The University Of Sheffield.

Department Of Economics.

Sheffield Economic Research Paper Series.

The Great Leveraging in the GIIPS Countries: Domestic Credit and Net Foreign Liabilities

Juan Carlos Cuestas and Karsten Staehr

ISSN 1749-8368

SERPS no. 2015012

May 2015

The Great Leveraging in the GIIPS Countries: Domestic Credit and Net Foreign Liabilities[*]

Juan Carlos Cuestas[**]

University of Sheffield, United Kingdom

Karsten Staehr

Tallinn University of Technology, Estonia
Eesti Pank, Estonia

Abstract: This paper analyses the relationship between domestic credit and foreign capital flows in the GIIPS countries during the Great Moderation before the global financial crisis. Cointegration analyses on the pre-crisis sample reveal that domestic credit and net foreign liabilities are cointegrated for Greece, Italy, Portugal and Spain, but not for Ireland. For the first four countries the long-run coefficient is in all cases around one, suggesting a close relationship between domestic leveraging and foreign capital inflows. Estimation of VECMs shows that the adjustment to deviations from the long-run relationship takes place through changes in domestic credit for Greece and Italy, while the adjustment is bidirectional for Spain and possibly also Portugal. These results suggest that "push" factors related to foreign capital inflows were important in the pre-crisis leveraging. The deleveraging after the crisis was largely unrelated to developments in foreign capital flows.

JEL codes: F32, E51, E44, C32

Keywords: leveraging, capital flows, financial crisis, cointegration

---

[*] The authors would like to thank participants at the ECEE6 conference in Tallinn, a seminar in Eesti Pank, the 'lunch seminar' on 2 March 2015 at INET, New York, and the Eastern Economics Association conference 2015 for comments. The usual disclaimer applies. Juan Carlos Cuestas acknowledges the financial support from the MINECO (Ministerio de Economía y Competitividad, Spain) research grant ECO2014-58991-C3-2-R. The views expressed are those of the authors and not necessarily those of Eesti Pank.

[**] Corresponding author: Department of Economics, University of Sheffield, 9 Mappin Street, Sheffield, S1 4DT, United Kingdom. E-mail address: j.cuestas@sheffield.ac.uk.

1. Introduction

The GIIPS countries – Greece, Ireland, Italy, Portugal and Spain – were among the European countries most adversely affected after the outbreak of the global financial crisis. The five countries experienced banking sector problems, credit crunches, government debt crises and deep recessions to varying degrees (Moro, 2014). Four of the countries received financial support from the IMF and the European Union; only the Italian authorities managed to borrow at commercial terms throughout the crisis period.

In the decade before the crisis all five GIIPS countries experienced fast economic growth, subdued inflation and rapidly growing domestic credit. Domestic credit grew faster than GDP and the leverage ratio increased substantially, a phenomenon that has been labelled *The Great Leveraging* (Taylor, 2011). These developments were reversed after the outbreak of the global financial crisis as extensive deleveraging occurred and the countries were plunged into deep recessions.

The decades before the crisis saw many developments that enhanced the importance of foreign capital flows. First, capital accounts were liberalised in Europe in the 1980s. Second, the introduction of the euro at the end of the 1990s removed exchange rate risks. Third, large current account surpluses, particularly in Asian and oil exporting countries, contributed to the *Global Savings Glut* in the 2000s and investors searched for new investment opportunities. As a result many countries in the periphery of Europe, including most of the GIIPS countries, experienced substantial capital inflows, reflected by large current account deficit before the crisis (Borio and Disyatat, 2011).

This paper ties together these developments by investigating the relationship between domestic credit and net foreign liabilities in the GIIPS countries. It is important to study the dynamics of domestic credit growth and foreign capital flows. Numerous studies find that these variables exhibit valuable information on the performance of individual economies, including their vulnerability to financial crises and the fallout after a crisis.[1] Moreover, linkages between the variables may be an indication of possible spillovers between domestic and foreign financial developments and hence of possible financial vulnerabilities.

The importance of domestic credit and foreign liabilities for economic performance raises the issue of possible linkages between the two variables, and there are indeed many potential linkages (Lane and McQuade, 2014). A net inflow of external capital implies that additional resources are made available for consumption and investment and these resources may or may not be

[1] Rapid domestic credit growth may help predict the outbreak and depth of financial rises (Gourinchas and Obstfeld 2012, Taylor 2013, Jordá et al. 2013). Large current account deficits may similarly be a predictor of financial instability in the future (Obstfeld 2012a,b; Reinhart and Reinhart 2008; Lane and Milesi-Ferretti 2010, 2012).

channelled through the banking sector and lead to increased credit.[2] Similarly, banks may finance domestic credit domestically or through external funding sources. It is clear that the relationship between domestic credit and net foreign liabilities may be time-varying and dependent on numerous factors.

In situations where there is a relationship between domestic credit and foreign liabilities, it is clearly of interest to ascertain the possible *direction* of the relationship. Kindleberger (1978) argued that capital flows may be the result of "pull" factors stemming from the country itself or "push" factors stemming from outside of the country and typically being common for many countries. Basu (1991) argues that push factors have been common and uses terms such as "credit rationing" and "loan pushing" to describe how external financing conditions may guide domestic credit. Fratzscher (2012) finds in a sample of 50 countries that "push" factors were particularly important at the height of the global financial crisis in 2008 while "pull" factors were more important in subsequent years.[3]

From a policy viewpoint the distinction between pull and push factors is clearly of importance. In the present context the direction from domestic credit growth to foreign capital flows may signify a "pull factor", i.e. a domestic factor eventually bringing in foreign capital flows. The direction from foreign capital to domestic credit may signify a "push factor", i.e. an external factor eventually driving domestic credit.

Only a few empirical studies have analysed the relationship between foreign domestic credit and capital flows and the papers have typically only considered one direction. Avdijev et al. (2012) analyse the impact of financial openness, economic size and exchange rate volatility on the growth of credit as a percentage of GDP. They find that international credit permits domestic credit booms to occur in emerging markets in Asia and that there is a direct relationship between the level of capital inflows and economic contractions. These results are supported by Reinhart and Vesperoni (2012) who look at the reaction of the domestic credit ratio to capital inflows, the exchange rate regime, money growth, and other fundamentals.

Lane and McQuade (2014) consider domestic credit growth and various components of capital flows for a panel of European countries and a broader panel of 54 advanced and emerging economies before the global financial crisis. The main finding is that the current account balance helped explain domestic credit growth, but this was largely driven by debt inflows and not by equity flows. Calderón and Kubota (2012) similarly distinguish between different components of capital inflows in a broad sample and find that increases in private gross capital inflows help predict credit booms.

[2] Bruno and Song (2014) link the two variables through the risk-taking behaviour of commercial banks at different stages of the business. Carvalho (2014) presents discussions of the definitional link between capital flows and the money stock and the link between the money stock and domestic credit.

