The Decline of EMU Core Countries' Portfolio Equity Investments in the Euro Area: The Role of Stock Return Correlations

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Abstract

This paper investigates the effect of time-varying stock market correlations on the abrupt and persistent decrease of the reciprocal foreign investments by Euro area member countries after 2007. A strong stock market correlation reduces the diversification opportunities and it may therefore have affected the reciprocal investment by EMU countries. The 2007 represents both the outbreak of the global financial crisis and the beginning of the enlargement process. The two events have had a very different impact on the stock returns' correlation among EMU members. While the enlargement to new countries has reduced the average returns' correlation within the Euro area as a whole, the financial crisis and the sovereign debt crisis have led to an increase in stock returns' correlation among old member states. We find that, among old EMU countries, core countries have been particularly affected by stock returns' correlation. They reduced their equity investments both in foreign EMU core and in foreign EMU periphery economies after the crisis, with a particularly pronounced contraction witnessed by those country-pairs that displayed highly correlated asset returns. These results highlight the importance of the diversification motive for international portfolio investments and complement the institution-based explanation of the decline of the Euro area investments.

1. Introduction

After the inception of the European Economic and Monetary Union (EMU), Eurozone countries displayed disproportionately large investment in other members' assets, both in bonds (Lane, 2006; Giofré, 2013), and in equities (Lane and Milesi-Ferretti, 2007; Balta and Delgado, 2009; Slavov, 2009).

However, after the financial crisis, bilateral cross-border portfolio equity holdings within the EMU area experienced an even more abrupt and persistent fall than the general downfall of international financial flows (Lane, 2013; Milesi-Ferretti and Tille, 2011). This peculiar evidence occurred in conjunction with the combination of two outstanding events, such as the enlargement process, on the one hand, and the financial crisis, later turned into the sovereign debt crisis, on the other hand. Giofré and Sokolenko (2022) highlighted that the crisis has drastically weakened the linkages among original members. A peculiar decline in economic development and, more importantly, a deterioration of the control of corruption standards of Euro periphery countries, those more severely injured in the sovereign debt crisis, induced a sharp decrease of their inward investments by the Euro area as a whole.

Vermeulen (2013) found a significant negative relationship between foreign equity holdings and stock market correlations during the financial crisis, while no significant relationship was found before the crisis.

We conjecture that the stronger stock market correlation induced by the crisis might have reduced the diversification opportunities, and then the reciprocal investment by Euro area member countries. We find, indeed, that the increase in stock returns' correlation induced by the global crisis has played a significant role in explaining the change in the investment pattern of a subset of old EMU economies, that is, core countries. We highlight that the latter reduced equity investment in foreign core and periphery EMU economies after the crisis, and that the decrease has been particularly pronounced for EMU country pairs that displayed highly correlated asset returns.

This paper contributes to the literature about the time-varying common currency effect on bilateral portfolio investments, by adding the diversification motive to the drivers of the decline of the within EMU investment after 2007, and complementing the institution-based explanation already highlighted in the literature.

The rest of the paper is structured as follows. In Section 2, we frame our analysis within the extant literature. In Section 3, we sketch the estimable equation. In Section 4, we describe the data and provide some descriptive statistics. In Section 5, we report the results of the empirical analysis. Section 6 concludes.

2. A Brief Literature Review

Since international investments aim at improving portfolio performance by reducing risk, large stock returns' correlations may jeopardize the benefits of international diversification.

Some scholars surprisingly disclosed that when investors diversify abroad, they prefer countries with a high correlation with the domestic returns (Aviat & Coeurdacier, 2007; Coeurdacier & Guibaud, 2011). Other researchers have explained this anomaly, labelled 'correlation puzzle', as a preference for familiarity when investing abroad (Huberman, 2001; Barberis & Thaler, 2004).

More recently, however, Bergin and Pyun (2016) developed a testable model that incorporates the overall covariance structure of returns and found that the latter could help resolve the correlation puzzle: as predicted by the theory, international investors do seek destination countries with low comovement of returns with the home country.

The literature has furthermore emphasized that the correlation structure among stock returns is not stable over time: it is stronger during periods of high volatility than it is during periods of low volatility (Forbes & Rigobon, 2002; Ang & Bekaert, 2015). Christoffersen et al. (2012; 2014), adopting various models to capture the dynamic dependence across equity markets, found that correlations have increased markedly, especially in developed markets. The benefits from international diversification therefore have reduced over time for advanced economies, while emerging markets still offer significant diversification benefits, especially during large market downturns.

A prolific literature investigated more specifically the change in returns' correlation after the global financial crisis and the European sovereign debt crisis. Wang et al. (2017) investigated stock market contagion during the global financial crisis from the US to the other six G7 and BRIC countries and found that cross-market correlations during the crisis period increased significantly. Gkillas et al. (2019) found that international equity portfolios experienced contagion effects through increased co-movements during the financial crisis and the UE debt crisis. Vermeulen (2013) disclosed a significant negative relationship between foreign equity holdings and stock market correlations during the financial crisis, while no relationship was detected before the crisis. Mollah et al. (2016) indicated that the benefits of portfolio diversification had significantly decayed during both crises for developed countries.

Importantly, the increase in correlation due to a crisis can persist. Correlation coefficients rise during economic crisis and decline again when the crash is over, but do not drop back to the original level as before the crisis (Teti et al., 2018). Zhang et al. (2013) found that the recent financial crisis has changed permanently the correlations between BRICS, U.S. and European stock markets, suggesting that the reducing diversification benefits are a long-run and world-wide phenomenon, especially after crises.

The importance of returns' correlation may be especially relevant for EMU countries because comovement of stock returns is stronger for countries that are close both in geographical and in cultural terms. Recent studies suggest indeed that the correlation of stock returns increases with decreasing geographical distance (Eckel et al., 2011) and that the number of overlapping opening hours and sharing a common border tend to increase cross–country stock market correlation (Flavin et al., 2002).

Focusing on the European market integration, Polanco-Martínez et al. (2018) presented an analysis of EU peripheral stock market indices and the S&P Europe 350 index, as a European benchmark market, over the pre-crisis (2004–2007) and crisis (2008–2011) periods. They found that the correlation is stronger for the crisis than for the pre-crisis period.

Conversely, Goldstein et al. (2019) disclosed that equity markets of the advanced European Union countries tend to comove more closely with each other than with the peripheral economies, but that the relative comovement structure before, during, and after the global financial crisis has been very stable.

When restricting the analysis to the Euro area, the empirical evidence depends on both the time and the cross-country dimension.

Pizzutilo (2012) considered the pre-crisis period (2001-2007) and highlighted that, notwithstanding the high degree of correlation among the Eurozone stock markets, opportunities for diversification were still present.

Sehgal et al. (2017) examined the stock market integration process amongst EMU countries from 2002 to 2013, thus encompassing a normal period as well as the global financial crisis and Eurozone debt crisis periods. The results suggested that large-sized EMU economies exhibited stronger stock market integration when moving from normal to crisis periods.

The evidence of heterogeneity in the correlation patterns within the Euro area over time and across-countries, suggests the need to investigate further the evolution of the effects of returns' correlation on international investment after the crisis and to identify the peculiar patterns of different EMU members.

3. Estimable Equation

Our baseline estimation builds on the following specification: (Note 1)

$$
\begin{aligned}
\log(FPE_{sh}) = {} & \alpha + \sum_{j=1,..,J} \beta^j X_h^j + \sum_{k=1,..,K} \varphi^k Y_s^k + \sum_{l=1,..,L} \delta^l Z_{sh}^l + \\
& \sum_{m=1,..,M} \theta^m \log(Q_h^m) + \sum_{n=1,..,N} \rho^n \log(T_s^n) + \sum_{p=1,..,P} \sigma^p \log(W_{sh}^p) + \gamma D + \varepsilon_{sh}
\end{aligned}
$$

(1)

The dependent variable, $\log(FPE_{sh})$, is the logarithm of the foreign portfolio equities (FPE) of source country s in host country h.

