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RESEARCH ARTICLE

Income Inequality and Inflation Relationship in Selected European Countries: Evidence from PMG-ARDL Model

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Abstract

To explore the dynamics of economic factors, this study undertakes a comprehensive analysis of the inflation and income inequality relationship (IIIR) for selected European countries in the period 2000-2020. By employing both cointegration testing and the Pooled Mean Group (PMG)/Autoregressive Distributed Lag (ARDL) modeling approach, the research sheds light on the short-run and long-run relationships underlying these crucial economic variables. The PMG/ARDL model indicates a significant long-run negative IIIR, consistent across most of the analyzed countries. This suggests that as inflation rises, income inequality tends to decrease in the long term, which may be attributed to various economic mechanisms that redistribute wealth during periods of inflation. However, the short-run analysis did not yield significant results, indicating that the short-run impact of inflation on income inequality might be less pronounced or overshadowed by other economic factors. These insights contribute to a deeper understanding of how inflation influences wealth distribution, with implications for economic policy, particularly in contexts where income inequality is an increasing issue. For policymakers, understanding the long-run inverse IIIR could be instrumental in designing economic policies that aim to mitigate inequality.

Keywords: *Income Inequality, Gini Index, Inflation, PMG/ARDL, Panel Data*
Jel Codes: *C23, E31, O52*

Seçili Avrupa Ülkelerinde Gelir Eşitsizliği ve Enflasyon İlişkisi: PMG-ARDL Modelinden Kanıtlar

Özet

Bu çalışmada, ekonomik faktörlerin dinamiklerini araştırmak amacıyla 2000-2020 dönemi için 15 Avrupa ülkesindeki gelir eşitsizliği ve enflasyon arasındaki etkileşim kapsamlı bir şekilde incelenmiştir. Hem koentegrasyon testi hem de Pooled Mean Group (PMG) / Otoregresif Dağıtılmış Gecikme (ARDL) modelleme yaklaşımı kullanılarak yapılan bu araştırma, bu kritik ekonomik değişkenlerin kısa ve uzun vadeli ilişkilerini aydınlatmaktadır. PMG/ARDL modeli, gelir eşitsizliği ile enflasyon arasında uzun vadede anlamlı bir negatif ilişki olduğunu göstermektedir; bu ilişki analiz edilen çoğu ülkede tutarlıdır. Bu durum, enflasyon arttıkça gelir eşitsizliğinin uzun vadede azalma eğiliminde olduğunu öne sürmektedir ve bu durum, enflasyon dönemlerinde servetin yeniden dağıtılması gibi çeşitli ekonomik mekanizmalara atfedilebilir. Ancak, kısa vadeli analizler anlamlı sonuçlar vermemiştir, bu da enflasyonun gelir eşitsizliği üzerindeki kısa dönemli etkisinin daha az belirgin olabileceğini veya diğer ekonomik faktörler tarafından gölgelenmiş olabileceğini göstermektedir. Bu bulgular, enflasyonun servet dağılımını nasıl etkilediğine dair daha derin bir anlayış sunmakta olup, gelir eşitsizliğinin artan bir endişe haline geldiği durumlarda ekonomik politika için önem taşımaktadır. Politika yapıcılar için, enflasyon ile gelir eşitsizliği arasındaki uzun vadeli ters yönlü ilişkileri anlamak, eşitsizliği azaltmayı hedefleyen ekonomik politikaların tasarımında önemli bir rol oynayabilir.

Anahtar kelimeler: *Gelir Eşitsizliği, Gini Endeksi, Enflasyon, PMG/ARDL, Panel Veri*
Jel Kodu: *C23, E31, O52*

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1. INTRODUCTION

Inflation and income inequality (IIIR) are two prominent economic issues that significantly affect people's lives. Income inequality indicates how evenly or unevenly income is distributed among individuals or households, while inflation signifies the overall increase in the price level of goods and services within an economy. And inflation influences the purchasing power of wages, salaries, rent, interest, dividends, and other financial assets, thereby impacting income distribution both in the short-run and the long-run. This causes a redistribution of income and wealth. In the short run, the inflation rate influences the fairness of income distribution. According to Easterly and Fisher (2001), when the inflation rate is low, it has a limited effect on people's purchasing power from pensions and transfers. Conversely, a high inflation rate significantly diminishes people's ability to purchase goods and services with their money from pensions and transfers.

