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Verónica Cañal-Fernández
University of Oviedo

Julio Tascón Fernández
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Verónica Cañal-Fernández*
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Abstract

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JEL classification: C22; E31; E50

Keywords: Foreign direct investment; exports; imports; GDP; ARDL bounds; causality

*Corresponding author, Department of Economics Faculty of Economics and Business University of Oviedo Tf. 0034 985104890 e-mail: vcanal@uniovi.es
** Department of Economics Faculty of Economics and Business University of Oviedo Tf. 0034 985103739 e-mail: juliotf@uniovi.es

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Abstract. This paper analyzes the relationship between foreign direct investment (FDI), exports and economic growth in Spain using annual time series data for the period 1970 to 2016. To examine these linkages the autoregressive distributed lag (ARDL) bounds testing approach to cointegration for the long-run is applied. The error correction model (ECM) is used to examine the short-run dynamics and the vector error correction model (VECM) Granger causality approach is used to investigate the direction of causality. The results confirm a long-run relationship among the examined variables. The Granger causality test indicates a strong unidirectional causality between FDI and exports with direction from FDI to exports. Besides, the results for the relationship between FDI and economic growth are interesting and indicate that there is no significant Granger causality from FDI to economic growth and vice-versa.

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1. Introduction

A growing interest in the relationship between foreign direct investment (FDI), trade and economic growth can be observed in the last years due to a progressive liberalization of international economic relations that has led to an important increase in both, goods and services exchange, as well as in capital movements.

According to the World Trade Organization's (WTO) definition, FDI occurs when an investor based in one country (the home country) acquires an asset in another country (the host country) with the intent to manage that asset. The management dimension is what distinguishes FDI from portfolio investment in foreign stocks, bonds and other financial instruments. FDI inflows are considered as one of the basic policies for supporting development and economic growth in less developed countries. Tekin (2012) states that FDI is a major source of finance that can facilitate the entrance of technology from advanced and developed countries to the host developing country allowing, through this channel, the host country to compete in international markets. Moreover, Xing and Pradhananga (2013) stand out that FDI enhances the efficiency of production, can promote specialization and productivity in the host country, the employment, job skills, managerial expertise, export markets and tax revenues.

There are a lot of studies that analyze the linkage between FDI, exports and economic growth in the literature focusing on both developing and developed countries. However, the empirical results on the effects of FDI on economic growth are inconclusive.

Neoclassical growth theory proposed by Harrod (2015), Domar (1946) and Solow (1956) stand out that FDI is a promoter for economic growth because it increases the investment. In the endogenous growth model presented by Romer (1986), Romer (1991) and Lucas (1988), FDI promotes economic growth by generating technological and knowledge spillovers. These models show that FDI is an important factor contributing to economic growth in the host countries. Lipsey and Weiss (1981, 1984) describe a positive causal relationship between trade flows and FDI disaggregated by industry. Blomström *et al.* (1988) show a similar relationship for Sweden and the U.S. Pfaffermayer (1994, 1996) reports similar evidence for Austrian manufacturing exports, while Barrel and Pain (1997) examine the diffusion of knowledge-based firm-specific assets throughout a range of European countries. For the Spanish case, Bajo-Rubio and López-Pueyo (2002) study the main features associated with FDI inflows in Spanish manufacturing, both across 20 industries and through time. Their results point to the importance of technological and skill advantages, as opposed to traditional advantages based on labor costs, in order to explain the industry allocation of FDI.