Our regression specification accounts for pair-specific regressors (Z_{sh} or W_{sh}), such as the returns' correlation, country-specific variables (X_h, Y_s, Q_h, T_s), such as size and institutional variables, and time factors (D).

Continuous regressors (Q_h, T_s and W_{sh}) are expressed in logarithmic terms, so that their coefficients can be easily interpreted in elasticity terms (e.g., if a significant coefficient is equal to 0.3, then a 10% increase in the regressor induces a 3% increase in the dependent variable). Conversely, the effect of a dichotomous variable (X_h, Y_s and Z_{sh}) on a dependent variable expressed in logs is captured by the following transformation of its coefficient β: $e^\beta - 1$. (Note 2)

EMU_{sh} is a bilateral-specific dummy variable taking value 1 when both the source country s and the host country h are EMU members, and 0 otherwise; EMU_s (or EMU_h) is instead a country- specific dummy variable equal to 1 when the source country (or host country) is a EMU member, and 0 otherwise.

Finally, D is a dummy capturing the time dimension, such as pre- or post-crisis period, which allows us to detect any global shift in foreign investment due to macroeconomic shocks.

We adopt a Difference-in-Difference approach: the econometric specification (1) is enriched to include the interactions of the EMU dummies with other factors (A), to estimate to which extent a factor A affects the FPE among EMU countries, on top of the global effect played by A on FPE. (Note 3)

$$
\log(FPE_{sh}) = \alpha + \beta EMU_* + \gamma A + \delta EMU_* \cdot A + controls + \varepsilon_{sh}
$$

(2)

To address the problem of inflation of zero investment observations and the need to get estimates robust to different patterns of heteroskedasticity, typical of standard trade log gravity models, we follow the econometric strategy developed by Santos Silva and Tenreyro (2006). Accordingly, we model the dependent variable FPE_{sh} as following a Poisson distribution: we apply the Poisson Pseudo-Maximum Likelihood estimator, with year dummy, individual fixed effect -that in our case corresponds to country-pair fixed effects- and with standard errors adjusted for two-way clustering, at the investing-destination country pair and year levels.

4. Data and Descriptive Statistics

4.1 Data

We draw the bilateral equity portfolio investments for the sample of 68 countries, in the period 2001-2017, from the Coordinated Portfolio Investment Survey (CPIS), released by the IMF. (Note 4)

This dataset has been used in many papers (Fidora et al., 2007; Lane & Milesi-Ferretti, 2007; Sorensen et al., 2007; Giannetti & Koskinen, 2010; Giofré, 2013, 2014; Bergin & Pyun, 2016), and collects security-level data from the major custodians and large end-investors. Portfolio investment is broken down by instrument (equity or debt) and residence of issuer, the latter providing information on the destination of portfolio investment. (Note 5)

Since the CPIS is unable to address the issue of third-country holdings and round-tripping, very frequent in the case of financial offshore centers, we exclude from our sample "the eight major pass-through economies -the

Netherlands, Luxembourg, Hong Kong SAR, the British Virgin Islands, Bermuda, the Cayman Islands, Ireland, and Singapore- [hosting] more than 85 percent of the world's investment in special purpose entities, which are often set up for tax reasons" (Damgaard et al., 2018). (Note 6)

4.2 Descriptive Statistics

Table 1 reports the variables included in our analysis and their main descriptive statistics.

Table 1. Descriptive statistics

	Descriptive Statistics						
	Mean	St. dev	1st Qu	Median	3rd Qu	Min	Max
I. Dependent variable							
Equities$_{s,h}$ (US $)	4.18E+09	2.901E+10	0	8.10E+06	3.04E+08	0	1.29E+12
II. Main regressor							
Equity return correlation$_{s,h}$	0.34	0.36	0.10	0.37	0.62	-1	1
III. Other controls							
Gravity variables							
Distance$_{s,h}$ (miles)	7207.36	4735.46	2781.71	7364.45	10159.53	59.62	19772.34
Border dummy$_{s,h}$	0.03	0.17	0	0	0	0	1
Colonial dummy$_{s,h}$	0.05	0.22	0	0	0	0	1
Language dummy$_{s,h}$	0.11	0.31	0	0	0	0	1
Legal origins dummy$_{s,h}$	0.25	0.43	0	0	0	0	1
Capital mobility							
Capital mobility*	4.48	2.82	1.54	4.62	6.92	0.00	10.00
Size variables							
GDP per cap* (US $)	24327.00	21976.61	7262.00	16681.00	38166.00	447.00	1.19E+05
GDP* (US $)	8.02E+11	2.07E+12	4.80E+10	2.14E+11	5.54E+11	1.27E+09	1.94E+13
Institutional variables							
Control of Corruption*	68.74	25.40	51.38	72.45	91.20	4.30	100.00
Perceived Control of Corruption*	56.33	21.86	37.00	53.00	75.00	17.00	99.00

Note. This table reports the descriptive statistics of the dependent variable and the regressors used in the analysis. The subscript *sh* refers to the country-pair *sh*,* indicates that the corresponding variable is included in the analysis for both the destination and the investing country.

The first panel reports the dependent variable, i.e., the bilateral portfolio equities holdings expressed in US$. They range from zero to 1295 billions of US$, with a median of 8.10 millions and a standard deviation of 29 billions.

The second panel refers to the main regressor, that is, the bilateral stock returns' correlation variable, with a mean equal to 0.34, a median of 0.37 and a standard deviation equal to 0.62.

The third panel comprises all other regressors, and is further split into sub-groups. The size variables included are GDP per capita and GDP in US$. The GDP per capita of source and host countries shows a large dispersion among countries: the GDP per capita mean is 24327 US$, while 50% of the sample has a GDP per capita lower than 16681 US$. The minimum value is equal to 447 US$, while the maximum is 119225 US$, with a standard deviation of 21977 US$. A notable degree of dispersion is also present in the GDP in US$ variable.

With the exception of the distance, the bilateral gravity covariates are all binary variables and capture the presence of a common border, language, legal origin or colonial linkages.

The capital mobility variable ranges from zero to 10, to indicate increasing levels of capital mobility: its mean is equal to 4.48, the first quartile is equal to 1.54, while the third quartile is equal to 6.92.

Finally, the institutional variables refer to the control of corruption and are drawn from the Worldwide Governance Indicators (WGI, World Bank) and from Transparency International. These variables' index goes from 0 to 100, reflecting increasing country governance standards. (Note 7)

5. Empirical Analysis

5.1 The Extant Empirical Literature

5.1.1 The Dynamics of FPE and EMU Linkages

In Figure 1, we show the dynamics of bilateral foreign portfolio equities (FPE), reported in Giofré and Sokolenko (2022). Panel a) reports the trend of bilateral foreign investment over years for all countries in the sample. The

figure displays an increasing pattern of world FPE until 2007, a drop in 2008, reflecting the abrupt fall in financial flows due to the crisis (Lane, 2013; Milesi-Ferretti and Tille, 2011), and then a recovery up to a level more than 3 times larger than its initial level. Panel b) reports the trend of FPE among EMU member countries over time. This figure shows, similarly to panel a), a fall in the FPE among EMU countries since 2007; differently from panel a), there has been no recovery, but rather a slow decline down to 40 percent of its initial level.
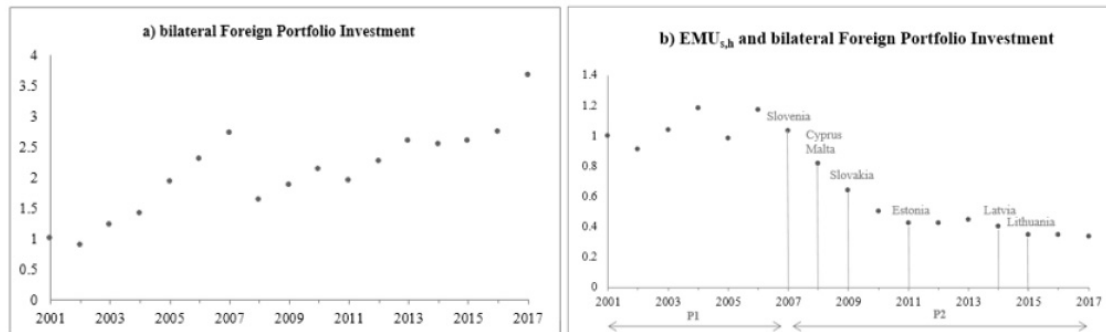

Figure 1. Bilateral foreign portfolio equity investment (FPE).