Inflation, a financial phenomenon, disproportionately affects the disadvantaged by eroding their purchasing power. Since the poor rely heavily on their income, inflation exacerbates their financial difficulties, thereby deepening income inequality. As a result, inflation widens the income gap and exacerbates economic inequality. Moreover, price increases often precede adjustments in financial compensation, causing inflation to shift wealth away from wage earners and towards those with income. Consequently, it is argued that inflation raises income inequality. Since it affects those with lower incomes more severely than those with higher incomes (Fisher & Modigliani, 1978).

Although the theoretical and empirical strength of the effect of inflation on income inequality is not very clear, it is a fact that it can cause negative socioeconomic crises. This inequality can lead to instability in society and disrupt economic sustainability (Duarte & Schnabl, 2019). According to Dabla-Norris et al. (2015), Dinardo and Pischke (1997), Galbraith and Berner (2001), and Berg et al. (2018), IIIR is significant. As prices rise faster than wages, people's purchasing power declines. Those who are struggling to make ends meet are disproportionately affected, exacerbating economic inequality, as individuals with higher incomes are better equipped to absorb the impact of rising costs.

Many researchers, including Aghion and Bolton (1997), Acemoglu and Robinson (2006), Jantti et al. (2006), Leibbrandt et al. (2010), and Atkinson et al. (2011), argue that inflation negatively impacts income inequality, suggesting that higher inflation rates exacerbate income inequalities. The research generally indicates that inflation is negatively related to income inequality, while a positive relationship with wealth inequality has also been observed, as noted by Kuznets (1955), Persson and Tabellini (1994), Bordo and Haubrich (2017), and Piketty and Saez (2014). However, no single study has definitively established a comprehensive and unequivocal relationship between these variables.

After providing a brief overview of income inequality, and inflation on introduction, this study analyzes the IIIR phenomenon employing data from 15 countries spanning from 2000 to 2020. Initially, the study presents examples of analytical research related to the topic from the literature. Subsequently, a summary of the data set and the analytical model employed is presented. Finally, the study presents the analysis outcomes and evaluates the results.

2. RELATED WORKS

Inflation and income inequality relationship (IIIR) closely connected two economic factors. Income inequality usually describes the disparity in income distribution across different segments of society. In contrast, inflation describes the rate at which the mean price of goods and services within an economy increases.

Balcilar et al. (2018) utilized panel data across U.S. states from 1976 to 2007 and a semiparametric instrumental variable (IV) method to determine the IIIR levels. They found a positive and nonlinear correlation regarding IIIR. Galli and Hoeven (2001) identified a non-linear relationship regarding the

IIIR phenomenon, estimating that the inflation rate that minimizes inequality in the United States is approximately 6%. Bulir (2001), building on the traditional Kuznets model, contributes to the understanding of income inequality by demonstrating that price stability positively influences nonlinear income distribution. The study shows that income inequality is significantly reduced as inflation decreases, with further gains in the Gini coefficient being minimal.

Some studies indicate a positive IIIR. Desai et al. (2003), in their analysis of political structures for 120 countries from 1960 to 2000, highlight the significance of the political system's competitiveness in explaining the often-observed positive correlation about the IIIR phenomenon. Balcilar et al. (2018) employed a cross-state panel for the U.S. for 1976-2007, using a semiparametric instrumental variable (IV) estimator to investigate the IIIR phenomenon. Similarly, studies by Albanesi (2007), Cardoso (1992), and Crowe (2006) also reveal a positive correlation for IIIR. Beck et al. (2007) also reached similar conclusions.