Alfaro *et al*. (2004) point out the positive influence of FDI on economic growth, emphasizing the importance of local financial markets in this process. Furthermore, these results are confirmed by other studies which analyze countries from different parts of the world. For example, Zhang (2001) finds, for 11 countries of East Asia and Latin America, a positive effect of FDI in promoting economic performance when host countries exert a liberalized trade regime, improve education, encouraged export-oriented FDI and maintain macroeconomic stability. Bengoa and Sanchez-Robles (2003) find this positive linkage between FDI and economic growth for 18 Latin American countries. Choong *et al*. (2004) emphasize the importance of the development level of the financial sector for Eastern Asian countries. This can be seen as a source of competitive advantage in attracting FDI by host countries and, in the end, in promoting economic growth. These results are valid also for Taiwan (Chang, 2006), Malaysia and Thailand (Chowdhury and Mavrotas, 2006). But the results stated above were not confirmed by the analysis conducted by Carkovic and Levine (2002). These authors pointed that the FDI does not exert an independent influence on economic performance and this influence depends on other determinants of economic growth. Hsiao and Hsiao (2006) examine Granger causality (1986) relations between GDP, exports, and FDI in East and Southeast Asia by using time series and panel data from 1986 to 2004. They find out that each country has a different causality relation, and results of panel-VAR causality indicate that FDI has unidirectional effects on GDP directly and also indirectly through exports. There also exists bidirectional causality between exports and GDP. Alexiou and Tsaliki (2007) examine the FDI-led growth hypothesis for Greece during the 1945-2003 years and find a long-run relationship between FDI and GDP. With respect to the Granger causality test, the FDI-led growth hypothesis has been rejected. Katircioglu (2009) investigates the causality relationship between FDI inflows and economic growth for Turkey over 1970-2005 by applying ARDL-Bounds test and Granger causality test. The Bounds test suggests the existence of a relationship between real GDP and FDI when real GDP is the dependent variable. The results of causality indicated unidirectional causality from GDP growth to FDI in the long-run. Miankhel *et al*., (2009) employ a VECM framework for examining the causality between export, FDI and GDP in six emerging countries (Chile, India, Mexico, Malaysia, Pakistan and Thailand). The long-run results indicate the existence of causality from GDP to other variables such as export in Pakistan and FDI in the case of India, and bidirectional causality between GDP and FDI in Malaysia. The findings also show causality from export to FDI and GDP in Latin American countries. Belloumi (2014) analyzes the relationship between FDI, trade openness and economic growth in Tunisia by applying the Bounds test (ARDL) approach for the period 1970 to 2008 and finds out that the variables of interest bound together in the long-run when FDI is the dependent variable. Sunde (2017) indicates that both FDI and exports spur economic growth contrary to some studies, which found that FDI does not cause economic growth. The VECM Granger causality analysis found unidirectional causality between economic growth and foreign direct investment running from foreign direct investment to economic growth, unidirectional causality between foreign direct investment and exports running from foreign direct investment to exports and bidirectional causality between economic growth and exports. The work by Sunde confirms the FDI-led growth hypothesis for South Africa.

Other studies have investigated the relationship between the recent global financial and economic crisis and FDI flows. One of the main consequences of the Great Recession has been the deterioration of the foreign direct investment observed in past decades. According to the data from the United Nations Conference on Trade and Development (UNCTAD, 2012), FDI inflows reached an unprecedented sudden stop in 2008 with a plunge of more than 13%. Despite turmoil in the global economy, global FDI flows exceeded the pre-crisis average in 2011, reaching 1.5 trillion USD. These facts have led economists to be interested on the effect on FDI of the crises because it may be a possible solution in, for example, unemployment reduction an economic growth. They believe that foreign direct investment may enhance private investments, encourage the creation of new jobs, transfer knowledge and technological skill in the workforce and, generally, boost economic growth in host countries' economies (Chowdhury and Mavrotas, 2006; Dritsakis and Stamatiou, 2014). Ucal *et al*. (2010) reveal that the financial crisis has decreased the level of FDI during the following years. Alfaro and Chen (2010) point out that FDI in economic growth, volatility and economic interdependence across the countries can be seen as a growth's vector for host countries and can play a very important role in micro economic responses in order to minimize the negative aspects of financial crisis.

Contrary to recent trends in international research, few empirical studies have examined the relationship between Spanish FDI outflows/inflows, exports and economic growth. The exceptions are Caballero *et al.* (1989), Doménech and Taguas (1997), Alguacil and Orts (1998, 2002) and Bajo-Rubio and Montero-Muñoz (1999a, 1999b, 2001). The first and third studies report evidence of a substitution relationship between outward FDI and exports in Spain, while the others found evidence of a positive relationship. None of them takes into account the recent evolution in Spain's international exchange flows, considers country-specific variables or distinguishes between goods and services. Other descriptive study is the one proposed by Martín and Rodríguez (2009) that use discrete choice data for Spanish firms. They report higher levels of exports among Spain's national firms that also invest abroad but further insights remain to be tested within an econometrics framework. Only Bajo-Rubio and Sosvilla-Rivero (1991, 1994) examine the role of FDI inflows in the Spanish economy during the 1964-1989. They find a long-run relationship between total gross FDI inflows and several macroeconomic variables such as the real GDP, the lagged foreign capital stock or the rate of inflation.

With this point of view, based on Stamatiou and Dritsakis (2014) research, this paper tries to survey the dynamic relationship between FDI inflows, exports, imports and gross domestic product for the period 1970 to 2016 in Spain by employing the Autoregressive Distributed Lag approach (ARDL-Bounds test), Vector Error Correction Model (VECM) and Granger causality test (Granger and Lin, 1995).

This paper is organized as follows: section 2 describes the characteristics of our sample. In section 3 the used methodology is displayed and in section 4 we report our results. Finally, the main conclusions are presented.

2. Data and variables

This section provides a descriptive analysis of the data and variables included in the specification of the model. Annual time series data on FDI, exports, imports, unemployment rate and GDP covering the 1970-2016 period have been used in this paper. The selection of the time period is limited by data availability. All variables are expressed in constant 2010 US dollars, deflating by the GDP deflator. The data have been gathered from economic databases the 2016 edition of the World Development Indicators (WDI) published online by the World Bank and the Annual Macro-Economic Database (AMECO) of the European Commission's Directorate General for Economic and Financial Affairs.