Note. This figure reports the dynamics of the bilateral FPE over time. Panel a) reports the regression coefficients of FPE on year dummy. Panel b) reports the regression coefficients of FPE on the bilateral dummy EMU_{sh} interacted with year dummy. The figure also displays the entrance of new EMU members and the time split into Period 1 and Period 2. In both panels, the value of the coefficient in 2001 is normalized to 1, so that the other coefficients are defined in relative terms.

This suggests that Euro area specific dynamics can be responsible of the persistence in the decline of FPE among member countries. To properly address this issue, we analyze below the EMU effect in a multivariate regression, properly accounting for the heterogeneity within the EMU group.

Table 2 replicates, as a benchmark, the analysis in Giofré and Sokolenko (2022), but considers the time period split in Period 1 (benchmark, excluded category) and Period 2 (2007-2017), rather than into crisis and post-crisis dummy. The dependent variable is the log of bilateral foreign equity investment (FPE). As specified above, the coefficients of all regressors expressed in logs can be interpreted in elasticity terms, while the effect of dummy variables on the dependent variable is captured by the coefficient β as follows: e^{β} - 1.

In column 1, we include standard gravity variables, used in literature to define the cultural and geographic proximity between two countries for equity flows (Portes and Rey, 2005; Portes et al., 2001), and equity holdings (Chan et al., 2005). We expect geographical and cultural proximity to have a positive impact on foreign portfolio equities, as a decrease in physical and cultural distance reduces information costs, and then enhances investment by foreign investors. Consistently with the gravity model approach, we also include the size variables, that express the economic weight of the investing and host countries, such as market capitalization and GDP per capita, and finally we control for capital mobility.

The results, as predicted, show that the gravity variables have a strong impact on the FPE allocation. The distance variable displays a negative coefficient (-0.069), meaning that an increase in distance is associated with a decrease in foreign portfolio equities. Sharing a common border leads to an increase of FPE by 49% ($e^{0.401}$-1 = 0.49), having an official language in common increases FPE by 84%, having a common colonial past increases equities share by 4.1 times, while the common legal origin seems to have no impact. The contribution of the size variables also appears important.

Table 2. FPE and EMU

	Dependent variable: $\log(\text{FPE}_{s,h})$							
	$\text{EMU}_{s,h}$		OLD_sEMU_h		EMU_sOLD_h		$\text{OLD}_{s,h}$	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
$\log(\text{Distance}_{s,h})$	-0.069 ***	-0.067 ***	-0.068 ***	-0.067 ***	-0.069 ***	-0.067 ***	-0.068 ***	-0.067 ***
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Border dummy$_{s,h}$	0.401 ***	0.399 ***	0.400 ***	0.398 ***	0.400 ***	0.398 ***	0.399 ***	0.397 ***
	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)	(0.065)
Language dummy$_{s,h}$	0.614 ***	0.608 ***	0.615 ***	0.609 ***	0.615 ***	0.608 ***	0.616 ***	0.610 ***
	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)	(0.059)
Colonial dummy$_{s,h}$	1.630 ***	1.636 ***	1.630 ***	1.635 ***	1.630 ***	1.635 ***	1.629 ***	1.635 ***
	(0.205)	(0.205)	(0.205)	(0.205)	(0.205)	(0.205)	(0.205)	(0.205)
Legal origins dummy$_{s,h}$	-0.084	-0.078	-0.085	-0.079	-0.085	-0.078	-0.086	-0.079
	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)	(0.056)
$\log(\text{Market cap}_s)$	0.567 ***	0.566 ***	0.566 ***	0.566 ***	0.567 ***	0.566 ***	0.566 ***	0.566 ***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
$\log(\text{Market cap}_h)$	0.783 ***	0.779 ***	0.782 ***	0.779 ***	0.782 ***	0.779 ***	0.782 ***	0.779 ***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
$\log(\text{GDP per cap}_s)$	1.484 ***	1.526 ***	1.482 ***	1.523 ***	1.484 ***	1.525 ***	1.482 ***	1.523 ***
	(0.070)	(0.073)	(0.070)	(0.073)	(0.070)	(0.073)	(0.070)	(0.073)
$\log(\text{GDP per cap}_h)$	0.039	0.066 *	0.039	0.066 *	0.039	0.066 *	0.039	0.066 *
	(0.033)	(0.034)	(0.033)	(0.034)	(0.033)	(0.034)	(0.033)	(0.034)
$\log(\text{Capital mobility}_s)$	0.134 ***	0.122 ***	0.134 ***	0.122 ***	0.134 ***	0.122 ***	0.134 ***	0.122 ***
	(0.046)	(0.045)	(0.046)	(0.045)	(0.046)	(0.045)	(0.046)	(0.045)
$\log(\text{Capital mobility}_h)$	-0.056 ***	-0.067 ***	-0.056 ***	-0.067 ***	-0.056 ***	-0.067 ***	-0.056 ***	-0.067 ***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
$\text{EMU}_{s,h}$	0.562 ***	0.733 ***						
	(0.049)	(0.062)						
$\text{EMU}_{s,h}\_\text{Period 2}$		-0.220 ***						
		(0.070)						
OLD_sEMU_h			0.567 ***	0.734 ***				
			(0.049)	(0.062)				
$\text{OLD}_s\text{EMU}_h\_\text{Period2}$				-0.214 ***				
				(0.070)				
EMU_sOLD_h					0.565 ***	0.733 ***		
					(0.049)	(0.062)		
$\text{EMU}_s\text{OLD}_h\_\text{Period 2}$						-0.216 ***		
						(0.070)		
$\text{OLD}_{s,h}$							0.570 ***	0.734 ***
							(0.049)	(0.062)
$\text{OLD}_{s,h}\_\text{Period 2}$								-0.211 ***
								(0.070)
Period 2		-0.299 ***		-0.299 ***		-0.299 ***		-0.299 ***
		(0.077)		(0.077)		(0.077)		(0.077)
Observations	45216	45216	45216	45216	45216	45216	45216	45216
Adjusted R^2	0.714	0.721	0.714	0.720	0.714	0.721	0.714	0.721

Note. This table reports the results of a Poisson Pseudo Maximum Likelihood regression (Santos Silva and Tenreyro (2006)), with year dummy, individual country pair fixed-effects and standard errors adjusted for two-way clustering at the investing-destination country pair and year levels. The dependent variable is $\log(\text{FPE}_{sh})$, where the subscript *sh* represents the couple investing country *s*-destination country *h*. The columns (#a) and (#b) consider specifications, respectively, without and with interactions with the Period 2 dummy. Columns (1a) and (1b) consider the investments among EMU countries, columns (2a) and (2b) consider OLD EMU countries investing in EMU host countries, columns (3a) and (3b) consider EMU source countries investing in OLD EMU host countries, and columns (4a) and (4b) consider investments among OLD EMU countries. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