In addition, Scully (2002) investigates the IIIR phenomenon as well as the role of economic freedom in economic growth and the distribution of market income. The research also analyzes the role of the rule of law in advancing economic development and promoting income equality and the impact of the level of economic development on this distribution. Thalassinos et al. (2012) utilized panel data techniques to explore the connection regarding the IIIR phenomenon for 13 European countries in the period of 2000-2009. Their findings align with the model, suggesting that inflation leads to a notable rise in income inequality.

Some studies suggest that the IIIR has negative correlation. Monnin (2014) examined the empirical IIIR study for eleven OECD countries in the period of 1971-2010, finding a U-shaped association between long-term inequality relationship. Specifically, income inequality becomes more pronounced when inflation rates are low. Fagiolo & Roventini (2012) agree with this observation, emphasizing the impact of analyzing both short-run and long-run characteristics of various inequality series in relation to major macroeconomic series for a group of OECD countries. This analysis involves tests for stationarity, detrending, co-movement analysis, and Granger causality. In another study, Göcen (2023) examined the role of institutions, using the Corruption Perception Index and Economic Freedom Index, in this relationship. Analyzing 58 countries from 2012 to 2018, it finds that inflation has a strong negative impact on income inequality. According to the study, decreasing corruption and increasing economic freedom reduce the negative impact of high inflation on income inequality. However, high inflation neutralizes the effect of good institutions on reducing income inequality.

Additionally, Coibion et al. (2017) investigate how monetary policy shocks have historically impacted American consumption and income inequality since 1980. Maussner (2004) utilized extensive micro-level data on income and consumption. The findings indicate that inflation tends to reduce income inequality. Tyson (1998) argues that inflation reduces real wages and decreases the income of the less affluent. Furthermore, the poor experience a higher tax burden from inflation compared to the wealthy, who tend to hold more of their assets in capital and fiat money. This is because the poor possess a larger proportion of their wealth in fiat money. In this regard, it is asserted that inflation exacerbates income inequality.

Liu and Cao (2008) also examine the IIIR phenomenon within an adapted cash-in-advance economy. Their findings suggest that there is an "optimal" inflation rate that does not exacerbate the income gap. Yue (2011) examined the IIIR phenomenon and economic development in Korea, analyzing data from 1980 to 2002 using the Error Correction Model. Its findings indicate that significant income inequality impedes economic growth. The findings do not indicate a long run cointegrated relationship regarding economic income distribution and the inflation phenomenon.

3. MATERIAL AND METHOD

The research analyzes the inflation and income inequality relationship (IIIR) in selected European region, focusing specifically for on 15 European countries in the period of 2000-2020, using panel data with a total of 20 years of annual data. All data on the key variables are sourced from the World Development Indicators (WDI). The model employed in this study is based on previous research conducted by Nantob (2015) and Thalassinos et al. (2012).

$$GINI_{i,t}=\beta_0+\beta_1 INF_{i,t}+\beta_2 UN_{i,t}+\beta_3 TR_{i,t}+\varepsilon_{i,t} \quad (1)$$

When a logarithmic transformation is applied to the equation above:

$$LOGGINI_{i,t}=\beta_0+\beta_1 LOGINF_{i,t}+\beta_2 LOGUN_{i,t}+\beta_3 LOGTR_{i,t}+\varepsilon_{i,t}. \quad (2)$$

In this context, LOGGINI represents the natural logarithm of the Gini index, which measures income inequality; LOGINF represents the natural logarithm of inflation; LOGTR refers to the natural logarithm of trade; and LOGUN signifies the natural logarithm of the unemployment rate. Finally, $\varepsilon_{i,t}$ denotes the error term. Additionally, the subscripts "i" and "t" describe the structures of the data; "i" denotes the cross-sectional unit, while "t" indicates the time-period.

