general equilibrium models. The model he proposed was:

$$\Delta RI_t = a + b\,\Delta SR_t + \gamma\,(SR_{t-1} - IR_{t-1}) + \delta\,SR_{t-1} + e_t.$$

His approach integrated the two steps of the Engle-Granger procedure, while both long-run and short-run dynamics could be simultaneously estimated. The estimate of γ (=0) could signal co-integration. He estimated the ECM on annual data for the OECD countries (exc. Luxembourg), the European Community, and the OECD total in order to detect the large country effect. He found saving and investment cointegrated in the majority of countries – the residuals were always found stationary. The estimate of δ would signal the status of the current account. Only Australia had a significant δ- coefficient, which meant that the current account would not converge to a constant in the long-run. France, Japan, and the OECD had current accounts displaying trend behaviour. For the rest of the countries, the current account converged to a constant in the long-run which is consistent with the intertemporal budget constraint.

On the whole, he concluded that substantial capital mobility was prevalent in Australia, Iceland, Ireland, Netherlands, New Zealand, Norway, Portugal and the United Kingdom.

He also compared four approaches for estimating the long-run behaviour of S&I:

- The ECM,
- The Engle-Granger Procedure,
- D-F test for stationarity of the CA= SR-IR, and
- The trace and maximum Eigenvalue test of Johansen,

And three approaches for the short-run:

- The ECM,
- The F-H static equation, and
- The F-H equation in first differences.

The ECM and the Engle-Granger procedure yielded comparable results for all countries except Germany, Ireland, Japan and UK. The ECM proved its greater power by signalling cointegration at the 10% level for Germany, at the 5% level for Ireland, Japan and the United Kingdom. The tests for the CA indicated that CA is stationary for the large majority of the countries. The ECM and the Johansen approach yielded comparable results. In the short-run, the static equation, which is also the cointegrating relation in the Engle-Granger procedure, produced higher estimates than the ECM. In contrast, using the equation in differences did not appear to be harmful, as the estimates of b were similar. He also found a structural break in the SI relation. In more than half of the cases, the break occurs around 1973-74.

In a second study, Jansen (1997) investigated the small-sample behavior of the cross-sectional S-I correlation, when S and I are cointegrated over time. He showed that the high S-I correlation generally found in the cross-section studies reflects the cointegration of national savings and investment rates in the time dimension. This cointegration may reflect the combined effects of 3 phenomena:

1. The intertemporal budget constraint,
2. Low capital mobility and
3. The long run Current Account targeting.

He conducted Monte Carlo Simulations in order to investigate the small-sample behavior of the cross-sectional S-I correlation and concluded that the effect of the intertemporal budget constraint was potentially powerful enough to account for the Feldstein- Horioka puzzle and to render the associated F-H test of global capital mobility uniformative.

Coakley, Kulasi and Smith (1995-1996) argued that the FH coefficient is not a puzzle, but a statistical artifact of the cross-section regression. "Savings and Investment rates appear to be integrated of order one, I(1), or stationary after being differenced once. The solvency constraint requires that the balance of payments (as a share of GDP) be stationary since debt cannot explode. Since the current balance (the difference between exports and imports plus net factor income and net current transfers from abroad) equals saving minus investment, saving and investment rates should cointegrate with a unit coefficient. The cross-section regression which measures the average long-run coefficient will tend to capture the unit coefficient implied by the solvency constraint, irrespective of the degree of capital mobility."

In 1995, they conducted a survey for 23 OECD countries covering the period from 1960-1992. Unit root tests provided strong evidence that current balances are stationary and that the current balance acts as an error correction mechanism on investment. The unit root hypothesis was rejected for gross saving in only one country and for gross investment only in four of the 23 countries. The methods used were:

- ADF test with the inclusion of trend and the order of augmentation determined by the Schwarz Posterior Odds Criterion. This test rejected the null hypothesis of a unit root at the 5% level for 3 countries for net saving, 1 country for net investment and 10 countries for the balance of payments.

- ADF tests on the residuals of the cointegrating levels regression which rejected the null hypothesis of a unit root for 10 countries for gross measures and 8 countries for net measures.

- Johansen tests for cointegration, using a VAR of order 2, suggested that saving and investment cointegrated with a unit coefficient in only 6 countries. The same 6 countries were identified using both net and gross measures. In 8 countries, no evidence for cointegration was found. Neither the trace, nor the eigenvalue tests accepted the hypothesis of one cointegrating vector at the 10% level for both net and gross measures. This could be explained by the low power of the tests in time series spanning only 30 years.

- The ECM model suggested by Kremers et al. (1992): they estimated the error correction model directly and tested for the significance of the feedback from the balance of payments to the investment. They used a second order VAR model where cointegration with a unit coefficient was assumed and discovered that the balance of payments was significant in 13 countries in the investment equation, but in only 2 countries in the saving equation. The VAR model indicated that lagged changes in S and I were not important in the investment equation, being significant in only one country.

In another study (1996), Coakley, Kulasi and Smith examined the saving-investment correlation in the Less Developed Countries, using a sample of 44 LDCs. The ADF unit root test rejected a unit root in investment for 10 countries and in saving for 7 countries, and showed that the current account was stationary in 14 out of 44 countries. The ADFCR (augmented Dickey Fuller cointegration regression) indicated that the residuals from the cointegrating regression were stationary in only 3 countries. The Error Correction Model used by Kremers et al. Suggested cointegration in 26 countries. Saving and Investment cointegrated in 21 countries according to at least one version of the Johansen Maximum Likelihood procedure tests.

Despite the fact that data pointed to cointegration between S and I according to at least one test for the majority of the LDCs (36 out of 44), the results for the LDCs appeared less definitive than those for the individual OECD countries. This was probably due to the fact that LDCs were more severely affected by shocks such as OPEC oil price increases in the 1970s and consistently ran CA balance of payments disequilibria for sustained periods between 1965 and 1990.

Apart from applying these tests to the OECD and LD countries individually, CKS exploited the panel structure of these data in order to look at them jointly. They used two panel data sets, one for the 44 LDCs (sample period: 1969-1990) and one for the 23 OECD countries (sample period: 1964-1992). The statistic they used was the t-bar statistic based on the average ADF, proposed by Im et al. (1995). Under the null hypothesis of a unit root, this statistic has a standard normal distribution for N, the number of countries, and T the number of time periods, sufficiently large and for N/T going to zero. Under the alternative hypothesis of stationarity the statistic diverges to negative infinity. The expected values and variances of the ADF statistic were calculated by simulation and tabulated in Im et al. (1995), who provided Monte Carlo evidence that this test has substantially more power than individual ADF tests.

In both cases (OECD & LDCs) the panels as a whole strongly rejected the null of non-stationary current balances, a fact that implied that saving and investment cointegrate with a unit coefficient and provided more empirical evidence to their individual time-series tests, presented above.

In 1998, Hussein provided empirical evidence against FH's findings using time-series techniques of dynamic OLS, where the endogeneity of national savings and investment is taken into account. He showed that capital was highly mobile in 18 OECD countries, while in 5 out of 23 countries he found support for the Feldstein-Horioka. Based on Saikkonen

(1991), Stock and Watson (1993) and Inder (1995), he included lags and leads of the first difference of savings in DOLS, eliminated the effect of the endogeneity, while the inclusion of lags of the 1st difference of investment corrected for the impact of the remaining autocorrelation of the residual term. The order of integration was obtained by ADF test and the PP test. The results of unit root tests indicated that the two variables were most likely I(1) for all countries as the null hypothesis of non-stationarity could not be rejected. The statistical significance of the cointegrating parameter was tested by the Wald test and the estimated cointegrating vector was then tested for stationarity.

On the whole, time-series studies point to testing whether the Saving and Investment rate series are integrated and in the case of integration to finding the cointegrating coefficient (vector), thus establishing a long-run equilibrium.

The extensive literature on the Feldstein-Horioka puzzle presented in the two previous sections is an asset to our study, which is time-series oriented. The outline of this study is presented in the next section.

Section 4
Brief outline of this study

The researchers mentioned above tried to deal with the Feldstein-Horioka puzzle by dealing with one or more of the following econometric issues, regarding the FH regression:

- ✓ The problem of identification: It is not clear what theoretical parameter the FH coefficient measures.
- ✓ The problem of mispecification: relevant common factors may have been omitted from the regression equation.
- ✓ The problem of simultaneity bias: saving may be endogenous.
- ✓ The problem of permanent or transitory effects: we are not sure if the FH coefficient is measuring short or long-run impacts.
- ✓ The problem of non-stationarity.

In this study, we focused on time-series analysis of the S-I correlation, thus dealing with the three latter points of the aforesaid econometric issues, for a variety of reasons.

Why time-series rather than cross-section?

- ✓ Saving – investment correlations answer the question of whether a single country is across time financially integrated to the world capital market (time series approach) or a group of countries at some point in time is financially open to the world capital market (cross-section approach).

- ✓ Countries display considerable differences in S-I dynamics in the short run as well as in the long run. The theoretical models developed show that the S-I correlation depends on the nature of the disturbances and the structure of the economy (Finn 1990, Baxter & Crucini 1993). Therefore, there is no reason to expect that the S-I relation is the same for every country in the sample tested, a fact that is implied by cross-section regressions.

- ✓ It is more likely to find a unity correlation between Savings and Investment when capital flows are mutually offset across the countries represented in the sample. The use of long-term averages of the S-I ratios leads to an upward bias in capital mobility correlations. Sinn (1992) points out that the intertemporal approach to the Balance of Payments implies that the Current Account balance moves over time from deficits to surpluses in order to meet the intertemporal budget constraint of the country.

- ✓ The savings retention coefficient obtained over a cross- section of countries might be the result of divergent individual observations. Countries can contribute to a high coefficient either because they have imposed capital controls or because they are large.

- ✓ The cross section analysis is subject to sample selection bias. For example, in the study of Tesar (1991) when Luxembourg is excluded from the sample, the findings change dramatically, as the correlation increase from 0,35 to 0,84.

- ✓ Results from cross- section models are hard to interpret, because as capital mobility estimates are derived at a particular point in time, the key question of how much of an increase in saving truly ends up in domestic investment becomes difficult to answer.

Thus, our approach is strictly time-series. Our sample of countries contains the 24 out of 25 OECD countries and our sample period is 1948-1998. We take annual data (reasons for this is provided in the next section) for the investment rate and the saving rate. The way those measures were calculated is available in the next section-data description-.

A graphical representation of these series is available in APPENDIX B, and the descriptive statistics of the series are shown in APPENDIX C. The co-movement of saving and investment rate is prevalent in the majority of the countries.

In this study, we

- ✓ exploit the statistical qualities of these series,
- ✓ test for stationarity,
- ✓ test for cointegration,
- ✓ estimate the cointegrating coefficient, and
- ✓ provide results from Monte-Carlo simulation.

Section 5
Data description

In this section, we provide description of the following:

- ✓ Sample of countries
- ✓ Time-period
- ✓ Data frequency
- ✓ Data calculation
- ✓ Data source

Sample of countries

Our sample contains 23 out of the 25 OECD countries (16 of which were used by FH). A list of these countries is available in Appendix A. Yugoslavia was excluded due to unavailability of data and Turkey due to a particularly small sample (12 years).

Time-period

We take the longest time series possible in order to increase the power of our tests. For the majority of the countries the longest time-series available was from 1948-1998.

Data frequency

We use annual data rather than quarterly, because annual data may be more reliable than quarterly, which are often based on interpolation and other approximate procedures. Moreover, annual data are not subject to seasonality. Short-term capital movements, such as trade credits that are essentially self-reversing should be less important in annual than in quarterly data.

Thus, we believe that calculations based on annual data may come closer to addressing the issue of long-term capital mobility that Feldstein-Horioka had in mind.

Why gross rather than net?

We use gross saving and gross investment rather than net because the measurement of depreciation is inaccurate (net = gross – depreciation) especially in the presence of high inflation rates. What is more, gross measurements respond to the world-wide yield differentials.

