CENTRE OF PLANNING AND ECONOMIC RESEARCH

DISCUSSION PAPERS

No 159

Is the Export-Led-Growth Hypothesis Asymmetric in the Euro Area Countries?

Ioanna Konstantakopoulou

November 2024

Ioanna Konstantakopoulou
Centre of Planning and Economic Research (KEPE), Athens, Greece
E-mail: ik@kepe.gr; joannapk@aueb.gr., Tel.: +30 210 3676406

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Is the Export-Led-Growth Hypothesis Asymmetric in the Euro Area Countries?

by

Ioanna Konstantakopoulou[1]

Abstract

This paper examines the asymmetric effect of exports on economic growth over the short and long run in the Euro Area countries. To this end, I employ a cointegrating Nonlinear Autoregressive Distributed Lag (NARDL) model suggested by Shin, Yu, and Greenwood-Nimmo (2014), using annual data from 1980 to 2022. The findings indicate that exports react differently to increases and decreases over the long run in Italy and the Netherlands and in the short run in Austria—an effect previously ignored in the empirical literature. Finally, the elasticity of adverse shocks of exports on economic growth is significantly greater than that of positive export shocks.

Keywords: Exports, real exchange rates, economic growth, asymmetry ARDL

JEL Classification: E0, F4, C32

[1] Centre of Planning and Economic Research, 11 Amerikis Street, 106 72 Athens, Greece. *E-mail addresses:* ik@kepe.gr; joannapk@aueb.gr. Tel.: +30 210 3676406. https://orcid.org/0000-0003-4810-5779

Είναι η Υπόθεση Ανάπτυξης που Βασίζεται στις Εξαγωγές Ασύμμετρη στις Χώρες της Ευρωζώνης?

Ιωάννα Κωνσταντακοπούλου
Κέντρο προγραμματισμού και Οικονομικών Ερευνών

Ελληνική Περίληψη

Αυτό το άρθρο εξετάζει την ασύμμετρη επίδραση των εξαγωγών στην οικονομική ανάπτυξη τόσο βραχυπρόθεσμα όσο και μακροπρόθεσμα στις χώρες της Ευρωζώνης. Για τον σκοπό αυτό, χρησιμοποιείται ένα μη γραμμικό μοντέλο Αυτοπαλινδρόμησης με Κατανεμημένες Χρονικές Υστερήσεις (NARDL, Nonlinear Autoregressive Distributed Lag), όπως προτάθηκε από τους Shin, Yu και Greenwood-Nimmo (2014), με ετήσια δεδομένα από το 1980 έως το 2022. Τα ευρήματα δείχνουν ότι οι εξαγωγές αντιδρούν διαφορετικά στις αυξήσεις και στις μειώσεις μακροπρόθεσμα στην Ιταλία και την Ολλανδία, καθώς και βραχυπρόθεσμα στην Αυστρία — ένα φαινόμενο που προηγουμένως είχε αγνοηθεί στην εμπειρική βιβλιογραφία. Τέλος, η ελαστικότητα των αρνητικών σοκ των εξαγωγών στην οικονομική ανάπτυξη είναι σημαντικά μεγαλύτερη από εκείνη των θετικών σοκ εξαγωγών.

1. Introduction

A prominent area of economics research explores the factors driving economic growth, emphasizing the role of exports. Numerous empirical studies examine the impact of exports on economic growth; however, they have not yet reached a common result. Notably, the variation in findings can be attributed to differences in econometric methods and the country samples used in the empirical analysis. Many studies support that exports positively affect economic growth (Feder, 1983; Awokuse, 2003; Konya, 2006; Konstantakopoulou, 2016; Konstantakopoulou and Tsiona, 2017; Ahmad et al., 2018; Kim, 2022; Bakas et al., 2023), an issue known as the export-led growth (ELG) hypothesis. The interest in investigating the Export-Led Growth (ELG) hypothesis was initially sparked by the work of Kunst and Marin (1989) and Marin (1992), Feder, (1982) Dollar and Wolff (1993), Henriques and Sadosky (1996), Reizman et al. (1996), Rivera-Batiz and Romer (1991), Balagued and Cantavella-Jorda (2004). Others works argue that there is a reverse relationship where economic growth affects exports (Sharma and Dhakal, 1994), while some works conclude a bidirectional relationship between exports and economic growth (Chuang, 2000; Balaguer and Cantavella-Jorda, 2004). Alternatively, limited studies report no relationship between exports and economic growth (Tang, 2006).

