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Abstract

We estimate the Feldstein-Horioka equation for the period 1960-2012 and find structural breaks that coincide with the introduction of the European single market in 1993, the introduction of the euro in 1999 and the financial crisis in 2008. The results suggest that the correlation between investment and savings depends on institutions, exchange rate risk and credit risk. Furthermore, we find that the pattern of capital flows within the euro zone reflect differences in output per capita, the rate of growth of output per capita and budget balances.

JEL-Code: E200.

Keywords: Feldstein-Horioka puzzle, European integration.

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1. Introduction

A large and growing literature has attempted to explain the findings of Feldstein and Horioka (1980) that savings and investment are correlated across countries. In a world of capital mobility the finding appears puzzling since a fall in savings in one country should not affect domestic interest rates or investment.

The FH equation is the following

$$\left(\frac{I}{Y}\right)_{jt} = a + b\left(\frac{S}{Y}\right)_{jt} + u_{jt} \quad (1)$$

where *I* denotes gross capital formation, *S* is savings, *Y* denotes GDP and *u* is an error term. If capital was perfectly mobile across countries we would find the coefficient *b* to be close to zero because a fall in savings in one country would not affect domestic interest rates or investment. However, Feldstein and Horioka found that the estimated coefficient of the saving rate was 0.887 in a cross section of industrialized countries for the period 1960 and 1974. The authors attributed their finding to barriers to capital mobility.

Although the Feldstein-Horioka (FH) equation was initially estimated as a cross-section relationship, most recent studies use panel estimation techniques that allow both for country heterogeneity and time-series variation. Many of these studies involve testing for cointegration between savings and investment using a variety of standard or more sophisticated econometric techniques,[1] while other studies attempt to study the FH relationship using estimators that are consistent even in the absence of cointegration.[2]

According to Coakley et al. (1996), excessive current account deficits may raise the interest rate faced by a country in international capital markets making further borrowing difficult. Similarly, as argued by Tobin (1983) and Summers (1988), governments may dislike deficits for financial stability reasons and surpluses since they indicate room for expansionary policies. Bai and Zhang (2010) show that financial frictions can explain the FH puzzle.

Frankel (1992) explains how the puzzle may arise if other variables affect both savings and investment. Thus countries with low tax rates may have both high saving and investment rates. There is also the possibility that real interest rates are not equalized across countries due to a country premium, exchange rate premium or the expected depreciation of the currency. In this case a fall in savings in one country may make real interest rate rise and investment fall. For the saving-investment correlation to be zero the real interest parity must hold. Real interest rate differential can be written as:

$$(r - \pi^e) - (r^* - \pi^{e*}) = (r - r^* - fd) + (fd - \Delta s^e) + (\Delta s^e - (\pi^e - \pi^{e*})) \quad (2)$$

where r and r^* denote domestic and foreign nominal interest rates, π^e and π^{e*} are the domestic and foreign expected inflation, fd is the forward discount on the domestic currency and Δs^e is the expected depreciation of the domestic currency. The first term

[1] For a survey see Apergis and Tsoumas (2009) and Kumar and Bhaskara (2009).
[2] De Vita and Abbott (2002), Kollias et al (2008) and Coakley et al (2004).

on the RHS of equation (2) is the covered interest differential and is defined by Frankel (1992) as the 'country premium' since it captures country specific factors that may not allow real interest rate differential such as capital controls or default risk. The second and third term represent the exchange risk premium and the expected real depreciation and together they form the 'currency premium'. The elimination of both the 'country' and the 'currency' premium would imply that the real interest parity holds.

In this paper we will estimate a ten-year window cross-sectional regression in order to describe the time series variation in the coefficient of the saving rate in contrast with the static coefficient estimation from long-run averaged cross-sectional regressions. This then provides a rationale for investigating the time-series variation in the coefficient of savings, such as testing for structural breaks due to institutional changes. We explore whether the FH coefficient is sensitive to institutional changes, in particular the removal of capital controls in Europe in the 1990s and EMU in 1999, and the financial crisis starting in 2008. One could argue that the creation of the single market should decrease the 'country' premium for participating countries while the fiscal crisis after 2008 must have worked towards the opposite direction due to a rise in default risks. Also one would expect the adoption of the common currency to reduce the 'currency premium' for euro area countries.