Data definition/calculation

- ✓ GROSS SAVING = GNP - PRIVATE CONSUMPTION - GOVERNMENT CONSUMPTION.

- ✓ GROSS INVESTMENT = GROSS CAPITAL FIXED FORMATION + CHANGE IN STOCKS.

- ✓ GROSS SAVING RATE = GROSS SAVING DIVIDED BY GDP.

- ✓ GROSS INVESTMENT RATE = GROSS INVESTMENT DIVIDED BY GDP.

- ✓ CURRENT ACCOUNT = EXPORTS-IMPORTS + NET FACTOR INCOME+ NET CURRENT TRANSFERS = GROSS SAVING – GROSS INVESTMENT.

Data source

International Financial Statistics. IMF CD-ROM / December 1999.

Section 6

Unit Root Tests

Standard inference procedures do not apply to regressions which contain an integrated dependent variable or integrated regressors. Therefore, it is important to check whether our series are stationary or not before conducting any inference. The formal method to test the stationarity of a series is the unit root test.

We tested our series for stationarity using two unit root tests:

- ✓ the Dickey-Fuller (DF) and augmented Dickey-Fuller (ADF) tests, and
- ✓ the Phillips-Perron (PP) test.

Next, we describe how the aforesaid tests are conducted. The econometric package we used for these tests is E-views.

Dickey-Fuller test

Let's consider an AR(1) process:

$y_t=\mu+\rho y_{t-1}+e_t$,

where μ and ρ are parameters and e_t is assumed to be white noise.

If $-1<\rho<1$, y is a stationary series. If $\rho=1$, y is a nonstationary series (a random walk with drift). If the absolute value of ρ is greater than one, the series is explosive.

Therefore, the hypothesis of a stationary series can be evaluated by testing whether the absolute value of ρ is strictly less than one, that is to test the null hypothesis Ho: $\rho=1$, against the one-sided alternative H_1: $\rho<1$, since explosive series do not make much economic sense.

The test is carried out by estimating the following equation:

$\Delta y_t = \mu + \beta y_{t-1} + e_t$,

where $\beta = \rho - 1$, (y_{t-1} has been subtracted both sides of the AR(1) model)

The null and alternative hypotheses are:

H_o: $\beta = 0$

H_1: $\beta < 0$.

This test cannot be carried out by performing a t-test on the estimated β, because the t-statistic under the null hypothesis of a unit root does not have the conventional t-distribution. Dickey and Fuller (1979) showed that the distribution under the null hypothesis is non-standard, and simulated the critical values for selected sample sizes. More recently, MacKinnon (1991) has implemented a much larger set of simulations than those tabulated by Dickey and Fuller. In addition, MacKinnon estimates the response surface using the simulation results, permitting the calculation of Dickey-Fuller critical values for any sample size and for any number of right-hand variables. E-Views reports these MacKinnon critical values for unit root tests.

Augmented Dickey-Fuller test

The simple unit root test described above is valid only if the series is an AR(1) process. If the series is correlated at higher order lags, the assumption of white noise disturbances is violated. The ADF and PP tests use different methods to control for higher-order serial correlation in the series. The ADF test makes a parametric correction for higher-order correlation by assuming that the y series follows an AR(p) process and adjusting the test methodology. The PP approach is non-parametric and will be described below.

The ADF approach controls for higher-order correlation by adding lagged difference terms of the dependent variable y to the right-hand side of the regression:

$$\Delta y_t=\mu+\beta y_{t-1}+ \delta_1\Delta y_{t-1}+ \delta_2\Delta y_{t-2} + \ldots+ \delta_{p-1}\Delta y_{t-p+1} + e_t.$$

This augmented specification is then used to test:

Ho: $\beta=0$

H_1: $\beta<0$

in this regression. An important result obtained by Fuller is that the asymptotic distribution of the t-statistic on β is independent of the number of lagged first differences included in the ADF regression. Moreover, while the parametric assumption that y follows an auto-regressive process may seem restrictive, Said and Dickey (1984) demonstrate that the ADF test remains valid even when the series has a moving average (MA) component, provided that enough lagged difference terms are added to the regression.

Apart from specifying the number of lagged differenced terms, we also have to decide whether to include a constant, a trend or both in the augmented regression.

The null hypothesis of a unit root is rejected against the one-sided alternative if the t-statistic is less than (lies to the left of) the critical value.

Choice of optimal lag-length

We will use the Schwartz Information Criterion (SIC) in order to determine the optimal lag-length of the ADF regression equation. The model we will select will be the one with the smallest information criterion.

Phillips-Perron (PP) Test

Phillips and Perron (1988) propose a non-parametric method of controlling for higher-order serial correlation in a series. The test regression for the Phillips-Perron (PP) test is the AR(1) process:

$\Delta y_t=\mu+\beta y_{t-1}+e_t$.

While the ADF test corrects for higher order serial correlation by adding lagged differenced terms on the right-hand side, the PP test makes a correction to the t-statistic of the β coefficient from the AR(1) regression to account for the serial correlation in e_t . The correction is non-parametric since we use the Newey-West heteroskedasticity autocorrelation consistent estimate.

The asymptotic distribution of the PP t-statistic is the same as the ADF t-statistic and E-Views again reports MacKinnon critical values. As with the ADF test, we have to decide whether to include a constant, a constant and linear trend, or neither in the test regression. For the PP test, we also have to specify the truncation lag q for the Newey-West correction, that is, the number of periods of serial correlation to include. The truncation lag can be calculated using the formula: $q = \text{floor}(4*(T/100)^{2/9})$, which is based solely on the number of observations used in the test regression.

Again, the null hypothesis of a unit root is rejected against the one-sided alternative if the t-statistic is less than (lies to the left of) the critical value.

Unit Root Tests - Results

The order of integration of our series was determined by:

- ADF tests on the levels of the Saving Ratios and Investment Ratios with the inclusion of a trend (where necessary) and the order of augmentation determined by the Schwarz Information Criterion,
- Phillips - Perron tests on the levels of the Saving Ratios and Investment Ratios.
- ADF tests on the detrended series of the Saving Ratios and Investment Ratios. The detrended series were obtained by running a regression of the original series on a constant and a time trend.
- Phillips - Perron tests on the detrended series of the Saving Ratios and Investment Ratios.

On the whole, the results of the unit root tests broadly confirm those reported in other studies, i.e. Saving and Investment ratios seem to be integrated of order 1: I(1).

Thus, we proceeded to cointegration tests, without excluding any series. The methodology and the results of these tests are described in the next section.

Section 7

Cointegration tests

We tested our series for cointegration using both the Johansen methodology and the two-step Engle-Granger procedure. These tests will point at a cointegrating relationship – if one exists - between the saving and investment ratio over long periods of time. Next, we describe these methods.

✓ Johansen's test for cointegration

This test for cointegration is a multivariate test, but it is possible to apply it to the 2- dimensional case to discover a unique cointegrating vector, which may exist between the Saving and Investment Ratio. Johansen's methodology is as follows:

Let's take a VAR(k) model of $z_t = \{x_{1t}, x_{2t}, \dots, x_{nt}\}$, where

$$z_t = c + A_1 z_{t-1} + \dots + A_{k-1} z_{t-k+1} + \Pi z_{t-1} + e_t, \; e_t \sim \text{Niid}.$$

Using the lag operator $\Delta = 1-L$, we have

$$\Delta z_t = c + \Gamma_1 \Delta z_{t-1} + \dots + \Gamma_{k-1} \Delta z_{t-k+1} + \Pi z_{t-1} + e_t, \text{ where}$$

$\Gamma_i = -(A_{i+1} - \dots - A_k)$, $_{i=1,\dots k-1}$ and

$\Pi = -(I - A_1 - \dots - A_k)$

The rank of the matrix Π gives us the number of the cointegrating vectors as follows:

✓ If rankΠ = n: x_{it} is stationary.

- ✓ If rankΠ = 0: our model is a VAR model for the first differences of the variables and there is no existing long-run relationships between the variables.
- ✓ If rankΠ = p, $0<p<n$: there are p cointegrating vectors and Π can be written as the product of two matrices (nxp) Π=AB′ and Δz_t, e_t are stationary processes as well as $\Pi\Delta z_{t-1}$.

The columns of B give the coefficients of the variables in the cointegrating relationship and the rows of A give the importance of every series x_I to the cointegrating relationship.

We can find the rank of the matrix Π with two ways, the λmax and the trace.

For the λmax, we test the hypothesis

H_0: rank(Π) = p?k, against

H_1: rank(Π) = p?n

For the Trace, we test the hypothesis

H_0: rank(Π) = p?k, against

H_1: rank(Π) = p?k+1.

✓ <u>Two-step Engle-Granger procedure</u>

This test for cointegration employs two stages. First, we run the regression of the Investment rate on the Saving rate (ie. the Feldstein-Horioka static equation) and save the residuals. The residuals are then tested for stationarity using the unit root tests we have already mentioned. If the residuals are stationary, then the original series (I rates & S rates) are cointegrated.

Cointegration tests - Results

We have carried out Johansen tests for cointegration, using a VAR(1,1) and the two-step Engle-Granger procedure for the Saving and Investment ratios series. The same tests were also applied on the detrended series.

Our results seem to agree with the general consensus that both S_t and I_t in OECD countries are I(1) and cointegrated, although cointegration evidence was fragile in the cases of Belgium, Denmark, Finland and Norway.

Having exploited the statistical properties of our series, we proceed with estimating the cointegrating coefficient between Saving and Investment.

Section 8

Estimation

We have conducted unit root and cointegration tests for our series and found that the majority of them are I(1) and cointegrated, so we will proceed in estimating the cointegrating coeffficient between the saving and the investment rate.

We can not use the OLS estimator because in the presence of unit roots, the least squares estimator is super consistent (converges with rate T to the true value), but is not optimal for statistical inference since second order effects are present. Second order effects are nuisance parameters (long-run correlation and endogeneity) in the asymptotic distribution of the OLS estimator.

In this respect, we made use of other estimators that correct for the previously mentioned problems. These estimators will be the following:

- ✓ the ADL estimator,
- ✓ the AADL estimator,
- ✓ the DOLS estimator,
- ✓ the DGLS estimator,
- ✓ the FMLS estimator, and
- ✓ the Johansen estimator (cointegrating vector).

In our study, we estimated the cointegrating coefficient between the saving rate and the investment rate using all the aforementioned estimators.

In the next section, we give a brief description of these estimators and the problems they correct.

✓ Autoregressive Distributed Lag Estimation (ADL)

The Autoregressive Distributed Lag Model ADL(p,q) is a model of the following form:

$A(L)\,y_t = a + B(L)\,x_t + u_t,\ u_t \sim \text{iid}\,(0, \sigma^2)$, including p lags on y and q lags on x.

In order to illustrate the way the ADL estimator is constructed, we will take the ADL (1,1) model:

$$y_t = b_0 + b_1 y_{t-1} + c_1 x_t + c_2 x_{t-1} + u_t,\ u_t \sim \text{iid}\,(0, \sigma^2)$$

The ADL estimator is $?_{ADL} = (c_1+c_2)/\,(1- b_0 - b_1)$ and represents the long-run steady state equilibrium value between y_t and x_t.

In this way, the savings retention coefficient (b) between the investment rate and the saving rate can be estimated indirectly by estimating the parameters of the ADL model.

✓ Augmented Autoregressive Distributed Lag Estimation (AADL)

The AADL model is constructed by adding leads of the regressor to the ADL model previously described.

We will illustrate this method of estimation by using the AADL (1,1,1) model:

$$y_t = b_0 + b_1 y_{t-1} + c_1 x_t + c_2 x_{t-1} + c_3 x_{t+1} + u_t,\ u_t \sim \text{iid}\,(0, \sigma^2)$$

The AADL estimator represents the coefficient at the equilibrium state and is equal to $?_{AADL} = (c_1+c_2+c_3)/\,(1- b_0 - b_1)$. In order to take this estimator, we have to estimate the parameters of the AADL model.