Export expansion offers a range of benefits through various mechanisms. In particular, exports drive technological advancements to meet global competition, facilitate technology spillover to non-export sectors, encourage the creation of economies of scale, promote efficient resource allocation, enhance capacity utilization, finance intermediate capital imports, promote comparative advantages and productivity (see Grossman and Helpman 1991; Helpman and Krugman, 1985, Rivera-Batiz and Romer, 1991, Bhagwati and Srinivasan, 1979; Krugman and Obstfeld, 2009; Konstantakopoulou and Tsionas, 2019; Kunst and Marin, 1989; Wagner, 2012). Lastly, exports enhance macroeconomic stability by improving the external balance and facilitating access to international capital markets.

The econometric methods employed in empirical studies include cointegration and causality analysis in both time series and panel data. Regardless of the specific econometric approaches used in these studies, they agree on a symmetric long-run relationship between exports and economic growth (Konstantakopoulou, 2016). This implies that the effects of changes in exports, whether they involve increases or decreases, on economic growth are presumed to be of equal magnitude, regardless of the direction of the change.

This paper contributes to the existing literature by embracing a cointegrating nonlinear framework that includes both long- and short-run asymmetry. Specifically, I employ a dynamic error correction model (ECM) compatible with the NARDL model, enabling testing for asymmetric long-run cointegrating relationships. The NARDL model enables examining the long- and/or short-run asymmetry response of exports and real exchange rates to economic growth. This approach decomposes the independent variables into positive and negative partial sums to capture the asymmetries, allowing for the investigation of whether positive or negative shocks to exports have symmetric or asymmetric effects on economic growth. Additionally, this methodology enables robust estimation without being influenced by different orders of integration of the regressors. The dynamic multipliers allow for the detection of the asymmetric dynamic adjustment path following positive or negative disturbances of the exogenous regressors.

This paper stands out from previous studies in two ways. First, it represents a significant effort to explore how economic growth responds to changes in exports and real exchange rates for EA countries. The existing literature mainly focuses on the symmetric effects of these variables. Second, we examine whether the effects of positive and negative changes in exports are asymmetric in the short and long term, a topic that is scarcely addressed in the literature.

2. Data and Methodology

Data

I employ a sample composed of 13 EA countries, including Austria (AT), Belgium (BE), Cyprus (CY), Finland (FI), France (FR), Germany (DE), Greece (EL), Ireland (IE), Italy (IT), Luxembourg (LU), the Netherlands (NL), Portugal (PT), and Spain (ES). The data set includes real exports and imports of goods and services (constant 2015 US$), real GDP (constant 2015 US$), and real effective exchange rate index (2015:100). These variables are obtained from the World Bank's World Development Indicators (WDI) database.

Methodology

The empirical analysis begins by examining the stationarity properties of each time series using the Augmented Dickey-Fuller test (ADF) , the Phillips and Perron test (PP), and the Generalized Least Squares transformed Dickey-Fuller (DFGLS) test. Subsequently, the NARDL model is employed for estimations. Following this, an ECM is used to uncover the dynamic relationships between the variables. NARDL bounds tests are then applied to examine the asymmetric long-run equilibrium relationships among the variables. Additionally, the study investigates the short-run and long-run asymmetry effects of exports and the real exchange rate on economic growth. Next, diagnostic tests are conducted on the residuals of the estimated NARDL models. The Breusch-Godfrey test (LM test) explores serial correlation, the Breusch-Pagan test examines heteroskedasticity, and the Ramsay reset test tests for functional form misspecification. The stability of the estimated long-run coefficients is assessed using the cumulative sum of recursive residuals (CUSUM) and cumulative sum of recursive residuals squares (CUSUMSQ) tests.