The choice of the explanatory variables is based on a thorough review of the literature on applications of the several econometric approaches and methods for the analysis of the relationship between FDI, trade and economic growth (Balassa, 1995; Ghirmay *et al.*, 2001; Belloumi, 2014; Dritsaki and Stiakakis, 2014; Faisal *et al.*, 2016; Mahmoodi and Mahmoodi, 2016).

The variables used in the empirical study are defined as follows:

- Foreign direct investment (FDI) refers to direct investment equity flows in the reporting economy. It is the sum of equity capital, reinvestment of earnings, and other capital. Direct investment is a category of cross-border investment associated with a resident in one economy having control or a significant degree of influence on the management of an enterprise that is resident in another economy. Ownership of 10 percent or more of the ordinary shares of voting stock is the criterion for determining the existence of a direct investment relationship.

- Exports of goods and services (EXP) represent the value of all goods and other market services provided to the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.
- Imports of goods and services (IMP) represent the value of all goods and other market services received from the rest of the world. They include the value of merchandise, freight, insurance, transport, travel, royalties, license fees, and other services, such as communication, construction, financial, information, business, personal, and government services. They exclude compensation of employees and investment income (formerly called factor services) and transfer payments.
- Economic growth (GDP) is measured by the increase of real GDP in each successive time period. GDP at purchaser's prices is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.
- A dummy variable (BREAK86) is introduced to capture the differences, if any, in the intercept before and after Spanish's being a member of European Community at 1986. We take into account this variable because, according to the Spain's Balance of Payments, the total gross FDI inflows received by the Spanish economy after the Spanish integration into European Community are more impressive that during the period 1974-1977, in which political instability was dominant, coinciding with the transition to a democratic regime (Bajo-Rubio and Sosvilla-Rivero, 1994).

The descriptive statistics for all variables are shown in Table 1. Natural logarithm has been applied to all the data to account for the expected non-linearities in the relationships and also to achieve stationarity in variance; the natural logarithms of FDI, EXP, IMP and GDP are denoted as LFDI, LEXP, LIMP and LGDP, respectively.

Table 1. Summary statistics of the variables

Variable	LFDI	LEXP	LIMP	LGDP
Mean	1,843,895	2,572,286	2,564,277	2,753,851
Median	1,870,203	2,566,036	2,571,040	2,752,976
Maximum	2,051,428	2,687,999	2,686,715	2,802,606
Minimum	1,596,031	2,422,719	2,408,980	2,685,002
Std. Dev.	1,288,702	0.822132	0.923994	0.357848
Skewness	-0.372976	-0.169159	-0.155250	-0.128411
Kurtosis	1,934,168	1,629,983	1,464,012	1,713,104
Observations	47	47	47	47

3. Methodology

Autoregressive distributed lag (ARDL) models have been in use for decades, but in more recent times, they have been shown to provide a very valuable vehicle for testing the presence of long-run relationships between economic time series[1].

The ARDL cointegration approach was developed by Pesaran (1997), Pesaran and Shin (1999) and Pesaran *et al*. (2001). It has several advantages in comparison with other cointegration methods such as Engle and Granger (1987) and Johansen and Juselius (1990) procedures:

- The ARDL can be applied whether the variables under the study are not integrated of the same order, while Johansen cointegration techniques require that all the variables in the system be of equal order of integration. This means that the ARDL can be applied when underlying variables are integrated of order one, zero of fractionally integrated.
- The ARDL test is relatively more efficient in the case of small and finite sample data sizes while the Johansen cointegration techniques require large data samples for validity.
- The ARDL methodology yields estimates and valid *t*-statistics, even in the presence of autocorrelation and endogeneity (Harris and Sollis, 2003).
- A simple error correction (ECM) model provides short-run coefficients along with long-run equilibrium without losing valid long-run coefficients.
- Finally, the last advantage is that the ARDL model can be regarded as the equal number of lag length for all variables or different orders of lag without affecting the asymptotic distribution of the test statistic (Pesaran *et al*., 2001).

In its basic form, an ARDL regression model of order (p,q) can be expressed as:

$$y_t + \beta_1 y_{t-1} + \ldots + \beta_p y_{t-p} = \lambda + \alpha_0 x_t + \alpha_1 x_{t-1} + \ldots + \alpha_q x_{t-q} + \varepsilon_t \qquad (1)$$

[1] For a clearly and comprehensive explanation of ARDL models see the web page of Professor Emeritus from the University of Vitoria Dave Giles (http://davegiles.blogspot.com.es/2013/06/ardl-models-part-ii-bounds-tests.html). Besides, see Hendry *et al.* (1984) for a comprehensive early review of ARDL models.

or

$$\beta(L)y_t = \lambda + \alpha(L)x_t + \varepsilon_t \tag{2}$$

where L is a distributed lag component and ε_t is a random disturbance term which it will be serially independent.