This model restores strong exogeneity and removes the second order asymptotic biases,thus rendering the AADL estimator asymptotically efficient.

✓ Dynamic least squares estimation (DOLS)

This method of estimation was developed by Stock & Watson (1983).

The model to be estimated (in our case) will be as follows:

$$I_t = a + b\, S_t + A(L)\, \Delta S_{t-k} + B(L)\, \Delta S_{t+k} + + A(L)\, \Delta I_{t-k} + u_t,$$

where A(L) is the polynomial lag operator,

B(L) is the polynomial lead operator, and

k is the number of lags and leads.

The inclusion of lags and leads of the first difference of the saving rate eliminates the effect of endogeneity, while the lags of the first difference of the investment rate correct for the impact of the remaining autocorrelation in the residual term.

The test statistics constructed in this way are asymptotically valid and the long-run relationship between saving and investment ratios can be estimated by the coefficient of the saving rate (S_t), which is the cointegrating parameter.

The cointegrating parameter (b) is directly estimated by the model.

✓ Dynamic Generalised Least Squares (DGLS)

This method of estimation comes from the dynamic least squares estimation. The difference lies in the way we correct for serial correlation in the errors. If we correct it either parametrically (constructing a model for the errors) or non parametrically following the method of Newey & West, instead of adding leads of the regressor, we have the DGLS method of estimation.

✓ Johansen estimator

Using Johansen's methodology, we will be able to discover the cointegrating relationship between the savings and investment ratio over long periods of time. Although the Johansen test is a multivariate test, it is also possible to apply it to the 2- dimensional case to discover a unique cointegrating vector, which may exist between the Saving and Investment Ratio. Johansen's methodology was described in the Cointegration section.

✓ Fully modified least squares estimation (FMOLS)

This method of estimation was proposed by Phillips & Hansen (1990) and provides direct estimation of the long-run relationship by correcting the OLS estimator for serial dependence and endogeneity in a semi-parametric way.

It involves non-parametric estimation of the long-run covariance matrix in the presence of heteroskedasticity and autocorrelation of unknown forms. These estimators depend on the choice of lag truncation or bandwidth parameter and a weighting scheme. We use kernel estimates such as the Bartlett, Parzen and Quadratic Spectral for this estimation.

The bandwidth parameter can be chosen either parametrically (Andrews) or non-parametrically (Newey & West) and its correct choice is very important as lags greater than the bandwidth parameter receive zero weight.

This method can be used as described above (standard) or by making use of prewhitened errors, which means that we model the errors parametrically –in case of heavy serial correlation- and then estimate the long-run covariance matrix following the aforementioned procedure.

The FMOLS estimator is free of second-order effects and removes any remaining serial correlation of the errors. This estimator is optimal if the bandwidth parameter is correctly chosen and is equivalent to the AADL – they are both asymptotically optimal-.

In our study, we employed the Quadratic Spectral kernel, since it is the best with respect to an asymptotic truncated mean square error criterion in the class of kernels that necessarily generate positive semi-definite estimators of the long-run variance covariance matrix in finite samples.

The bandwidth parameter, S_T , has been selected by applying the Andrews (1991) data-dependent procedure. Specifically, the optimal bandwidth parameter S_T^+ for the Quadratic Spectral kernel is

$$S_T^+ = 1.3221[\, a(2)\, T]^{1/5}$$

where a(2) is a function of the unknown spectral density matrix of ut at frequency zero, its second generalised derivative and a 4x4 weighting matrix of known constants. This means that a(2) and hence S_T^+ are also unknown in practice.

Estimates of a(2) may be obtained either by estimating simple parametric models, as suggested by Andrews (1991) or non-parametrically as suggested by Newey & West (1994).

Thus, **FM-S-A** refers to the Fully Modified Estimator for which the estimate of a(2) was obtained by estimating simple parametric models.

FM-S-NW refers to the Fully Modified Estimator for which the estimate of a(2) was obtained non-parametrically.

In the case that we pre-whiten the errors, i.e. correct the errors for serial correlation (model them parametrically) before estimating the long run variance covariance matrix, we have the prewhitened Fully Modified estimator.

Thus, **FM-PW-A** refers to the Fully Modified Estimator for which the estimate of a(2) was obtained by estimating simple parametric models and the errors were corrected for serial correlation.

FM-PW-NW refers to the Fully Modified Estimator for which the estimate of a(2) was obtained non-parametrically and the errors were corrected for serial correlation.

Estimation-Results

We estimated the Saving-Investment coefficient using twelve estimators: the OLS, the FMOLS (Standard-Andrews), the FMOLS (Standard-Newey&West), the FMOLS (Prewhitened-Andrews), the FMOLS (Prewhitened-Newey&West), the DOLS, the DGLS, the ADL(1,2), the AADL(1,2,1), the ADL(4,4), the AADL(4,4,4) and the Johansen estimator.

The estimation was based on the detrended series of each country, for which the coefficient b, its standard error and the t-stat were obtained in order to test the hypothesis that b=1. Appendix D presents the results of the estimation for each country.

The following table presents the average estimate for the cointegrating coefficient obtained for each country.

Country	b	Country	b	Country	b
Austria	0,648	Greece	0,888	Norway	-0,075
Australia	0,865	Iceland	0,938	Portugal	0,300
Belgium	0,576	Ireland	1,032	Spain	-0,104
Canada	0,566	Italy	1,087	Sweden	0,750
Denmark	0,625	Japan	0,859	Switzerland	1,016
Finland	1,319	Luxembourg	-0,103	UK	0,882
France	0,903	New Zealand	1,030	USA	0,469
Germany	0,672	Netherlands	0,862		

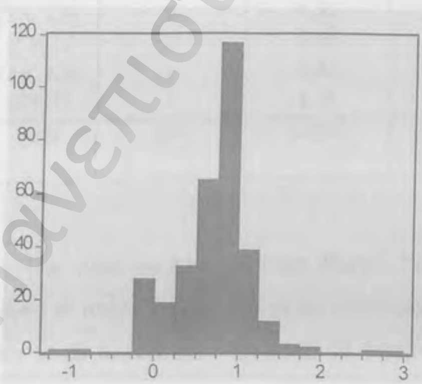
Interestingly, the average coefficients between saving rates and investment rates range from -0,104 to 1,319. One third of the countries have a coefficient between 0,7 and 1. These countries are: Australia, France, Greece, Iceland, Japan, Netherlands, Sweden and the United Kingdom. These estimates denote –in the FH sense- capital immobility, thus representing quite closed economies.

Six countries (Austria, Belgium, Canada, Denmark, Germany, Portugal, USA) have average coefficients between 0 and 0,7. Those countries are assumed to have increased capital mobility, because less than 70% of the domestic saving is invested in the same country.

It is worth mentioning that Luxembourg, Norway and Spain have a negative savings retention coefficient. Luxembourg is a country that has been excluded from all cross-section studies as an outlier due to the fact that it has a considerably big financial and banking sector. Norway has also produced strange results due to its big industrial sector.

It should be noted that five countries – Finland, Ireland, Italy, New Zealand and Switzerland produced estimates over 1. This estimate shows that investment exceeds savings systematically.

The following graph shows the "distribution" and the "descriptive statistics" of the sample of estimates of the countries. On average, the FH coefficient is 0,69, although the estimates range from −1,02 to 2,94.



Descriptive statisticss	
Observations 322	
Mean	0.696047
Median	0.793861
Maximum	2.940000
Minimum	-1.021000
Std. Dev.	0.442986
Skewness	-0.031875
Kurtosis	6.207478
Jarque-Bera	138.0841
Probability	0.000000

We also split the observations of estimates in 14 categories and came up with the following table that shows that over 30% of our observations are between 0,8 and 1, while 60% of them ranges from 0,6 to 1,2, very close to a unit coefficient.

Distribution of Estimates

Included observations: 322
Number of categories: 14

Value	Count	Percent	Cumulative Count	Cumulative Percent
[-1.2, -1)	1	0.31	1	0.31
[-1, -0.8)	1	0.31	2	0.62
[-0.2, 0)	28	8.70	30	9.32
[0, 0.2)	16	4.97	46	14.29
[0.2, 0.4)	24	7.45	70	21.74
[0.4, 0.6)	36	11.18	106	32.92
[0.6, 0.8)	57	17.70	163	50.62
[0.8, 1)	**101**	**31.37**	**264**	**81.99**
[1, 1.2)	36	11.18	300	93.17
[1.2, 1.4)	13	4.04	313	97.20
[1.4, 1.6)	5	1.55	318	98.76
[1.8, 2)	2	0.62	320	99.38
[2.4, 2.6)	1	0.31	321	99.69
[2.8, 3)	1	0.31	322	100.00
Total	322	100.00	322	100.00

The next section provides Monte Carlo Simulation, which were employed in order to have the exact distribution of each estimator of each country so as to test the hypothesis of whether the coefficient is equal to one or not.

Section 9

Monte-Carlo Simulations

We used Monte Carlo simulations in order to obtain the critical values $t_{0,025}$ and $t_{0,975}$ on which the hypothesis testing (b=1) will be based. The critical values of the Normal distribution are no longer valid because each estimator is distributed in a different way.

We assumed that the Data Generating Process (DGP) is the following:

$I_t = bS_t + u_{1t}$

$\Delta S_t = u_{2t}$ for t=1,2,...,T,

and u_t follows a VAR(1) process:

$u_t = A\, u_{t-1} + e_t,\ e_t \sim$ Niid.

For each country we needed an estimate for the A_{2x2} matrix, as well as the Variance-covariance matrix of the DGP. These estimates were obtained as follows:

We first ran the Feldstein-Horioka equation using the detrended series and saved the residuals (u_{it}), then we ran an AR(1) regression for S_t and saved the residuals (u_{2t}). Using the series u_{1t} and u_{2t}, we estimated a VAR(1) and consequently the A matrix and the Variance-Covariance matrix. These estimates were plugged into our Monte Carlo application and the exact distribution of each estimator for each country was obtained. The mislocation of the distributions is prevalent. The critical values are presented along with the estimates in Appendix D.

Had we used the critical values of the Standard normal distribution as a benchmark for rejection of the null hypothesis that b=1 (the Feldstein-Horioka coefficient equals one), we would have rejected more often.

The distributions of the estimators provided by our Monte Carlo simulations are less leptokurtic than the Standard Normal, leading to an augmented area of acceptance.

It should also be noted that the standard errors of the estimates are big, thus decreasing the ratio of b-1 over s.e and I this way leading to an acceptance of the null hypothesis, although the value of b is considerably lower than the unity.

The following table shows the percentages of rejection for each country.

Country	**% rejection**	**Country**	**% rejection**	**Country**	**% rejection**
Austria	8%	Greece	8%	Norway	83%
Australia	8%	Iceland	0%	Portugal	8%
Belgium	58%	Ireland	0%	Spain	42%
Canada	58%	Italy	0%	Sweden	0%
Denmark	8%	Japan	0%	Switzerland	0%
Finland	8%	Luxembourg	100%	UK	0%
France	0%	New Zealand	0%	USA	67%
Germany	8%	Netherlands	0%		

Based on the percentages of rejection, we could assume that Belgium, Canada, Luxembourg, Norway, Spain and USA are countries with increased capital mobility, while the rest seem to have a savings retention coefficient close to unity.

Section 10

Conclusions

In this study, we adopted the time-series approach to the Feldstein-Horioka puzzle in order to test the capital mobility of the OECD countries (exc. Yugoslavia & Turkey).

In this perspective, we tested the saving and investment ratios of the countries for stationarity, cointegration, estimated the savings retention coefficient and tested the hypothesis of b=1 using the critical values obtained from Monte Carlo simulations. Stationarity was tested by using the ADF and the PP test and cointegration by using the Johansen's test and the 2-step Engle-Granger procedure. The previously mentioned tests were conducted with the help of E-views. The estimation and hypothesis testing was conducted with two specially designed applications for the Gauss package.

This study was innovative in the respect of the variety of estimators used (12 estimators) and the Monte Carlo simulations conducted in order to replicate the real processes of the Investment and Saving series.

