

External Imbalances and Sovereign Debt Crisis: Eurozone Countries

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ABSTRACT: The purpose of this article is to formally link the external imbalances to the sovereign debt crisis that the EMU has been experiencing since 2009. Based on Capital enhanced Equilibrium Exchange Rate approach, which links the goods market to the capital market via the expected exchange rate, we show that when a country belonging to a monetary union faces an external imbalance vis-à-vis another member country, the corresponding interest rate differential tends to increase. Moreover, when these imbalances persist, they can trigger a balance of payments crisis. Our results indicate that such a phenomenon seems to be at play for European countries under international financial assistance.

KEYWORDS : Balance of payments, CHEER, debt crisis, external imbalances, Euro-Zone.

JEL Classification : F33, F34, G01.

1. INTRODUCTION

The main objective of European integration is to maintain peace and ensure freedom and prosperity in Europe (European Commission, 2015). Moreover, economists' opinions on the benefits of the single currency, the euro, for a group of countries as diverse as the EMU are very different. Confirmations are constantly changing the increasingly risky conditions and rules of the EMU. The ratification of the Maastricht Treaty in 1992 cannot be considered an economically sufficient and reasonable decision due to the lack of labor mobility and fiscal transfers, the artificial suppression of unit labor costs Germans. Ferreira, Dionisio and Zebende (2014) highlighted that there are significant differences in the levels of financial integration achieved between some Eurozone countries. Their results, based on data from before the introduction of the euro, show the problems of peripheral countries with asymmetric shocks that prevented them from achieving the full degree of financial integration and reaping benefits from it. The example of such an asymmetric shock is the debt crisis in the Eurozone. For example, a country that decides to abandon its currency by adopting a single monetary policy to create a monetary union loses an important instrument for smoothing internal and external imbalances emerging in a monetary union (De Grauwe and Ji, 2013). There is also a certain compromise between the homogeneity of the countries belonging to a monetary union and the existence of real adjustment mechanisms which would be present there. The persistence of external imbalances in a monetary union is the main reason for its problems and the main reason for the debt difficulties of its members. In this article we presented the relationship between external imbalances and interest rate differentials. More precisely, this article revealed to us that a sovereign debt crisis is strongly linked to real imbalances and that the particular form taken by a balance of payments crisis if parities are fixed irrevocably. For this reason, we considered it necessary to work with the CHEER "Capital Enhanced Equilibrium Exchange Rate" approach, introduced by Johansen and Juselius (1992), through a cointegrated VAR. This approach produced a faster rate of convergence of estimates than other models.

2. LITERATURE REVIEW

In order to better explore the economic literature of the sovereign debt crisis, some authors considered the European debt crisis to be a hidden monetary crisis or, at the very least, they believed that there was a causal link between the monetary crisis and the debt crisis. Dreher, Herz, and Karb (2006) concluded that currency crises have a negative but delayed impact on debt crises and often occur simultaneously based on panel data from 80 countries during 1975–2000.

The study by Arghyrou and Kontonikas (2012) confirmed the previous conclusion. Furthermore, the authors added that the reason is the absence of foreign exchange markets, with systemic risk being diverted to the government bond market. Furthermore, economists have argued that the main factors impacting the debt crisis were international risk, macroeconomic fundamentals and

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contagion. To examine the causes of the debt crisis, there is a so-called monetary approach. Lane (2012), in their contribution to the debate on the sovereign debt crisis, pointed out that the causes of the European sovereign debt crisis were necessary to examine the original Euro model. One of the other sources triggering the sovereign debt crisis in Europe is the news of sovereign ratings in European financial markets examined in the study by Arezki, Candelon and Sy (2011). They analyzed the spillover effects during the period 2007-2010. The main conclusion was that sovereign rating downgrades had statistically and economically significant impacts on countries and financial markets.

The study by Reinhart and Rogoff (2010) can be considered a breakthrough in the study of a possible link between banking crises and debt crises. They developed long historical time series including two centuries on public debt and external debts. The results confirmed a significant link between banking crises and sovereign defaults in advanced and emerging economies around the world. Furthermore, they argued that banking crises could behave as predictors of sovereign debt crises. A similar study by Candelon and Palm (2010) based on the balance sheet approach showed a transformation of the Subprime crisis into a sovereign debt crisis. Candelon and Palm (2010) concluded that the possibility of default in the Eurozone at the end of 2009 was lower than six months earlier. Furthermore, they highlighted the importance of the relationship between banking crises and sovereign debt. Angeloni and Wolff (2012) support the previous conclusions quite well. Calabrese, Elkind and Giudici (2014), highlighted the importance of the contagion effects of bank failures which had a significant impact on the development of the European sovereign debt crisis. They have already applied the spatial autocorrelation parameter of a spatial autoregressive model for Eurozone countries that exhibited high levels of systemic risk due to contagion. Similar results were presented in the study of De Grauwe and Ji (2013) and Croci Angelini, Farina and Valentini (2015).

3. EMPIRICAL METHODOLOGY

3.1. Econometric modeling

The econometric study concerns 12 Eurozone countries: Austria, Belgium, Finland, France, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain and Germany. The time component of our dataset is 1990-2018.