[3] The distinction between pull and push factors has also been the focus of numerous studies of foreign capital flows to emerging markets in Latin America and Asia; see e.g. Calvo et al. (1996), Fernandez-Arias (1996), Taylor and Sarno (1997) and Chuhan et al. (1998).

Carvalho (2014) analyses the effect of, amongst other things, capital flows on credit creation and money holdings, and finds positive relationships. Focusing on Spain, Veld et al. (2014) find that a number of local factors such as the loosening of collateral requirements and a reduction in the risk premium of the Spanish housing market fuelled the capital inflows that funded the housing market bubble. After the outbreak of the global financial crisis, falling house prices, credit restrictions and the tightening of collateral constraints affected capital inflows negatively and subdued economic activity in Spain.

Most of the empirical studies discussed above use panels of countries. Although this increases the number of observations, it imposes restrictions on the estimated parameters that rule out differential effects between countries. The studies typically use capital inflows and changes in credit. The variables are taken in first differences of stock variables since capital inflows, or the current account, is the flow version of the net international investment position plus or minus valuation changes, and so the problem of potentially spurious regressions is solved, though the studies may be omitting the long-run information on the relationships if cointegration exists.

In this paper we investigate the relationship between the stock of credit and the stock of net foreign liabilities for each of the five GIIPS countries which came under severe financial stress after the outbreak of the global financial crisis. The analysis is based on a comprehensive cointegration analysis comprising several steps. The time series properties of the two variables are analysed and the period in which both variables are integrated of order one is identified. Tests of cointegration are implemented and the cointegrating vector is estimated if cointegration is confirmed. Finally, a full Vector Error Correction Model (VECM) is estimated to ascertain the adjustment over time to deviations from the cointegrating relationship.

The paper contributes in four respects to the incipient literature on the linkages between domestic leveraging and foreign capital flows (see review in Section 2). First, the analyses are carried out for countries individually whereas previous studies have used panel data methods. The GIIPS countries are evidently of particular interest due to the economic and financial problems in the countries after the outbreak of the global financial crisis. There is a considerable degree of heterogeneity across the sample countries and this makes it particularly instructive to compare the results across the countries.

Second, the analyses in this paper consider the levels of the variables of interest, i.e. domestic credit and net foreign liabilities, not changes in these variables as is typically seen in the literature. Taylor (2013) argues that the correlation between capital flows and credit growth is generally low, but this may be due to most analyses ignoring long-run information in the data. Therefore we consider the *stocks* of net foreign liabilities and domestic credit, rather than changes in these variables.

Third, the estimation of a VECM with equations for domestic credit and net foreign liabilities means that equations for the two variables are to be esti-

mated simultaneously. This facilitates a detailed modelling of the dynamics of the relationship between the two variables.

The final, and arguably most important, contribution is that the study considers the dynamic adjustment in cases of deviations from the cointegrating relationship between domestic credit and net foreign liabilities. The aim is to ascertain whether domestic credit, net foreign liabilities or both react to shocks that cause deviations from the cointegrating relationship. This provides additional insights into the linkages between the two variables.

The analysis of the direction of causality is evidently important for understanding the pre-crisis leveraging of many European countries, including the GIIPS countries, and the subsequent deleveraging. It may also be important if it is considered desirable to implement measures to head off similar developments in the future. Unlike previous studies on the topic (see survey in Section 2), we also analyse the possibility of bidirectional causality between both variables.

The rest of the paper is organised as follows. Section 2 documents the data and examines their time series properties. Section 3 provides a graphical analysis of the relationship between domestic credit and net foreign liabilities. Section 4 contains the cointegration analysis. Finally, Section 5 concludes.

2. Data

The analyses are carried out for the five GIIPS countries using two variables, net foreign liabilities and domestic credit, both relative to GDP. Data are quarterly and start in 1998:4 and end in 2013:3, except for Ireland for which reliable data on net foreign liabilities are only available from 2000:4.

Quarterly data for domestic credit, i.e. credit to the *private* non-financial sector from domestic banks, have been obtained from BIS (2015, code: *Q:XX:B:P:U*, where *XX* indicates the country). The series have been converted into shares of GDP by dividing by nominal GDP in current prices obtained from Eurostat (Eurostat 2014, code: *namq_gdp_c*). To attain comparability with annual data, the quarterly GDP series has been annualised by multiplying it by 4. Due to the presence of a clear pattern of seasonality, the variable has been seasonally adjusted using the multiplicative X12 procedure. The resulting variable, seasonally adjusted domestic credit as a share of GDP, is labelled CR.

Eurostat publishes quarterly data for the net international investment position in percent of GDP at the end of the period (Eurostat 2014, code: *tipsii40*). The availability of quarterly data back in time varies across the five countries. Quarterly data for Greece are available from 2007:4 and annual data from 1998, so data for the first, second and third quarters have therefore been in-

terpolated for the period from 1999:1 to 2007:3.[4] Quarterly data for Ireland for the first, second and third quarters have been interpolated for the period 2000:4-2003:3. Semi-annual data are available for Italy for the period 1998:4-2003:3 so data for the first and third quarters have been interpolated for this period. Data for Portugal for the first, second and third quarters have been interpolated for the period 1998:4-2003:3. Finally, quarterly data for Spain are available throughout the sample period.

For ease of interpretation, we consider net foreign liabilities instead of the net international investment position. Net foreign liabilities as a share of GDP (NFL) are simply minus the net international investment position.

To ensure that extreme observations do not affect results unduly we have in all cases used the logarithmic approximation $\log(1+x) \approx x$. The approximate leverage ratio, domestic credit as a share of GDP, is thus computed as L1CR = log(1 + CR), while the approximate net foreign liabilities as a share of GDP are L1NFL = log(1 + NFL). Qualitatively similar results are found using the variables in log levels.

As part of the time series analysis, we need to test for the order of integration of the variables. We apply the unit root test of Leybourne et al. (2007), which not only estimates the order of integration but also changes in the order of integration from I(1) to I(0) and vice versa. This is particularly important in our context as the financial crisis may have affected the time series properties of the variables. The estimation of a VECM model requires that both variables are I(1).

The test of Leybourne et al. (2007) is based on the Dickey-Fuller unit root test, with the modification proposed by Elliot et al. (1996) to detrend the series. The test statistic for the null of unit root against the alternative that the series is I(0) in some continuous subsample is:

$$M = \inf_{\lambda \in (0,1)} \inf_{\tau \in (\lambda,1)} DF_G(\lambda, \tau) \tag{1}$$

where a subsample between λT and τT with $0 \leq \lambda < \tau \leq 1$ is used to compute $DF_G(\lambda, \tau)$, which is the *t*-ratio for the estimated autoregressive parameter in the basic Dickey-Fuller regression. Table 1 shows the results of the computations of *M*, where a constant term has been included and a lag length of 4 has been used in all cases.