Table 3. FPE composition of OLD EMU: CORE and PERIPHERY

	Dependent variable: log($FPE_{s,h}$)							
	$CORE_{s,h}$		$CORE_s PERIPH_h$		$PERIPH_s CORE_h$		$PERIPH_{s,h}$	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
log($Distance_{s,h}$)	-0.089 ***	-0.088 ***	-0.102 ***	-0.101 ***	-0.103 ***	-0.102 ***	-0.102 ***	-0.100 ***
	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)	(0.017)
Border dummy$_{s,h}$	0.395 ***	0.393 ***	0.463 ***	0.461 ***	0.451 ***	0.449 ***	0.469 ***	0.468 ***
	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)	(0.067)	(0.068)	(0.067)
Language dummy$_{s,h}$	0.519 ***	0.512 ***	0.530 ***	0.524 ***	0.532 ***	0.527 ***	0.523 ***	0.517 ***
	(0.059)	(0.060)	(0.063)	(0.063)	(0.061)	(0.061)	(0.061)	(0.062)
Colonial dummy$_{s,h}$	1.574 ***	1.580 ***	1.525 ***	1.531 ***	1.527 ***	1.534 ***	1.530 ***	1.537 ***
	(0.205)	(0.204)	(0.206)	(0.206)	(0.205)	(0.205)	(0.205)	(0.205)
Legal origins dummy$_{s,h}$	0.005	0.011	-0.020	-0.014	-0.015	-0.009	-0.015	-0.009
	(0.057)	(0.057)	(0.062)	(0.062)	(0.059)	(0.059)	(0.060)	(0.060)
log(Market cap$_s$)	0.561 ***	0.561 ***	0.557 ***	0.556 ***	0.560 ***	0.559 ***	0.559 ***	0.558 ***
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
log(Market cap$_h$)	0.776 ***	0.773 ***	0.771 ***	0.768 ***	0.771 ***	0.768 ***	0.771 ***	0.768 ***
	(0.011)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
log(GDP per cap$_s$)	1.461 ***	1.501 ***	1.466 ***	1.506 ***	1.487 ***	1.528 ***	1.478 ***	1.519 ***
	(0.069)	(0.072)	(0.069)	(0.072)	(0.070)	(0.073)	(0.070)	(0.073)
log(GDP per cap$_h$)	0.037	0.064 *	0.048	0.074 **	0.043	0.070 **	0.048	0.075 **
	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)	(0.033)
log(Capital mobility$_s$)	0.139 ***	0.126 ***	0.144 ***	0.132 ***	0.140 ***	0.127 ***	0.142 ***	0.129 ***
	(0.046)	(0.045)	(0.046)	(0.045)	(0.046)	(0.045)	(0.046)	(0.045)
log(Capital mobility$_h$)	-0.053 ***	-0.064 ***	-0.057 ***	-0.067 ***	-0.055 ***	-0.066 ***	-0.056 ***	-0.067 ***
	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)	(0.014)
$CORE_{s,h}$	0.536 ***	0.655 ***						
	(0.065)	(0.082)						
$CORE_{s,h}$ _Period 2		-0.158 *						
		(0.096)						
$CORE_s PERIPH_h$			0.247 ***	0.662 ***				
			(0.070)	(0.092)				
$CORE_s PERIPH_h$ _Period2				-0.562 ***				
				(0.108)				
$PERIPH_s CORE_h$					0.409 ***	0.414 ***		
					(0.058)	(0.075)		
$PERIPH_s CORE_h$ _Period 2						0.010		
						(0.095)		
$PERIPH_{s,h}$							0.704 ***	0.612 ***
							(0.132)	(0.167)
$PERIPH_{s,h}$ _Period 2								0.137
								(0.222)
Period 2		-0.308 ***		-0.309 ***		-0.324 ***		-0.324 ***
		(0.075)		(0.075)		(0.075)		(0.075)
Observations	45216	45216	45216	45216	45216	45216	45216	45216
Adjusted R²	0.714	0.721	0.707	0.713	0.708	0.714	0.707	0.713

Note. This table reports the results of a Poisson Pseudo Maximum Likelihood regression (Santos Silva and Tenreyro, 2006), with year dummy, individual country pair fixed-effects and standard errors adjusted for two-way clustering at the investing-destination country pair and year levels. The dependent variable is log (FPE_{sh}), where the subscript *sh* represents the couple investing country *s*-destination country *h*. The columns (#a) and (#b) consider specifications, respectively, without and with interactions with the Period 2 dummy. Columns (1a) and (1b) consider the investments among CORE countries, columns (2a) and (2b) consider CORE countries investing in PERIPHERY host countries, columns (3a) and (3b) consider PERIPHERY source countries investing in CORE host countries, and columns (4a) and (4b) consider investments among PERIPHERY countries. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.
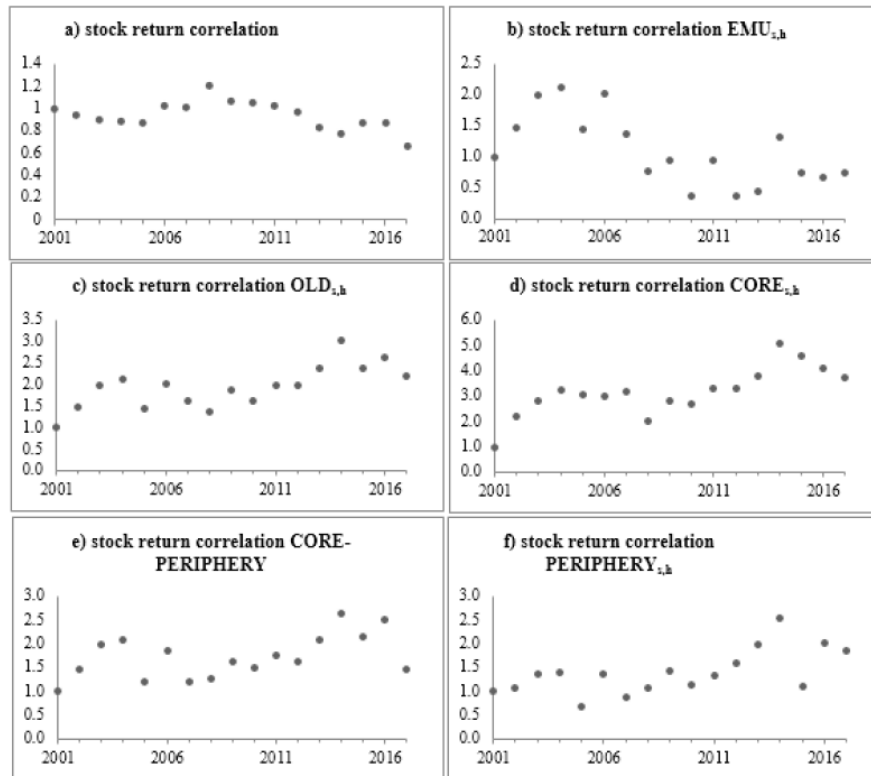
Figure 2. Stock returns' correlations

Note. This figure reports the dynamics of the bilateral one-year lagged correlation of monthly returns regressed on year dummies (panel a)), or on year dummies and their interaction with the corresponding EMU dummy (panel b) to f)). In all panels, the value of the coefficient in 2001 is normalized to 1, so that the other coefficients are defined in relative terms.

Stock market capitalization has a significant and positive impact on the FPE, which appears to be stronger for the host (0.783) than for the source country (0.567). The opposite happens to the GDP per capita variable: an increase in the source country's GDP strongly fosters foreign investment, with a non-significant effect for the host countries. Capital mobility variables play a positive significant role on the investing size, and a modest negative impact on the host side.

The coefficient of the bilateral EMU dummy variable over the whole period is equal to 0.562, that is, EMU countries invest one another 75% more than other country-pairs. In column (2) of Table 2, we include a dummy for the period 2007-2017 (Period 2), that is, the declining period observed in panel (b) of Figure 1. Since we also include the interaction between the Period 2 dummy and the EMU_{sh} dummy, the coefficient of the Period 2 dummy (-0.299) captures the general fall (-26%) of bilateral FPE for non-EMU country pairs, while the coefficient of the EMU_{sh} dummy (0.733), is referred to the pre-financial crisis period, and is large, positive and statistically significant (+108%). The effect of the EMU dummy in the subsequent period is computed by adding up the coefficient of the corresponding interaction term ($EMU_{sh} \cdot Period2$) to the non-interacted one (EMU_{sh}).

The negative coefficient of the interaction term $EMU_{sh} \cdot Period2$ can be interpreted as the change of the EMU effect (on FPE) induced by the crisis (or, symmetrically, as the change of the crisis effect on FPE for EMU country pairs). It is negative and significant, thus suggesting a significant drop from 108% ($e^{0.733}-1$) to 67% ($e^{0.733-0.220}-1$) in the EMU effect on FPE, relatively to the pre-crisis period (or, symmetrically, a more negative effect of the crisis for EMU country pairs).