3.2. Technical estimate

We follow the cointegrated VAR (CVAR) model. The model to be estimated is as follows:

$$\Delta x_t = \sum_{i=1}^{s+1} \Gamma \Delta x_{t-i} + \Pi x_{t-1} + \Psi D_t + \varepsilon_t$$

With $x_t = (p_t, p_t^*, i_t^l, i_t^{l*})$, D_t : contains the deterministic components; $\Pi = \alpha \beta'$: β' is the matrix containing the cointegration vectors and that containing the loading parameters associated with each cointegration vector.

4. DATA AND RESULTS

4.1. Data

We rely on the World Bank's International Comparison Program (ICP), which aims to provide comparable international prices. Based on this framework, Eurostat and the OECD have calculated series of comparative price levels (CPL) for each European country. The OECD defines these "CPLs" as the ratio between the purchasing power parity conversion factor for private consumption and the nominal exchange rate. This ratio measures differences in price levels and can be expressed as follows:

$$PCI_{i,t} = \frac{PPA_{i,t}}{TCN_{i,t}} \times 100$$

With $PPA_{i,t}$: represents the PPP conversion factor for private final consumption of country i relative to the United States at time t , expressed in euros per United States dollar, and $TCN_{i,t}$ is the euro/dollar exchange rate at time t . The ICP (International Comparison Program) are calculated by Eurostat and the OECD for each European country only every year since 1990.

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Table.1. Unit root tests in I(0)

Country	P-value (ADF)			P-value (PP)			P-value (ADF)	
	Without trend	With trend	Without trend and constant	Without trend	With trend	Without trend and constant	Without trend	With trend
Austria	-2,317 (0,173)	0,764 (0,451)	-1,155 (0,219)	-2,363 (0,160)	-2,474 (0,337)	-1,115 (0,233)	0,788 (0,437)	-2,365 (0,387)
Belgium	1,446 (0,159)	0,829 (0,414)	-1,964 (0,048)**	1,446 (0,159)	0,829 (0,414)	-1,964 (0,048)	0,040 (0,967)	-2,991 (0,151)
Finland	0,530 (0,600)	-0,080 (0,936)	-	0,530 (0,600)	-0,080 (0,936)	-4,289 (0,000)***	1,737 (0,094)	2,387 (0,024)**
France	2,130 (0,042)	1,554 (0,132)	-2,768 (0,010)**	2,130 (0,042)	1,554 (0,132)	-2,768 (0,010)**	0,982 (0,335)	1,606 (0,120)
Greece	0,670 (0,508)	2,649 (0,179)	-	0,670 (0,508)	2,649 (0,179)	-	-1,519 (0,140)	1,534 (0,137)
Ireland	1,021 (0,316)	0,389 (0,700)	-1,621 (0,116)	1,021 (0,316)	0,389 (0,700)	-1,621 (0,116)	0,686 (0,498)	0,439 (0,664)
Italy	1,083 (0,288)	0,655 (0,518)	-2,104 (0,044)**	1,083 (0,288)	0,655 (0,518)	-2,104 (0,044)	-1,519 (0,140)	1,534 (0,137)
Luxembourg	-0,463 (0,646)	0,170 (0,866)	-2,540 (0,017)	-0,463 (0,646)	0,170 (0,866)	-2,540 (0,017)**	1,312 (0,200)	-1,375 (0,181)
The Netherlands	1,535 (0,136)	1,580 (0,126)	-1,549 (0,133)	1,535 (0,136)	1,580 (0,126)	-1,549 (0,133)	0,728 (0,472)	-2,212 (0,464)
Portugal	2,009 (0,056)	0,450 (0,656)	2,390 (0,024)**	1,264 (0,217)	0,172 (0,864)	-1,372 (0,181)	-2,416 (0,146)	-0,120 (0,905)
Spain	1,172 (0,251)	0,535 (0,597)	-	1,172 (0,251)	0,535 (0,597)	-	0,872 (0,391)	-

Source: Eviews based on OECD and Eurostat data (2018).

Note: ***significance at 1%, **significance at 5%, *significance at 10%.

Table.1.a. Unit root tests in I (1)

Country	P-value (ADF)			P-value (PP)			P-value (Phillips-Perron)		
	Without trend	With trend	Without trend and constant	Without trend	With trend	Without trend and constant	Without trend	With trend	Without trend
Austria	0,781 (0,442)	0,379 (0,707)	-9,694 (0,000)***	0,781 (0,442)	0,379 (0,707)	-9,694 (0,000)***	0,228 (0,820)	-0,336 (0,739)	-5,258 (0,000)***
Belgium	0,235 (0,816)	0,080 (0,936)	-6,095 (0,000)***	0,235 (0,816)	0,080 (0,936)	-6,095 (0,000)***	-0,161 (0,872)	0,116 (0,908)	-4,290 (0,000)***
Finland	-0,240 (0,811)	0,799 (0,431)	-4,164 (0,000)***	-0,240 (0,811)	0,799 (0,431)	-4,164 (0,000)***	-1,772 (0,088)*	2,938 (0,007)***	-
France	-0,261 (0,795)	0,389 (0,700)	-5,956 (0,000)***	-0,261 (0,795)	0,389 (0,700)	-5,956 (0,000)***	-0,277 (0,783)	0,777 (0,444)	-6,922 (0,000)***
Greece	-0,316 (0,754)	0,777 (0,444)	-4,530 (0,000)***	-0,316 (0,754)	0,777 (0,444)	-4,530 (0,000)***	2,671 (0,013)***	-	-
Ireland	0,603	-2,296	-3,569	0,603	-2,296	-3,569	-0,027	-0,235	-4,223