2. Institutional changes

Two major institutional reforms increasing capital mobility have taken place in recent decades. The first was the single European market in 1993 and the second the introduction of the euro in 1999.

The introduction of the single market involved the removal of capital controls with obvious implications for equation (2) above. The introduction of EMU may also have been important. Regions within countries do not face currency risk when it comes to intra-country capital movements. Thus regional authorities can be expected to be less concerned about current account imbalances than national authorities. Real rates of interest should also be the same across regions with given intra-country purchasing power parity. Since the correlation between savings and investment should for this reason be much higher between countries than between regions within a country, the establishment of the euro zone in 1999 may have coincided with a structural break in the coefficient of savings in the Feldstein-Horioka equation.[3]

Blanchard and Giavazzi (2002) studied current account balances, savings and investment and found that the FH puzzle had disappeared in the euro zone. Telatar et al. (2007) looked at nine EU countries for the 1970-2002 period and found that six of these countries moved from a low to a high capital mobility regime with EMU. Supportive evidence for a negative EMU effect on the saving retention coefficient has also been found by Kumar and Rao (2009) in a sample of 13 OECD countries. However, these studies do not look at differences between various groups of countries within and outside the euro zone nor do they include the period of the recent financial crisis. An exception is Johnson and Lamdin (2014) who find a positive impact of the financial crisis on the coefficient of the saving ratio for the euro zone and non-euro

[3] These results are supported by Helliwell (1998), Bayoumi and Rose (1992) for British regions, Helliwell and McKitrick (1998) for Canadian regions and Sinn (1992) for U.S. regions.

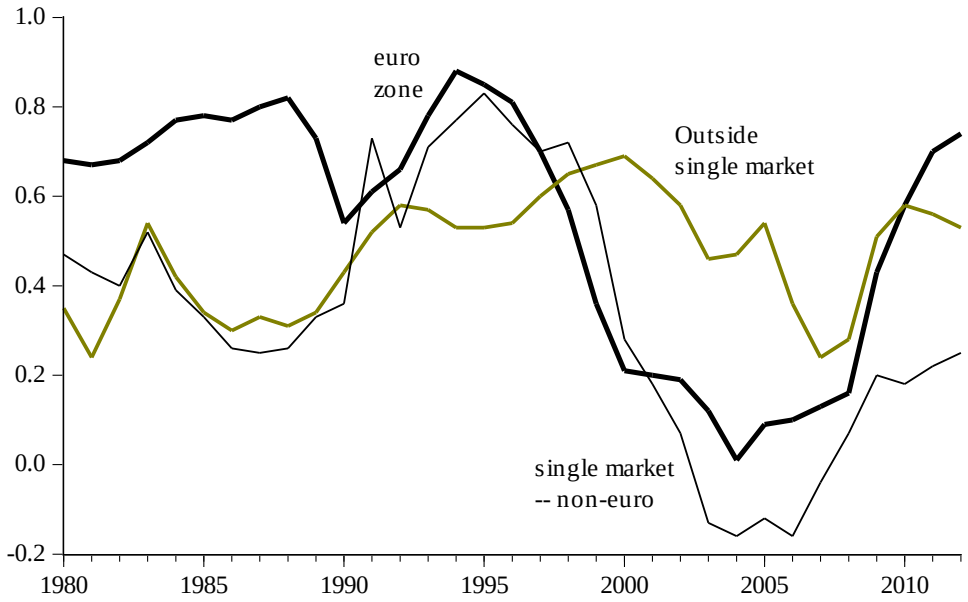
countries of the EU. Specifically, they estimate the FH equation for a sample of 40 OECD countries for the 1980-2012 period and find that *b* increases (by 0.06) in the 2006-2012 period for the EU and euro zone countries while for the rest of the countries the savings ratio coefficient remains unaffected. However, somewhat surprisingly, they find that this effect comes from the 2006-2008 period and disappears in the subsequent years.