Table 4. Stock returns' correlations and EMU

	Dependent variable: stock returns' correlation ($correl_{s,h}$)					
	(1)	(2)	(3)	(4)	(5)	(6)
EMU-EMU		0.302 ***				
		(0.010)				
EMU-EMU_Period 2		-0.160 ***				
		(0.013)				
OLD-OLD			0.323 ***			
			(0.019)			
OLD-OLD _Period 2			0.127 ***			
			(0.022)			
CORE-CORE				0.291 ***		
				(0.019)		
CORE-CORE_Period 2				0.044 **		
				(0.022)		
CORE-PERIPHERY					0.267 ***	
					(0.017)	
CORE-PERIPHERY_Period 2					0.091 ***	
					(0.021)	
PERIPHERY-PERIPHERY						0.246 ***
						(0.021)
PERIPHERY-PERIPHERY_Period 2						0.091 ***
						(0.026)
Period 2	0.293 ***	0.301 ***	0.292 ***	0.293 ***	0.293 ***	0.293 ***
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Observations	42728	42728	42728	42728	42728	42728
Adjusted R^2	0.077	0.095	0.093	0.087	0.087	0.082

Note. This table reports the results of an OLS regression of the bilateral one-year lagged correlation of monthly returns on different EMU dummies, the Period 2 dummy, and their interactions. The regression specification also includes year dummy, individual country pair fixed-effects and standard errors adjusted for two-way clustering at the investing-destination country pair and year levels. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

The results in Table 2 confirm, in a multivariate setting, that after 2007, the common currency effect on bilateral FPE has significantly fallen, and therefore the linkages among EMU countries have significantly loosened. The results are quite similar, when restricting to the sample of OLD EMU members, either on the investing side ((2a) and (2b)), or on the destination side ((3a) and (3b)), or on both ((4a) and (4b)). As emphasized by Giofré and Sokolenko (2022), this points to a slackening of the linkages among the original members because of the crisis, more than to the inclusion of new countries eventually less connected with the euro area.

5.1.2 OLD EMU Group Decomposition

In Table 3, following Lane and Milesi-Ferretti (2017), among others, we distinguish within the OLD EMU group, the Euro core countries (Austria, Belgium, Finland, France, Germany, Luxembourg and the Netherlands) and the Euro periphery or Euro crisis countries (Greece, Ireland, Italy, Portugal and Spain), and investigate their investment patterns.

In column (1a) and (1b) of Table 3, we observe that bilateral FPE among Euro core countries fell from 93% to 64%, after the crisis. When considering the cross investment of Euro core countries in Euro periphery countries (columns (2a) and (2b)), the drop is much more relevant, starting from 94% to only 11% larger investment, after the crisis.

Table 5. Main findings: FPE and the role of stock returns' correlations

	Dependent variable: log(FPE_{s,h})							
	EMU_{s,h}		OLD_{s,h}		CORE_{s,h}		CORE_sPERIPH_h	
	(1a)	(1b)	(4a)	(4b)	(1a)	(1b)	(2a)	(2b)
EMU_{s,h}	0.726 ***	0.724 ***						
	(0.062)	(0.062)						
EMU_{s,h} _Period 2	-0.218 ***	0.417 **						
	(0.070)	(0.164)						
EMU_{s,h} _H correl_{s,h} _Period 2		-0.661 ***						
		(0.160)						
OLD_{s,h}			0.727 ***	0.725 ***				
			(0.062)	(0.062)				
OLD_{s,h} _Period 2			-0.210 ***	0.635 ***				
			(0.071)	(0.132)				
OLD_{s,h} _H correl_{s,h} _Period 2				-0.875 ***				
				(0.127)				
CORE_{s,h}					0.649 ***	0.649 ***		
					(0.081)	(0.082)		
CORE_{s,h} _Period 2					-0.156	0.836 ***		
					(0.096)	(0.132)		
CORE_{s,h} _H correl_{s,h} _Period 2						-1.035 ***		
						(0.127)		
CORE_sPERIPH_h							0.654 ***	0.654 ***
							(0.092)	(0.092)
CORE_sPERIPH_h _Period2							-0.560 ***	0.378
							(0.108)	(0.309)
CORE_sPERIPH_h _H correl_{s,h} _Period 2								-0.981 ***
								(0.305)
H correl_{s,h}	0.052	0.078	0.050	0.080	0.070	0.095	0.077	0.084
	(0.060)	(0.061)	(0.060)	(0.061)	(0.060)	(0.060)	(0.061)	(0.061)
Period 2	-0.306 ***	-0.300 ***	-0.306 ***	-0.297 ***	-0.316 ***	-0.307 ***	-0.317 ***	-0.316 ***
	(0.077)	(0.076)	(0.077)	(0.077)	(0.075)	(0.075)	(0.075)	(0.075)
Controls: size, gravity and capital mobility variables								
Observations	41513	41513	41513	41513	41513	41513	41513	41513
Adjusted R^2	0.721	0.722	0.721	0.723	0.721	0.723	0.714	0.714

Note. This table reports the results of a Poisson Pseudo Maximum Likelihood regression (Santos Silva and Tenreyro (2006)), with year dummy, individual country pair fixed-effects and standard errors adjusted for two-way clustering at the investing-destination country pair and year levels. The dependent variable is log (FPE_{sh}), where the subscript *sh* represents the couple investing country *s*-destination country *h*. The columns (#a) and (#b) consider specifications, respectively, without and with interactions with the High returns' correlation (H correl_{s,h}) binary variable. Columns (1a) and (1b) consider the investments among EMU countries, columns (2a) and (2b) consider the investments among OLD countries, columns (3a) and (3b) consider the investments among CORE countries, columns (4a) and (4b) consider CORE source countries investing in PERIPHERY host countries. As specified at the bottom of the table, all controls of Table 2 are included, but not reported. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

When considering the investments by Euro periphery countries, we observe that their investment in Euro core countries ((3a) and (3b)) are on average 51% larger than other country pairs, while their investment in periphery economies are 102% larger than other country pairs, with no substantial difference between the pre-crisis and the subsequent period.

These results solicit a specific deeper investigation of the investment by core countries in other OLD countries' assets.

In particular, we conjecture that the investment diversion out of the Euro area is attributable to the pursuit of diversification benefits, that might have shrunk within the area, as a consequence of the stronger correlation induced by the global and sovereign debt crisis.

5.2 Contribution to the Literature

5.2.1 The role of Returns' Correlation

In Figure 2, we report the dynamics of the bilateral one-year lagged correlation of monthly returns, after normalizing to 1 its 2001 value. Panel a) shows the dynamics of the worldwide stock correlation, with a not clear-cut behavior. The returns' correlation in the EMU group (panel b)), shows instead a slightly decreasing pattern. This trend appears however mostly related to the enlargement of the Euro area: when restricting in fact to the OLD EMU sample, we observe an increasing trend, which appears particularly pronounced for the core countries, as evident from the y-axis scale.

In Table 4, we report the results of a regression with the stock return correlation as dependent variable. The first column shows an increase in worldwide stock correlation in the second period. While it declines for the whole EMU group, when focusing on OLD EMU countries, this correlation significantly increases after the crisis, thus confirming what shown in Figure 2: the decreasing trend of the whole EMU group is attributable to the entrance of new members featuring less correlated stock markets.