On the whole, the countries displayed different characteristics regarding each of the aforementioned tests and methods. Different economic structures and government policies reveal a different degree of financial openness across countries. Traditionally financially open countries such as the United States provided lower estimates of the Savings-Investment coefficient than countries on which extensive capital controls were imposed (closed economies) like Japan.

As a result, our estimates as well as the percentage of rejection of the hypothesis that b=1 varied across countries. The following table summarises the estimation and Monte Carlo simulations results.

Country	Estimation			% rejection b=1
	Avg b	min	max	
Australia	0,648	0,283	0,847	8%
Austria	0,865	0,739	1,022	8%
Belgium	0,576	0,508	0,697	58%
Canada	0,566	0,268	0,802	58%
Denmark	0,625	0,225	1,003	8%
Finland	1,319	0,883	2,559	8%
France	0,903	0,856	0,958	0%
Gernany	0,672	0,506	0,870	8%
Greece	0,888	0,844	0,918	8%
Iceland	0,938	0,724	1,136	0%
Ireland	1,032	0,265	2,944	0%
Italy	1,087	0,928	1,534	0
Japan	0,859	0,830	1,047	0%
Luxembourg	-0,103	-0,164	-0,023	100%
New Zealand	1,030	0,673	1,376	0%
Netherlands	0,862	0,423	1,315	0%
Norway	-0,075	-0,192	0,108	83%
Portugal	0,300	0,093	0,438	8%
Spain	-0,104	-1,022	0,209	42%
Sweden	0,750	0,486	1,401	0%
Switzerland	1,016	0,837	1,053	0%
UK	0,882	0,800	0,994	0%
US	0,469	0,044	1,199	67%

Attempting to categorize the countries in the Feldstein- Horioka sense- regarding capital mobility- led us to the following results:

- Austria, France, Greece, Iceland, Japan, Netherlands, Sweden & United Kingdom display capital immobility in the ($0.75<b<1$).

- Australia, Belgium, Canada, Denmark, Germany display medium capital mobility ($0.5<b<0.75$).

- Portugal and the United States display capital mobility ($0<b<0.5$).

- Finland, Ireland, Italy, New Zealand & Switzerland had a FH coefficient greater than one, which indicates that investment is greater than saving and thus foreign capital is invested in those countries.

- Luxembourg, Norway and Spain displayed a negative correlation between the Savings and Investment Ratios.

If we exclude the countries with the negative coefficients, we can assume that only 25% of the countries represent closed economies, while the rest represent more financially open and integrated economies.

Based on this assumption, capital mobility seems to have increased since 1980 when the Feldstein-Horioka puzzle appeared and gave food for thought to many researchers.

Section 11

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(chronological order)

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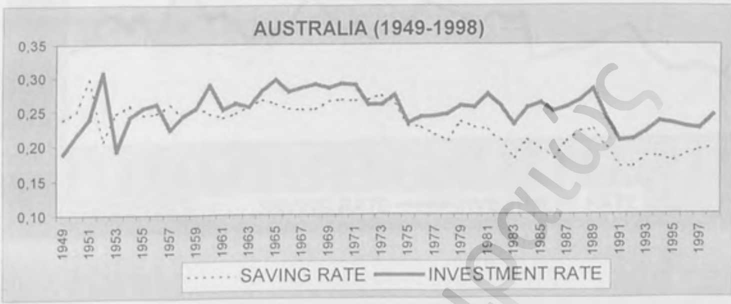
Section 12
Appendices

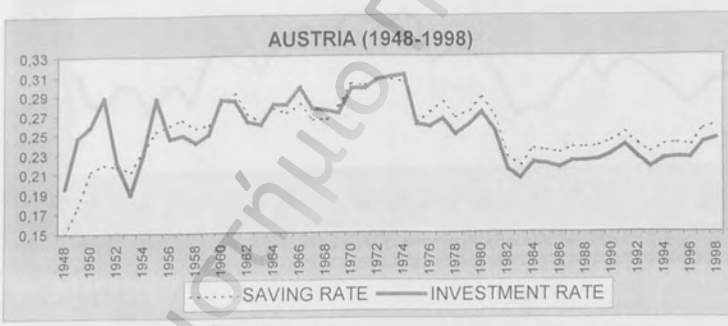
APPENDIX A
LIST OF COUNTRIES

AUSTRALIA (1951-1998)
AUSTRIA (1948-1998)
BELGIUM (1953-1998)
CANADA (1948-1998)
DENMARK (1950-1998)
FINLAND (1950-1998)
FRANCE (1950-1998)
GERMANY (1950-1998)
GREECE(1948-1998)
ICELAND (1950-1998)
IRELAND (1948-1998)
ITALY (1951-1998)
JAPAN (1955-1998)
LUXEMBOURG (1950-1998)
NETHERLANDS (1950-1998)
NEW ZEALAND (1948-1998)
NORWAY (1949-1998)
PORTUGAL (1953-1992)
SPAIN (1954-1998)
SWEDEN (1950-1993)
SWITZERLAND (1948-1995)
TURKEY (1987-1998)
UNITED KINGDOM (1948-1998)
UNITED STATES (1948-1998)

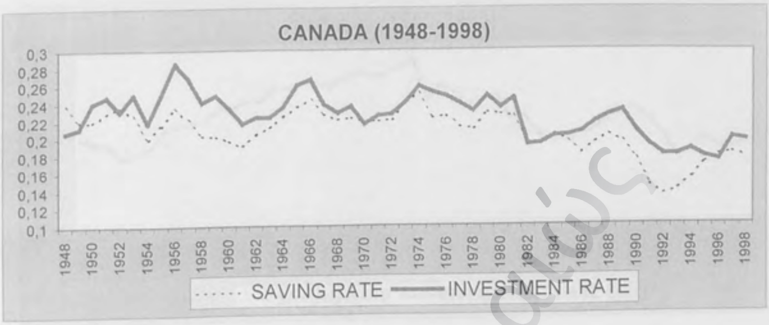
APPENDIX B
GRAPHICAL REPRESENTATION

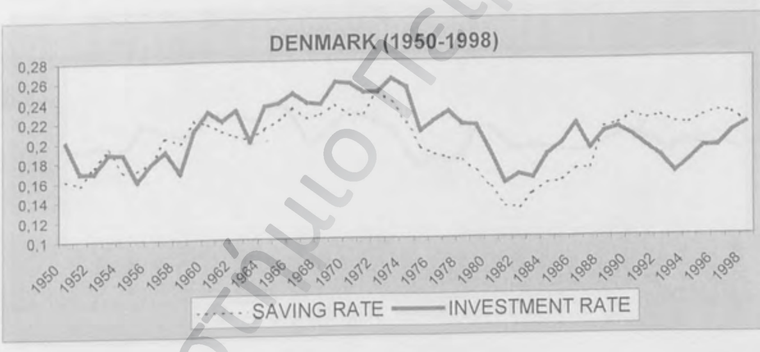
Countries: Australia, Austria, Belgium



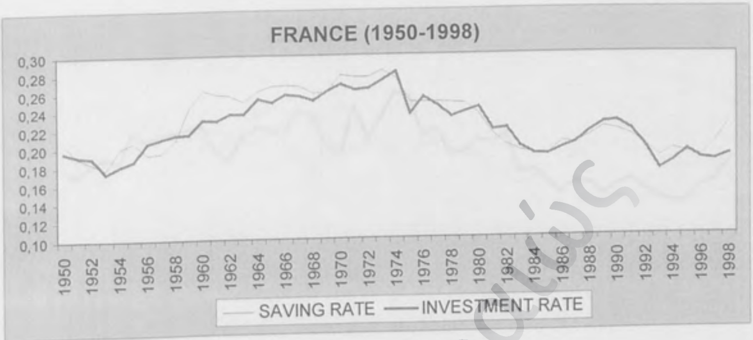


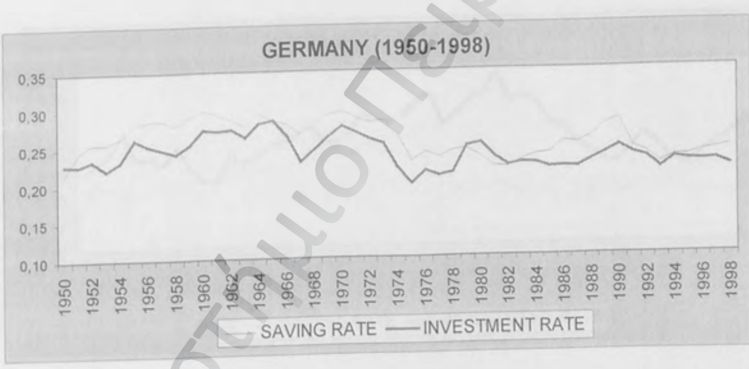
Countries: Canada, Denmark, Finland



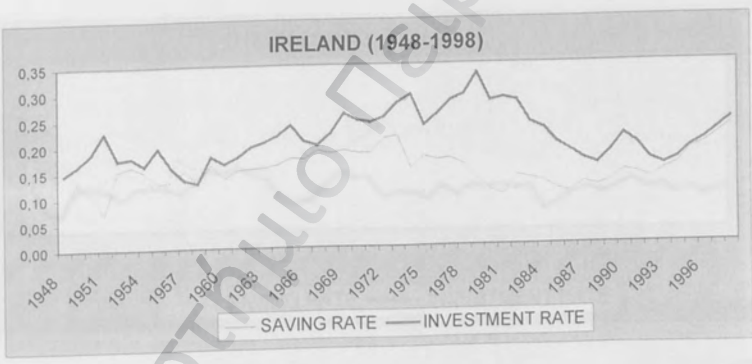


Countries: France, Germany, Greece

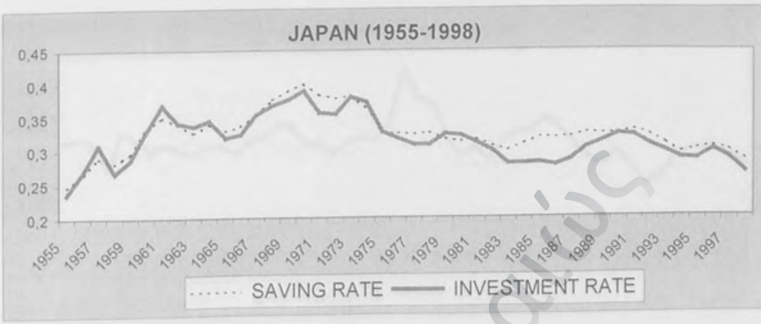


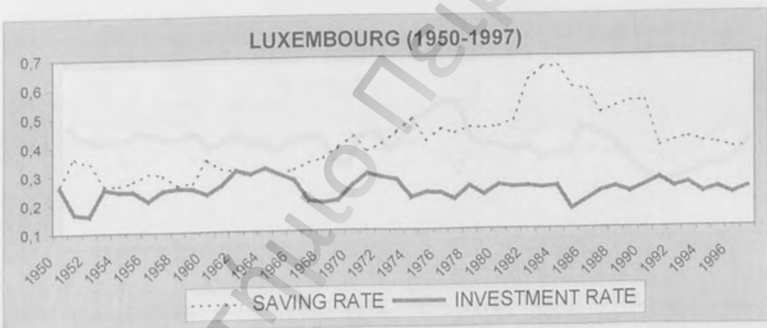


Countries: Iceland, Ireland, Italy

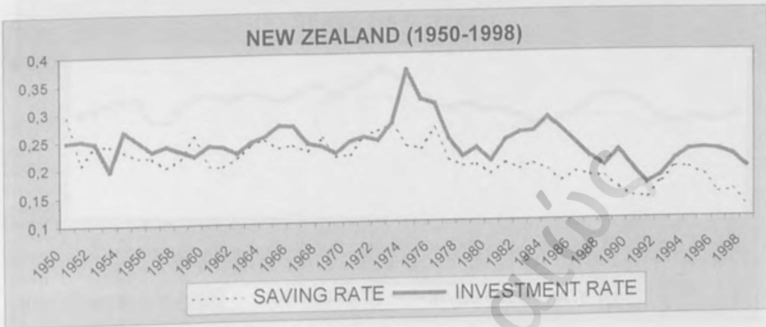


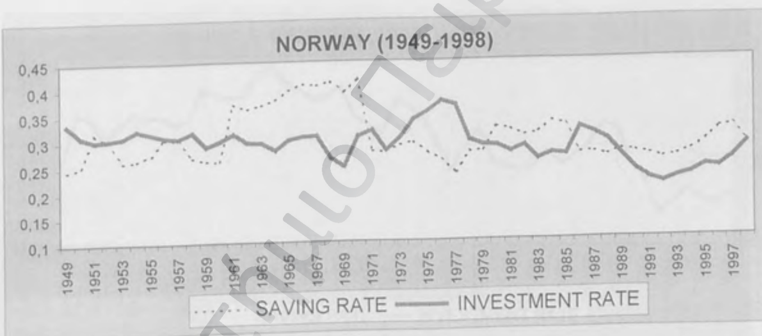
Countries: Japan, Luxembourg, Netherlands