3. Statistical results

We observe savings and investment for 30 OECD countries going back to 1960 and ending in 2012. Unit-root tests and panel tests for cointegration between savings and investment show that over the period 1960-2012 many of the series have a unit root and it is difficult to reject cointegration for the whole period, easier for the sub period 1993-2012 (see Table A1). The value of the LM test of Hansen (1992) rejects the null of parameter stability for all countries but Belgium, Finland and Israel.

According to Bai and Zhang (2010), the cross section rather than the time-series dimension of the data is appropriate for evaluating the significance of the factors explaining the FH puzzle. The figure below highlights the evolution of the cross-section coefficients from equation (1) over time by plotting estimates for *b* using a "moving sample" of 10 observations.[4]

Figure 1. The evolution of cross-section coefficients



Capital mobility increased more in the single-market countries in 1993 than in the non-single market ones while the subsequent fall in capital mobility after the financial crisis appears stronger in the euro zone than elsewhere.

Tables 1 and 2 show the results of (unbalanced) panel estimations of the FH equation for all countries as well as groups of countries defined in appendix. In Table 1 we

[4] For example the observation in 1980 is estimated using 1971-1980 data.

estimate equation (1) with OLS while in Table 2 we perform IV estimations using the lagged savings ratio as instrument in order to address a possible endogeneity problem pointed out in the literature (see Feldstein and Horioka; 1980, Frenkel; 1992).[5] We allow for three time dummies to test for structural breaks; one for the years 1993-98, another for 1999-2007 and the third one for 2008-2012. The time dummies are also interacted with the saving rate to test for structural breaks in the coefficient *b* in the equation above. A Wald test rejects the hypothesis of a constant intercept term as well as a constant coefficient of the saving rate across time.

Comparing the OLS coefficients in Table 1 to the IV coefficients in Table 2 one can see that they are qualitatively quite similar. The values of the coefficients on the saving ratio are somewhat higher in the IV regressions while the coefficients of the interaction of savings with the time dummies have very similar values across estimation methods in most cases.

For the whole sample of 30 countries we get a coefficient of 0.544 for the saving rate in Table 1 (and of 0.638 in Table 2). The southern euro-zone countries seem to have the lowest capital mobility over the whole sample period reflected in a coefficient of 0.80 in OLS estimations and 0.85 in IV regressions, which is the highest among the group of countries we examine. Countries outside the single market have a coefficient lower than countries inside the single market (0.51 compared to 0.67 in Table 1 and 0.61 compared to 0.77 in Table 2). To the extent that this difference reflects lower capital mobility in the single market countries, it may also explain the need for promoting free movement of capital factors through the creation of the single market. Within the single market, the results from IV regressions indicate a similar saving coefficient for the euro-zone and the non-euro countries whereas OLS estimates point to a higher saving coefficient for countries using the euro.

Turning to the impact of the single market, the adoption of the euro and the economic crisis, one can see in Table 1 that the coefficient of the saving rate for the whole sample of countries shifts downwards in 1999-2007 to 0.093 and then back in 2008-2012 to 0.284. Similarly, in Table 2 the coefficient shifts downwards in 1999-2007 to 0.2 and then back in 2008-2012 to 0.4. This indicates greater capital mobility in the 1999-2007 period which is partly reversed during the crisis. In contrast, both OLS and IV estimates indicate that the creation of the single market does not seem to affect *b* when looking at the whole sample of countries.

In column (2) of Table 1 we see that, as expected, the creation of the single market does affect *b* for the single-market countries. The coefficient of the saving rate falls significantly from 0.67 to 0.483 in 1993-98 and further to 0.023 in 1999-2007. About half of the fall in *b* is due to euro area creation is offset by the crisis after 2008 when it rises to 0.246. Interestingly, in Table 2 the effect of the single market was confined to the single-market countries that did not later adopt the euro. One can see in column (4) for the non-euro single-market countries that the coefficient of the saving rate falls significantly from 0.76 to 0.61 in 1993-98 and further to 0.12 in 1999-07. Again about half of the fall in *b* due to euro area creation is offset by the crisis.

[5] We have also obtained similar results using alternative instruments such as the ratio of the population aged 65+ and the benefit replacement rate. However, in order not to restrict our sample substantially due to the availability of these instruments across countries and over time, we decided to perform the IV regressions using the lagged savings ratio as an instrument. See, amongst others, Kasuga (2004).