Table 6. Robustness: alternative high correlation definition (relative to the median)

| | Robustness: higher than median returns' correlation | | | | | | | |
| | $EMU_{s,h}$ | | $OLD_{s,h}$ | | $CORE_{s,h}$ | | $CORE_sPERIPH_h$ | |
	(1a)	(1b)	(4a)	(4b)	(1a)	(1b)	(2a)	(2b)
$EMU_{s,h}$	0.729 ***	0.727 ***						
	(0.062)	(0.062)						
$EMU_{s,h}$_Period 2	-0.219 ***	0.311 *						
	(0.070)	(0.173)						
$EMU_{s,h}$_H correl$_{s,h}$_Period 2		-0.553 ***						
		(0.169)						
$OLD_{s,h}$			0.730 ***	0.727 ***				
			(0.062)	(0.062)				
$OLD_{s,h}$_Period 2			-0.210 ***	0.548 ***				
			(0.070)	(0.136)				
$OLD_{s,h}$_H correl$_{s,h}$_Period 2				-0.786 ***				
				(0.131)				
$CORE_{s,h}$					0.650 ***	0.650 ***		
					(0.081)	(0.082)		
$CORE_{s,h}$_Period 2					-0.157	0.795 ***		
					(0.096)	(0.130)		
$CORE_{s,h}$_H correl$_{s,h}$_Period 2						-0.993 ***		
						(0.125)		
$CORE_sPERIPH_h$							0.656 ***	0.656 ***
							(0.093)	(0.093)
$CORE_sPERIPH_h$_Period2							-0.559 ***	0.208
							(0.108)	(0.336)
$CORE_sPERIPH_h$_H correl$_{s,h}$_Period 2								-0.804 **
								(0.332)
H correl$_{s,h}$	0.011	0.031	0.008	0.033	0.029	0.050	0.036	0.041
	(0.054)	(0.055)	(0.054)	(0.055)	(0.054)	(0.054)	(0.055)	(0.055)
Period 2	-0.303 ***	-0.299 ***	-0.303 ***	-0.296 ***	-0.313 ***	-0.305 ***	-0.315 ***	-0.314 ***
	(0.077)	(0.077)	(0.077)	(0.077)	(0.076)	(0.075)	(0.075)	(0.075)
Controls: size, gravity and capital mobility variables								
Observations	41513	41513	41513	41513	41513	41513	41513	41513
Adjusted R^2	0.721	0.722	0.721	0.722	0.721	0.723	0.713	0.713

Note. This table is the same as Table 5, but the binary High stock returns' correlation variable (H correl$_{s,h}$) is defined relative to the median, rather than to the mean.

In Table 5, we add to the econometric specification the stock returns' correlation variable and its interaction with the EMU dummies. We aim to assess how foreign portfolio investments in the Euro area have responded to diversification benefits and to detect to which extent their contraction contributed to explain the fall of core countries' investment in OLD EMU assets shown in Table 3.

To enhance the interpretability of the results' size, we include, rather than the continuous version of the correlation variable, its dichotomic counterpart, H correl$_{sh}$, equal to 1 if the correlation between the stock returns of country s and h is larger than the mean, and 0 otherwise. (Note 8) Columns (#a) add only the correlation binary variable, while columns (#b) also include the interaction between this variable and the corresponding EMU dummy. The coefficient of the binary variable H correl$_{sh}$ in columns (#a) is non-significant. This finding is consistent with the literature, which highlights a non-systematic role of stock returns' correlation in explaining foreign portfolio equities for Euro area investors, in the first decade of the EMU (Lane & Milesi-Ferretti, 2007). However, the results in columns (#b) show that a systematic diversification motive of Euro area investors emerges after 2007, when the returns' correlation among member countries gets stronger.

We observe that, in the second period (column (1b)), the linkages among EMU members are even tightened, from 106% ($e^{0.724}$-1) to 213% ($e^{0.724+0.417}$ -1), but only for those country pairs with weakly correlated stock returns (H correl$_{sh}$ = 0). The investments are instead hardly undercut, down to 62% ($e^{0.724+0.417-0.661}$ -1) for those country pairs

whose stock returns are highly correlated (H correl$_{sh}$ = 1).

Table 7. Robustness: alternative offshore centers

	EMU$_{s,h}$		OLD$_{s,h}$		CORE$_{s,h}$		CORE,PERIPH$_h$	
	IMF (2007) (1a)	L-MF (2017) (1b)	IMF (2007) (4a)	L-MF (2017) (4b)	IMF (2007) (1a)	L-MF (2017) (1b)	IMF (2007) (2a)	L-MF (2017) (2b)
EMU$_{s,h}$	0.931 *** (0.064)	0.919 *** (0.068)						
EMU$_{s,h}$_Period 2	0.383 ** (0.156)	0.371 ** (0.164)						
EMU$_{s,h}$_H correl$_{s,h}$_Period 2	-0.707 *** (0.151)	-0.658 *** (0.159)						
OLD$_{s,h}$			0.932 *** (0.064)	0.919 *** (0.068)				
OLD$_{s,h}$_Period 2			0.562 *** (0.132)	0.547 *** (0.139)				
OLD$_{s,h}$_H correl$_{s,h}$_Period 2			-0.882 *** (0.126)	-0.829 *** (0.133)				
CORE$_{s,h}$					0.831 *** (0.079)	0.762 *** (0.088)		
CORE$_{s,h}$_Period 2					0.748 *** (0.133)	0.735 *** (0.128)		
CORE$_{s,h}$_H correl$_{s,h}$_Period 2					-1.038 *** (0.129)	-0.954 *** (0.122)		
CORE,PERIPH$_h$							0.656 *** (0.096)	0.785 *** (0.099)
CORE,PERIPH$_h$_Period2							0.443 (0.309)	0.457 (0.321)
CORE,PERIPH$_h$_H correl$_{s,h}$_Period 2							-1.059 *** (0.305)	-1.098 *** (0.316)
H correl$_{s,h}$	0.111 * (0.065)	0.113 * (0.066)	0.113 * (0.065)	0.115 * (0.066)	0.132 ** (0.064)	0.132 ** (0.065)	0.122 * (0.065)	0.125 * (0.066)
Period 2	-0.309 *** (0.080)	-0.282 *** (0.083)	-0.305 *** (0.080)	-0.279 *** (0.083)	-0.322 *** (0.078)	-0.296 *** (0.082)	-0.347 *** (0.078)	-0.307 *** (0.082)
Controls: size, gravity and capital mobility variables								
Observations	37031	35828	37031	35828	37031	35828	37031	35828
Adjusted R^2	0.698	0.700	0.699	0.701	0.701	0.702	0.692	0.692

Note. This table is the same as Table 5, but the offshore countries are defined according to two alternative definitions: columns (#a) follow the classification in Zoromé (2007), while columns (#b) follow Lane and Milesi-Ferretti (2017) (see Appendix A for details).

This effect in the EMU group is led by the OLD EMU dynamics and, more specifically, by the core countries' dynamics. Indeed, the negative impact of the correlation variable in the second period is larger for the OLD EMU sub-group than for the whole EMU group, and even larger for the CORE sub-sub-group. In particular, the linkages among core countries fall from 91% to 57% in the second period, but only for highly correlated country pairs, while the weakly correlated country pairs witness an even stronger reciprocal attractiveness. The underweighting of highly correlated assets is particularly dramatic when considering the investment of core countries in periphery countries: the strong attractiveness before the crisis (92%) turned into a deterrence (-28%), compared to other country pairs' FPE. This latter finding is consistent with the results in Giofré and Sokolenko (2022), who identify the core-periphery linkages as the ones that have experienced the harshest deterioration after the crisis.

5.2.2 Robustness: alternative regressors and sample specifications

To provide consistency to our findings, in Table 6 and 7, we subject our main results to robustness checks.

In Table 6, we test the sensitivity of our analysis to a redefinition of our main regressor, that is, the dichotomic correlation variable, H correl$_{sh}$: we re-compute it relative to the median benchmark, rather to the mean, and the results are left substantially unchanged.