[4] The interpolation entails adding the current account balance to the net international investment position quarter-by-quarter. Since there is typically a discrepancy between the value of the fourth quarter interpolated net international investment position and the published value, the discrepancy is spread proportionately over the interpolated data of the first, second and third quarters.

Table 1: Test for changes in the order of integration

	Variable	*M*-statistic	I(0) start-end
Greece	L1CR	-1.72	..
	L1NFL	-8.88***	2007:3-2010:3
Ireland	L1CR	-7.09***	2006:1-2008:4
	L1NFL	-4.92**	2004:1-2008:1
Italy	L1CR	-3.26	..
	L1NFL	-4.42**	2008:1-2011:1
Portugal	L1CR	-2.57	..
	L1NFL	-4.54**	2008:4-2011:4
Spain	L1CR	-3.06	..
	L1NFL	-2.07	..

Note: The critical values at the 1%, 5% and 10% are -3.88, -4.24 and -5.13 respectively, and have been obtained from Leybourne et al. (2007, p. 13). The superscripts *, **, *** denote rejection of the null hypothesis at the 10%, 5% and 1% levels respectively.

It follows from Table 1 that the L1CR variable is I(1) in all of the sample for Greece, Italy, Portugal and Spain, while it appears to be I(0) for Ireland for a short period around the outbreak of the global financial crisis. The L1NFL variable exhibits a structural break for all of the countries except Spain. A change from I(1) to I(0) happens around 2008 in Greece, Italy and Portugal, while change happens earlier for Ireland.

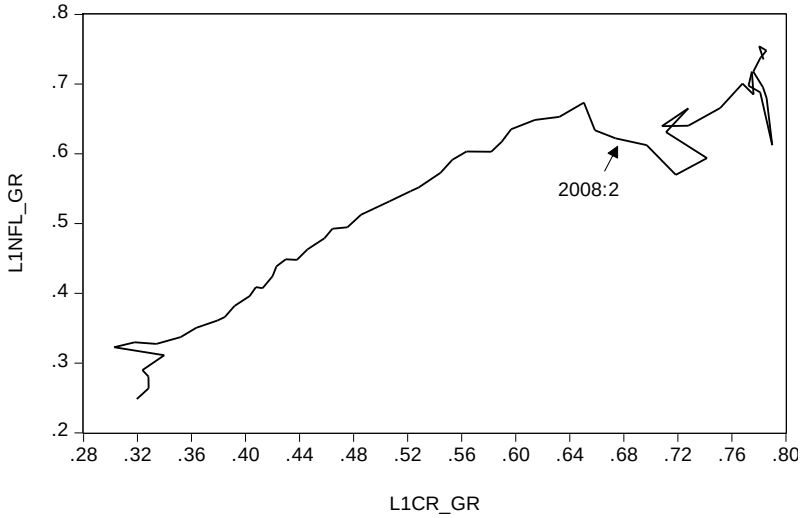
The results would justify continuation of the cointegration analyses until around 2008:2, just before the bankruptcy of Lehman Brothers. The case of Ireland is interesting as the variables seem to be stationary around the middle of the sample. This would rule this country out from the analysis and indeed the results in Section 5 will confirm the lack of a causal relation between the two variables in the case of Ireland.

4. Descriptive analysis

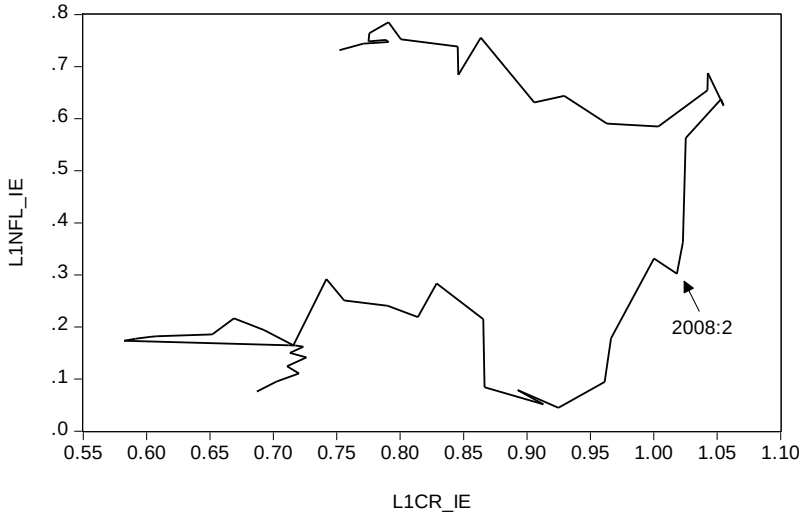
This section provides a first look at the relationship between the domestic credit variable L1CR and the net foreign liabilities variable L1NFL for the five GIIPS countries. Figure 1 shows cross-plots of the two variables for each of the five countries.

Figure 1: Cross-plots of private credit and net foreign liabilities, shares of GDP