To approximate the short-term and long-term limits of the model, the PMG/ARDL approach is employed. This model was utilized by (Olayungbo & Quadri (2019):

$$\Delta LOGGINI_{i,t-1}= \alpha_0+\alpha_1 LOGINF_{i,t-1}+\alpha_2 LOGUN_{i,t-1}+\alpha_3 LOGTR_{i,t-1}+\sum_{j=1}^{p}\delta_{1i}\Delta LOGGDP_{i,t-j} +\sum_{i=0}^{q}\delta_{2i}\Delta LOGINF_{i,t-j}+\sum_{i=0}^{q}\delta_{3i}\Delta LOGUN_{i,t-j}+\sum_{i=0}^{q}\delta_{4i}\Delta LOGTR_{i,t-j}+\mu_{i,t}\varepsilon_{i,t} \quad (3)$$

The model's long-run estimates are represented by the parameters with lag periods, while the short-run estimates correspond to the parameters with different operators.

4. FINDINGS AND RESULTS

All data have been transformed into their natural logarithmic form for analysis. An exploratory statistical analysis and correlation matrix of log-transformed income inequality, inflation, trade, and unemployment reveal a negative relationship between inflation and income inequality. This result is given in Table below.

Table 1: Descriptive info. & correlation matrix

	LOGGINI	LOGINF	LOGTR	LOGUN
Mean	3.409	0.586	1.973	4.37
Median	3.411	0.631	2.02	4.4
Maximum	3.658	3.661	3.067	5.115
Minimum	3.17	-2.753	0.751	3.612
Std. Dev.	0.104	0.983	0.409	0.356
Skewness	-107	-0.237	-0.046	0.142
Kurtosis	2.037	4.926	3.152	2.381
Observations	292	292	292	292
	LOGGINI	LOGINF	LOGTR	LOGUN
LOGGINI	1			
LOGINF	-0.197	1		
LOGTR	0.092	-0.066	1	
LOGUN	-0.522	-0.049	-0.217	1

This research intends to examine the characteristics of panel data for the Gini index, inflation, trade, and unemployment. Although there is a wide range of unit root tests available, this study will employ

two tests from the first generation: the LLC test by Levin, Lin, and Chu (Levin et al., 2002) and the IPS test by Im, Pesaran, and Shin (Im et al., 2003). And the findings for these unit root tests show that the variables exhibit mixed stationarity, being stationary at either level or first difference, as detailed in Table 2. When considering cross-sectional correlation, the Cross sectionally Augmented IPS (CIPS) test developed by Pesaran (2007) and the Cross-sectional Augmented ADF (CADF) test introduced by Pesaran (2006) show different results compared to the first-generation unit root tests assuming cross-sectional independence (see Table A, Appendix 1). According to the findings of the second-generation tests, which account for cross sectional dependence, all variables are primarily stable in their first differences.

Table 2: First generation unit root test

Variables	CD Test	Different I (0)		First Difference I (1)	
		LLC	IPS	LLC	IPS
LOGGINI	-2.071	-0.969	1.067	-	-8.492*
LOGINF	8.485	-1.543***	-2.602*	-	-7.749*
LOGTR	9.649	-4.200*	-3.857*	-	5.250*
LOGUN	26.79	-2.741*	-1.123	-	-7.186*

Note: (***), (**) and (*) significant at 10%, 5% and 1%

Table 3 presents the results of the Pedroni panel test for cointegration (Pedroni, 1999). The unit root test was performed to the residuals, considering country and time heterogeneity, the dimensional approach to statistics, and the autoregressive coefficients across various European nations. Additionally, long-run cointegration relationships were examined within the framework of both industrialized and emerging countries. In the Pedroni panel test, the null hypothesis posits that there is no cointegration between the variables. Six out of the eleven Pedroni tests yield p-values below 1% (the significance level), indicating that the null hypothesis is rejected and that cointegration among the variables is present. According to the findings from the second-generation tests, all variables are generally stable in their first differences, assuming cross sectional dependence.