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	(0,551)	(0,769)	(0,001)***	(0,551)	(0,769)	(0,001)***	(0,978)	(0,815)	(0,000)***
<i>Italy</i>	-0,316 (0,754)	0,777 (0,444)	-4,530 (0,000)***	-0,316 (0,754)	0,777 (0,444)	-4,530 (0,000)***	-0,436 (0,666)	1,125 (0,271)	-4,497 (0,000)***
<i>Luxembourg</i>	1,148 (0,261)	0,405 (0,688)	-7,227 (0,000)***	1,148 (0,261)	0,405 (0,688)	-7,227 (0,000)***	0,051 (0,959)	0,382 (0,705)	-6,257 (0,000)***
<i>The Netherlands</i>	0,654 (0,518)	0,493 (0,626)	-5,000 (0,000)***	0,654 (0,518)	0,493 (0,626)	-5,000 (0,000)***	-0,156 (0,876)	0,438 (0,665)	-5,761 (0,000)***
<i>Portugal</i>	0,415 (0,681)	-1,386 (0,178)	-4,723 (0,000)***	0,415 (0,681)	-1,386 (0,178)	-4,723 (0,000)***	-0,109 (0,913)	-0,191 (0,849)	-3,546 (0,001)***
<i>Spain</i>	1,838 (0,077)*	0,295 (0,770)	-10,757 (0,000)***	1,838 (0,077)*	0,295 (0,770)	-10,757 (0,000)***	-0,435 (0,667)	0,457 (0,651)	-4,542 (0,000)***

Source: Eviews based on OECD and Eurostat data (2018).

Note: ***significance at 1%, **significance at 5%, *significance at 10%.

4.2. Main results and discussions

Table.2. Specification tests

Country	LM	Skewnesss	Kurtosis	Jarque -Bera
<i>Austria</i>	11,597 (0,771)	3,106 (0,540)	2,605 (0,625)	5,711 (0,679)
<i>Belgium</i>	13,309 (0,650)	6,708 (0,152)	11,725 (0,019)	18,434 (0,018)
<i>Finland</i>	21,533 (0,158)	5,883 (0,208)	4,091 (0,393)	9,975 (0,266)
<i>France</i>	13,698 (0,621)	3,246 (0,517)	8,541 (0,073)	11,787 (0,160)
<i>Greece</i>	7,516 (0,962)	1,399 (0,844)	0,813 (0,589)	4,212 (0,837)
<i>Ireland</i>	18,625 (0,288)	8,163 (0,085)	3,355 (0,500)	11,518 (0,174)
<i>Italy</i>	7,894 (0,951)	2,990 (0,559)	1,879 (0,758)	4,869 (0,771)
<i>Luxembourg</i>	11,914 (0,749)	6,227 (0,182)	1,787 (0,774)	8,015 (0,432)
<i>The Netherlands</i>	14,251 (0,579)	5,309 (0,257)	0,933 (0,919)	6,243 (0,620)
<i>Portugal</i>	14,254 (0,579)	5,793 (0,215)	9,114 (0,058)	14,907 (0,061)
<i>Spain</i>	1,900 (0,754)	4,391 (0,355)	1,590 (0,810)	5,981 (0,649)

Source: Author's calculation using Eviews.

5. MAIN RESULTS AND DISCUSSIONS

Firstly speaking of the first concern when examining the VAR specification which is explained by an assessment of the integration of each variable across countries. To this end, we carry out different tests for each country in our sample such as; the tests proposed by Ng and Perron (2001) and by Lee-Strazicich (2003) on long-term interest rates and price levels. Compared to usual unit root tests such as Dickey-Fuller (1979) or Phillips-Perron (1988), the Ng and Perron (2001) test provides better size and power by more precisely selecting the lag offset through a modified AIC sample (MAIC). “...The tests introduced by Ng and Perron [Ng. S. Perron. P. 2011: “...Lag Length Selection and the Construction of Unit Root Tests with Good Size and Power”. While that of Lee and Strazicich (2003) takes into consideration the different ruptures in the series. In our case, the series are stationary of the first order.

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Table.3. Cointegration Rank Analysis

Number of cointegration relationships	Austria		Belgium		Finland		France		Greece		Ireland	
	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace
$r \leq 3$	0.63 (0.42)	0.63 (0.42)	0.99 (0.31)	0.99 (0.31)	0.37 (0.54)	0.37 (0.54)	0.11 (0.73)	0.11 (0.73)	1.93 (0.16)	1.93 (0.16)	2.72 (0.09)	2.72 (0.09)
$r \leq 2$	10.43 (0.18)	11.07 (0.20)	5.95 (0.61)	6.95 (0.58)	10.16 (0.20)	10.53 (0.24)	6.42 (0.55)	6.54 (0.63)	8.08 (0.37)	10.02 (0.27)	6.07 (0.60)	8.79 (0.38)
$r \leq 1$	17.52 (0.14)	28.59 (0.06) *	19.19 (0.09)	26.14 (0.12)	24.54 (0.01)* **	35.08 (0.01)* **	23.93 (0.01)* **	30.47 (0.04)* *	12.75 (0.47)	22.77 (0.25)	9.30 (0.80)	18.09 (0.55)
$r = 0$	24.03 (0.13)	52.62 (0.01) ***	26.99 (0.05)* *	53.14 (0.01) ***	36.62 (0.00)* **	71.70 (0.00)* **	34.56 (0.00)* **	65.03 (0.00)* **	72.33 (0.00)* **	95.11 (0.00) ***	46.89 (0.00)* **	64.98 (0.00)* **

Source: Author's calculation using Eviews.