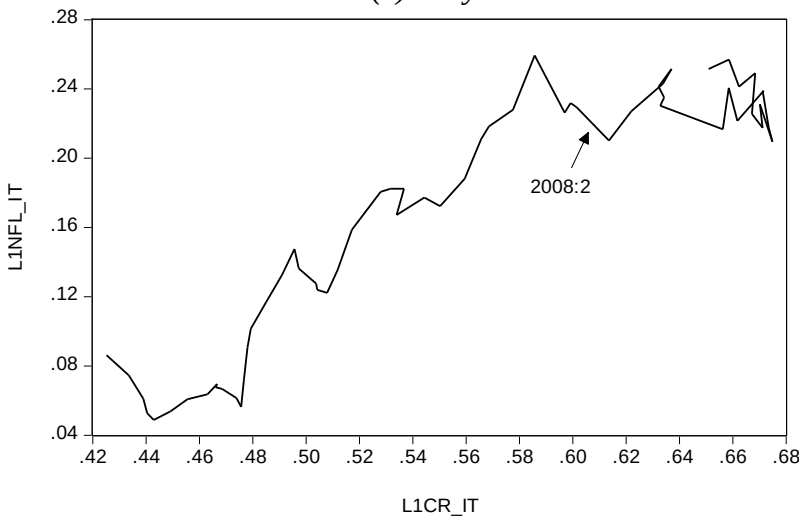
(a) Greece



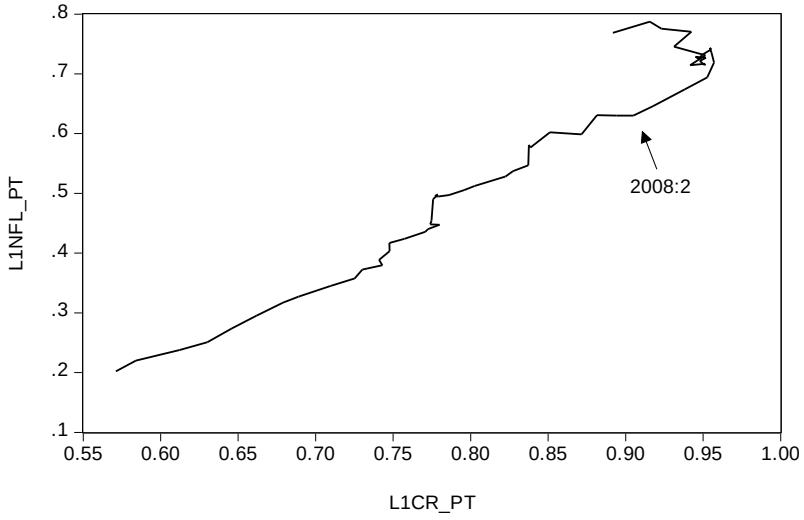
(b) Ireland



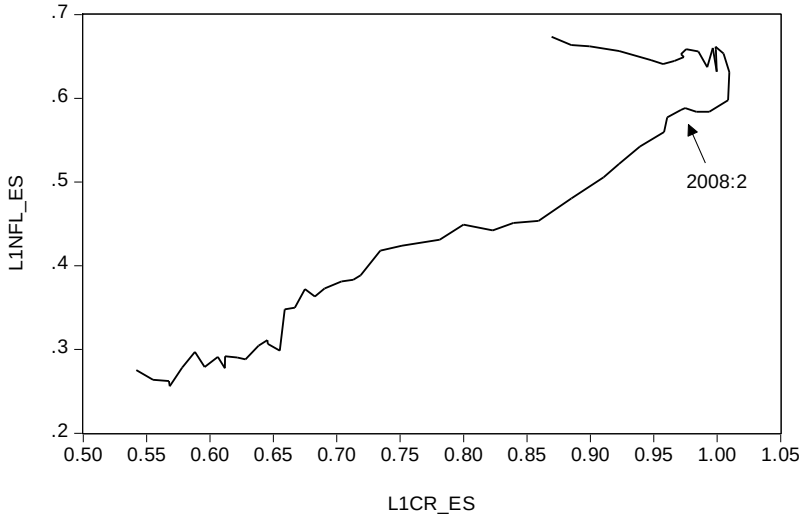
(c) Italy



(d) Portugal



(e) Spain



Note: The sample is 2000:4-2013:3 for Ireland and 1998:4-2013:3 for the other four countries. Private credit is denoted L1CR and net foreign liabilities L1NFL, both shown with succeeding country identifiers.

For Greece the great leveraging went hand-in-hand with increased net foreign liabilities until the end of 2007, from which time the relationship between the two variables became unstable. Towards the very end of the sample the private credit stock as a share of GDP stagnated, while net foreign liabilities exhibited sizeable gyrations. These gyrations were in part due to the IMF and EU bailout packages, which typically increased net foreign liabilities, and to the private sector debt write-down at the end of 2011, which reduced net foreign liabilities.

For Ireland the pre-crisis leveraging of the domestic private sector occurred while net foreign liabilities remained broadly constant. The bailout was agreed with the IMF and EU in November 2010. The Irish economy subsequently experienced an extreme deleveraging with the private credit variable L1CR declining from more than 100 percent of GDP to around 75 percent of

GDP in a few years. Ireland did not experience an extreme deleveraging after 2010. Rather, the large-scale transfer of commercial property loans from the banking system to the government's 'bad bank' meant that these loans were no longer present in the credit statistics due to a measurement quirk.

For Italy the pre-crisis credit growth was accompanied by a corresponding accumulation of net foreign liabilities. The net foreign liabilities remained relatively small, however, compared to those in the other sample countries. After the crisis the deleveraging started relatively late and was relatively modest, while the net foreign liabilities stayed largely constant.

Developments for Portugal and Spain followed the same broad pattern, although the global financial crisis affected the countries differently. The pre-crisis period was characterised by rapid leveraging and corresponding growth in net foreign liabilities. The process of deleveraging started towards the end of 2008, but net foreign liabilities continued to increase. Portugal received a bailout after facing government financing problems in May 2011, while Spain received aid for the banking sector in June 2012 after serious problems in several saving banks.

The cross-plots in Figure 1 show many similarities across the five GIIPS countries, but also notable differences. Before the global financial crisis the countries all underwent a process of rapid leveraging accompanied, in all cases except that of Ireland, by a rapid increase in net foreign liabilities. After the outbreak of the crisis a process of deleveraging took place in all five countries, but it was most pronounced in the cases of Ireland and, to a lesser extent, Spain. It is noticeable, however, that that the deleveraging was not accompanied by a corresponding decline in net foreign liabilities in any of the GIIPS countries. Instead any sign of a stable relationship between the two variables disappeared.

The next section extends the analysis of the linkages between stocks of domestic credit and net foreign liabilities for each of the countries using time series econometrics. The focus is on the pre-crisis period as it is evidently not possible to estimate a stable relationship for the period after the bankruptcy of Lehman Brothers, an issue aggravated by the very short crisis sample.

5. Cointegration analysis

In order to analyse the relationship between credit to the private sector and net foreign liabilities, we estimate the VECMs or cointegrated vector autoregression models developed by Johansen (1988, 1991). The Johansen approach is based on estimation of the following equation:

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum_{i=1}^{p} \gamma_i \Delta X_{t-i} + \mu + \varepsilon_t \qquad (2)$$

The vector X_t contain the non-deterministic variables of the model, α represents the loading or adjustment matrix, β is a matrix with the long run coefficients, γ_i are the short run parameters, and μ is a constant term. As usual, ε_t denotes the error term. The assumption behind this model is that at least two of the variables are I(1), and it is possible to find one or more cointegrated relationship amongst the variables, i.e. a linear combination which cancels out the overall stochastic trend.

The global financial crisis constituted a major disruption of financial markets and growth prospects. As discussed in Section 3, the five sample countries experienced government financing or banking sector problems and all except Italy received financial support from the IMF and the EU.

The time sample covers both a boom and a bust. The global financial markets were under increasing strain in 2007-2008 as witnessed by the bailout of Bear Sterns in June 2007 and the bankruptcy of Lehman Brothers in September 2008. The discussion of the cross-plots in Figure 1 also suggested that the dynamics of domestic credit and foreign liabilities might differ in the periods before and after the outbreak of the global financial crisis, which has been corroborated by the unit root tests applied in the previous section. We will therefore cover the period from the introduction of the euro to the beginning of the crisis in 2008:2.

We now test for the presence of a cointegrating relationship between private credit and net foreign liabilities for each of the five GIIPS countries. The models are based upon 4 lags and a non-restricted constant, except for Portugal where 7 lags have been used, and Spain where 5 lags were included in the model. The choice of lag length is based upon a misspecification test of the models. Tests for autocorrelation reveal that the models are free from autocorrelated residuals.