Table 3: Pedroni panel cointegration test

Dependent Variable: LOGGDP				
Alternative hypothesis: common AR coef. (with dimension)				
	Stat.	p	Weighted stat.	P
Panel v	-0.465	0.6791	-1.321	0.9067
Panel rho	0.266	0.6048	0.181	0.572
Panel PP	-3.156*	0.0008	-3.673*	0.0001
Panel ADF	-3.144*	0.0008	-3.586*	0.0002
Alternative hypothesis: common AR coef. (between dimension)				
	Stat.	P		
Group rho	0.919	0.821		
Group PP	-4.546*	0.0000		
Group ADF	-3.742*	0.0001		

Note: (*) significant at 1%

As illustrated in Table 4, Fisher's panel cointegration test is utilized to complement the Johansen methodology. This test aggregates the p-values from individual Johansen trace statistics and eigenvalue tests. It further rejects the null hypothesis of no cointegration by excluding the 'at most 2' criterion in the maximum eigenvalue test. This approach provides a robust assessment of cointegration among the variables, strengthening the validity of the Johansen method's findings (Maddala & Kim, 1999).

Table 4: Fisher-Johansen test

Hypothesized	FS (trace test)	P	FS (max-eigen test)	P
None	188.4	0.0000*	143.8	0.0000*
At most 1	69.77	0.0000*	50.4	0.0028*
At most 2	40.19	0.0374**	28.96	0.3127
At most 3	50.5	0.0027*	50.5	0.0027*

Note:(**) and (*) significant at 5% and 10%

This research utilized the Pool Mean Group (PMG) estimator to further explore the long-term relationship among inflation, income inequality, and other relevant variables, following the establishment of cointegration through the Pedroni test and the Johansen Fisher test. The PMG estimator is advantageous as it accommodates cross-sectional dependency between countries and adjusts for potential endogeneity issues, providing a more nuanced analysis of long-term associations. The analysis findings are detailed in Table below.

Income inequality and the inflation relationship (IIIR) phenomenon are demonstrated to have a strong negative relationship with clean energy use across the entire sample region, with an inflation coefficient of -0.020. The data suggests that a 1% increase in inflation is linked to a 0.02% decline in income inequality in the long term. Conversely, in the short term, inflation and income inequality show a positive but weak correlation. Trade exhibits negligible effects on income inequality in both long-term and short-term perspectives. Furthermore, the analysis indicates that income inequality and unemployment have substantial negative effects over time. Specifically, a 1% increase in inflation corresponds to a 0.008% reduction in income inequality. Conversely, in the short term, the relationship between unemployment and income inequality is positive but of minimal magnitude. The coefficient of the error correction term (EC) is -0.423, suggesting that the system adjusts towards equilibrium at a rate of 0.423 per period. This coefficient is statistically significant at the 1% level, underscoring its reliability and the robustness of the adjustment process.

Table 5: Long-run / short-run estimation for PMG-ARDL model

ARDL (1,1,1,1) Dependent Variable LNGDPPC			
Variables	Coef.	St. Err.	t
Long-run coef.			
LOGINF	-0.020**	0.007	-2.600
LOGTR	0.044	0.016	2.677
LOGUN	-0.008*	0.040	-0.215
Error correction coef. (EC)	-0.423*	0.109	-3.857
Short-run coefficient			
D (LOGINF)	0.001	0.002	0.523
D (LOGTR)	-0.015	0.020	-0.734
D (LOGUN)	0.009	0.050	0.195
Intercept	1.450*	0.381	3.800

Note: (***), (**) and (*) significant at 1%, 5% and 10%.

The findings presented in Table 6 indicate that, except for the Netherlands, all panel countries exhibit negative and significant error correction term (ECT) values. For Germany, the estimated ECT value is -0.028, suggesting that 2.8% of the disequilibrium in the model adjusts towards long term equilibrium annually. In Italy, the ECT value is -1.119, indicating that 111.9% of the disequilibrium will be corrected within a year, reflecting an over-adjustment towards the long-run equilibrium. The ECT for the United Kingdom is -0.252, meaning that 25.2% of the disequilibrium will converge to