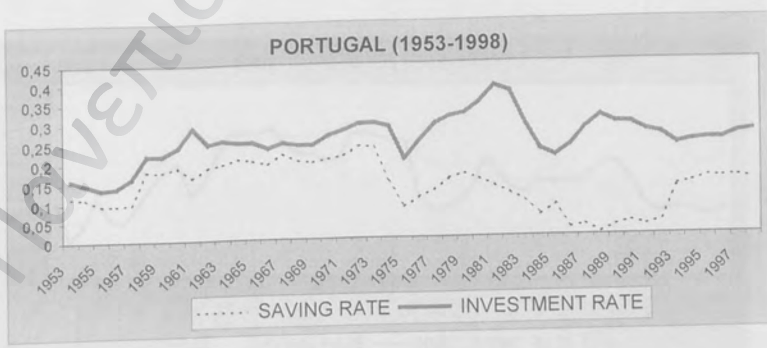




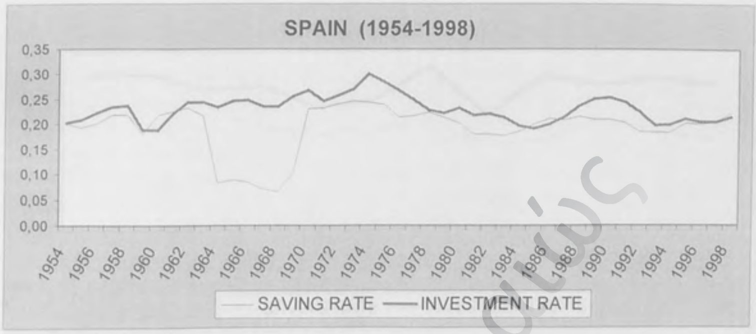
Countries: New Zealand, Norway, Portugal

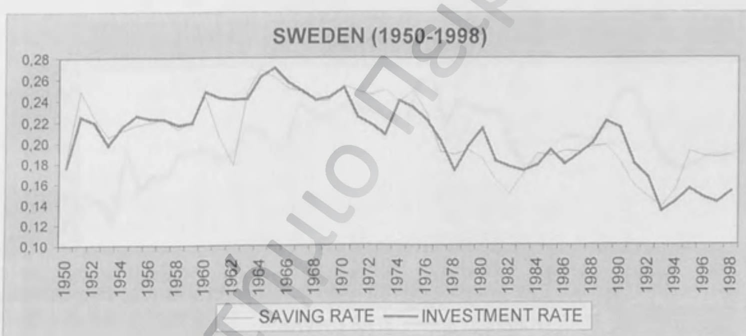


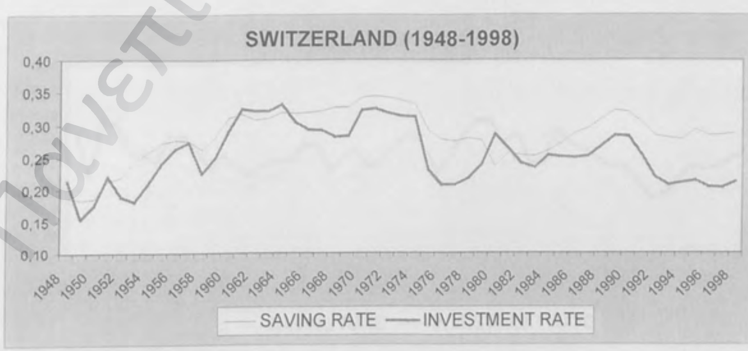




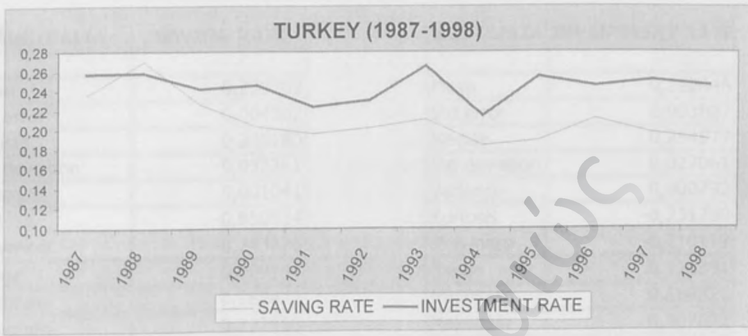
Countries: Spain, Sweden, Switzerland

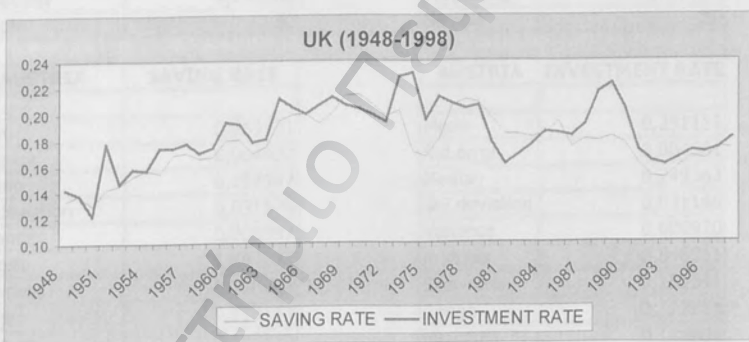


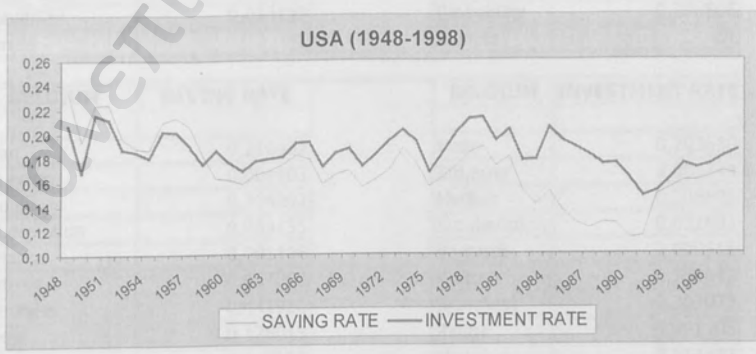




<u>**Countries: Turkey, UK, USA**</u>







APPENDIX C
DESCRIPTIVE STATISTICS
Countries: Australia, Austria, Belgium

AUSTRALIA	SAVING RATE
Mean	0,229202
Std.error	0,004562
Median	0,236180
Std.deviation	0,032261
Variance	0,001041
Kurtosis	-0,950524
Skewness	-0,243226
Range	0,129194
Minimum	0,168472
Maximum	0,297666
Jarque-Bera	2,447102
Probability	0,294184
Sample	50

AUSTRALIA	INVESTMENT RATE
Mean	0,252446
Std.error	0,003827
Median	0,254877
Std.deviation	0,027061
Variance	0,000732
Kurtosis	-0,231730
Skewness	-0,210113
Range	0,118351
Minimum	0,189321
Maximum	0,307672
Jarque-Bera	0,568528
Probability	0,752568
Sample	50

AUSTRIA	SAVING RATE
Mean	0,253131
Std.error	0,004422
Median	0,257547
Std.deviation	0,031578
Variance	0,000997
Kurtosis	1,484296
Skewness	-0,728065
Range	0,158113
Minimum	0,148320
Maximum	0,306433
Jarque-Bera	7,443377
Probability	0,024193
Sample	51

AUSTRIA	INVESTMENT RATE
Mean	0,251133
Std.error	0,004361
Median	0,249363
Std.deviation	0,031146
Variance	0,000970
Kurtosis	-0,848051
Skewness	0,151391
Range	0,122515
Minimum	0,188881
Maximum	0,311396
Jarque-Bera	1,838563
Probability	0,398805
Sample	51

BELGIUM	SAVING RATE
Mean	0,216982
Std.error	0,004903
Median	0,224202
Std.deviation	0,033255
Variance	0,001106
Kurtosis	-0,657882
Skewness	-0,441910
Range	0,126015
Minimum	0,145258
Maximum	0,271272
Jarque-Bera	2,383334
Probability	0,400278
Sample	46

BELGIUM	INVESTMENT RATE
Mean	0,203630
Std.error	0,003344
Median	0,208695
Std.deviation	0,022683
Variance	0,000515
Kurtosis	-0,731643
Skewness	-0,303073
Range	0,091105
Minimum	0,154483
Maximum	0,245588
Jarque-Bera	1,831191
Probability	0,400278
Sample	46

Countries: Canada, Denmark, Finland

CANADA	SAVING RATE
Mean	0,206423
Std.error	0,003798
Median	0,212696
Std.deviation	0,027126
Variance	0,000736
Kurtosis	0,621123
Skewness	-0,946917
Range	0,117784
Minimum	0,133098
Maximum	0,250883
Jarque-Bera	7,599833
Probability	0,022373
Sample	51

CANADA	INVESTMENT RATE
Mean	0,225039
Std.error	0,003647
Median	0,228447
Std.deviation	0,026042
Variance	0,000678
Kurtosis	-0,478498
Skewness	-0,164027
Range	0,112270
Minimum	0,172789
Maximum	0,285059
Jarque-Bera	0,854037
Probability	0,652452
Sample	51

DENMARK	SAVING RATE
Mean	0,197357
Std.error	0,004301
Median	0,209992
Std.deviation	0,030104
Variance	0,000906
Kurtosis	-0,662157
Skewness	-0,587782
Range	0,119603
Minimum	0,128995
Maximum	0,248598
Jarque-Bera	3,698056
Probability	0,15739
Sample	49

DENMARK	INVESTMENT RATE
Mean	0,205788
Std.error	0,004217
Median	0,204722
Std.deviation	0,029518
Variance	0,000871
Kurtosis	-0,936209
Skewness	0,160242
Range	0,106603
Minimum	0,154533
Maximum	0,261136
Jarque-Bera	2,091775
Probability	0,35138
Sample	49

FINLAND	SAVING RATE
Mean	0,247043
Std.error	0,004628
Median	0,250974
Std.deviation	0,032399
Variance	0,001050
Kurtosis	1,939255
Skewness	-1,094034
Range	0,156837
Minimum	0,148549
Maximum	0,305386
Jarque-Bera	14,584670
Probability	0,000681
Sample	49

FINLAND	INVESTMENT RATE
Mean	0,254279
Std.error	0,005958
Median	0,259900
Std.deviation	0,041704
Variance	0,001739
Kurtosis	0,348286
Skewness	-0,269691
Range	0,190289
Minimum	0,163403
Maximum	0,353692
Jarque-Bera	0,634512
Probability	0,728144
Sample	49

Countries: France, Germany, Greece

FRANCE	SAVING RATE
Mean	0,226301
Std.error	0,004662
Median	0,215562
Std.deviation	0,032631
Variance	0,001065
Kurtosis	-1,492601
Skewness	0,225559
Range	0,106245
Minimum	0,176548
Maximum	0,282793
Jarque-Bera	4,769624
Probability	0,092106
Sample	49