Although in countries outside the European single market capital mobility appears not to be affected by the single market, euro zone creation seems to have coincided with a decrease in the value of *b* in the whole sample. However, this effect is much weaker for the non-single market countries (becomes statistically insignificant in the OLS regressions) and much stronger for the euro zone. Column (3) of Table 2 shows that the adoption of the euro coincides with a decrease of the coefficient of the savings ratio for countries outside the single market to 0.48, which is, however, four times higher than the same coefficient for single market countries. The effect is much greater within the euro zone as shown in column (5) of Tables 1 and 2 where the creation of the euro area decreases the value of the savings ratio coefficient from 0.71 to 0.02 according to the OLS estimates and from 0.77 to 0.16 in IV regressions.

Finally, the financial crisis leads to a rise in the saving ratio coefficient throughout the EU but it does not affect non-single market countries. According to the estimates presented in Table 2, the magnitude of this effect is greater for the non-euro member states.

4. Factors affecting capital flows

Increased capital mobility in the European single market starting in 1993 and in the euro zone starting in 1999 may have increased economic efficiency; capital flowing to equalize marginal rates of return. Differences in the age structure of the population across countries, in output per capita and in growth prospects can thus be expected to have played a role in affecting capital flows. There is also the possibility that the capital flows have been destabilizing by generating unsustainable credit expansions and asset price bubbles. Thus the capital flows have been blamed for the recent financial crises in countries such as Greece, Iceland, Ireland and Spain.

In this section we explore to which extent observed current account imbalances can be explained by differences in the population age structure of different countries and to differences in growth rates and output per capita, on the one hand, and to which extent they are unexplained hence possibly be causing asset price bubbles and financial instability, on the other hand.

The life-cycle hypothesis (see Modigliani, 1975) and the national account identity imply that the age structure of the population should affect current-account balances so that a country with proportionately more young and old people should have deficits and a country with proportionately more middle-aged people should have current account surpluses. Studies of the relationship between the age structure and the current account go back to the work of Leff (1969) who regarded dependency rates as the determinant of saving rates. In a recent paper, Gudmundsson and Zoega (2014) find an inverted U-shaped relationship between the age structure and the current account so that the larger the share of the young and the old of the population the smaller is the current account surplus and the larger the share of the middle aged the greater is the surplus.[6]

[6] A relationship between age structure variables and domestic savings has been found by many authors, such as Fry and Mason (1982), Mason (1987, 1988), Higgins (1998), Lindh (1999), Bloom et al. (2010) and Herbertsson and Zoega (1999). In an interesting paper, Taylor and Higgins (1994) explain the capital flow from Britain to Australia, Canada, the U.S. and Argentina in the late 19th

In addition we include variables measuring economic growth defined as the rate of growth of output per capita, the level of output per capita and budget balances for the government as a ratio to GDP. Economic growth is included because in the medium to long term higher growth rates may reflect differences in the rate of technological progress which may coincide with an inflow of capital. A country having high rates of technological progress could be expected to have a greater demand for capital that would be expected to generate a capital inflow and current account deficits. Moreover, in the short term, a domestic demand expansion will lead to both output growth as well as lower current account deficits. The level of GDP per capita is included because a lower level of output per capita may reflect a higher marginal product of capita in a given country if its steady state output per capita is the same as elsewhere. Finally, government budget balances may be related to the current account since the sum of private and public savings net of investment has to equal the current account surplus. While the presence of such "twin deficits" does not prove *prima facie* evidence for causality, the link between the two may be stronger within a single currency area.

Table 3 reports the results for the same sample of countries.[7] We use two age groups, 0-24 and 65+ (in percentage) in addition to the annual rate of growth of output per capita (in percentage), the level of output per capita (US thousands of dollars at 2005 prices) and the budget balance as a share of GDP (in percentage).

We start by introducing time dummies; the first takes the value one for each year since the start of the single market in 1993 and zero for all remaining years and another that takes the value one for each year since the start of the euro zone and zero for all other years. We report the results of the pooled estimation in column (1), the fixed effect estimation in column (2) using annual data. In columns (3) and (4) we remove the time dummies and replace them with a dummy for the single market countries and a dummy for the euro zone countries.[8] The effect of each of the variables can be gauged by looking at three coefficient estimates when the variable is interacted with each dummy variable.