The model is autoregressive because y_t is explained by lagged values of itself. It also has a distributed lag component, in the form of successive lags of the x explanatory variable. The ARDL*(p,q)* model can be estimated by applying the OLS method. This estimation will yield biased coefficient estimates due to the presence of lagged values of the dependent variable as regressors. If the disturbance term, ε_t, is autocorrelated, the OLS will also be an *inconsistent* estimator, and in this case Instrumental Variables estimation was generally used in applications of this model (Giles, 1975, 1977).

The methodology of this article follows several steps:

- In the first step, we test for a unit root test. The literature proposes several methods for unit root tests. Since these methods may give different results, we selected the Dickey-Fuller (ADF) test (1979, 1981), the Phillips-Perron (P-P) test following Phillips and Perron (1988) and the Dickey-Fuller generalized least square (DF-GLS) de-trending test proposed by Elliot *et al*. (1996). In all these tests, the null hypothesis is that the variable contains a unit root, i.e., it is not stationary. The optimal lags for unit root test are to include lags sufficient to remove any serial correlation in the residuals. The ARDL bounds test is based on the assumption that the variables are *I(0)* or *I(1)*, but if any series are integrated of order *I(2)* or higher, then the calculated F-statistic becomes invalid (Ouattara, 2004). Therefore, before applying this test, we determine the order of integration of all variables using unit root tests. The main objective is to ensure that the variables are not *I(2)* so as to avoid spurious results. In the presence of variables integrated of order two we cannot interpret the values of F statistics provided by Pesaran *et al*. (2001) and Narayan (2005).
- In the second step, a particular type of ARDL model is formulated (model (3)-(6)), called unrestricted error correction model (ECM) or “conditional ECM” according to Pesaran *et al*. (2001). Before the estimation of the model, we determine the appropriate lag structure for this using the pre-estimation version of Stata command named *varsoc*. This can be used to find lag lengths for VAR or VEC models of unknown order. As shown by Nielsen (2001), this lag-order selection statistics can be used in the presence of *I(1)* variables. The ARDL model (3)-(6) used here is expressed as follows:

$$\Delta LFDI_t = \alpha_{01} + \sum_{i=1}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \\ + \delta_{11} LFDI_{t-1} + \delta_{21} LEXP_{t-1} + \delta_{31} LIMP_{t-1} + \delta_{41} LGDP_{t-1} + \delta_{51} BREAK\,86_t + \varepsilon_{1t}. \quad (3)$$

$$\Delta LEXP_t = \alpha_{02} + \sum_{i=0}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=1}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \\ + \delta_{12} LFDI_{t-1} + \delta_{22} LEXP_{t-1} + \delta_{32} LIMP_{t-1} + \delta_{42} LGDP_{t-1} + \delta_{52} BREAK\,86_t + \varepsilon_{2t}. \quad (4)$$

$$\Delta LIMP_t = \alpha_{03} + \sum_{i=0}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=1}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \\ + \delta_{13} LFDI_{t-1} + \delta_{23} LEXP_{t-1} + \delta_{33} LIMP_{t-1} + \delta_{43} LGDP_{t-1} + \delta_{53} BREAK\,86_t + \varepsilon_{3t}. \quad (5)$$

$$\Delta LGDP_t = \alpha_{04} + \sum_{i=0}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=1}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \\ + \delta_{14} LFDI_{t-1} + \delta_{24} LEXP_{t-1} + \delta_{34} LIMP_{t-1} + \delta_{44} LGDP_{t-1} + \delta_{54} BREAK\,86_t + \varepsilon_{4t}. \quad (6)$$

where $\Delta LFDI_t$, $\Delta LEXP_t$, $\Delta LIMP_t$ and $\Delta LGDP_t$ are the dependent variables defined in the section 2. β_{1i}, β_{2i}, β_{3i} and β_{4i} are the long terms and p, q_1, q_2 and q_3 are the optimal lag lengths of the ARDL model. L is the logarithm operator, Δ is the first difference and $\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}, \varepsilon_{4t}$ are the error terms assumed to be independently and identically distributed.