long-run equilibrium each year. In contrast, France has a positive ECT of 0.318, demonstrating an adjustment rate towards equilibrium of 31.8% annually. Greece's ECT is -1.030, signifying that 103% of the disequilibrium will return to long-run equilibrium within a year. Switzerland's ECT is 0.419, indicating that 41.9% of the disequilibrium will adjust to long-run equilibrium annually. Ukraine's ECT value is -0.239, suggesting that 23.9% of the disequilibrium will correct towards equilibrium in one year. For Poland, the estimated ECT is 0.276, implying a 27.6% adjustment rate towards equilibrium each year. Belgium shows an ECT of -0.557, meaning that 55.7% of the disequilibrium will correct to long-run equilibrium after one year. Lastly, Croatia's ECT is -0.077, indicating that 7.7% of the disequilibrium will adjust towards long-run equilibrium annually.

Australia has an error correction term (ECT) of -1.413, which indicates that 141.3% of the disequilibrium will be corrected towards long-term equilibrium within one year. For Sweden, the estimated adjustment rate towards equilibrium is 0.115, meaning that 11.5% of the disequilibrium will be corrected annually. In the case of Denmark, the ECT is -0.238, signifying that 23.8% of the disequilibrium will transition to long-run equilibrium within a year. Finland has an ECT of -0.247, indicating that 24.7% of the disequilibrium will be corrected towards long-run equilibrium annually. The analysis also reveals considerable inflation across all countries. The estimated inflation coefficients for the United Kingdom, the Netherlands, Sweden, and Denmark are -0.001, -0.002, and 0.000, respectively, indicating minimal effects. In contrast, the inflation effects in other nations are more favorable.

Table 6: ARDL Country Specification

	ETC	D (LOGINF)	D (LOGTR)	D (LOGUN)	Intercept
Germany	-0.028***	0.000*	0.028*	0.064*	0.100*
Italy	-1.119*	0.012*	0.033*	0.024**	3.900*
U.K.	-0.252*	-0.001*	0.202*	0.099*	0.875*
France	-0.318*	0.006*	-0.038**	0.050***	1.078***
Greece	-1.030*	0.007*	-0.093*	0.001	3.589***
Netherlands	-0.030	-0.002*	-0.507*	0.182*	0.094
Switzerland	-0.419*	0.002*	-0.161*	-0.032*	1.465***
Ukraine	-0.239*	0.005*	-0.141*	0.036**	0.776*
Poland	-0.276*	0.008*	0.092*	0.0501	0.095***
Belgium	-0.557*	0.027*	0.057**	0.265**	1.837**
Croatia	-0.077*	0.005*	0.087*	-0.287*	0.267
Australia	-1.413*	0.018*	-0.098**	-0.156	4.863*
Sweden	-0.115*	-0.014*	0.002	0.193*	0.378***
Denmark	-0.238*	-0.000*	0.029*	-0.048**	0.780*
Finland	-0.247*	0.002*	0.016*	0.077*	0.805*

Note: (***), (**) and (*) significant at 10%, 5% and 1%

5. CONCLUSION

The research examines economic income inequality and the inflation relationship (IIIR) phenomenon for 15 European countries in the period of 2000-2020. Panel data estimation methods, including PMG/ARDL models and cointegration tests, are employed in the analysis. And, the GINI index is used as a measure of income inequality, while the inflation rate, unemployment rate, and trade are considered independent variables. Cointegration tests, specifically the Pedroni panel test and Fisher test, reveal a long-term relationship among the variables. PMG/ARDL model indicates a significant and robust long-term negative economic IIIR phenomenon, consistent across most of the analyzed countries. This suggests that as inflation rises, income inequality tends to decrease in the long term,

which may be attributed to various economic mechanisms that redistribute wealth during periods of inflation.

However, the short-run analysis did not yield significant results, indicating that the immediate impact of inflation on income inequality might be less pronounced or overshadowed by other economic factors. When applying the ARDL country-specific approach, it is found that inflation affects income inequality in the long-term in all countries except for the Netherlands. The economic IIIR phenomenon is negative in the UK, the Netherlands, Sweden, and Denmark, while it is positive in the remaining countries. The variation in the error correction terms (ECT) among countries further emphasizes the heterogeneous nature of these relationships across different national contexts, with some countries showing a quicker adjustment to equilibrium than others.