The results show that current account surpluses tend to be associated with government budget surpluses, high level of GDP per capita and low rates of growth of output. This tendency becomes stronger in the 1990s and 2000s when capital mobility has increased as shown in Tables 1 and 2.

The relationships between the current account and the demographic variables appears to be counterintuitive in that the share of the young and the share of the old have positive coefficients except for the period 1999-2007 for the whole sample. Thus in the euro zone a higher proportion of the young and the old is associated with current account surpluses. As shown by Gudmundsson and Zoega (2014) this should not

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century, early 20th century by high youth dependency ratios in the colonies. Aksoy et al. (2012) find a strong effect of demography on growth using OECD data.

[7] Korea excluded because of missing data on government budget balances.

[8] When a single-market country enters the euro zone the value of the single-market dummy changes from one to zero while the value of the euro zone dummy changes from zero to one. If a country remains in the single market and does not enter the euro zone (Sweden for example) then the single market dummy remains equal to one.

come as a surprise because based on the age structure Germany, Austria, Belgium and Denmark should have smaller surpluses while the age structure cannot fully explain the current account deficits of Greece, Portugal and Spain, to mention a few of these countries.

Turning to the results using time dummies in columns (1) and (2), the growth variable has a negative and statistically significant coefficient during the period 1999-2009 implying that a 5% increase in the rate of growth (as from 1% to 6%) reduces the current account by 1.15% of GDP (using the coefficient estimate -0.23 = -0.33 + 0.10 from the fixed effect estimation). Note that he sign of the coefficient is positive before 1999. Output per capita has a positive and statistically significant coefficient in all periods using the fixed effect estimation. Finally, the budget surplus has a positive and significant coefficient after 1993 under the fixed effects estimation and for the period after 1999 using the pooled estimator, implying that a 5% increase in the budget surplus (as a fraction of GDP) will make the current account improve by 1.15% of GDP using the fixed effect estimator with annual data.

The variable measuring the share of the population over 65 (old) is statistically significant and negative in the post 1999 period. During this period the current account surplus is smaller the greater the proportion of old people in the population. However, it is positive in the period 1993-1998. The coefficient for the young is, in contrast to what expected, positive after 1999 (-0.39+0.64=0.25) when using annual data and the fixed effects estimator, albeit smaller than the coefficient of the old.

Hence using time dummies for the 1993-2007 and 1999-2007 periods we have found that in the last period having a large share of the population over 65 and, surprisingly, a small share of population under 25, having high rates of growth of output, a low level of output per capita and government budget deficits all contributed to having current account deficits and a capital inflow. The relationship between the current account, output per capita and the budget balance holds for the period 1993-2007 and before 1993 current account surpluses were also associated with high levels of output per capita.

Now turning to columns (3) and (4) where the time dummies are replaced by dummy variables for the single-market countries and the euro zone countries we find that within the euro zone high output per capita and positive government budget balances are more likely to have current account surpluses. This implies that within the euro zone current account deficits – that is capital inflows – coincide with low GDP per capita and government deficits. What is surprising, however, is the current account surpluses within the euro zone go together with having a large share of the population under 25 and over 65 years of age. A similar impact of the age structure on the current account also applies to the single-market countries outside the euro zone.[9] In this group of countries there is also a positive effect of having budget surpluses on the current account. In contrast to the euro zone, economic growth and output per capita have a negative effect on the current account surplus in those countries.

The R-square of the pooled estimate in column (1) of Table 3 is 0.43 while the fixed

[9] Using a 55 country sample used by Gudmundsson and Zoega (2014) we find a strong effect of the age structure in the predicted direction.

effect estimate has an R-square of 0.76. This implies that a significant share of the capital flows is unexplained by the factors considered here. The residuals from the four regressions show that Germany, Austria, Canada, Norway, Sweden and Switzerland developed unexplained current account surpluses in the 2000s while Belgium, Estonia, Greece, Ireland, Iceland, Italy, New Zealand, Portugal, Spain and the U.K. had unexplained deficits during this period. This opens the possibility that speculative capital flows from northern European countries to the southern periphery of the euro zone, Estonia, Ireland, and Iceland may have caused the financial crises that hit these countries in the late 2000s.