FRANCE	INVESTMENT RATE
Mean	0,220247
Std.error	0,004295
Median	0,217107
Std.deviation	0,030067
Variance	0,000904
Kurtosis	-1,120060
Skewness	0,184724
Range	0,109575
Minimum	0,171469
Maximum	0,281044
Jarque-Bera	2,864061
Probability	0,238824
Sample	49

GERMANY	SAVING RATE
Mean	0,258804
Std.error	0,003640
Median	0,256410
Std.deviation	0,025481
Variance	0,000649
Kurtosis	-1,445092
Skewness	-0,018966
Range	0,084946
Minimum	0,214724
Maximum	0,299670
Jarque-Bera	4,129943
Probability	0,126822
Sample	49

GERMANY	INVESTMENT RATE
Mean	0,239138
Std.error	0,003086
Median	0,232849
Std.deviation	0,021605
Variance	0,000467
Kurtosis	-0,832051
Skewness	0,424715
Range	0,086625
Minimum	0,197783
Maximum	0,284408
Jarque-Bera	2,927263
Probability	0,231394
Sample	49

GREECE	SAVING RATE
Mean	0,143223
Std.error	0,009063
Median	0,139124
Std.deviation	0,063440
Variance	0,004025
Kurtosis	0,514897
Skewness	-0,431294
Range	0,304883
Minimum	-0,026634
Maximum	0,278248
Jarque-Bera	1,668129
Probability	0,434281
Sample	49

GREECE	INVESTMENT RATE
Mean	0,214526
Std.error	0,008323
Median	0,213778
Std.deviation	0,058260
Variance	0,003394
Kurtosis	0,616278
Skewness	-0,318055
Range	0,309351
Minimum	0,048426
Maximum	0,357777
Jarque-Bera	1,162530
Probability	0,559191
Sample	49

Countries: Iceland, Ireland, Italy

ICELAND	SAVING RATE
Mean	0,209187
Std.error	0,006084
Median	0,218019
Std.deviation	0,042587
Variance	0,001814
Kurtosis	-1,424977
Skewness	-0,039469
Range	0,138544
Minimum	0,146437
Maximum	0,284981
Jarque-Bera	4,034604
Probability	0,133014
Sample	49

ICELAND	INVESTMENT RATE
Mean	0,237648
Std.error	0,007069
Median	0,239056
Std.deviation	0,049483
Variance	0,002449
Kurtosis	-0,891617
Skewness	-0,017969
Range	0,187631
Minimum	0,151114
Maximum	0,338745
Jarque-Bera	1,74258
Probability	0,418411
Sample	49

IRELAND	SAVING RATE
Mean	0,149127
Std.error	0,004718
Median	0,151454
Std.deviation	0,033696
Variance	0,001135
Kurtosis	-0,145111
Skewness	0,060603
Range	0,157670
Minimum	0,068878
Maximum	0,226548
Jarque-Bera	0,158675
Probability	0,923728
Sample	51

IRELAND	INVESTMENT RATE
Mean	0,209599
Std.error	0,006582
Median	0,198856
Std.deviation	0,047006
Variance	0,002210
Kurtosis	-0,462539
Skewness	0,464296
Range	0,203415
Minimum	0,126761
Maximum	0,330176
Jarque-Bera	2,330796
Probability	0,311799
Sample	51

ITALY	SAVING RATE
Mean	0,210877
Std.error	0,003483
Median	0,204626
Std.deviation	0,024131
Variance	0,000582
Kurtosis	-0,224440
Skewness	0,149242
Range	0,116430
Minimum	0,154105
Maximum	0,270535
Jarque-Bera	0,377317
Probability	0,828669
Sample	48

ITALY	INVESTMENT RATE
Mean	0,222321
Std.error	0,004346
Median	0,218357
Std.deviation	0,030107
Variance	0,000906
Kurtosis	-0,180193
Skewness	0,294660
Range	0,132158
Minimum	0,169187
Maximum	0,301345
Jarque-Bera	0,813270
Probability	0,665887
Sample	48

Countries: Japan, Luxembourg, Netherlands

JAPAN	SAVING RATE
Mean	0,325195
Std.error	0,004904
Median	0,324234
Std.deviation	0,032528
Variance	0,001058
Kurtosis	0,431390
Skewness	0,295412
Range	0,155714
Minimum	0,245140
Maximum	0,400854
Jarque-Bera	0,711779
Probability	0,70055
Sample	44

JAPAN	INVESTMENT RATE
Mean	0,315982
Std.error	0,005334
Median	0,312267
Std.deviation	0,035380
Variance	0,001252
Kurtosis	-0,421427
Skewness	0,222304
Range	0,153923
Minimum	0,236239
Maximum	0,390162
Jarque-Bera	0,811695
Probability	0,666412
Sample	44

LUXEMBOURG	SAVING RATE
Mean	0,404147
Std.error	0,015341
Median	0,389440
Std.deviation	0,106285
Variance	0,011296
Kurtosis	-0,071130
Skewness	0,734367
Range	0,398677
Minimum	0,262399
Maximum	0,661076
Jarque-Bera	4,116099
Probability	0,127703
Sample	48

LUXEMBOURG	INVESTMENT RATE
Mean	0,240712
Std.error	0,005083
Median	0,243292
Std.deviation	0,035214
Variance	0,001240
Kurtosis	0,311250
Skewness	-0,034050
Range	0,159992
Minimum	0,161045
Maximum	0,321037
Jarque-Bera	0,811695
Probability	0,666412
Sample	48

NETHERLANDS	SAVING RATE
Mean	0,257483
Std.error	0,003205
Median	0,260464
Std.deviation	0,022432
Variance	0,000503
Kurtosis	-0,094664
Skewness	-0,455590
Range	0,103025
Minimum	0,200851
Maximum	0,303876
Jarque-Bera	1,418263
Probability	0,492071
Sample	49

NETHERLANDS	INVESTMENT RATE
Mean	0,230936
Std.error	0,004747
Median	0,221706
Std.deviation	0,033226
Variance	0,001104
Kurtosis	-1,304372
Skewness	0,158097
Range	0,110749
Minimum	0,174554
Maximum	0,285303
Jarque-Bera	3,474359
Probability	0,176016
Sample	49

Countries: New Zealand, Norway, Portugal

NEW ZEALAND	SAVING RATE
Mean	0,207005
Std.error	0,005502
Median	0,208362
Std.deviation	0,038511
Variance	0,001483
Kurtosis	-0,288855
Skewness	-0,180172
Range	0,173127
Minimum	0,120197
Maximum	0,293324
Jarque-Bera	0,54413
Probability	0,761805
Sample	49

NEW ZEALAND	INVESTMENT RATE
Mean	0,238449
Std.error	0,005139
Median	0,239300
Std.deviation	0,035973
Variance	0,001294
Kurtosis	3,071043
Skewness	0,969547
Range	0,208805
Minimum	0,160784
Maximum	0,369589
Jarque-Bera	21,50983
Probability	0,000021
Sample	49

NORWAY	SAVING RATE
Mean	0,301510
Std.error	0,007017
Median	0,283719
Std.deviation	0,049614
Variance	0,002462
Kurtosis	-0,091646
Skewness	1,010443
Range	0,183586
Minimum	0,231089
Maximum	0,414675
Jarque-Bera	8,084926
Probability	0,017554
Sample	50

NORWAY	INVESTMENT RATE
Mean	0,287890
Std.error	0,005213
Median	0,294841
Std.deviation	0,036861
Variance	0,001359
Kurtosis	0,072081
Skewness	-0,248788
Range	0,164739
Minimum	0,206532
Maximum	0,371271
Jarque-Bera	0,490818
Probability	0,782385
Sample	50

PORTUGAL	SAVING RATE
Mean	0,132684
Std.error	0,009442
Median	0,141994
Std.deviation	0,064039
Variance	0,004101
Kurtosis	-0,826167
Skewness	-0,370260
Range	0,230253
Minimum	0,005491
Maximum	0,235745
Jarque-Bera	2,422801
Probability	0,29778
Sample	46

PORTUGAL	INVESTMENT RATE
Mean	0,253853
Std.error	0,007839
Median	0,249860
Std.deviation	0,053165
Variance	0,002827
Kurtosis	0,826686
Skewness	-0,114889
Range	0,251208
Minimum	0,134831
Maximum	0,386039
Jarque-Bera	0,812198
Probability	0,666244
Sample	46

Countries: Spain, Sweden, Switzerland

SPAIN	SAVING RATE
Mean	0,193143
Std.error	0,007078
Median	0,204312
Std.deviation	0,047481
Variance	0,002254
Kurtosis	1,908377
Skewness	-1,663359
Range	0,181672
Minimum	0,064690
Maximum	0,246362
Jarque-Bera	24,01363
Probability	0,000006
Sample	45

SPAIN	INVESTMENT RATE
Mean	0,231066
Std.error	0,003865
Median	0,232389
Std.deviation	0,025928
Variance	0,000672
Kurtosis	-0,029154
Skewness	0,454158
Range	0,112078
Minimum	0,189064
Maximum	0,301141
Jarque-Bera	1,490488
Probability	0,474616
Sample	45

SWEDEN	SAVING RATE
Mean	0,207357
Std.error	0,004855
Median	0,204287
Std.deviation	0,033983
Variance	0,001155
Kurtosis	-0,919738
Skewness	-0,075555
Range	0,132267
Minimum	0,136973
Maximum	0,269240
Jarque-Bera	1,880692
Probability	0,390493
Sample	49

SWEDEN	INVESTMENT RATE
Mean	0,206398
Std.error	0,004985
Median	0,215148
Std.deviation	0,034892
Variance	0,001217
Kurtosis	-0,690724
Skewness	-0,351322
Range	0,137272
Minimum	0,132762
Maximum	0,270033
Jarque-Bera	2,07149
Probability	0,354967
Sample	49

SWITZERLAND	SAVING RATE
Mean	0,284149
Std.error	0,005531
Median	0,283301
Std.deviation	0,039500
Variance	0,001560
Kurtosis	0,552084
Skewness	-0,815590
Range	0,160277
Minimum	0,182992
Maximum	0,343269
Jarque-Bera	5,637120
Probability	0,059692
Sample	51

SWITZERLAND	INVESTMENT RATE
Mean	0,253351
Std.error	0,006404
Median	0,250927
Std.deviation	0,045736
Variance	0,002092
Kurtosis	-0,946151
Skewness	0,030578
Range	0,177165
Minimum	0,154467
Maximum	0,331632
Jarque-Bera	2,012207
Probability	0,365641
Sample	51

Countries: Turkey, UK, USA

TURKEY	SAVING RATE
Mean	0,209719
Std.error	0,006987
Median	0,202995
Std.deviation	0,024204
Variance	0,000586
Kurtosis	2,495545
Skewness	1,525976
Range	0,085643
Minimum	0,183942
Maximum	0,269585
Jarque-Bera	4,143221
Probability	0,125983
Sample	12

TURKEY	INVESTMENT RATE
Mean	0,244724
Std.error	0,004290
Median	0,245809
Std.deviation	0,014861
Variance	0,000221
Kurtosis	0,060438
Skewness	-0,774956
Range	0,050521
Minimum	0,214792
Maximum	0,265313
Jarque-Bera	0,999612
Probability	0,606648
Sample	12

UK	SAVING RATE
Mean	0,176194
Std.error	0,002999
Median	0,176206
Std.deviation	0,021417
Variance	0,000459
Kurtosis	-0,552404
Skewness	-0,164133
Range	0,084639
Minimum	0,129284
Maximum	0,213923
Jarque-Bera	1,019591
Probability	0,600618
Sample	51

UK	INVESTMENT RATE
Mean	0,184004
Std.error	0,003295
Median	0,180525
Std.deviation	0,023529
Variance	0,000554
Kurtosis	-0,086162
Skewness	-0,240515
Range	0,109017
Minimum	0,121558
Maximum	0,230575
Jarque-Bera	0,542397
Probability	0,762465
Sample	51