Table 2 reports the results of the trace test and lambda-maximum for the number of cointegrated vectors in the pre-crisis sample until 2008:2. For Ireland the hypothesis of no cointegration cannot be rejected for the full sample and the pre-crisis sample, results that appear consistent with the cross-plot in Figure 1.

Table 2: Cointegration tests

Country	No. of CE(s)	Trace statistic	5% critical value	*p*-value[a)]	Max-eigenvalue	5% critical value	*p*-value[a)]
Greece	None	36.398	15.494	0.000	30.334	14.264	0.000
	At most 1	6.064	3.841	0.014	6.064	3.841	0.014
Ireland	None	9.218	15.494	0.346	9.100	14.264	0.278
	At most 1	0.118	3.841	0.730	0.118	3.841	0.730
Italy	None	19.277	15.494	0.013	13.832	14.264	0.058
	At most 1	5.445	3.841	0.020	5.445	3.841	0.020
Portugal	None	15.747	15.494	0.046	10.043	14.264	0.210
	At most 1	5.703	3.841	0.017	5.703	3.841	0.017
Spain	None	18.442	15.494	0.018	17.582	14.264	0.014
	At most 1	0.859	3.841	0.354	0.859	3.841	0.354

[a)] MacKinnon-Haug-Michelis (1999) *p*-values.
Note: The sample is 1998:4-2008:2, 2000:4-2008:2 for Ireland.

For each of the other countries there is at least one cointegrating vector. In some cases the tests indicate more than one cointegrating vector, but the tests may over-estimate the number of cointegrated vectors in short samples (Cheung and Lai, 1993). In addition, a full rank would imply that both variables are stationary, which is not the case, cf. Section 3. It is also worth mentioning that Portugal is a borderline case as one of the tests indicates one cointegrating relationship, whereas the other rejects cointegration.

Taken together the results in Table 2 provide strong support for the hypothesis that private credit and net foreign liabilities are cointegrated for the four Mediterranean GIIPS countries, but not for Ireland.

Table 3 reports the estimated cointegrated vectors for the full sample for the four countries for which the hypothesis of one cointegrating vector cannot be rejected. The hypothesis of cointegration was rejected for Ireland.

Table 3: Cointegrating vectors

	Greece	Italy	Portugal	Spain
L1CR(-1)	1.000	1.000	1.000	1.000
L1NFL(-1)	-0.877***	-1.058***	-0.844**	-1.155***
	(0.019)	(0.105)	(0.073)	(0.109)
C	-0.047	-0.366	-0.382	-0.285

Note: Standard errors are given in brackets. The superscripts *, **, *** denote rejection of the null hypothesis at the 10%, 5% and 1% levels respectively.

It follows from Table 3 that the estimated long-run parameter of L1NFL(-1) is negative and, in numerical terms, very close to 1 for all four countries. This implies a positive and more or a less one-to-one relationship between the net

foreign liabilities variable L1NFL and the domestic credit variable L1CR. These results corroborate the initial hypothesis of a positive relationship between the two variables.

Table 4 shows the results of the short-run specifications for the four southern GIIPS countries. The error correction term is labelled ECT and contains the deviations from the long-run specifications shown in Table 3. The quarter-to-quarter change in a variable is depicted by a prefixed Δ.

Table 4: Vector error correction models

	Greece		**Italy**		**Portugal**		**Spain**	
	ΔL1CR	ΔL1NFL	ΔL1CR	ΔL1NFL	ΔL1CR	ΔL1NFL	ΔL1CR	ΔL1NFL
ECT(-1)	-0.761***	-0.306	-0.122***	-0.054	-0.234***	-0.119	-0.174**	0.409**
	(0.142)	(0.242)	(0.035)	(0.158)	(0.086)	(0.096)	(0.083)	(0.171)
ΔL1CR(-1)	0.244	0.074	-0.151	-0.451	0.162	0.282	0.408**	0.532
	(0.153)	(0.261)	(0.178)	(0.799)	(0.221)	(0.247)	(0.199)	(0.408)
ΔL1CR(-2)	0.362***	0.051	-0.050	-0.260	0.580***	0.248	0.307	-0.604
	(0.140)	(0.238)	(0.165)	(0.739)	(0.227)	(0.253)	(0.212)	(0.434)
ΔL1CR(-3)	0.319**	0.007	-0.449**	-0.746	0.174	0.389	0.434*	-0.195
	(0.138)	(0.236)	(0.198)	(0.889)	(0.258)	(0.289)	(0.253)	(0.520)
ΔL1CR(-4)	0.156	0.167	0.045	-0.242	-0.107	-0.270	0.022	-0.901*
	(0.145)	(0.247)	(0.191)	(0.857)	(0.268)	(0.300)	(0.250)	(0.512)
ΔL1NFL(-1)	-0.844***	-0.124	-0.048	-0.059	-0.470*	-0.791***	-0.060	0.001
	(0.173)	(0.295)	(0.048)	(0.215)	(0.243)	(0.272)	(0.098)	(0.202)
ΔL1NFL(-2)	-0.460*	-0.339	-0.013	0.086	-0.454**	-0.575**	-0.160*	0.091
	(0.254)	(0.434)	(0.044)	(0.200)	(0.227)	(0.254)	(0.096)	(0.198)
ΔL1NFL(-3)	-0.373*	-0.224	-0.043	0.144	-0.186	-0.713***	-0.055	0.110
	(0.207)	(0.354)	(0.060)	(0.271)	(0.206)	(0.230)	(0.089)	(0.183)
ΔL1NFL(-4)	-0.177	0.352	-0.138**	-0.623**	-0.320	-0.371*	-0.140	0.106
	(0.227)	(0.388)	(0.064)	(0.290)	(0.201)	(0.225)	(0.087)	(0.179)
C	0.020***	0.010	0.008***	0.014*	0.007	0.024***	-0.002	0.014*
	(0.006)	(0.011)	(0.002)	(0.009)	(0.005)	(0.006)	(0.003)	(0.007)
R^2	0.592	0.164	0.453	0.256	0.538	0.749	0.568	0.460

Note: Standard errors are given in brackets. The superscripts *, **, *** denote rejection of the null hypothesis at the 10%, 5% and 1% levels respectively. To save space only the first 4 lags are reported for Portugal and Spain .The models have passed the usual autocorrelation tests.

For Greece, Italy and Portugal the estimated coefficient of ECT(-1) is negative and statistically significant in each of the ΔL1CR equations, but not statistically significant in the ΔL1NFL equations. In other words, only credit growth reacts to disequilibria from the long-run relationship, while net foreign liabilities do not and can therefore be taken as weakly exogenous. This would suggest that the pre-crisis leveraging in these countries is in large part the result of capital inflows, i.e. push factors. For Spain a different finding emerges as the estimated coefficients of ECT(-1) are statistically significant in both the ΔL1CR equation and the ΔL1NFL equation. There is a bidirectional relationship as domestic credit and net foreign liabilities react to each

other, suggesting that both pull and push factors played a role in the pre-crisis leveraging in Spain.