5. Conclusions

The increase in the FH measure of capital mobility coincides with the start of the European single market in 1993 and the introduction of the euro in 1999. We find that the former effect occurs in single-market countries that remain outside the euro zone whereas the latter is greater in the euro zone countries. The increased capital mobility within the euro zone consists of capital coming from nations with a higher output per capita and lower government budget deficits. Also, the financial crisis that started in 2008 has led to a fall in the FH measure in the EU, i.e. the coefficient of savings in the investment equation has risen. This recent development has occurred in both the member states of the single market that use the euro as well as in those countries that use their own currencies. In contrast, the financial crisis has not affected the magnitude of the savings ratio coefficient in non-single market countries.

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Table 1. OLS estimation, unbalanced

	All countries	Single market countries	Non-single market	Single market, non-euro	Euro zone	Euro zone – north	Euro zone – south
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	15.067**	10.417**	15.719**	19.573**	9.358**	9.433**	7.632**
	(9.01)	(10.14)	(5.83)	(8.15)	(6.83)	(7.10)	(3.68)
$c_{93\text{-}98}$	-0.819	1.270	-1.504	1.447	-0.202	-1.160	3.350*
	(0.58)	(1.07)	(1.40)	(1.07)	(0.07)	(0.37)	(1.72)
$c_{99\text{-}07}$	8.276**	12.676**	1.979	11.176**	13.791*	8.274*	11.61**
	(3.39)	(5.15)	(0.70)	(2.98)	(4.33)	(1.87)	(2.35)
$c_{08\text{-}12}$	2.205	5.395**	-0.865	4.139*	5.331*	0.415	7.188**
	(1.29)	(3.75)	(0.36)	(1.68)	(1,86)	(0.07)	(2.80)
S/Y	0.544**	0.670**	0.506**	0.585**	0.709**	0.715**	0.801**
	(8.50)	(16.04)	(5.06)	(5.84)	(12.53)	(11.55)	(10.19)
$d_{93\text{-}98}$*s	-0.060	-0.187**	0.034	-0.211**	-0.115	-0.085	-0.254**
	(0.87)	(3.20)	(0.84)	(2.86)	(0.87)	(0.53)	(2.46)
$d_{99\text{-}07}$*s	-0.451**	-0.647*	-0.160	-0.603**	-0.686**	-0.500**	-0.463*
	(4.34)	(6.22)	(1.45)	(4.08)	(4.46)	(2.48)	(1.69)
$d_{08\text{-}12}$*s	-0.260**	-0.424**	-0.060	-0.393**	-0.393**	-0.205	-0.360**
	(3.61)	(7.63)	(0.66)	(4.30)	(3.03)	(0.83)	(2.67)
Difference: 60-92 and 93-98	-0.060	-0.187	0.034	-0.211	-0.115	-0.085	-0.254
Difference: 93-98 and 99-07	-0.391	-0.46	-0.194	-0.392	-0.571	-0.415	-0.209
Difference: 99-07and 08-12	0.191	0.223	0.1	0.21	0.293	0.295	**0.103**
Countries (clusters)	30	20	11	7	11	7	4
Observations	1075	699	398	232	409	254	155
R-squared	0.67	0.65	0.70	0.67	0.61	0.61	0.64
Wald test							
F: $c_{93\text{-}98}$= $c_{99\text{-}07}$= $c_{08\text{-}12}$=0	6.86 (0.00)	8.93 (0.00)	5.44 (0.02)	2.99 (0.12)	12.69 (0.00)	1.94(0.22)	14.65 (0.03)
F: $d_{93\text{-}98}$= $d_{99\text{-}07}$= $d_{08\text{-}12}$=0	7.01 (0.0)	20.02 (0.0)	2.42 (0.13)	8.27 (0.01)	9.78 (0.00)	3.06 (0.11)	266 (0.00)

White cross-section standard errors & covariance (d.f. corrected). T ratios in parentheses. Significance denoted by stars: * at the 5% and ** at the 10% level of significance.