Note: ***: significant at the 1% level; **: significant at the 5% level; *: Significant at the 10% threshold.

Table.3.a. Cointegration Rank Analysis

Number of cointegration relationships	Italy		Luxembourg		Netherlands		Portugal		Spain	
	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace	λ_{max}	Trace
$r \leq 3$	0.01 (0.98)	0.016 (0.89)	0.07 (0.77)	0.07 (0.77)	0.72 (0.39)	0.72 (0.39)	2.74 (0.09)	2.74 (0.09)	5.79 (0.20)	5.79 (0.20)
$r \leq 2$	4.30 (0.70)	5.31 (0.77)	7.93 (0.38)	8.01 (0.46)	13.53 (0.06)	14.26 (0.07)	6.40 (0.56)	9.15 (0.35)	8.96 (0.43)	14.76 (0.24)
$r \leq 1$	32.85 (0.00)** *	38.16 (0.00)** *	17.74 (0.13)	25.76 (0.13)	15.36 (0.26)	29.62 (0.05)**	15.17 (0.27)	24.33 (0.18)	18.26 (0.16)	33.02 (0.08)
$r = 0$	62.26 (0.00)** *	100.43 (0.00)** *	45.96 (0.00)** *	71.72 (0.00)* *	37.07 (0.00)** *	66.70 (0.00)** *	37.88 (0.00)** *	62.22 (0.00)* *	35.43 (0.00)** *	68.46 (0.00)** *

Source: Author's calculation using Eviews

Note: ***: significant at the 1% level; **: significant at the 5% level; *: Significant at the 10% threshold.

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Table.4. Cointegration Space

	<i>Austria</i>	<i>Belgium</i>	<i>Finland</i>	<i>France</i>	<i>Greece</i>	<i>Ireland</i>	<i>Italy</i>	<i>Luxembourg</i>	<i>Netherlands</i>	<i>Portugal</i>	<i>Spain</i>
Standardized Eigenvectors β											
p	1	1	1	1	1	1	1	1	1	1	1
p^*	-1.00	-0.79	-0.68	-1.74	-0.83	-0.98	-1.24	-0.86	-1.44	-1.98	0.28
i^l	-0.03	-0.19	0.02	0.69	-1.05	-0.09	0.04	0.01	0.16	-0.17	0.001
i^{l*}	0.04	0.19	0.01	-0.62	0.02	0.12	-0.02	0.05	-0.12	0.24	-0.02
Adjustment coefficients α											
Δp	1.07	0.27	-0.59	-0.11	-0.73	0.07	-0.48	-0.31	0.41	0.08	-0.04
Δp^*	1.25	-0.02	0.24	-0.03	0.16	0.18	0.14	0.13	0.48	0.06	-1.66
Δi^l	-7.86	8.33	-1.80	-2.48	0.02	6.59	-3.73	-5.96	-3.13	2.59	-2.11
Δi^{l*}	-13.11	4.70	-2.74	-1.82	-3.02	2.11	-3.84	-13.46	-2.63	0.74	-0.62

Source: Author's calculation using Eviews.

Note: ***: significant at the 1% level; **: significant at the 5% level; *: Significant at the 10% threshold.

Refers to the rejection of the null hypothesis of no cointegration with Germany at the level of 10% (resp. 5%, 1%).

Table.5. Low Exogeneity

Country	p	p^*	i^l	i^{l*}	p and p^*	i^l and i^{l*}
<i>Austria</i>	4.167 (0.12)	1.096 (0.57)	10.007 (0.00)***	8.648 (0.01)**	2.395 (0.09)	4.600 (0.01)***
<i>Belgium</i>	0.967 (0.61)	0.269 (0.87)	12.65 (0.00)***	9.66 (0.00)***	3.740 (0.02)**	5.091 (0.00)***
<i>Finland</i>	3.701 (0.15)	8.375 (0.01)**	8.680 (0.01)**	3.334 (0.18)	3.349 (0.04)**	3.249 (0.04)**
<i>France</i>	2.676 (0.26)	3.314 (0.19)	8.849 (0.01)**	5.998 (0.04)**	3.744 (0.02)**	3.853 (0.02)**
<i>Greece</i>	0.119 (0.94)	1.063 (0.58)	7.989 (0.01)**	3.906 (0.14)	8.107 (0.00)***	2.744 (0.05)**
<i>Ireland</i>	0.513 (0.77)	0.320 (0.85)	4.728 (0.09)	7.101 (0.02)**	0.952 (0.45)	3.954 (0.02)**
<i>Italy</i>	0.119 (0.94)	1.063 (0.58)	7.190 (0.02)**	1.779 (0.41)	2.015 (0.14)	3.396 (0.07)
<i>Luxembourg</i>	0.760 (0.68)	5.601 (0.06)	7.162 (0.02)**	5.521 (0.05)**	1.787 (0.19)	2.656 (0.07)
<i>The Netherlands</i>	0.372 (0.83)	0.190 (0.90)	3.856 (0.14)	3.740 (0.15)	0.196 (0.82)	3.643 (0.03)**
<i>Portugal</i>	2.654 (0.26)	3.010 (0.22)	6.360 (0.04)**	3.721 (0.15)	1.254 (0.27)	3.889 (0.02)**
<i>Spain</i>	1.137 (0.28)	58.377 (0.00)***	9.331 (0.00)***	3.451 (0.17)	0.011 (0.91)	2.852 (0.05)**

Source: Author's calculation using Eviews.