The implications of these findings are multifaceted. For policymakers, understanding the long-run inverse IIIR phenomenon could be instrumental in designing economic policies that aim to mitigate inequality. This could involve managing inflation rates within certain thresholds that do not exacerbate income inequality, while also considering the broader economic environment in which these policies are implemented.

Future research could build upon this study by examining the underlying factors that contribute to the varying short-term impacts of inflation on income inequality across different countries. Additionally, further investigation into the role of other macroeconomic variables, such as unemployment and trade, could provide a more comprehensive understanding of how income inequality evolves in response to economic changes.

In summary, this study adds to the expanding literature on economic determinants of income inequality and provides significant insights for both academic research and policy development.

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Appendix 1: Table A: The second-generation unit root test

Country	LOGGINI				LOGINF			
	I (0)		I (1)		I (0)		I (1)	
	lag	CADF	lag	CADF	lag	CADF	lag	CADF
Germany	0	-2.76	0	-3.9**	1	-1.78	0	-1.25
Italy	0	-1.32	0	-4.04**	1	-1.13	0	-1.28
U.K.	0	-1.36	1	-4.11**	1	-2.87	0	-1.57
France	0	-1.54	0	-3.53***	1	0.098	0	-0.65
Greece	1	-2.11	1	-2	1	-2.29	0	-2.8
Netherlands	0	-1.61	0	-4.03**	1	-2.82	0	-1.87
Switzerland	0	-1.64	0	-2.81	0	-1.99	0	-2.49
Ukraine	0	-1.28	1	-1.55	1	-2.59	0	-1.28
Poland	1	-0.89	0	-5.46*	1	-4.63	0	-2.8
Belgium	1	-2.41	1	-9.63*	1	-2.82	0	-1.17
Croatia	0	-1.52	0	-2.96	1	-1.38	0	-4.39**
Australia	0	-4.32**	0	-6.09*	1	0.23	0	-0.84
Sweden	1	-0.7	1	-5.42*	1	-3.04	0	-3.43*
Denmark	0	-1.32	1	-3.46**	1	-1.84	0	-0.31
Finland	0	-1.4	0	-4.74*	1	-2.49	0	-2.36
	CIPS	-1.75	CIPS	-4.25*	CIPS	-2.92*	CIPS	-2.738*
Country	LOGUN				LOGTR			
	I (0)		I (1)		I (0)		I (1)	
	lag	CADF	lag	CADF	lag	CADF	lag	CADF
Germany	0	-0.9	0	-2.09	1	-3.58**	0	-0.47
Italy	1	-2.14	0	-4.30**	1	-1.88	0	-2.08
U.K.	0	-2.35	0	-4.11**	0	-0.16	0	-2.59
France	0	-1.13	0	-2.6	1	-1.41	0	-4.81*
Greece	0	-1.26	0	-3.23*	1	-1	1	-3.33*
Netherlands	0	-1.77	0	-3.80**	1	-5.47*	1	-2.07
Switzerland	0	-1.34	0	-4.16**	1	-2.77	1	-2.56
Ukraine	1	-2.4	1	-4.63*	1	-2.41	0	-3.75**
Poland	1	-2.38	1	-5.170*	1	-1.38	1	-3.97**
Belgium	0	-4.13**	1	-6.35*	0	-1.2	0	-3.21***
Croatia	1	-2.99	0	-1.75	1	-3.24*	0	-3.88**
Australia	1	-2.42	0	-6.38*	1	-2.43	1	-1.54
Sweden	1	-1.69	0	-2.54	1	-3.11*	1	-3
Denmark	1	-2.42	1	-3.40***	0	-1.26	0	-3.01
Finland	0	-1.257	1	-1.823	0	-1.87	0	-3.15***
	CIPS	-2.04	CIPS	-3.75*	CIPS	-2.21***	CIPS	-2.899*

Note: (***), (**) and (*) indicate significance at 10%, 5% and 1% level of significance respectively.