Table 2. Panel estimation, IV

	All countries	Single market countries	Non-single market	Single market, non-euro	Euro zone	Euro zone – north	Euro zone – south
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Constant	8.469**	5.109**	9.400**	5.380**	8.733**	1.916	5.685
	(11.99)	(5.20)	(9.85)	(3.58)	(5.04)	(0.87)	(1.68)
$c_{93\text{-}98}$	-2.132*	-0.431	-2.919*	0.795	-3.751	-4.608	5.904
	(1.67)	(0.29)	(1.67)	(0.45)	(1.35)	(1.38)	(0.65)
$c_{99\text{-}07}$	8.002**	12.836**	1.173	12.193**	13.398**	5.549*	11.652**
	(7.05)	(8.78)	(0.80)	(6.26)	(6.53)	(1.86)	(2.82)
$c_{08\text{-}12}$	2.072**	5.514**	-1.541	5.113**	4.802**	-0.553	5.217
	(2.00)	(4.12)	(0.98)	(2.75)	(2.03)	(0.14)	(1.25)
S/Y	0.638**	0.771**	0.609**	0.764**	0.768**	0.839**	0.848**
	(17.83)	(15.90)	(12.01)	(9.47)	(10.53)	(9.57)	(5.65)
$d_{93\text{-}98}$*s	0.005	-0.098	0.092	-0.159*	0.055	0.078	-0.369
	(0.09)	(1.46)	(1.13)	(1.95)	(0.44)	(0.52)	(0.86)
$d_{99\text{-}07}$*s	-0.438**	-0.650**	-0.129**	-0.646**	-0.662**	-0.392**	-0.451**
	(9.09)	(10.39)	(2.09)	(8.26)	(7.32)	(3.12)	(2.32)
$d_{08\text{-}12}$*s	-0.242**	-0.413**	-0.025	-0.427**	-0.347**	-0.149	-0.181
	(5.35)	(7.19)	(0.34)	(5.64)	(3.25)	(0.84)	(0.85)
Difference: 60-92 and 93-98	0.005	-0.098	0.092	-0.159	0.055	0.078	-0.369
Difference: 93-98 and 99-07	-0.443	-0.552	-0.221	-0.487	-0.717	-0.470	-0.082
Difference: 99-07and 08-12	0.196	0.237	0.104	0.218	0.315	0.243	0.270
Countries (clusters)	30	20	11	7	11	7	4
Observations	1040	677	384	224	397	247	150
R-squared	0.66	0.64	0.70	0.65	0.59	0.58	0.60
Wald test							
F: $c_{93\text{-}98}$= $c_{99\text{-}07}$= $c_{08\text{-}12}$=0	67.44 (0.00)	96.84 (0.00)	6.62 (0.08)	46.41 (0.00)	67.33 (0.00)	7.20(0.06)	9.59 (0.02)
F: $d_{93\text{-}98}$= $d_{99\text{-}07}$= $d_{08\text{-}12}$=0	100.29 (0.0)	130.24 (0.0)	8.08 (0.04)	80.42 (0.00)	68.61(0.00)	11.92 (0.01)	6.05 (0.11)

White cross-section standard errors & covariance (d.f. corrected). T ratios in parentheses. Significance denoted by stars: * at the 5% and ** at the 10% level of significance.

Table 3. The current account and the age structure (1981-2007)