- In the third step, we use the LM test to test the null hypothesis that the errors are serially independent, against the alternative hypothesis that the errors are AR(m) or MA(m). The errors of the estimated model must be serially independent. As Pesaran *et al*. (2001) note, this requirement may also be influential in our final choice of the maximum lags for the variables in the model.
- In the fourth step the Bound testing is performed. The F test is used for testing the absence of a long-run equilibrium relationship between the variables. This absence coincides with zero coefficients for the lagged levels of the variables, $LFDI_{t-1}, LEXP_{t-1}, LIMP_{t-1}$ and $LGDP_{t-1}$ (model (3)-(6)). A rejection of null hypothesis implies that we have a long-run relationship. When long-run relationship exists, F test indicates which variable should be normalized. The null hypothesis for no cointegration among variables in equation (3) is H_0: $\delta_{11} = \delta_{21} = \delta_{31} = \delta_{41} = \delta_{51} = 0$ against the alternative hypothesis H_1: $\delta_{11} \neq \delta_{21} \neq \delta_{31} \neq \delta_{41} \neq \delta_{51} \neq 0$. The same for the equations (4) to (6). The F-test has a non-standard distribution which depends on (i) whether variables included in the model are *I(0)* or *I(1)*, (ii) the number of regressors and (iii) whether the model contains an intercept and/or a trend. The test involves asymptotic critical value bounds, depending whether the variables are *I(0)* or *I(1)*. In each case, the lower bound is based on the assumption that all of the variables are integrated of order zero, and the upper bound is based on the assumption that all of the variables are integrated of order one. If the computed F-statistic falls below the lower bound we would conclude that the variables are

I(0), so no cointegration is possible. If the F-statistic exceeds the upper bound, we conclude that we have cointegration and it lies between the bounds, the test is inconclusive. Besides, a Bound t-test of H_0: $\delta_{11} = 0$, against H_1: $\delta_{11} < 0$ is performed as a cross-check. If the t-statistic for the lagged levels of the dependent variables is greater than the *I(1)* bound tabulated by Pesaran *et al*. (2001), this would support the conclusion that there is a long-run relationship between the variables. If the t-statistic is less than the *I(0)* bound, we would conclude that the data are all stationary.

- In the fifth step, assuming that the bounds test leads to the conclusion of cointegration, we estimate the long-run relationships between the variables using the following equations:

$$LFDI_t = \alpha_{01} + \sum_{i=1}^{p} \beta_{1i} LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} LGDP_{t-i} + \varepsilon_{1t}. \qquad (7)$$

$$LEXP_t = \alpha_{02} + \sum_{i=0}^{p} \beta_{1i} LFDI_{t-i} + \sum_{i=1}^{q_1} \beta_{2i} LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} LGDP_{t-i} + \varepsilon_{2t}. \qquad (8)$$

$$LIMP_t = \alpha_{03} + \sum_{i=0}^{p} \beta_{1i} LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} LEXP_{t-i} + \sum_{i=1}^{q_2} \beta_{3i} LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} LGDP_{t-i} + \varepsilon_{3t}. \qquad (9)$$

$$LGDP_t = \alpha_{04} + \sum_{i=0}^{p} \beta_{1i} LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} LIMP_{t-i} + \sum_{i=1}^{q_3} \beta_{4i} LGDP_{t-i} + \varepsilon_{4t}. \qquad (10)$$

Moreover, a dynamic error correction model (ECM) can be derived from the ARDL bounds test through a simple linear transformation. The short-run dynamic parameters by estimating an unrestricted ECM or conditional ECM associated with the long-run estimates are obtained:

$$\Delta LFDI_t = \alpha_{01} + \sum_{i=1}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \lambda_1 ECM_{t-1} + \varepsilon_{1t}. \qquad (11)$$

$$\Delta LEXP_t = \alpha_{02} + \sum_{i=0}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=1}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \lambda_2 ECM_{t-1} + \varepsilon_{2t}. \qquad (12)$$

$$\Delta LIMP_t = \alpha_{03} + \sum_{i=0}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=1}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=0}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \lambda_3 ECM_{t-1} + \varepsilon_{3t}. \qquad (13)$$

$$\Delta LGDP_t = \alpha_{04} + \sum_{i=0}^{p} \beta_{1i} \Delta LFDI_{t-i} + \sum_{i=0}^{q_1} \beta_{2i} \Delta LEXP_{t-i} + \sum_{i=0}^{q_2} \beta_{3i} \Delta LIMP_{t-i} + \sum_{i=1}^{q_3} \beta_{4i} \Delta LGDP_{t-i} + \lambda_4 ECM_{t-1} + \varepsilon_{4t}. \qquad (14)$$

where ECM_{t-1} is the error correction term that should be negative and statistically significant because indicates the speed of adjustment, that is to say, how quickly the variables return to the long-run equilibrium.

The existence of cointegration derived from the model (11)-(14) does not necessarily imply that the estimated coefficients are stable. Therefore, Pesaran and Pesaran (1997) and Pesaran *et al*. (2001) proposed assessing parameter stability in estimated models using Brown *et al*. (1975) tests, which are known as cumulative sum (CUSUM) and as cumulative sum of squares (CUSUMQ) (Stamatious and Dritsakis, 2014). If the plots of the CUSUM and CUSUMSQ statistics stay within the critical bonds of a 5 percent level of significance, the null hypothesis of all coefficients in the given regression is stable and cannot be rejected. To ensure the goodness of fit of the model, diagnostic and stability tests are conducted. Diagnostic tests examine the model for serial correlation, non-normality and heteroscedasticity.