Model

The empirical model to estimate the effect of exports and real exchange rates on economic growth is specified in Equation (1):

$$gdp_t = \alpha + \beta_1 ex_t + \beta_2 ref_t + \varepsilon_t \quad (1)$$

where gdp_t stands for real GDP, ex_t and ref_t stand for real exports and real exchange rates, respectively. ε_t is the error term. The asymmetric NARDL cointegration approach is founded on the ARDL approach proposed by Pesaran et al. (2001). We analyse the variables' long-term and short-term dynamic relationships through the Error Correction Model (ECM). Thus, the NARDL bounds tests were used to test the cointegration of the variables. This cointegration approach has better properties than traditional cointegration methods. The NARDL model addresses asymmetrical effects, dissecting short- and long-term nonlinearities into partial sum processes of positive and negative changes. The econometric framework introduced is described as follows:

$$gdp_t = \alpha + \beta_1^+ ex_t^+ + \beta_1^- ex_t^- + \beta_2^+ ref_t^+ + \beta_2^- ref_t^- + \varepsilon_t \quad (2)$$

where β_1^+ (β_2^+) and β_1^- (β_2^-) are the long-run positive and negative coefficients of export changes (real exchange rate), respectively. To account for potential asymmetrical effects, I compute the partial sums of positive and negative changes in the independent variables. Thus,

$$ex_t^+ = \sum_{j=1}^{t} \Delta\, ex_j^+ = \sum_{j=1}^{t} \max\,(\Delta\, ex_j\,, 0)$$

$$ex_t^- = \sum_{j=1}^{t} \Delta\, ex_j^- = \sum_{j=1}^{t} \min\,(\Delta\, ex_j\,, 0)$$

and

$$ref_t^+ = \sum_{j=1}^{t} \Delta\, ref_j^+ = \sum_{j=1}^{t} \max\,(\Delta\, ref_j\,, 0)$$

$$ref_t^- = \sum_{j=1}^{t} \Delta\, reef_j^- = \sum_{j=1}^{t} \min\,(\Delta\, ref_j\,, 0)$$

The asymmetric error correction model is as follows:

$$\Delta gdp_t = \alpha_0 + \alpha_1 gdp_{1-1} + \alpha_2^+ ex_{t-1}^+ + \alpha_2^- ex_{t-1}^- + \alpha_3^+ ref_{t-1}^+ + \alpha_3^- ref_{t-1}^-$$

$$+ \sum_{j=1}^{p} \gamma_j \Delta gdp_{t-j} + \sum_{j=0}^{q_1^+} \delta_j^+ \Delta ex_{t-j}^+ + \sum_{j=0}^{q_1^-} \delta_j^- \Delta ex_{t-j}^-$$

$$+ \sum_{j=0}^{q_2^+} \theta_j^+ \Delta ref_{t-j}^+ + \sum_{j=0}^{q_2^-} \theta_j^- \Delta ref_{t-j}^- + DU_t + v_t \tag{3}$$

where $\gamma_j, \delta_j^+, \delta_j^-, \theta_j^+,$ and θ_j^- are the short-run coefficients, α_0 is the deterministic drift component. The optimal lags $p,\ q_1^+,\ q_1^-,\ q_2^+,\ q_2^-$ of dependent and independent variables are selected using the Akaike Information Criterion. D_{nt} denotes the dummy variable to capture the effects of the financial crisis. The asymmetric long-run parameters in Equation (3) can be estimated as follows:

$$\alpha = -\alpha_0/\alpha_1, \beta_1^+ = -{\alpha_2^+}/{\alpha_1}, \quad \beta_1^- = -{\alpha_2^-}/{\alpha_1}, \quad \beta_2^+ = -{\alpha_3^+}/{\alpha_1}, \quad \beta_2^- = -{\alpha_3^-}/{\alpha_1}.$$

I initially test for asymmetric cointegration using two statistics: the F_{PSS} statistic (Wald test) proposed by Pesaran, Shin, and Smith (2001) with the null hypothesis $H_0: \alpha_1 = \alpha_2^+ = \alpha_2^- = \alpha_3^+ = \alpha_3^- = 0$ against the alternative that the coefficients on the lagged levels terms are jointly non-zero ($H_1: \alpha_1 \neq \alpha_2^+ \neq \alpha_2^- \neq \alpha_3^+ \neq \alpha_3^- \neq 0$) and the t_{BDM} statistic suggested by Banerjee, Dolado, and Mestre (1998) with $H_0: \alpha_1 = 0$ ($H_1: \alpha_1 < 0$). The rejection of the null hypotheses indicates long-run asymmetric cointegration.