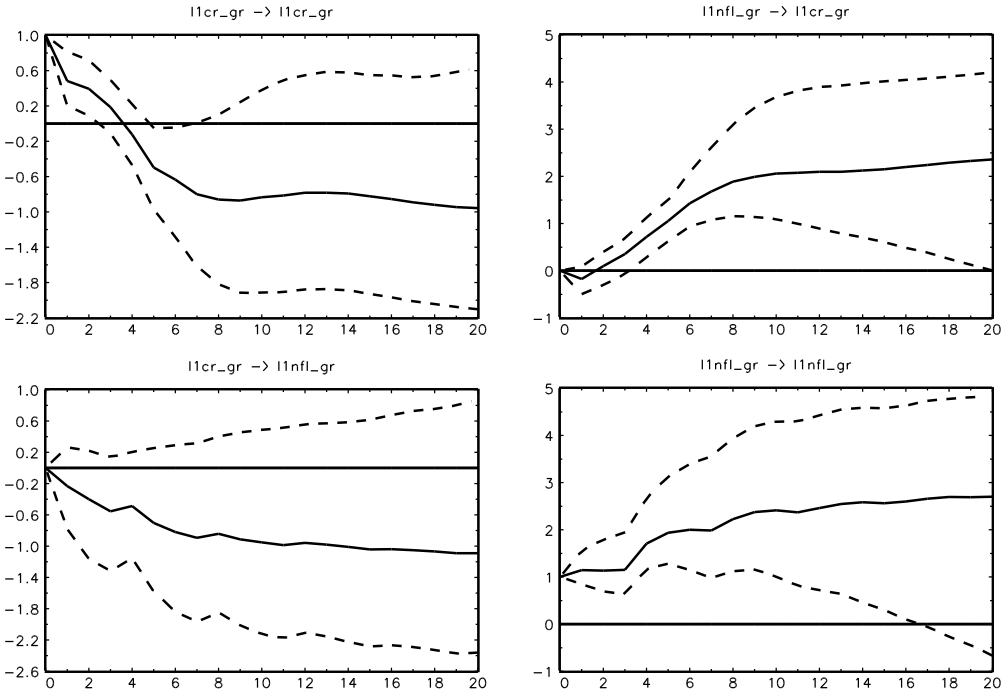
The size of the estimated coefficients of ECT(-1) and the lagged values of ΔL1CR and ΔL1NFL vary substantially across the countries. To gain additional insights into the dynamics, we have therefore computed impulse response functions based on the vector error correction models from Table 4.

Figure 3 show the reaction of domestic credit and the net foreign liabilities to a one standard deviation shock in each of the variables. The vertical axis represents the forecast evolution of each variable after the shock with the first value normalised to 1. The upper right and the lower left panels are of particular interest. The upper right panels show the effect on L1CR of an increase in L1NFL, while the lower left panels show the effect on L1NFL of an increase in L1CR. The dotted lines represent the 95% confidence intervals, based on a bootstrap with 10,000 replications, using the method of Hall (1992).[5]

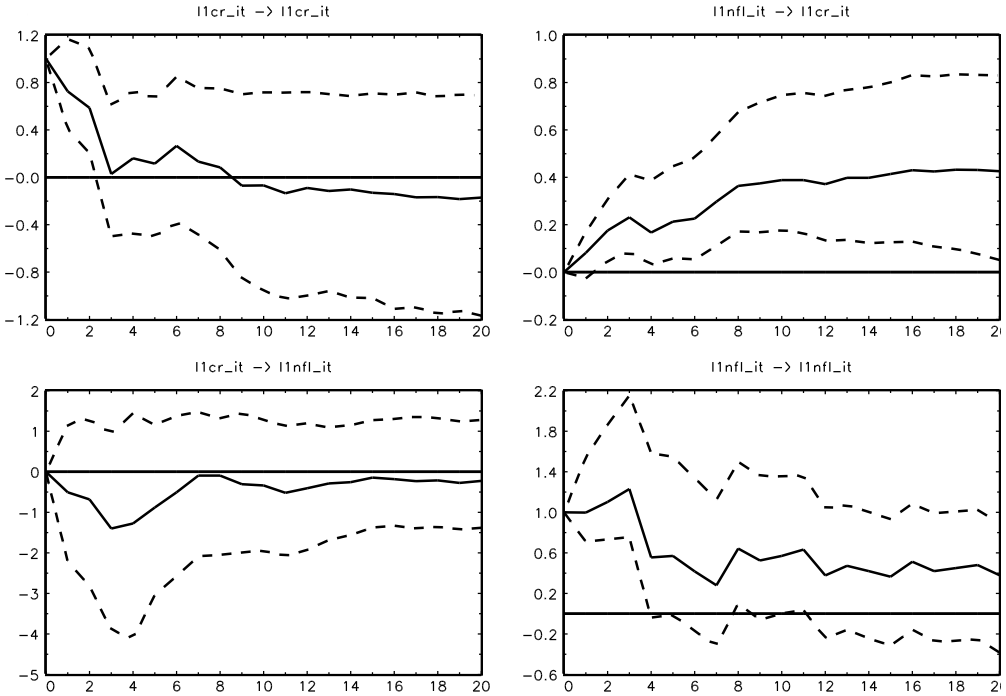
[5] The impulse-responses have been computed using the software *JMulti*, version 4. A similar pattern of the confidence intervals was found using the method of Efron and Tibshirani (1993).