Table 8. Stock returns' correlation, institutions and size

	EMU							
	Control of corruption				Size			
	WGI Index (World Bank)		Perceived Index (Transparency Intl.)		GDP per capita		GDP US$	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
$EMU_{s,h}$	0.457 ***	0.459 ***	0.366 ***	0.366 ***	-1.152 ***	-1.171 ***	0.379 **	0.348 **
	(0.095)	(0.095)	(0.116)	(0.116)	(0.232)	(0.232)	(0.154)	(0.154)
$EMU_{s,h}$ _H WGI$_h$	0.121	0.642 ***						
	(0.101)	(0.195)						
$EMU_{s,h}$ _H WGI$_h$ _H correl$_{s,h}$		-0.547 ***						
		(0.168)						
$EMU_{s,h}$ _H Perc Index$_h$			0.213 *	0.766 ***				
			(0.121)	(0.197)				
$EMU_{s,h}$ _H Perc Index$_h$ _H correl$_{s,h}$				-0.577 ***				
				(0.156)				
$EMU_{s,h}$ _H GDP per cap$_h$					1.752 ***	2.386 ***		
					(0.235)	(0.276)		
$EMU_{s,h}$ _H GDP per cap$_h$ _H correl$_{s,h}$						-0.638 ***		
						(0.150)		
$EMU_{s,h}$ _H GDP$_h$ US$							0.182	0.838 ***
							(0.157)	(0.209)
$EMU_{s,h}$ _H GDP$_h$ US$ _H correl$_{s,h}$								-0.645 ***
								(0.143)
H WGI$_h$	0.114 *	0.121 *						
	(0.066)	(0.066)						
H Perc Index$_h$			0.110	0.114				
			(0.071)	(0.071)				
H GDP per cap$_h$					-0.271 ***	-0.297 ***		
					(0.098)	(0.098)		
H GDP$_h$ US$							0.786 ***	0.756 ***
							(0.055)	(0.055)
H correl$_{s,h}$		0.008		0.010 ***		0.023 ***		0.000
		(0.055)		(0.055)		(0.057)		(0.055)
Controls: size, gravity and capital mobility variables								
Observations	45216	41513	45216	41513	45216	41513	45216	41513
Adjusted R^2	0.717	0.719	0.717	0.718	0.711	0.713	0.722	0.723

Note. This table reports the results of a Poisson Pseudo Maximum Likelihood regression (Santos Silva and Tenreyro (2006)), with year dummy, individual country pair fixed-effects and standard errors adjusted for two-way clustering at the investing-destination country pair and year levels. The dependent variable is log (FPE$_{sh}$), where the subscript *sh* represents the couple investing country *s*-destination country *h*. Columns (#a) report the results of the interaction of the bilateral EMU$_{sh}$ dummy with two measures of corruption ((1a) to (2b)) and two measures of size ((3a) to (4b)). Columns (#b) consider the additional interaction with the High returns' correlation (H correl$_{s,h}$) dummy. As specified at the bottom of the table, all controls of Table 2 are included, but not reported. ***, **, and * indicate significance at the 1, 5, and 10% levels, respectively.

In Table 7, we consider alternative definitions of the offshore centers. In columns (#a), we follow a classification, which, among EMU countries, excludes the Netherlands from the offshore list, but adds Cyprus, Latvia and Malta (Zoromé, 2007). In columns (#b), we extend the list of offshore centers to other EMU countries, such as Cyprus, Malta and Belgium, following the classification in Lane and Milesi-Ferretti (2017). (Note 9) We find that, under alternative definitions of offshore centers, the results, though marginally different in size, confirm the baseline specification's ones.

5.2.3 Returns' correlation, size and institutions

Finally, we try to reconcile our results with the previous findings in the recent literature. Giofré and Sokolenko (2022) find that the worsening of the economic condition and the weakened control of corruption mechanisms in peripheral countries have triggered the decline in bilateral FPE among EMU countries.

In Table 8, we check if the role of the returns' correlation is robust to the inclusion of these factors.

The first index considered (columns (1a) and (1b)) is the "Control of Corruption" drawn from Worldwide Governance Indicators (WGI, Source: World Bank), which captures the perceptions of the extent to which public power is exercised for private gain. As an alternative, in columns (2a) and (2b), we consider the "Perceived Control of Corruption index" (Source: Transparency International), which captures the perceived level of corruption in the public sector, relying on different country sources. As far as the size indicators are concerned, we consider the GDP per capital, as a proxy of the standard of living, and the GDP in US$, as a standard size measure.

Table 9. Stock returns' correlation, institutions and size (OLD countries)

	OLD							
	Control of corruption				Size			
	WGI Index (World Bank)		Perceived Index (Transparency Intl.)		GDP per capita		GDP US$	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
$OLD_{s,h}$	0.470 ***	0.473 ***	0.454 ***	0.459 ***	0.456 ***	0.467 ***	0.479 ***	0.444 ***
	(0.056)	(0.056)	(0.057)	(0.057)	(0.061)	(0.062)	(0.135)	(0.058)
$OLD_{s,h}$_H WGI$_h$	0.195 ***	0.408 ***						
	(0.050)	(0.156)						
$OLD_{s,h}$_H WGI$_h$_H correl$_{s,h}$		-0.227						
		(0.160)						
$OLD_{s,h}$_H Perc Index$_h$			0.205 ***	0.422 ***				
			(0.050)	(0.152)				
$OLD_{s,h}$_H Perc Index$_h$_H correl$_{s,h}$				-0.231				
				(0.157)				
$OLD_{s,h}$_H GDP per cap$_h$					0.222 ***	0.493 ***		
					(0.052)	(0.151)		
$OLD_{s,h}$_H GDP per cap$_h$_H correl$_{s,h}$						-0.292 *		
						(0.157)		
$OLD_{s,h}$_H GDP$_h$ US$							0.085	0.300 **
							(0.137)	(0.117)
$OLD_{s,h}$_HGDP$_h$ US$ _H correl$_{s,h}$								-0.091
								(0.123)
H WGI$_h$	0.079	0.085						
	(0.060)	(0.060)						
H Perc Index$_h$			0.092	0.095				
			(0.065)	(0.065)				
H GDP per cap$_h$					-0.260 ***	-0.289 ***		
					(0.097)	(0.098)		
H GDP$_h$ US$							0.793 ***	0.729 ***
							(0.055)	(0.054)
H correl$_{s,h}$		0.005		0.004 ***		0.025 ***		-0.024
		(0.057)		(0.057)		(0.058)		(0.060)
Controls: size, gravity and capital mobility variables								
Observations	45216	41513	45216	41513	45216	41513	45216	41513
Adjusted R^2	0.721	0.722	0.721	0.722	0.716	0.716	0.722	0.726

Note. This table is the same as Table 8, but focuses on OLD countries.

Since in Giofré and Sokolenko (2022) the size and control of corruption indexes are dichotomic and defined relatively to their time-varying median, for consistency and the ease of comparability, the high returns' correlation binary variable is also defined relative to the median (as in Table 6).

Let us focus on columns (#b) of Table 8, reporting all interactions. Column (1b) shows that EMU investments in destination countries which display high values of control of corruption (less corrupted economies) are significantly larger (from 58% to 200%), but this larger effect is significantly dampened by a high returns' correlation with domestic assets (174%). The same evidence emerges when considering the role of the alternatively defined perceived corruption (column (2b)), of GDP per capita, or nominal GDP (columns (3b) and (4b)).

We replicate the analysis of Table 8 restricting to OLD EMU in Table 9 and to core countries in Table 10. In Table 9, the results found in Giofré and Sokolenko (2022) are confirmed, while the evidence of the diversification motive is weaker.

When focusing on core countries in Table 10, the results resume significance: hence, the non-significant interaction coefficients for OLD EMU in Table 9 are due to periphery investing countries. Table 10 shows that core countries are significantly driven by diversification motives, on top of other concurrent factors: a higher returns' correlation, inevitably produced by the persistent crisis, has reduced the diversification opportunities of core countries in member countries' assets, thus contributing to the general shrunk in bilateral portfolio investment within the Euro area.