Table.2 shows the different results of the cointegration tests: eigenvalue test and trace test proposed by Johansen. Thus, the results found in the table show the existence of a cointegration relationship between interest rates and price level differences compared to Germany for each European country. In light of the empirical results found, we can say that the parity differences compared to Germany are indeed linked for all members of the euro zone. This result confirms the point of view that we have developed and according to which external imbalances could be at the root of the sovereign crisis.

However, for confirmation of this result. We find it necessary at this stage to carry out the causality test to ensure the direction of causality. That is to say, whether the causal link goes from the price to the interest rate or the opposite. This can be achieved

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throughout the Weak Exogeneity tests. Generally, The usefulness of the “Granger Causality/Block Exogeneity” test to determine the number of variables to test long-term causality (McDonald and Juselius. 2003). Hall and Milne (1994). In table 26, we validate the hypothesis of the presence of causality in both unidirectional and multidirectional directions. Following the above, we obtain a remarkable improvement in interest rates in some countries which confirms that these countries are going through a balance of payments crisis.

About the table called “The cointegration space”, it designates the vector space generated by the r cointegrating vectors which are linearly independent. According to the causality table almost in most countries, the rejection of the hypothesis of low Exogeneity is possible only for common interest rates and not for prices. This explains that the improvement in interest rate differentials can be attributed to the non-stationarity of price differentials such as Austria, Ireland, Italy, Netherlands, Portugal and Spain. These results ensure and confirm the fact that the sovereign debt crisis is due to a balance of payments crisis for these countries. Furthermore, the causal link is not called into question for Belgium, Finland, France and Greece, but it is more restricted because the prices are weakly exogenous only in the case where they are tested individually. Still in the same vein, low exogenous prices suggest that causality runs from the goods market to the capital market. Specifically, purchasing power parity (PPP) imbalances led to imbalances in the uncovered interest rate parity (UIP).

Table.6. Restrictions Test

Country	Hypothesis A		Hypothesis B	
	χ^2	p-value	χ^2	p-value
Austria	13.674	0.003***	16.120	0.000***
Belgium	24.533	0.000***	6.253	0.044**
Finland	9.726	0.021***	7.769	0.020**
France	11.997	0.007***	7.970	0.018**
Greece	59.122	0.000***	2.182	0.335
Ireland	20.162	0.000***	3.960	0.138
Italy	25.376	0.000***	6.809	0.033**
Luxembourg	31.137	0.000***	0.222	0.894
Netherlands	26.584	0.000***	11.600	0.003***
Portugal	32.340	0.000***	3.727	0.155

Source: Author's calculation using Eviews.

Note: The hypothesis: $H_A: \beta = (1, -1, -1, 1)$. with $\beta = (p_t, p_t^*, i_t^l, i_t^{l*})$. This hypothesis is removed according to equation (10) of the relationship between goods market and capital market.

Table.7. Restriction test and economic interpretations

Hypotheses	Restrictions on β	Economic interpretation	Implications
<i>Hypothesis A</i>	$\beta = [1, -1, -1, 1]$	Unit price and interest rate spreads.	High sensitivity since the elasticity is equal to 1.
<i>Hypothesis B</i>	$\beta = [1, -1, -\gamma, \gamma]$	Unit price and restricted interest rate differentials.	Average sensitivity if γ is greater than 1.

Source: David Guerreiro (2014): « Restrictions economic interpretation and sensitivity implications ».

Note: **Hypotheses:** $H_A: \beta = (1, -1, -1, 1)$. $\beta = (p_t, p_t^*, i_t^l, i_t^{l*})$

To interpret the long-term cointegration relationship, we can start with the theory of Johansen (1995): “... The elements of the matrices Σ and Γ are not identified. The restrictions on Γ relate to the long-term relationship of the model and require the use of theoretical a priori to be able to interpret them economically. In Table 6, the long-term structure of the cointegrated VARs can be compared to theoretical predictions by imposing restrictions on the cointegrating vectors.

We examine the sensitivity of interest differentials to price differentials in each country relative to Germany. The results found show that the version of CHEER (Hypothesis A) is rejected for each country with a p-value equal to zero. Despite the fact that PPP deviations lead to deviations in interest rate parities (according to the Weak Exogeneity tests), the elasticity between these two components remains less than 1. Concerning the semi-strong sensitivity (elasticity) $0;1[)$ is accepted only for Greece, Ireland and Portugal and Luxembourg, but rejected for the rest of the countries.

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Overall, these results confirm that countries that have called on international assistance are the most sensitive to external imbalances in the Eurozone: to remain in the monetary union (i.e. their rate nominal exchange rate is equal to zero compared to Germany) face an increase in their domestic rates greater than that of the rest of European countries. On the other hand, Netherlands and Austria are the countries which reveal the lowest sensitivity. In parallel with the sovereign debt crisis, these results (supplemented by those of the causality tests) are very informative on the causes and form of the crisis. Indeed, they support the idea that Greece, Ireland, Luxembourg and Portugal experienced a balance of payments crisis. The parity irrevocably fixed in relation to Germany prevents these countries from resolving their external imbalance by devaluing their currency.