USA	SAVING RATE
Mean	0,168724
Std.error	0,003821
Median	0,166429
Std.deviation	0,027285
Variance	0,000744
Kurtosis	0,226135
Skewness	0,128042
Range	0,121627
Minimum	0,112334
Maximum	0,233961
Jarque-Bera	0,148114
Probability	0,928619
Sample	51

USA	INVESTMENT RATE
Mean	0,184908
Std.error	0,002124
Median	0,184291
Std.deviation	0,015169
Variance	0,000230
Kurtosis	-0,097964
Skewness	0,001660
Range	0,068006
Minimum	0,148022
Maximum	0,216028
Jarque-Bera	0,088460
Probability	0,956734
Sample	51

APPENDIX D

ESTIMATION & MONTE CARLO SIMULATIONS RESULTS

AUSTRALIA				
Estimator	**Estimate (s.e.)**	**t-stat.**	**$t_{0,025}$**	**$t_{0,975}$**
OLS	0,602 (0,164)	-2,430	-2,654	1,854
FM-S-A	0,73 (0,156)	-1,724	-2,789	2,276
FM-S-NW	0,758 (0,174)	-1,860	-3,071	2,127
FM-PW-A	0,462 (0,164)	-3,278	-3,357	2,034
FM-PW-NW	0,316 0,174	-3,928*	-3,397	2,057
DOLS	0,833 (0,168)	-0,990	-3,589	2,568
DGLS	0,847 (0,209)	-0,735	-2,893	2,045
ADL (1,2)	0,589 (0,251)	-1,635	-3,244	1,438
AADL (1,2,1)	0,719 (0,239)	-1,170	-2,995	1,784
ADL (4,4)	0,283 (0,873)	-0,821	-3,210	2,251
AADL (4,4,4)	0,833 (0,428)	-0,391	-3,053	2,237
		LR-stat.		**$x^2_{0,95}$**
JOHANSEN	0,812	0,209		5,937

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

AUSTRIA				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	0,805 (0,069)	**-2,791**	-2,444	4,040
FM-S-A	0,787 (0,107)	-1,995	-3,292	3,000
FM-S-NW	0,793 (0,095)	-2,177	-2,829	2,961
FM-PW-A	0,739 (0,113)	-2,310	-3,189	2,637
FM-PW-NW	0,754 (0,111)	-2,213	-3,074	2,789
DOLS	0,854 (0,078)	-1,875	-3,292	3,717
DGLS	0,855 (0,119)	-1,219	-2,873	2,703
ADL (1,2)	0,949 (0,127)	-0,397	-2,331	2,336
AADL (1,2,1)	0,916 (0,13)	-0,645	-2,675	2,258
ADL (4,4)	1,041 (0,111)	0,370	-3,170	2,869
AADL (4,4,4)	1,022 (0,13)	0,168	-4,313	2,422
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,868	0,751		5,225

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

BELGIUM				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	0,56 (0,065)	-6,793*	-4,246	4,841
FM-S-A	0,582 (0,104)	-4,003	-4,946	3,591
FM-S-NW	0,563 (0,103)	-4,255*	-3,588	3,893
FM-PW-A	0,53 (0,12)	-3,903*	-3,334	3,009
FM-PW-NW	0,544 (0,119)	-3,847*	-3,437	3,928
DOLS	0,567 (0,058)	-7,524*	-4,702	5,149
DGLS	0,595 (0,119)	-3,411*	-2,973	2,969
ADL (1,2)	0,693 (0,178)	-1,727	-1,868	3,228
AADL (1,2,1)	0,659 (0,18)	-1,889	-1,970	3,008
ADL (4,4)	0,697 (0,142)	-2,131*	-1,654	3,206
AADL (4,4,4)	0,508 (0,182)	-2,705	-4,086	2,666
		LR-stat		$x^2_{0,95}$
JOHANSEN	0,408	5,35		7,899

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

CANADA				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	0,662 (0,105)	-3,222*	-2,527	3,993
FM-S-A	0,562 (0,136)	-3,219*	-2,993	3,028
FM-S-NW	0,598 (0,136)	-2,961*	-2,651	3,472
FM-PW-A	0,526 (0,151)	-3,137*	-2,911	2,470
FM-PW-NW	0,537 (0,148)	-3,117*	-2,914	2,875
DOLS	0,566 (0,101)	-4,319*	-3,798	3,687
DGLS	0,606 (0,173)	-2,821*	-2,620	2,749
ADL (1,2)	0,802 (0,227)	-0,872	-1,289	2,846
AADL (1,2,1)	0,631 (0,199)	-1,853	-2,333	2,662
ADL (4,4)	0,721 (0,247)	-1,129	-1,899	3,061
AADL (4,4,4)	0,268 (0,366)	-2,002	-3,978	3,213
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,315	6,358		6,459

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

DENMARK

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,641 (0,107)	-3,364*	-2,984	5,803
FM-S-A	0,684 (0,186)	-1,693	-2,593	4,543
FM-S-NW	0,652 (0,196)	-1,78	-3,106	4,372
FM-PW-A	0,537 (0,231)	-2,004	-2,793	3,540
FM-PW-NW	0,540 (0,238)	-1,932	-2,976	3,993
DOLS	0,619 (0,112)	-1,695	-4,836	5,925
DGLS	0,62 (0,224)	-1,694	-2,396	3,768
ADL (1,2)	0,849 (0,363)	-0,413	-1,174	3,728
AADL (1,2)	0,629 (0,352)	-1,054	-2,187	3,624
ADL (4,4)	0,940 (0,389)	-0,154	-1,532	3,405
AADL (4,4,4)	1,003 (0,747)	0,004	3,735	3,995
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,225	1,062		8,201

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

FINLAND				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	0,946 (0,152)	-0,352	-2,662	5,404
FM-S-A	0,979 (0,206)	-0,101	-2,960	4,287
FM-S-NW	1,057 (0,173)	0,328	-2,442	4,272
FM-PW-A	0,883 (0,259)	-0,452	-2,971	3,870
FM-PW-NW	1,266 (0,208)	1,28	-2,840	3,780
DOLS	1,309 (0,176)	1,75	-4,669	6,321
DGLS	1,191 (0,199)	0,959	-1,876	3,945
ADL (1,2)	1,806 (0,482)	1,674	-1,082	3,032
AADL (1,2,1)	1,546 (0,333)	1,638	-1,776	3,201
ADL (4,4)	2,559 (0,958)	1,627	-1,360	3,317
AADL (4,4,4)	1,258 (0,888)	0,291	-3,159	3,449
		LR-stat.		$x^2_{0,95}$
JOHANSEN	183,23357	**11,60**		5,700

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

FRANCE

Estimator	Estimate (s.e.)	$t_{0,025}$	$t_{0,975}$	$t_{0,975}$
OLS	0,856 (0,052)	-2,784	-3,879	3,162
FM-S-A	0,885 (0,052)	-2,221	-3,863	3,010
FM-S-NW	0,901 (0,057)	-1,733	-2,674	2,951
FM-PW-A	0,928 (0,069)	-1,049	-2,665	2,554
FM-PW-NW	0,919 (0,069)	-1,164	-3,027	2,843
DOLS	0,897 (0,042)	-2,44	-4,503	2,940
DGLS	0,882 (0,069)	-1,698	-3,195	2,453
ADL (1,2)	0,928 (0,074)	-0,973	-2,440	2,398
AADL (1,2,1)	0,9 (0,073)	-1,359	-2,812	2,391
ADL (4,4)	0,903 (0,079)	-1,228	-4,303	2,407
AADL (4,4,4)	0,877 (0,082)	-1,501	-4,930	2,274
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,958	0,332		6,409

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

GERMANY

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,661 (0,084)	-4,038*	-2,635	4,185
FM-S-A	0,808 (0,109)	-1,768	-3,298	3,940
FM-S-NW	0,653 (0,137)	-2,528*	-2,518	3,940
FM-PW-A	0,538 (0,197)	-2,346	-2,590	3,188
FM-PW-NW	0,506 (0,198)	-2,491	-2,505	3,926
DOLS	0,682 (0,11)	-2,888	-3,656	4,693
DGLS	0,729 (0,172)	-1,571	-2,049	3,286
ADL (1,2)	0,87 (0,262)	0,495	-1,255	3,728
AADL (1,2,1)	0,768 (0,265)	-0,874	-2,006	3,339
ADL (4,4)	0,665 (0,151)	-2,22	-2,273	3,838
AADL (4,4,4)	0,672 (0,234)	-1,402	-3,454	3,779
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,549	4,274		8,293

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

GREECE

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,844 (0,044)	-3,587*	-2,582	2,874
FM-S-A	0,879 (0,051)	-2,337	-3,239	2,731
FM-S-NW	0,879 (0,05)	-2,337	-3,227	2,848
FM-PW-A	0,867 (0,052)	-2,556	-3,314	2,415
FM-PW-NW	0,854 (0,059)	-2,449	-3,302	2,464
DOLS	0,914 (0,035)	-2,437	-3,910	2,926
DGLS	0,922 (0,060)	-1,292	-2,815	2,249
ADL (1,2)	0,937 (0,055)	-1,159	-2,222	2,438
AADL (1,2,1)	0,921 (0,06)	-1,323	-2,741	2,183
ADL (4,4)	0,885 (0,046)	-2,512	-3,197	2,76
AADL (4,4,4)	0,879 (0,057)	-2,095	-3,553	2,175
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,918	1,899		5,897

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

ICELAND				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	0,724 (0,128)	-2,155	-5,445	1,476
FM-S-A	0,944 (0,154)	-0,368	-3,747	1,883
FM-S-NW	0,944 (0,154)	-0,368	-3,715	1,883
FM-PW-A	0,996 (0,158)	-0,024	-3,656	2,188
FM-PW-NW	0,971 (0,165)	-0,775	-3,971	2,341
DOLS	0,939 (0,130)	-0,468	-5,171	2,796
DGLS	0,864 (0,177)	-0,768	-3,901	1,866
ADL (1,2)	0,839 (0,181)	-0,890	-3,517	1,613
AADL (1,2,1)	0,906 (0,184)	-0,513	-3,243	1,899
ADL (4,4)	0,956 (0,150)	-0,271	-4,611	1,827
AADL (4,4,4)	1,026 (0,177)	-0,145	-3,784	2,051
		LR-stat.		$x^2_{0,95}$
JOHANSEN	1,136	0,561		5,650

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

IRELAND

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,297 (0,191)	-3,690	-5,874	6,442
FM-S-A	0,265 (0,261)	-2,820	-4,985	4,896
FM-S-NW	0,496 (0,291)	-1,733	-4,724	4,439
FM-PW-A	0,750 (0,436)	-0,572	-4,160	3,714
FM-PW-NW	1,066 (0,421)	0,157	-4,316	4,056
DOLS	0,591 (0,203)	-2,015	-7,519	7,139
DGLS	0,514 (0,324)	-1,501	-4,001	3,432
ADL (1,2)	1,465 (0,645)	0,721	-2,219	3,966
AADL (1,2,1)	1,372 (0,666)	0,559	-3,654	3,699
ADL (4,4)	2,944 (1,726)	1,126	-2,641	3,971
AADL (4,4,4)	1,863 (1,272)	0,679	-4,902	4,235
		LR-stat.		$\chi^2_{0,95}$
JOHANSEN	1,517	0,501		8,782

Notes: Standard errors in parentheses
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FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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ITALY

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,935 (0,114)	-0,568	-4,156	3,676
FM-S-A	0,928 (0,162)	-0,446	-4,379	3,280
FM-S-NW	0,993 (0,148)	-0,045	-3,897	3,391
FM-PW-A	1,017 (0,182)	0,095	-3,238	2,960
FM-PW-NW	1,022 (0,178)	0,126	-3,878	3,672
FMOLS 6	1,016 (0,185)	0,088	-3,898	5,921
DOLS	1,013 (0,118)	0,114	-4,645	4,387
DGLS	1,011 (0,183)	0,060	-2,817	2,674
AADL (1,2,1)	1,323 (0,250)	1,295	-1,533	3,330
AADL (1,2)	1,207 (0,244)	0,850	-2,177	2,806
ADL (4,4)	1,534 (0,449)	1,189	-2,481	3,694
AADL (4,4,4)	1,054 (0,312)	0,172	-3,651	3,220
		LR-stat.		$x^2_{0,95}$
JOHANSEN	1,184	0,203		7,325