- In the last step, after the long-run relationship between variables, the direction of causality using the ECM-ARDL model is analyzed.

4. Estimation and results

Time series univariate properties were examined using three unit root test that are the conventional ADF test, the P-P test DF-GLS. The results of the stationarity test show that all variables are nonstationary at levels (Table 2) but stationary at the first differences (Table 3). The numbers within parentheses followed by ADF statistics represent the lag length of the dependent variable used to obtain white noise residuals. The lag lengths for ADF equation were selected using SIC. In the case of PP statistics these parentheses represent the bandwidth selected based on Newey West method using Bartlett Kernel. According to the results, it is therefore worth concluding that all the variables are integrated of order one.

Table 2. Unit root test on log levels of variables

Variable	**ADF test**		**PP test**		**DF-GLS test**	
	C	C,T	C	C,T	C	C,T
LFDI	-1.88(1)	-2.84(0)	-1.72(2)	-2.78(3)	-0.55(1)	-2.91(0)
LEXP	-0.78(3)	-1.36(3)	-1.80(2)	-1.24(2)	0.68(3)	-1.66(3)
LIMP	-1.52(1)	-1.31(1)	-1.33(4)	-1.10(4)	0.11(1)	-1.60(1)
LGDP	-1.22(1)	-3.06(1)	-1.87(4)	-1.81(4)	0.31(1)	-2.94(1)

Notes: ***, **, * denote statistical significance at the 1, 5 and 10% levels. C=constant, T= linear trend.

Table 3. Unit root test on first log levels of variables

Variable	ADF test		PP test		DF-GLS test	
	C	C,T	C	C,T	C	C,T
DLFDI	-9.11(0)***	-9.24(0)***	-9.10(0)***	-9.68(2)***	-8.75(0)***	-9.04(0)***
DLEXP	-4.89(0)**	--4.97(0)***	-4.91(1)***	-5.01(1)***	-1.82(2)*	-2.74(2)
DLIMP	-4.36(0)***	-4.58(0)***	-4.43(3)***	-4.58(2)***	-4.14(0)***	-4.42(0)***
DLGDP	-2.87(0)**	-2.92(0)	-2.89(2)**	-3.02(1)	-2.63(0)***	-2.99(0)*

Notes: ***, **, * denote statistical significance at the 1, 5 and 10% levels. C=constant, T= linear trend.

Table 4 shows the information criteria for selecting the lag-lengths in time-efficient way: the final prediction error (FPE), Akaike's information criterion (AIC), Schwarz's Bayesian information criterion (SC), and the Hannan and Quinn information criterion (HQIC) lag-order selection statistics for a series of vector autoregressions. Most of the results display that the optimal lag length of the variables is 3.

Table 4. Selection-order criteria

lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	28.9219				3.70E-06	-1.15916	-1.09874	-0.995327
1	249.733	441.62	16	0	2.70E-10	-10.6852	-10.3832	-9.86608
2	277.993	56.521	16	0	1.60E-10	-11.2555	-10.7117	-9.781
3	310.366	64.745	16	0	7.7e-11*	-12.017	-11.2316*	-9.88719*
4	326.949	33.167*	16	0.007	8.30E-11	-12.0442*	-11.0171	-9.259

Note: sample: 1974-2016. Num. obs.: 43. * denotes the optimal lag length of the variables.

In order to analyze the long-run relationships and short-run dynamic interactions among the variables of interest (FDI, exports, imports, economic growth and unemployment), we apply an autoregressive distributed lag (ARDL) cointegration technique as a general vector autoregressive (VAR) model of order p in A_t, where A_t is a column vector composed of the four variables: $\mathrm{A}_t = (FDI_t, EXP_t, IMP_t, GDP_t)'$.

The ARDL model used in this study is expressed by equations (3) to (6). The calculated F-statistics are reported in Table 5 where each variable is considered as a dependent variable (normalized) in the ARDL-OLS regressions. From these results, it is clear that there is a long-run relationship amongst the variables when LFDI is the dependent variable because its F-statistic (8.20) is higher than the upper-bound critical value (5.61) at the 1%. Besides, the same occurs in the case of LEXP (10.03>5.61). The models fulfill the assumptions of normality, autoregressive conditional heteroscedasticity (ARCH), functional forms and serial correlation of models.

The bounds F-test for cointegration test yields no evidence of a long-run relationship among variables for the equations (3) to (6) in Spain for 1970-2016. The null hypothesis of no cointegration is not rejected. Thus, the econometric analysis suggests that any causal relationship within dynamic ECM cannot be estimated for $F_{LIMP}(LIMP/LFDI, LEXP, LGDP)$ and $F_{LGDP}(LGDP/LFDI, LEXP, LIMP)$.