Table.8. Short-term adjustment

Country		Δp	Δp^*	Δi^l	Δi^{l*}
Austria	<i>Coefficient</i>	0.296	-0.198	1.110	-1.265
	<i>S.E</i>	(8.909)	(9.733)	(0.711)	(0.735)
	χ^2	0.033	-0.020	1.560	-1.719
	<i>p-Value</i>	0.973	0.984	0.013**	0.010**
Belgium	<i>Coefficient</i>	-6.284	2.092	-1.647	-1.704
	<i>S.E</i>	(3.188)	(0.884)	(0.44)	(0.519)
	χ^2	-1.971	2.366	-3.709	-3.279
	<i>p-Value</i>	0.066	0.478	0.001***	0.004***
Finland	<i>Coefficient</i>	-3.013	-0.126	-0.322	-0.546
	<i>S.E</i>	(1.713)	(2.380)	(0.314)	(0.462)
	χ^2	-1.758	-0.052	-1.026	-1.221
	<i>p-Value</i>	0.097	0.958	0.319	0.239
France	<i>Coefficient</i>	-4.543	4.447	1.339	-1.486
	<i>S.E</i>	(2.076)	(2.700)	(0.343)	(0.380)
	χ^2	-2.188	1.647	3.898	-3.909
	<i>p-Value</i>	0.043	0.119	0.001***	0.001***
Greece	<i>Coefficient</i>	0.193	-0.132	0.048	0.208
	<i>S.E</i>	(0.255)	(0.281)	(0.848)	(0.864)
	χ^2	0.758	-0.472	0.057	0.241
	<i>p-Value</i>	0.457	0.641	0.955	0.812
Ireland	<i>Coefficient</i>	-0.261	-0.125	- 0.012	0.008
	<i>S.E</i>	(0.415)	(0.333)	(0.009)	(0.009)
	χ^2	-0.630	-0.377	1.272	0.934
	<i>p-Value</i>	0.536	0.710	0.220	0.363
Italy	<i>Coefficient</i>	0.058	-0.179	0.014	0.020
	<i>S.E</i>	(0.252)	(0.330)	(0.015)	(0.016)
	χ^2	0.229	-0.542	0.939	1.245
	<i>p-Value</i>	0.820	0.594	0.360	0.022**
Luxembourg	<i>Coefficient</i>	5.754	-2.884	0.786	-0.942
	<i>S.E</i>	(3.930)	(3.520)	(0.218)	(0.269)
	χ^2	1.463	-0.819	3.606	-3.495
	<i>p-Value</i>	0.162	0.424	0.002***	0.003***
Netherlands	<i>Coefficient</i>	-0.024	1.447	2.025	-2.405
	<i>S.E</i>	(4.205)	(4.521)	(0.662)	(0.888)
	χ^2	-0.005	0.320	3.058	-2.706
	<i>p-Value</i>	0.995	0.752	0.007***	0.015**
Portugal	<i>Coefficient</i>	-0.634	0.818	0.696	-1.555
	<i>S.E</i>	(9.240)	(10.22)	(0.169)	(0.604)
	χ^2	-0.068	-0.079	4.104	-2.572
	<i>p-Value</i>	0.946	0.937	0.000***	0.020**

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Spain	Coefficient	0.166	-0.710	0.002	0.089
	<i>S.E</i>	(0.109)	(0.228)	(0.010)	(0.030)
	χ^2	1.518	-3.101	0.248	2.982
	<i>p-Value</i>	0.142	0.005	0.806	0.006***

Source: Author's calculation using Eviews

In the absence of real adjustments, deficits were financed through borrowing that pressured interest rates upwards until financing costs became unsustainable, forcing these countries to demand international help. According to the short-term adjustment table, domestic and foreign prices do not react in all countries with the exception of domestic prices in France and foreign prices in Spain, which explains that the adjustment towards Common stationarity of PPP and interest rate parity is achieved by means of interest rates. For Spain and Italy, only external interest rates are at stake. While for Austria, Belgium, France, Luxembourg, the Netherlands and Portugal, internal interest rates and exteriors (Germans) participate in the adjustments.

6. CONCLUSION AND IMPLICATIONS

The objective of this article was to highlight the idea that a sovereign debt crisis is strongly linked to real imbalances and that the particular form taken by a balance of payments crisis if parities are fixed irrevocably. For this reason, we considered it necessary to work with the CHEER “Capital Enhanced Equilibrium Exchange Rate” approach introduced by Johansen and Juselius (1992) through a cointegrated VAR. This approach produced a faster rate of convergence of estimates than other PPP models. It is for this reason that we find it necessary to examine whether the sovereign debt crisis experienced by certain EMU countries is in reality a balance of payments crisis. We try to highlight the different sources of the debt crisis but no study establishes formal relationships between the effect of external imbalances and the sharp increase in interest rates within the euro zone. To overcome its inadequacies at the level of theoretical reviews, we rely on the equilibrium exchange rate model set up by Juselius (1991-1995) “The CHEER approach”.