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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JAPAN

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,985 (0,057)	-0,270	-2,407	4,423
FM-S-A	0,933 (0,081)	-0,820	-2,752	3,940
FM-S-NW	0,925 (0,080)	-0,943	-2,466	4,954
FM-PW-A	0,830 (0,102)	-1,673	-2,704	3,906
FM-PW-NW	0,866 (0,088)	-1,531	-2,715	4,305
DOLS	0,908 (0,059)	-1,571	-3,523	3,993
DGLS	0,906 (0,102)	-0,920	-2,292	3,405
ADL (1,2)	1,047 (0,150)	0,313	-1,191	3,888
AADL (1,2,1)	0,944 (0,127)	-0,438	-1,883	3,359
ADL (4,4)	0,950 (0,106)	-0,476	-1,669	3,323
AADL (4,4,4)	0,836 (0,181)	-0,906	-4,124	3,009
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,859	1,988		7,295

Notes: Standard errors in parentheses
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FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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LUXEMBOURG

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	-0,117 (0,062)	-18,029*	-4,292	2,850
FM-S-A	-0,107 (0,075)	-14,813*	-3,627	2,592
FM-S-NW	-0,098 (0,086)	-12,702*	-3,658	2,559
FM-PW-A	-0,098 (0,101)	-10,896*	-3,131	2,709
FM-PW-NW	-0,150 (0,094)	-12,209*	-3,397	2,506
DOLS	-0,092 (0,078)	-13,933*	-4,587	3,184
DGLS	-0,073 (0,109)	-9,807*	-3,256	2,229
ADL (1,2)	-0,086 (0,125)	-8,690*	-3,241	2,027
AADL (1,2,1)	-0,079 (0,137)	-7,862*	-3,102	2,138
ADL (4,4)	-0,109 (0,094)	-11,792*	-4,214	2,674
AADL (4,4,4)	-0,164 (0,148)	-7,842*	-4,392	2,346
		LR-stat.		$x^2_{0,95}$
JOHANSEN	-0,023	10,354*		6,030

Notes: Standard errors in parentheses
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FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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NETHERLANDS

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,423 (0,159)	-3,622	-5,531	3,461
FM-S-A	0,676 (0,243)	-1,331	-4,808	2,790
FM-S-NW	0,786 (0,244)	-0,876	-4,040	2,686
FM-PW-A	0,768 (0,302)	-0,770	-4,138	2,425
FM-PW-NW	0,836 (0,281)	-0,585	-4,081	2,435
DOLS	0,854 (0,189)	-0,756	-6,079	3,870
DGLS	0,797 (0,280)	-0,727	-3,818	2,487
ADL (1,2)	1,048 (0,328)	0,147	-3,564	2,279
AADL (1,2,1)	1,035 (0,359)	0,096	-3,637	2,311
ADL (4,4)	0,828 (0,281)	-0,613	-5,318	2,620
AADL (4,4,4)	1,315 (0,500)	0,630	-5,014	2,883
		LR-stat.		$x^2_{0,95}$
JOHANSEN	1,106	0,109		6,892

Notes: Standard errors in parentheses
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FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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NEW ZEALAND

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,673 (0,163)	-2,002	-4,240	2,666
FM-S-A	0,742 (0,196)	-1,316	-3,887	2,616
FM-S-NW	0,822 (0,210)	-0,848	-3,887	2,568
FM-PW-A	1,199 (0,242)	0,821	-3,639	2,273
FM-PW-NW	0,836 (0,254)	-0,645	-3,650	2,263
DOLS	1,244 (0,254)	0,960	-5,087	3,235
DGLS	1,207 (0,262)	0,792	-3,485	2,245
ADL (1,2)	1,333 (0,250)	1,332	-3,637	1,975
AADL (1,2,1)	1,315 (0,272)	1,157	-3,470	2,265
ADL (4,4)	1,022 (0,195)	0,111	-3,917	2,399
AADL (4,4,4)	0,814 (0,147)	-1,270	-3,529	2,167
		LR-stat.		$x^2_{0,95}$
JOHANSEN	1,376	2,907		6,582

Notes: Standard errors in parentheses
FM-S-A = Fully Modified Standard Andrews Estimator
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FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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NORWAY				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	-0,132 (0,086)	-13,238*	-3,706	5,095
FM-S-A	-0,061 (0,141)	-7,552*	-4,436	3,743
FM-S-NW	-0,107 (0,145)	-7,613*	-4,436	3,329
FM-PW-A	-0,182 (0,193)	-6,138*	-3,321	3,014
FM-PW-NW	-0,137 (0,185)	-6,157*	-3,877	3,574
DOLS	-0,144 (0,103)	-11,052*	-4,967	5,036
DGLS	-0,192 (0,180)	-6,621*	-3,125	3,217
ADL (1,2)	0,040 (0,266)	-3,614*	-1,581	3,293
AADL (1,2,1)	-0,129 (0,265)	-4,261*	-2,434	3,225
ADL (4,4)	0,027 (0,207)	-4,699*	-2,464	3,307
AADL (4,4,4)	0,108 (0,322)	-2,775	-4,153	2,881
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,091	2,659		7,456

Notes: Standard errors in parentheses
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FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

PORTUGAL

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,385 (0,107)	-5,761	-6,781	5,519
FM-S-A	0,312 (0,121)	-5,679*	-5,411	3,808
FM-S-NW	0,252 (0,193)	-3,881	-5,501	3,705
FM-PW-A	0,368 (0,390)	-1,622	-5,122	3,293
FM-PW-NW	0,183 (0,355)	-2,305	-5,064	3,218
DOLS	0,331 (0,124)	-5,410	-7,055	6,096
DGLS	0,438 (0,200)	-2,811	-4,389	3,210
ADL (1,2)	0,348 (0,392)	-1,661	-3,958	3,198
AADL (1,2,1)	0,336 (0,439)	-1,514	-4,215	2,937
ADL (4,4)	0,248 (0,359)	-2,096	-4,628	3,842
AADL (4,4,4)	0,156 (0,376)	-2,244	-5,577	3,482
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,093	2,590		9,672

Notes: Standard errors in parentheses
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FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
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SPAIN				
Estimator	**Estimate (s.e.)**	**t-stat.**	$t_{0,025}$	$t_{0,975}$
OLS	0,069 (0,082)	-11,400*	-6,338	7,704
FM-S-A	0,051 (0,118)	-8,047*	-5,525	4,653
FM-S-NW	0,034 (0,147)	-6,580*	-6,120	3,570
FM-PW-A	0,021 (0,257)	-3,802	-4,436	3,791
FM-PW-NW	-0,037 (0,272)	-3,816	-4,240	3,865
DOLS	0,042 (0,109)	-8,756*	-7,702	7,168
DGLS	0,114 (0,136)	-6,527*	-3,880	4,086
ADL (1,2)	0,209 (0,305)	-2,588	-3,988	3,169
AADL (1,2,1)	0,182 (0,344)	-2,376	-3,785	3,766
ADL (4,4)	-0,152 (0,354)	-3,251	-3,957	3,860
AADL (4,4,4)	-1,022 (1,569)	-1,289	-6,641	3,252
		LR-stat.		$x^2_{0,95}$
JOHANSEN	-0,945	2,289		8,981

Notes: Standard errors in parentheses
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FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

SWEDEN

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,660 (0,096)	-3,542	-5,118	3,812
FM-S-A	0,758 (0,155)	-1,562	-4,008	2,775
FM-S-NW	0,709 (0,138)	-2,109	-4,062	2,896
FM-PW-A	0,704 (0,221)	-1,340	-4,128	2,647
FM-PW-NW	0,795 (0,214)	-0,959	-4,100	2,581
DOLS	0,730 (0,097)	-2,779	-6,398	4,794
DGLS	0,735 (0,181)	-1,468	-3,632	2,405
ADL (1,2)	0,724 (0,259)	-1,064	-3,793	2,626
AADL (1,2,1)	0,769 (0,250)	-0,925	-3,796	2,325
ADL (4,4)	0,694 (0,211)	-1,449	-4,467	2,571
AADL (4,4,4)	0,606 (0,290)	-1,355	-4,171	2,384
		LR-stat.		$x^2_{0,95}$
JOHANSEN	1,401	0,568		7,198

Notes: Standard errors in parentheses
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FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

SWITZERLAND

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	1,013 (0,097)	0,135	-5,742	4,094
FM-S-A	1,116 (0,164)	0,703	-4,354	3,144
FM-S-NW	1,043 (0,161)	0,266	-4,244	3,171
FM-PW-A	1,028 (0,245)	0,116	-4,284	2,835
FM-PW-NW	1,028 (0,244)	0,114	-4,234	2,942
DOLS	1,014 (0,101)	0,135	-6,668	4,265
DGLS	1,058 (0,209)	0,280	-3,757	2,816
ADL (1,2)	0,970 (0,249)	-0,119	-3,741	2,807
AADL (1,2,1)	0,971 (0,273)	-0,108	-3,664	2,580
ADL (4,4)	1,047 (0,208)	0,224	-4,215	2,797
AADL (4,4,4)	1,019 (0,261)	0,074	-5,015	2,900
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,837	0,437		6,479

Notes: Standard errors in parentheses
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FM-S-NW = Fully Modified Standard Newey & West Estimator
FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

UNITED KINGDOM

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,827 (0,103)	-1,682	-4,484	2,882
FM-S-A	0,917 (0,151)	-0,551	-3,825	2,650
FM-S-NW	0,911 (0,162)	-0,552	-3,825	2,665
FM-PW-A	0,890 (0,187)	-0,591	-3,390	2,624
FM-PW-NW	0,902 (0,188)	-0,521	-3,375	2,627
DOLS	0,830 (0,100)	-1,694	-4,655	3,217
DGLS	0,814 (0,196)	-0,951	-3,402	2,431
ADL (1,2)	0,800 (0,213)	-0,937	-3,216	2,280
AADL (1,2,1)	0,809 (0,235)	-0,812	-3,315	2,350
ADL (4,4)	0,971 (0,185)	-0,157	-4,804	2,707
AADL (4,4,4)	0,994 (0,254)	-0,022	-4,906	2,515
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,905	0,123		6,213

Notes: Standard errors in parentheses
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FM-PW-A = Fully Modified Prewhitened Andrews Estimator
FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level

UNITED STATES

Estimator	Estimate (s.e.)	t-stat.	$t_{0,025}$	$t_{0,975}$
OLS	0,441 (0,085)	-6,572*	-1,944	5,523
FM-S-A	0,379 (0,131)	-4,735*	-2,747	4,039
FM-S-NW	0,350 (0,125)	-5,187*	-2,556	4,224
FM-PW-A	0,251 (0,155)	-4,547*	-2,034	3,237
FM-PW-NW	0,476 (0,132)	-3,971*	-2,216	5,233
DOLS	0,343 (0,108)	-6,103*	-3,417	5,401
DGLS	0,386 (0,147)	-4,180*	-1,891	3,822
ADL (1,2)	1,057 (0,534)	0,107	-0,204	3,618
AADL (1,2,1)	0,373 (0,352)	-0,931	-1,088	3,271
ADL (4,4)	1,199 (0,728)	0,273	-0,564	4,039
AADL (4,4,4)	0,431 (0,376)	-1,511	-5,126	3,533
		LR-stat.		$x^2_{0,95}$
JOHANSEN	0,044	7,341*		6,738

Notes: Standard errors in parentheses
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FM-PW-NW = Fully Modified Prewhitened Newey & West Estimator
An asterisc indicates rejection at the 5% level