On the other hand, the bounds F-test for cointegration test yields evidence of a long-term relationship among variables for the equations (3) and (6) at a 1% significance level.

Table 5. Estimated ARDL models and bounds F-test for cointegration

Bounds testing to cointegration				Diagnostic tests			
Estimated ARDL models	Optimal lag	F-stat.	Decision	χ^2_{NOR}	χ^2_{ARCH}	χ^2_{RESET}	χ^2_{SERIAL}
$F_{LFDI}(LFDI/LEXP, LIMP, LGDP)$	(1,1,4,3)	10.03***	Cointegration	0.40	0.40(1)	0.53(1)	0.18(1)
$F_{LEXP}(LEXP/LFDI, LIMP, LGDP)$	(3,1,0,1)	1.86	No cointegration	0.41	0.54(1)	1.84(1)	0.38(2)
$F_{LIMP}(LIMP/LFDI, LEXP, LGDP)$	(2,0,4,3)	2.10	No cointegration	0.06	0.98(1)	2.59(1)	0.85(1)
$F_{LGDP}(LGDP/LFDI, LEXP, LIMP)$	(2,1,3,0)	3.73	Inconclusive	0.63	0.26(1)	2.58(1)	0.27(1)
Significant level	Critical value bounds (Num. Obs.=43)						
	Lower bounds I(0)	Upper bounds I(1)					
1% level	4.29	5.61					
5% level	3.23	4.35					
10% level	2.72	3.77					

Note: Numbers in parenthesis are the order of diagnostic tests.

Once cointegration is established, the conditional ARDL (p, q_1, q_2, q_3) long-run model for LFDI can be estimated according to the equation (7). Equations (7) is estimated using the following ARDL(1,1,4,3) specification. The results obtained by normalizing LFDI in the long-run are reported in Table 6.

The estimated coefficients of the long-run relationship are significant for all variables. We can see that in the long-run term equation of LFDI that exports, economic growth and the Spanish accession to the European Community in 1986 has involved a new boost in FDI, meaning these variables have a positive significant impact on FDI at 5%. With the coefficient 1.39, a 1% increase in exports will cause FDI to increase by 1.39 in the long run. In addition, the coefficient of imports implies that a 1% decrease in import will raise the FDI to 3.48 in the long-run. The dummy variable (BREAK86) for the years after the Spanish integration into de European Community reflects the expectations associated with European Community membership and as expected, it is positively related to FDI inflows.

Table 6. Estimated long-run coefficients for LFDI using the ARDL approach

Variable	Coefficient	Std.Error
Constant	-206.39	44.92***
LEXP	1.39	0.81**
LIMP	-3.48	0.98***
LGDP	10.06	2.49***
BREAK86	0.57	0.17***

Following Odhiambo (2007) and Narayan and Smyth (2008), we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. The long-run relationship between the variables indicates that there is Granger-causality in at least one direction which is determined by the F-statistic and the lagged error-correction term. The equation (3), where the null hypothesis of no cointegration is rejected, is estimated with an error-correction term (Narayan and Smith, 2006; Morley, 2006).

The results of the short-run dynamic coefficients associated with the long-run relationship obtained from equation (1) are given in Table 7.

In the short-run, exports, economic growth and imports are significant at the % level and has an important impact of FDI. The error correction coefficient is negative (-0.69), as required, and is significant at 1% confidence level, so indicates that any deviation from the long-run equilibrium between variables is corrected about 69% for each year. Finally, the diagnostics tests do not shown any problem.

Table 7. Estimated short-run coefficients for $\Delta LFDI$ using the ARDL approach

Variable	Coefficient	Std.Error
Constant	-142.95	35.16***
$\Delta LGDP$	-3.91	4.41
$\Delta LGDP_{t-1}$	-6.69	5.73
$\Delta LGDP_{t-2}$	14.39	6.32**
$\Delta LIMP$	0.56	1.25
$\Delta LIMP_{t-1}$	4.33	1.52**
$\Delta LIMP_{t-2}$	0.09	1.07
$\Delta LIMP_{t-3}$	1.91	0.82**
$\Delta LEXP$	7.34	1.74***
$BREAK86$	0.40	0.33
$ECT(-1)$	-0.69	0.13***
R-squared	0.72	
F-statistic	5.86	
Durbin-Watson stat	1.99	

The stability of the long-run coefficient is tested by the short-run dynamics. Once the ECM model given by equation (1) has been estimated, the cumulative sum of recursive residuals (CUSUM) and the CUSUM of square (CUSUMQ) test are applied to assess parameter stability (Pesaran and Pesaran, 1997). Figures 1 and 2 plot the results for both tests. The results indicate the absence of any instability of the coefficients because the plot of CUSUM and CUSUMQ statistic fall inside the critical bands of the 5% confidence interval of parameter stability.