	Periods			Participation in European	
	(1)	(2)		(3)	(4)
	Pooled	F.E.		Pooled	F.E.
Constant	0.20	-28.52*	Constant	4.60**	-5.41
	(0.05)	(3.02)		(1.91)	(0.92)
Young	-0.09	0.64*	Young	-0.21*	0.07
	(1.51)	(3.07)		(4.87)	(0.65)
Old	0.12	0.16	Old	0.11	0.06
	(1.22)	(0.85)		(1.57)	(0.45)
Growth	0.20*	0.10*	Growth	0.06	0.13*
	(2.11)	(2.30)		(0.65)	(2.71)
Output per capita	0.001*	0.002*	Output per capita	0.001*	0.001*
	(6.15)	(3.40)		(10.48)	(2.69)
Budget surplus as share of GDP	0.05	0.00	Budget surplus as share of GDP	0.05	0.01
	(0.88)	(0.01)		(1.51)	(0.21)
1993-2007			Single market countries		
Constant (93-09)	-12.62*	-4.05	Constant (93-09)	-32.39*	-25.04*
	(2.91)	(0.63)		(7.01)	(4.99)
Young	0.11	0.04	Young	0.71*	0.62*
	(1.41)	(0.29)		(10.47)	(6.25)
Old	0.74*	0.47*	Old	0.95*	0.63*
	(5.60)	(2.99)		(5.55)	(3.75)
Growth	-0.19	0.05	Growth	-0.77*	-0.45*
	(1.06)	(0.54)		(4.53)	(3.94)
Output per capita	-0.004*	0.001*	Output per capita	-0.004*	-0.003*
	(2.64)	(2.97)		(3.65)	(2.79)
Budget surplus as share of GDP	0.11	0.13**	Budget surplus as share of GDP	0.56*	0.37*
	(1.17)	(1.89)		(7.06)	(4.37)
1999-2007			Euro zone countries		
Constant (99-09)	7.26	24.87*	Constant (99-09)	-43.55*	-45.80*
	(1.49)	(3.68)		(5.44)	(6.20)
Young	-0.01	-0.39*	Young	0.39*	0.59*
	(0.17)	(2.96)		(2.58)	(3.64)
Old	-0.38*	-0.76*	Old	1.08*	1.26*
	(2.63)	(3.92)		(4.25)	(5.51)
Growth	-0.75*	-0.33*	Growth	0.11	0.06*
	(4.51)	(2.55)		(0.57)	(0.40)
Output per capita	0.569*	0.001	Output per capita	0.569*	0.347*
	(2.41)	(4.87)		(16.57)	(7.91)
Budget surplus as share of GDP	0.48*	0.23*	Budget surplus as share of GDP	0.43*	0.35*
	(5.64)	(2.71)		(3.35)	(2.57)
Cross sections	29	29	Cross sections	29	29
Observations	586	586	Observations	586	586
R-squared	0.43	0.76	R-squared	0.47	0.76

White cross-section standard errors & covariance (d.f. corrected). T ratios in parentheses.
Significance denoted by stars: * at the 5% and ** at the 10% level of significance.

Appendix I

Table A1. Panel cointegration test (Pedroni)

Null Hypothesis: No cointegration

	1993-2012				1960-2012			
Panel v-Statistic	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.	Statistic	Prob.
Panel rho-Statistic	-0.68	0.753	-0.45	0.67	0.61	0.274	-0.358	0.640
Panel PP-Statistic	1.66	0.951	0.44	0.67	-3.04	0.001	-9.93	0.000
Panel ADF-Statistic	0.72	0.763	-1.33	0.09	-3.28	0.001	-9.41	0.000
	-3.74	0.000	-2.61	0.01	-4.62	0.000	-6.96	0.000
Sample:	1993 2012				1960=2012			
Observations:	620				1643			
Cross-sections:	30 (1 dropped)				30 (1 dropped)			

Trend automatic lag length selection based on AIC with lags from 1 to 10: Deterministic intercept and trend. Newey-West automatic bandwidth selection and Bartlett kernel.

Appendix II

EU- single market: Austria, Belgium, Czech R., Denmark, Estonia, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden Switzerland, U.K.

Non single market: Australia, Canada, Chile, Israel, Japan, Korea, New Zealand, Poland, Slovakia, Slovenia, U.S.

EU- euro: Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain.

EU-euro-north: Austria, Belgium, Finland, France, Germany, Ireland and the Netherlands

EU-euro-south: Greece, Italy, Portugal, Spain

Single market – non euro: Estonia, Iceland, Norway, Poland, Sweden, Switzerland, the U.K.

Data

Gross capital formation as a share of GDP. Source: World Bank.

Gross national saving as a share of GDP. Source: World Bank

General government net lending/borrowing. Source: IMF.

Real GDP per capita in US collars. Calculated as the ratio of output-side real GDP at chained PPPs (in mil. 2005US$) and population in millions. Source: Penn-World Tables.

Share of population under age 25 and 65 and older. Source: World Bank.

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