Figure 3: Impulse-response functions of VECM models

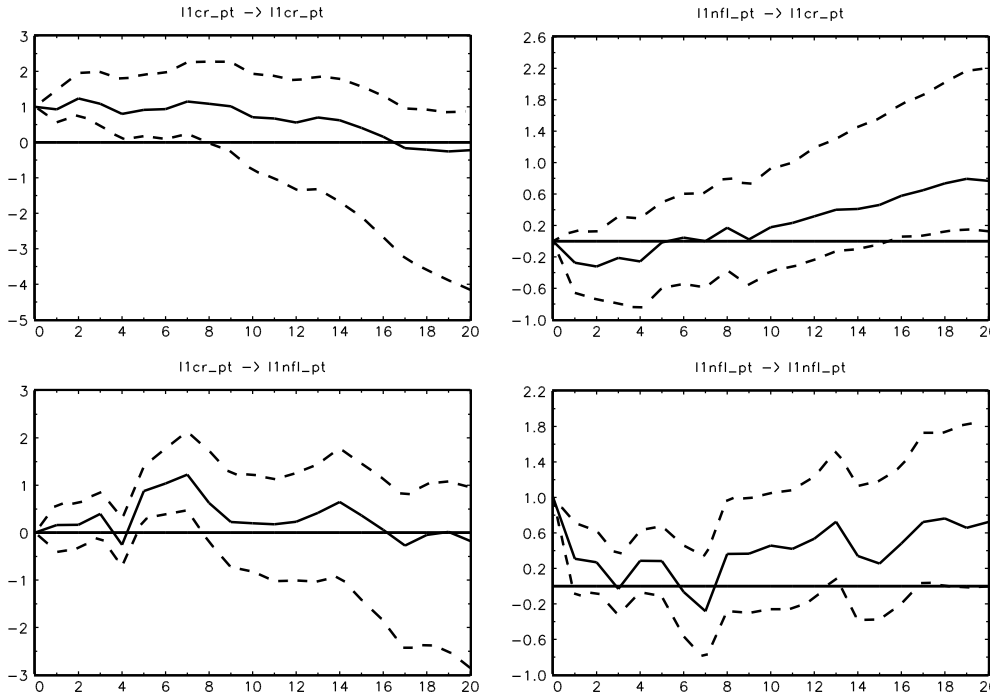
(a) Greece



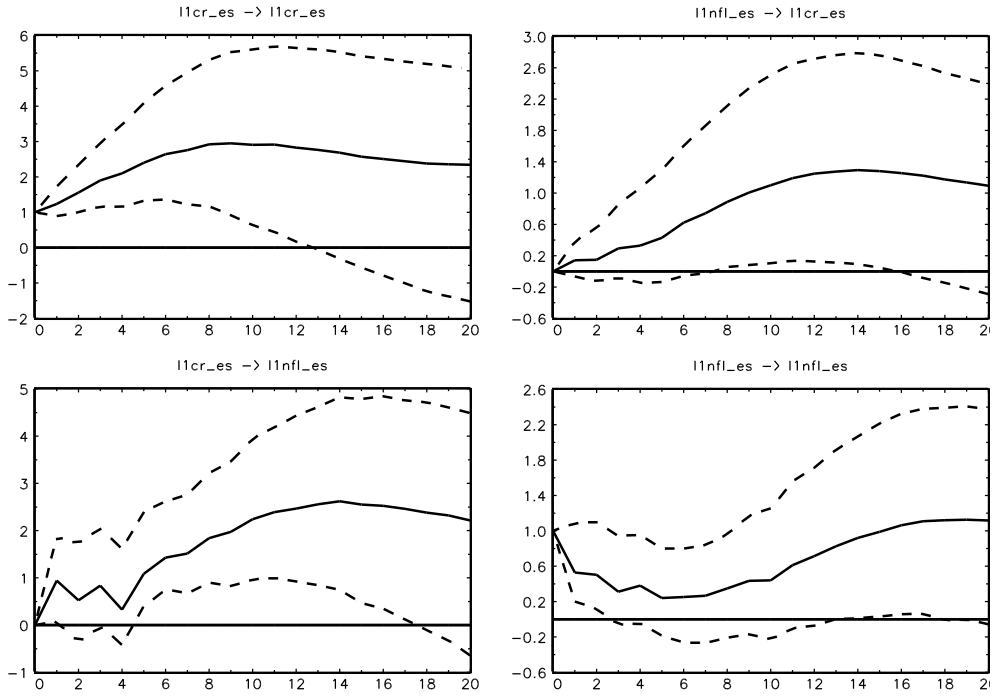
(c) Italy



(d) Portugal



(e) Spain



A number of additional insights emerge from the impulse responses in Figure 3. The adjustment results from Table 4 are generally confirmed. In the cases of Greece and Italy foreign capital flows affect domestic credit, while there is no evidence of statistically significant relationships in the reverse direction. The same holds for Portugal, but the effect on domestic credit of the accumu-

lation of net foreign liabilities is relatively subdued and occurs with a substantial lag.

In the case of Spain the bidirectional relationship is confirmed. It is noticeable that the effect on domestic credit of a change in net foreign liabilities builds up gradually and only becomes statistically significant after approximately two years. The effect on net foreign liabilities of a change in domestic credit is similarly gradual although the effect is statistically significant after one year.

We have carried out a number of robustness checks of the results in Tables 2-4 (results are available upon request). We have tried to shorten the sample by several quarters both from the beginning of the sample and from the end, but the results are unchanged in qualitative terms. We have also tried to use the variables CR and NFL instead of the logarithmic transformations L1CR and L1NFL, and the results are again qualitatively unchanged although the point estimates change somewhat. Finally, extending the sample to include the crisis period typically changed the Tables 2-4, reflecting how the outbreak of the crisis represents a structural break, but the results vary substantially across the GIIPS countries.

6. Final comments

This paper examines the processes of leveraging and deleveraging of the GIIPS countries in the geographical periphery of Europe before and after the outbreak of the global financial crisis. The focus is on the linkages between domestic credit and net foreign liabilities and the dynamic processes of adjustment. The analyses are carried out for each of the five countries separately.

Tests of the time series properties reveal the presence of structural breaks in the net foreign liabilities for all of the GIIPS countries except Spain. For Greece, Italy and Portugal the break is located around the outbreak of the global financial crisis. The net foreign liabilities exhibited a unit root in the pre-crisis period, but became stationary after the *sudden stops* in 2008-2009. Background information on the financial and government debt crises in Europe, the tests of time series properties, and graphical analyses all point to a structural break in 2008-2009.

The econometric analyses are carried out for the pre-crisis period until 2008:2 and thus shed light on the dynamics of the pre-crisis leveraging. Tests for cointegration show that domestic credit and net foreign liabilities are cointegrated for Greece, Italy, Portugal and Spain, but *not* for Ireland. Ireland is thus an example of a country which experienced rapid leveraging without the accumulation of substantial net foreign liabilities. For the first four countries the long-run coefficient is in all cases close to one, suggesting a one-to-one link between domestic leveraging and the accumulation of net foreign liabilities in the pre-crisis period.

Estimations of VECMs show the adjustment to deviations from the long-run relationship. For Greece and Italy the adjustment takes place only through changes in domestic credit, while net foreign liabilities are weakly exogenous. For Portugal domestic credit adjusts, while there may or may not be adjustment in the other direction. For Spain the estimations reveal a bidirectional relationship where domestic credit and net foreign liabilities adjust when there are deviations from the long-run relationship.

The conclusion from the analyses is that Ireland followed a unique pattern before the crisis and leveraged without a corresponding accumulation of net foreign liabilities. The south European GIIPS countries, meanwhile, exhibited many similarities. Their pre-crisis leveraging was accompanied by an accumulation of net foreign liabilities, so foreign capital inflows appear to have been a push factor in the pre-crisis leveraging. For Spain, push from foreign capital concurred with pull from domestic credit growth; the pull factor might relate to the dynamic developments in the Spanish banking sector before the crisis (Carballo-Cruz, 2011; Veld et al., 2014).