First talking about the theoretical side, we have shown that external imbalances of one country vis-à-vis another can transform into a balance of payments crisis in the case of real adjustments that are difficult to implement. The results obtained show that external imbalances generate an increase in interest differentials in order to maintain fixed parities between members. In monetary union only real adjustments, make it possible to reduce these imbalances. To chain ideas together, the existence of external imbalances poses a long-term challenge for monetary commitments: a remarkable increase in deficits leads to an improvement in debt which subsequently gives rise to the phenomenon of external imbalances.

In addition, a diversification of empirical studies has however arrived at different conclusions. We perform a cointegration analysis between each EMU country and Germany to verify our theoretical predictions. We note the persistence of a long-term cointegration relationship for each country between the two markets; the goods market and the capital market. Following the above, we obtain a remarkable improvement in interest rates in some countries which confirms that these countries are going through a balance of payments crisis. Following the above, Austria, Belgium, France and Luxembourg are not very sensitive to external imbalance, which is linked to the fact that there is no significant increase in interest rate differentials compared to Germany. For Finland, Greece, Ireland and Portugal and Spain; the sensitivity is even lower.

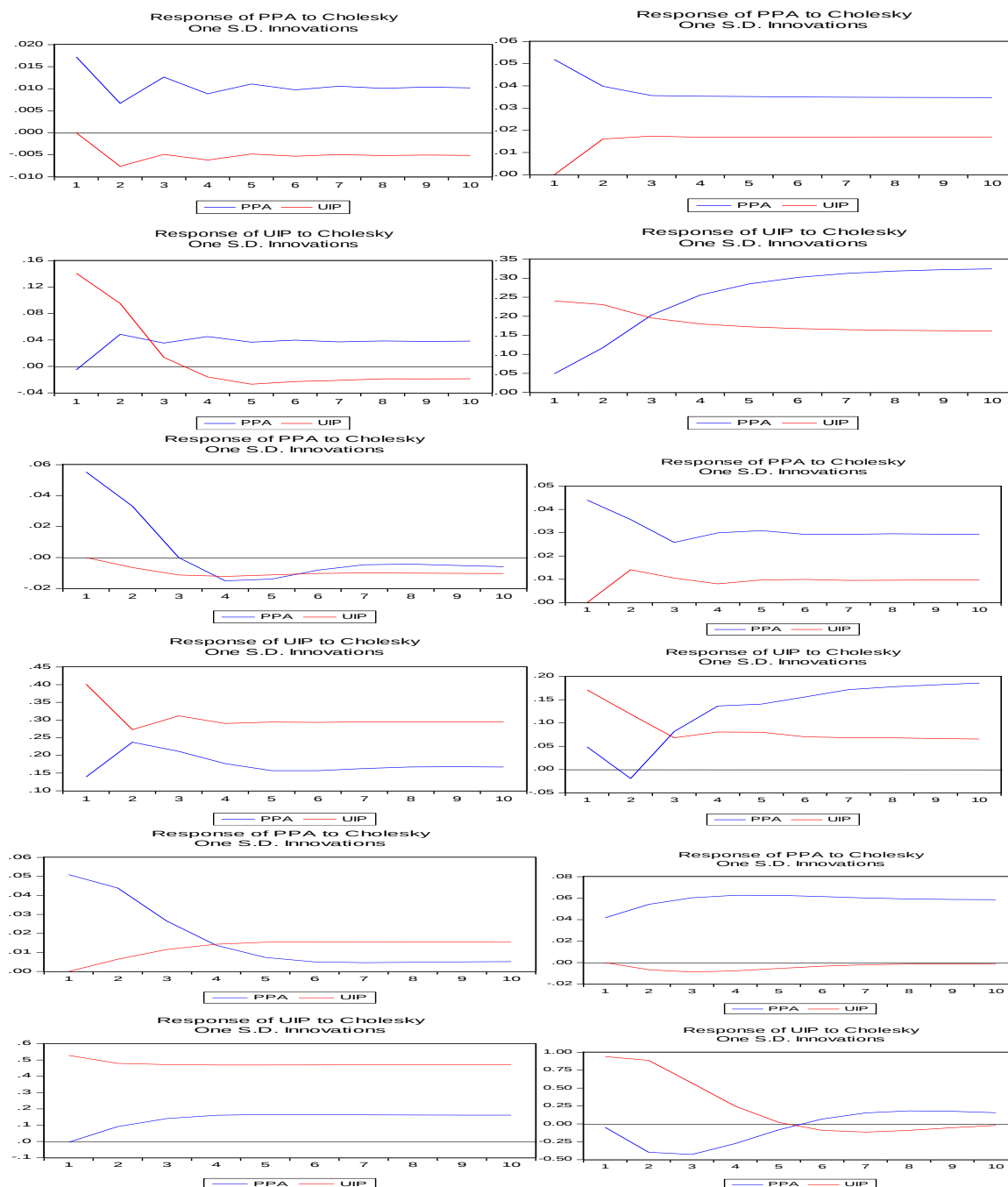
Regarding the normality test of the residuals, we provide the determination of the symmetry coefficients “Skewness” and the kurtosis coefficient “kurtosis” separately as shown by Gonzalo (1994) in their study. According to the results found, we can see that the probability of the Jarque –Bera statistic is not significant in all countries except for Belgium and Portugal. We can conclude, in view of the empirical results according to the normality test, that there seems to exist a normality distribution of the series, therefore the normality hypothesis is accepted.