Figure 1. Plot of CUSUM test for equation (3)

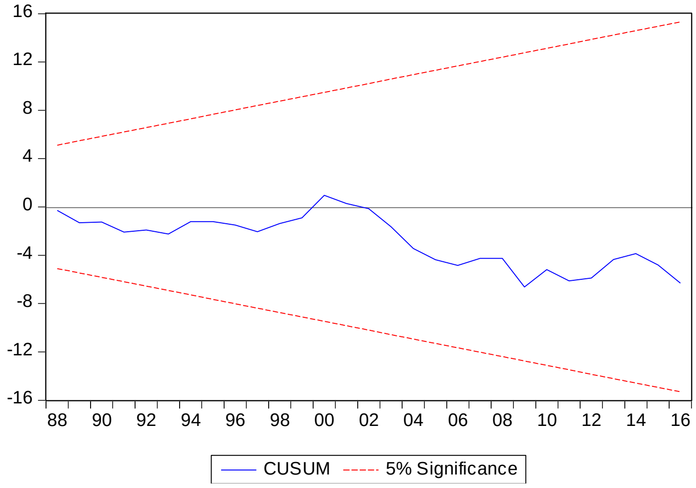
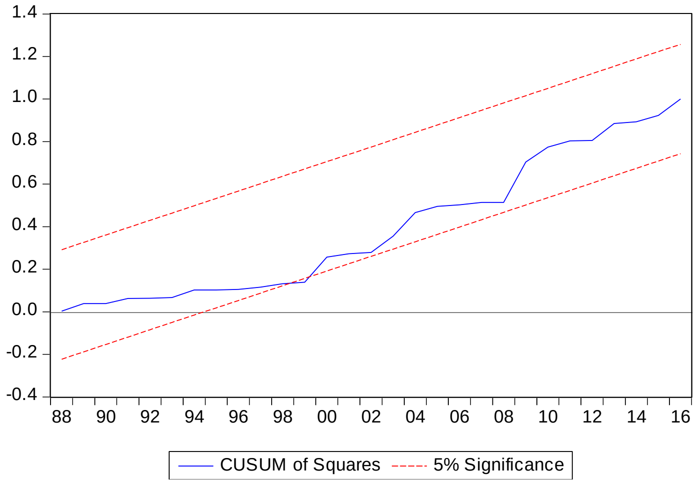


Figure 2. Plot of CUSUMQ test for equation (3)



The results of the short-run Granger causality test are shown in Table 8. We see that there is a unidirectional causality relation between foreign direct investments and exports with direction from foreign direct investments and exports. Exports are crucial for acquiring the potential growth impact of FDI (Balasubramanyam *et al*., 1996). There is a bi-directional Granger causality between exports and economic growth and between exports and imports. Exports promotes economic growth because can increase productivity and alleviate the country's foreign exchange constraints; imports can provide the country with advanced technology.

Table 8. Results of short-run Granger causality

Dependent variable	F-statistic				Direction of causality
	$\Delta LFDI$	$\Delta LEXP$	$\Delta LIMP$	$\Delta LGDP$	
$\Delta LFDI$		0.97	3.82	3.04	
$\Delta LEXP$	12.41***		11.10**	11.73***	$FDI \rightarrow EXP$ $IMP \rightarrow EXP$ $GDP \rightarrow EXP$
$\Delta LIMP$	4.81	7.50**		9.47**	$EXP \rightarrow IMP$ $GDP \rightarrow IMP$
$\Delta LGDP$	3.13	9.56**	5.81		$EXP \rightarrow GDP$

Note: ** statistical significance at 5% and *** statistical significance at 1%.

5. Conclusions

This paper analyzes the relationship between foreign direct investment, exports, imports and economic growth in Spain during the years 1970-2016. This period coincides with the first years of the Spanish integration into the European Community, and the prospects about the completion of the Single European Market by 1992. This process was accompanied by a great amount of foreign direct investment inflows directed to the Spanish economy, one of the favorite destinations of foreign direct investment during those years. We have implemented an ARDL cointegration model to study the existence of a long-run relationship among the foreign direct investment, exports, imports and gross domestic product. The Granger causality within vector error correction model is used to test the direction of causality between the variables. This issue can be interesting due to the possible interrelations among the series with implications for economic growth. The results show that there is cointegration among the variables specified in the model when foreign direct investment is the dependent variable. Exports, imports and gross domestic product promote foreign direct investment in Spain in the long run. There is no significant Granger causality from foreign direct investment to economic growth or from economic growth to foreign direct investment in the short run.

These results can generate important implications and recommendations for policy makers in Spain. They suggest that for foreign direct investment to have the anticipated positive impact on economic growth Spain will have to undertake reforms with clear objectives and commitments, for example, it has to improve its attraction of foreign direct investment through more structural policies. The most important implication of the econometric results is to use foreign direct investment as the main engine of exports.

Besides, it is worth noting that the attraction of FDI is important to promote economic growth, but not sufficient.

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