The very short sample after the outbreak of the global financial crisis means that econometric analyses cannot be carried out. Graphical evidence suggests, however, that the deleveraging following the crisis varied substantially across the five GIIPS countries and that it was largely unrelated to developments in foreign capital flows.

The main message of this paper is that cases of domestic leveraging and deleveraging should be considered in conjunction with developments in foreign capital flows. This is particularly apparent in the case of the southern European GIIPS countries where the domestic leveraging in the pre-crisis period appears in part to have been a result of push factors from foreign capital flows. The liberalisation of capital flows in Europe in the 1980s, the introduction of the euro at the end of the 1990s and the global savings glut in the 2000s may thus have been important factors facilitating the rapid growth in domestic credit, which eventually made the GIIPS countries very susceptible to the fallouts of the global financial crisis.

The VECMs estimated are simple and further studies might seek to include additional variables. Such exercises may be complex as they suggest the need for the specification of a structural model. It should be noted that three variables *effectively* enter the VECMs in Section 5 as the net foreign liabilities and private credit enter as ratios of GDP and consequently the GDP level also enters, albeit in a constrained way.

References

Avdjiev, S., R. Mccauley and P. Mcguire (2012): "Rapid credit growth and international credit: Challenges for Asia", Bank of International Settlements Working Papers, No. 377.

Basu, K. (1991): "The international debt problem, credit rationing and loan pushing: theory and experience", *Princeton Studies in International Finance*, No. 79.

BIS (2015): "Long series on credit to the private non-financial sector", Bank of International Settlements, http://www.bis.org/statistics/credtopriv/credtopriv.xlsx (data downloaded on 9 March).

Bruno, V. and S. H. Song (2014): "Cross-border banking and global liquidity", mimeo, Princeton University.

Calderón, C. and M. Kubota (2012): "Gross inflows gone wild. Gross capital inflows, credit booms and crises", Policy Research Working Paper, no. 6270, The World Bank.

Calvo, G. A., L. Leiderman and C. M. Reinhart (1996): "Inflows of capital to developing countries in the 1990s", *Journal of Economic Perspectives*, Vol. 10, pp. 123-139.

Carballo-Cruz, F. (2011): "Causes and consequences of the Spanish economic crisis: why the recovery is taken so long?", *Panoeconomicus*, Vol. 58, pp. 309-328.

Carvalho, D. (2014): "Financial integration and the great leveraging", Banco de Portugal Working Papers 2014.

Cheung, Y.-W. and K. S. Lai (1993): "Finite-sample sizes of Johansen's likelihood ratio test for cointegration", *Oxford Bulletin of Economics and Statistics*, Vol. 55, pp. 313-328.

Chuhan, P., S. Claessens and N. Mamingi (1998): "Equity and bond flows to Latin America and Asia: The role of global and country factors", *Journal of Development Economics*, Vol. 55, pp. 439-463.

Cuestas, J. C. (2013): "The current account sustainability of European transition economies", *Journal of Common Market Studies*, Vol. 51, pp. 232-245.

Efron, B. and R. J Tibshirani (1993): *An introduction to the bootstrap*, Chapman and Hall, New York.

EUROSTAT (2014): Statistics Database, Eurostat, http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database (data downloaded on 2 June).

Fernandez-Arias, E. (1996): "The new wave of private capital inflows: Push or pull?", *Journal of Development Economics*, Vol. 48, pp. 389-418.

Fratzscher, M. (2012): "Capital flows, push versus pull factors and the global financial crisis", *Journal of International Economics*, Vol. 88, pp. 341-356.

Gómez, E., A. Murciay and N. Zamudioz (2013): "Foreign debt flows and domestic credit: A principal-agent approach", Banco de Republica Colombia, Temas de Estabilidad Financiera, No. 75.

Gourinchas, P.-O. and M. Obstfeld (2012): "Stories of the twentieth century for the twenty-first", *American Economic Journal: Macroeconomics*, Vol. 4, pp. 226-265.

Hall, P. (1992): *The bootstrap and Edgeworth Expansion*, Springer, New York.

Johansen, S. (1988): "Statistical analysis of cointegrated vectors", *Journal of Economic Dynamic and Control*, Vol. 12, pp. 231-254.

Johansen, S. (1991): "Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models", *Econometrica*, Vol. 59, pp. 1551-1580.

Jordá, O., M. Schularick and A. M. Taylor (2013): "When credit bites back", *Journal of Money, Credit and Banking*, Vol. 45, pp. 3-28.

Lane, P. R. and G. M. Milesi-Ferretti (2010): "The cross-country incidence of the global financial crises", IMF Working Paper, WP/10/171.

Lane, P. R. and G. M. Milesi-Ferretti (2012): "External adjustment and the global crises", *Journal of International Economics*, Vol. 88, pp. 252-265.

Lane, P. R. and P. Mcquade (2014): "Domestic credit growth and international capital flows", *Scandinavian Journal of Economics*, Vol. 116, pp. 218-252.

Leybourne, S., T.-H. Kim and A. M. R. Taylor (2007): "Detecting multiple changes in persistence", *Studies in Nonlinear Dynamics and Econometrics*, Vol. 11, pp. 1-34.

MacKinnon, J., A. Haug and L. Michelis (1999): "Numerical distribution functions of likelihood ratio tests for cointegration", *Journal of Applied Econometrics*, Vol. 14, pp. 563-577.

Moro, B. (2014): "Lessons from the European economic and financial great crisis: A survey", *European Journal of Political Economy*, Vol. 34, Supplement, pp, S9–S24.

Obstfeld, M. (2012a): "Financial flows, financial crises, and global imbalances", *Journal of International Money and Finance*, Vol. 31, pp. 469-480.

Obstfeld, M. (2012b): "Does the current account still matter?", *American Economic Review. Papers & Proceedings*, Vol. 102, pp. 1-23.

Obstfeld, M. and A. M. Taylor (1998): "The Great Depression as a watershed: international capital mobility over the long run", in Bordo, M. D., C. D. Goldin and E. N. White (eds.): *The Defining Moment: The Great Depression and the American Economy in the Twentieth Century*, University of Chicago Press, Chicago, pp. 353-402.

Reinhart, C. M. and V. R. Reinhart (2008): "Capital flows bonanzas: An encompassing view of the past and present", NBER working paper no 14321, NBER.

Taylor, A. M. (2011): "The great leveraging", NBER Working Paper, No. 18290.

Taylor, A. M. (2013): "External imbalances and financial crises", IMF Working Paper, WP/13/260.

Taylor, M. P. and L. Sarno (1997): "Capital flows to developing countries: Long- and short-term determinants", *World Bank Economic Review*, Vol. 11, pp. 451-470.

Veld, J. I., R. Kollmann, B. Pataracchia and M. Ratto (2014): "International capital flows and the boom-bust cycle in Spain", Globalization and Monetary Policy Institute, Federal Reserve Bank of Dallas, Working Paper, No. 181.