Furthermore, in the same table we validate the null hypothesis of absence of autocorrelation in each country according to the LM test. Concerning the table of the cointegration space, this table designates the vector space generated by the r cointegrating and linearly independent vectors at the same time. Thus, the rejection of the hypothesis of low Exogeneity is possible only for common interest rates and not for prices. This explains that the improvement in interest rate differentials can be attributed to the non-stationarity of price differentials such as Austria, Ireland, Netherlands, Portugal and Spain. These results confirm the fact that the sovereign debt crisis is due to a balance of payments crisis. Furthermore, the causal link is not called into question for Belgium, Finland, France and Greece. But it is more restricted because the prices are weakly exogenous only in the case where they are tested individually.

The results obtained in the adjustment table show that domestic and foreign prices do not react in all countries with the exception of domestic prices in France and foreign prices in Spain, which explains that the adjustment towards common stationarity PPP and interest rate parity is achieved through interest rates. For Spain and Italy only external interest rates are at stake, while for Austria,

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Belgium, France, Luxembourg, the Netherlands and Portugal, internal interest rates and external parties participate in the adjustments. Alongside the sovereign debt crisis, these results are very instructive on the causes and form of the crisis. Indeed, they support the idea that Greece, Ireland, Portugal and Luxembourg experienced a balance of payments crisis. The parity irrevocably fixed in relation to Germany prevents these countries from resolving their external imbalance by devaluing their currency.



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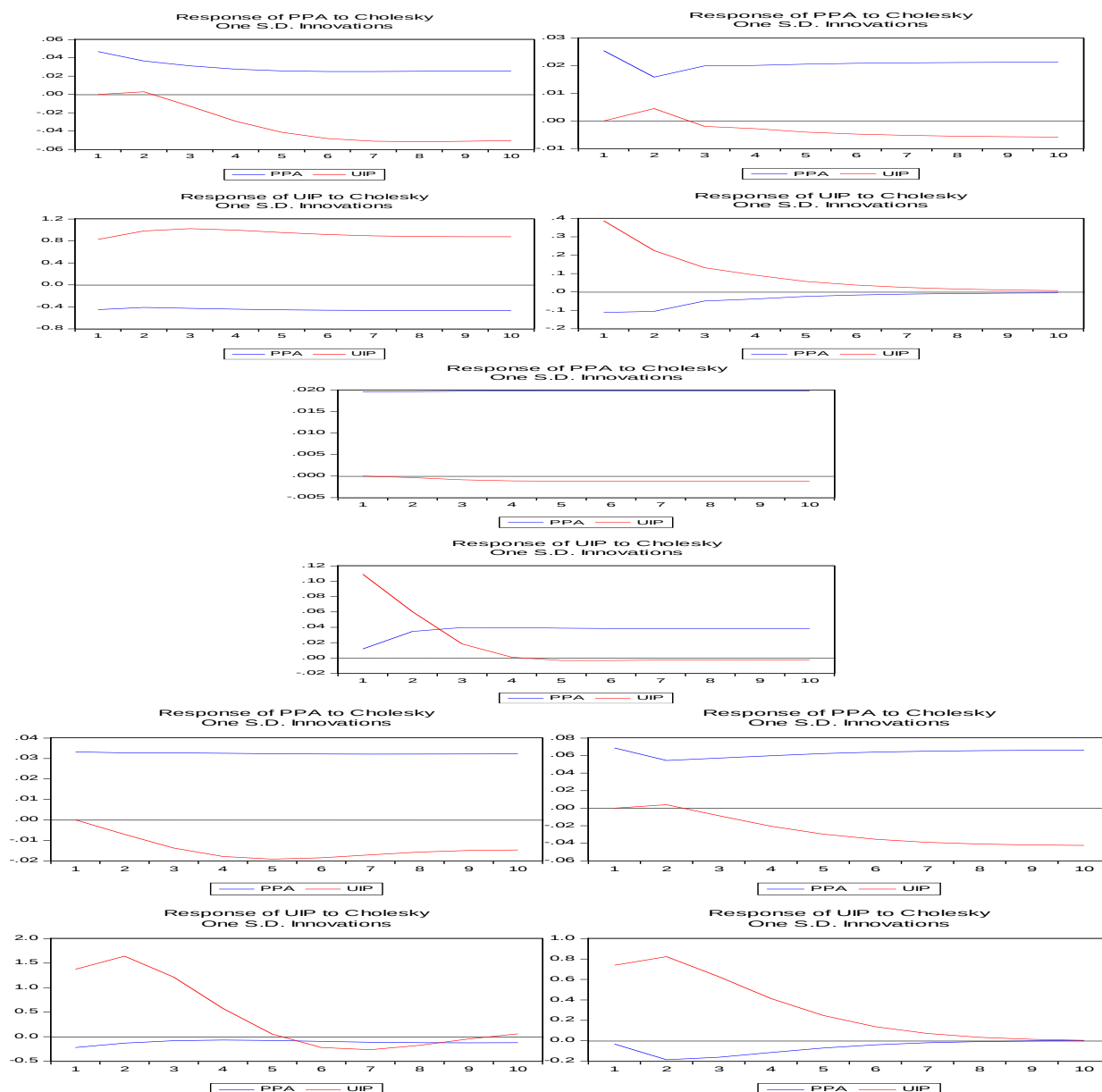


Fig1. IRF

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