Table 10. Stock returns' correlation, institutions and size (CORE countries)

	CORE							
	Control of corruption				Size			
	WGI Index (World Bank)		Perceived Index (Transparency Intl)		GDP per capita		GDP US$	
	(1a)	(1b)	(2a)	(2b)	(3a)	(3b)	(4a)	(4b)
CORE$_{s,h}$	0.338 ***	0.345 ***	0.328 ***	0.337 ***	0.346 ***	0.356 ***	0.345 ***	0.354 ***
	(0.075)	(0.075)	(0.074)	(0.074)	(0.073)	(0.073)	(0.070)	(0.071)
CORE$_{s,h}$_H WGI$_h$	0.256 ***	0.713 ***						
	(0.054)	(0.194)						
CORE$_{s,h}$_H WGI$_h$_H correl$_{s,h}$		-0.482 **						
		(0.198)						
CORE$_{s,h}$_H Perc Index$_h$			0.271 ***	0.724 ***				
			(0.053)	(0.188)				
CORE$_{s,h}$_H Perc Index$_h$_H correl$_{s,h}$				-0.479 **				
				(0.192)				
CORE$_{s,h}$_H GDP per cap$_h$					0.287 ***	0.775 ***		
					(0.052)	(0.187)		
CORE$_{s,h}$_H GDP per cap$_h$_H correl$_{s,h}$						-0.516 ***		
						(0.191)		
CORE$_{s,h}$_H GDP$_h$ US$							0.284 ***	0.478 ***
							(0.048)	(0.134)
CORE$_{s,h}$_H GDP$_h$ US$_H correl$_{s,h}$								-0.210
								(0.140)
H WGI$_h$	0.052	0.055						
	(0.061)	(0.061)						
H Perc Index$_h$			0.079	0.077				
			(0.066)	(0.066)				
H GDP per cap$_h$					-0.173 *	-0.207 **		
					(0.096)	(0.096)		
H GDP$_h$ US$							0.765 ***	0.735 ***
							(0.053)	(0.053)
H correl$_{s,h}$		0.037		0.035 ***		0.048 ***		0.004
		(0.057)		(0.057)		(0.058)		(0.059)
Controls: size, gravity and capital mobility variables								
Observations	45216	41513	45216	41513	45216	41513	45216	41513
Adjusted R^2	0.717	0.718	0.718	0.718	0.714	0.714	0.723	0.723

Note. This table is the same as Table 8, but focuses on CORE countries.

6. Conclusions

This paper focuses on the contraction of core EMU countries' investments in the Euro area. We find that the increase in stock returns' correlation induced by the global crisis has played a significant role in explaining the change in the investment pattern of core countries towards other EMU members after 2007. An increase in returns' correlations implies lower diversification opportunities and may turn into lower investments. We find indeed that core countries reduced equity investment in core and periphery economies after the crisis, and that the decrease has been significantly larger in those economies offering fewer diversification opportunities, due to the higher return correlation with the domestic assets.

This paper adds the diversification motive to the drivers of the fall of the within EMU investment after 2007, and complements the size- and institution-based explanation already highlighted in the recent literature. Core countries investors are confirmed to have underweighted assets issued by countries with poor control of corruption, but, as a novel finding, this effect has proven to be particularly harsh for destination EMU countries with returns highly correlated with the domestic ones.

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Notes

Note 1. Our data are time varying, but for the sake of simplicity in notation, we drop the time index in the equations.

Note 2. If a significant coefficient β is equal to 0.3, then the effect of a dummy equal to 1 on the dependent variable is $e^{0.3}-1 = 0.35$; to be interpreted as the effect being 35% larger than the effect of a dummy equal to 0). If the coefficient is null (or non statistically significant) then $e^0 -1= 0$, i.e., the effect of a dummy equal to 1 is not different from the effect of a dummy equal to 0.

Note 3. The subscript "*" indicates sh, s or h, when the EMU dummy is, respectively, bilateral, source country-specific or host country-specific.

Note 4. See Appendix A for the full list of investing and destination countries.

Note 5. While the CPIS provides the most comprehensive survey of international portfolio investment holdings, it is still subject to a number of important caveats. See data.imf.org/cpis, for more details on the survey.

Note 6. In Table 7, we consider alternative classifications of offshore centers.

Note 7. Details on the definition of the dependent variable and regressors, and information on their respective sources, are reported in Appendix A.

Note 8. Even though we do not fully account for the multilateral correlation structure of stock markets as in Bergin and Pyun (2016), by considering the H_corr_{sh} variable, we acknowledge the important role played by other countries' correlation. Indeed, our dichotomic variable takes into account the evolution of the time-varying *sh* bilateral correlation relative to the average world time-varying bilateral correlation.

Note 9. For a detailed list of offshore centers in the different specifications, see Appendix A.

A Data appendix

I. Dependent variable

Foreign Portfolio Equities. Cross-border holdings of equities issued by host country residents and held by the source country residents. Source: Coordinated Portfolio Investment Survey (IMF).

Investing and destination countries

Argentina, Australia, Austria, Bahrain, Barbados, Belgium, Brazil, Bulgaria, Canada, Chile, China Hong Kong, China, Colombia, Costa Rica, Cyprus, Czech Republic, Denmark, Egypt, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, India, Indonesia, Ireland, Israel, Italy, Japan, Kazakhstan, Korea, Kuwait, Latvia, Lebanon, Lithuania, Luxembourg, Malaysia, Malta, Mauritius, Mexico, Mongolia, Netherlands, New Zealand, Norway, Pakistan, Panama, Philippines, Poland, Portugal, Romania, Russia, Saudi Arabia, Singapore, Slovak Republic, Slovenia, South Africa, Spain, Sweden, Switzerland, Thailand, Turkey, Ukraine, United Kingdom, United States, Uruguay, Venezuela.

Offshore centers

Note that, as an exception to the list above, the below mentioned countries are considered as investing, but not as destination economies.

Baseline specification: the Netherlands, Luxembourg, Hong Kong SAR, Ireland, and Singapore (Damgaard et al. (2018)).

Robustness, Table 7, columns #a): Bahrain, Hong Kong, Cyprus, Ireland, Luxembourg, Malta, Mauritius, the Netherlands, Panama, Singapore, Switzerland, Belgium, United Kingdom (Lane and Milesi-Ferretti (2017))

Robustness: Table 7, columns #b): Bahrain, Barbados, Hong Kong, Cyprus, Ireland, Luxembourg, Malta, Mauritius, Panama, Singapore, Switzerland, United Kingdom, Latvia, Uruguay (Zoromé (2007))

II. Stock returns' correlation

Stock returns' correlation. The bilateral correlation between the stock market returns of the host and source country, expressed in US dollars, is computed as the lagged correlation of monthly returns in the previous year. Source: Monthly Monetary and Financial Statistics (MEI), OECD

III. Size variables

GDP per capita. Gross domestic product divided by midyear population (in current US $). Source: World Development Indicators, World Bank.

GDP in US$. Gross Domestic Product, Current US Dollars, Annual, Not Seasonally Adjusted. Source: Federal Reserve Economic Data (FRED).

IV. Gravity variables

Distance. Measure of the distance between the capital of the source and the host country, estimated with the great circle distance in miles. Source: CEPII's distance measures, the GeoDist database.

Border dummy. Dummy variable that takes the value equal to 1 when a pair of countries have at least one border in common, and 0 otherwise. Source: CEPII's distance measures, the GeoDist database.

Colonial dummy. Dummy variable that takes the value equal to 1 for those pair of countries that share a common

colonial past, and 0 otherwise. Source: CEPII's distance measures, the GeoDist database.

<u>Language dummy</u>. Dummy variable that takes the value equal to 1 when a pair of countries have an official language in common, and 0 otherwise. Source: CEPII's distance measures, the GeoDist database.

<u>Legal origins dummy</u>. Dummy variable that takes the value equal to 1 for those pair of countries that share a common origin (British, French, Socialist, German or Scandinavian).

V. Capital mobility

<u>Capital mobility</u>. Rank from 1 to 10, denoting increasing capital mobility, for both the source and the host country. Source: Economic Freedom of the World.

VI. Institutional variables

<u>Control of Corruption</u>. Percentile Rank of control of corruption in the host country. Control of corruption captures perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as "capture" of the state by elites and private interests. Source: Worldwide Governance Indicators (World Bank)

<u>Perceived Corruption Index</u>. The index scores and ranks countries and territories around the world on the perceived level of corruption in the public sector. It is an aggregate index which scores 1-100 from very clean to highly corrupted countries and which draws on a number of different data sources that capture business and expert views across different countries. Source: Transparency International (https://www.transparency.org/en/cpi)