Sequentially, I test for asymmetrical effects of exports and the real exchange rate on GDP. To test long-run asymmetry, the null hypothesis (long-run symmetry) is as follows:

$$H_0: {a_2^+}/{a_1} = {a_2^-}/{a_1}, \ {a_3^+}/{a_1} = {a_3^-}/{a_1}.$$

To test for short-run symmetry, the null hypothesis (short-run symmetry) is as follows

$$H_0: \delta_j^+ = \delta_j^- \text{ or } \sum_{j=0}^{q_1^+} \delta_j^+ = \sum_{j=0}^{q_1^-} \delta_j^- \text{ and } \theta_j^+ = \theta_j^- \text{ or } \sum_{j=0}^{q_2^+} \theta_j^+ = \sum_{j=0}^{q_2^-} \theta_j^-.$$

3. Empirical Results

The results of the Unit Roots Tests presented in Table 1 indicate that the null hypothesis is rejected for all variables when considering the first differences. Table 2 reports the F_{PSS} and t_{BDM} statistics of the NARDL bounds testing approach. We observe that the computed statistics exceed their respective upper critical values. This indicates that the null hypothesis of no long-run relationship at levels is rejected for Austria, France, the Netherlands, and Portugal. Therefore, we detected an asymmetric cointegration long-run relationship between real GDP, real exports, and real exchange rates for these countries.

The Wald tests, for short (W_{SR})- and long-run symmetry (W_{LR}) are reported at the bottom of Table 3. I observe that exports react differently to increases and decreases over the long run in Italy and the Netherlands and in the short run in Austria—an effect that was previously ignored in the empirical literature. Additionally, the Wald test results reject the null hypothesis of the long-run symmetry of real exchange rates for France.

Table 3 also shows that the estimated long-run coefficient of exports for Italy and the Netherlands is statistically significant at the 1% level. Keeping other factors constant, a 1% increase in exports will result in a 0.423% (0.552%) increase in economic growth for Italy (the Netherlands), while a 1% decrease in exports will lead to a 0.767% (0.935%) decrease in economic growth. The magnitudes of the changes are asymmetric, i.e., the transmission elasticity of adverse shocks in exports is much greater than that of positive export shocks. In the short run, empirical evidence indicates that the lagged one year of exports positively impacts economic growth in France.

Table 1: Unit roots results.

	ADF	DF-GLS	PP	ADF	DF-GLS	PP	ADF	DF-GLS	PP
	Real GDP			Real exports			Real exchange rates		
AT	-5.8808***	-5.4171***	-8.3279***	-6.2394***	-6.244***	-6.4245***	-6.3311***	-5.6223***	-6.333***
BE	-7.2607***	-6.7437***	-7.4321***	-7.3352***	-7.4579***	-7.9313***	-5.1945***	-4.4482***	-5.2073***
DE	-5.8696***	-5.7816***	-7.747***	-6.2549***	-6.4089***	-6.4828***	-6.4616***	-5.0671***	-6.6348***
EL	-3.8696**	-3.7953***	-3.7893***	-6.5143***	-6.6131***	-6.5195***	-4.7269***	-4.6517***	-4.7531***
ES	-5.1922***	-4.9274***	-5.1574***	-4.767***	-5.6623***	-5.6262***	-4.9992***	-4.679***	-4.9438***
FI	-4.1934**	-4.231***	-4.0805**	-5.5842***	-5.7286***	-5.5842***	-5.862***	-5.7619***	-6.9473***
FR	-7.1895***	-7.0868***	-8.2691***	-6.4101***	-6.5207***	-6.4534***	-5.2465***	-4.9792***	-5.1718***
IE	-4.3192***	-4.4313***	-4.3672***	-4.3972***	-4.2595***	-4.3903***	-5.4452***	-5.5312***	-5.4368***
IT	-5.1468***	-6.3471***	-6.5657***	-5.9056***	-6.6149***	-10.518***	-4.6268***	-4.5482***	-6.9793***
NL	-4.8224***	-4.352***	-4.7175***	-5.8412***	-5.8492***	-5.8392***	-6.9784***	-5.5892***	-11.8492***
PT	-4.2999***	-4.3151***	-4.2631***	-6.0672***	-5.1595***	-10.2507***	-5.177***	-7.0811***	-4.6023***

Note: *** p<0.01 and **p<0.05.

Table 2. NARDL Bounds results.

Model	$F(gdp/ex^{+}, ex^{-}, ref^{+}, ref^{-})$	
	F_{PSS}	t_{BDM}
AT	5.5657	-4.6459
BE	2.9135	-3.2064
DE	1.8854	-1.9738
EL	3.1823	-2.1596
ES	2.7603	-2.5955
FI	3.1502	-2.6274
FR	4.7329	-3.8950
IE	2.655	-2.5492
IT	4.6215	-3.5395
NL	5.8460	-3.9019
PT	1.4201	-1.8584

Notes: Critical values for 90% and 95% significance levels are (3.17;4.14) and (3.79;4.85), respectively.

Table 3. The NARDL model.

Countries	AT		FR		IT		NL	
Variables	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat	coeff.	t-stat
$\boldsymbol{\beta_1^+}$	0.328***	19.85	0.130	2.115	0.423**	3.783	0.552***	28.62
$\boldsymbol{\beta_1^-}$	-0.385***	17.00	-0.308**	6.724	-0.767***	21.03	-0.935***	36.12
$\boldsymbol{\beta_2^+}$	0.009***	13.37	0.008***	9.591	0.003	1.0641	-0.001	0.7799
$\boldsymbol{\beta_2^-}$	-0.004	1.652	0.005*	3.087	-0.003	1.6013	-0.003	0.7309
$\boldsymbol{\alpha_0}$	15.5896***	4.65	14.8904***	3.90	11.2334***	3.54	12.747***	3.92
$\boldsymbol{\gamma_1}$	0.0632	0.84	0.51004***	3.44	0.2126	1.44	0.4015***	2.93
$\boldsymbol{\delta_0^+}$	0.1171*	1.93	0.2313***	3.59	0.2848***	3.72	0.4225***	5.83
$\boldsymbol{\delta_0^-}$	0.073	1.78	0.4846***	10.61	0.5413***	7.15	0.162*	2.02
$\boldsymbol{\delta_1^+}$	-0.0315	-0.62	-0.0592	-0.96	0.0352	0.42	-0.0912	-0.99
$\boldsymbol{\delta_1^-}$	0.069	0.97	-0.3102***	-3.38	-0.3026***	-3.16	-0.478**	-2.18
$\boldsymbol{\theta_0^+}$	0.003*	1.92	0.0018	1.12	0.0025	0.85	-0.0006	-0.46
$\boldsymbol{\theta_0^-}$	0.0012	0.74	0.0009	0.69	0.0021**	3.03	0.0045***	3.12
$\boldsymbol{\theta_1^+}$	-0.0022	-1.15	-0.0017	-1.23	0.0001	0.71	0.0009	0.75
$\boldsymbol{\theta_1^-}$	-0.0001	-0.111	0.0012	1.38	-0.009	-0.92	-0.0025	-1.62
$\boldsymbol{DU}$	0.0555***	-3.391	0.0288**	2.80	0.0608	3.16	0.0606***	2.98
$\boldsymbol{R^2}$	0.8746		0.9473		0.8879		0.8873	
adj R^2	0.7994		0.8918		0.8206		0.8197	
Breusch-Godfrey LM	14.11 (0.7220)		10.86 (0.9001)		10.45 (0.9161)		7.367 (0.9867)	
Breusch-Pagan	0.7405 (0.3895)		1.446 (0.2291)		1.078 (0.2991)		2.129 (0.1445)	
Ramsey Test	3.668 (0.0333)		0.9279 (0.4499)		5.449 (0.0600)		1.896 (0.1598)	
Jarque-Bera test	0.8175 (0.6645)		0.73 (0.6942)		2.014 (0.3653)		9.592 (0.0083)	
CUSUM	Stable	stable	stable	stable	Stable	stable	stable	stable
CUSUMSQ	Stable	stable	stable	stable	Stable	stable	stable	stable
$\boldsymbol{W_{LR}^{ex}}$					16.95*** (0.000)		4.041* (0.055)	
$\boldsymbol{W_{LR}^{ref}}$			8.622*** (0.008)					
$\boldsymbol{W_{SR}^{ex}}$	7.155*** (0.015)							
$\boldsymbol{W_{SR}^{ref}}$								

Notes: *** p<0.01, **p<0.05, and *p<0.1. Value in () are p-values.

4. Conclusion

This study investigates the asymmetric relationship between exports and economic growth by applying a nonlinear ARDL model. The findings support the positive impact of exports on economic growth in most Euro Area economies. Moreover, the results reveal asymmetric responsiveness of economic growth to export variations in Italy, the Netherlands, and Austria. Notably, the magnitudes of these changes exhibit asymmetry, with the transmission elasticity of adverse shocks in exports being significantly greater than that of positive export shocks.

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