# THE RELATIONTHIP BETWEEN TRADE OPENNESS AND PUBLIC EXPENDITURE. THE SPANISH CASE, 1960-2000

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**ABSTRACT:**

Recently, greater attention has been paid to the possible relation between trade openness and public expenditure. Most of the articles of this kind of literature are based on the central argument of the work of Rodrik (1998): more open economies are exposed to a greater risk as a result of the possible turbulences in the international markets, which can affect their domestic economy. The public sector can exert an isolation function over this external risk, increasing its participation in the whole economy. Today, this is a controversial and open subject, in spite of the many empirical studies carried out.

The aim of this paper is to empirically determine whether there is a relation between trade openness and public expenditure in Spain in the period 1960-2000, a relatively short period that has witnessed an accelerated process both of openness to the international markets of goods and services and of public sector growth. The time series analysis for the Spanish economy in the period 1960-2000, based on the cointegration test of Johansen, reveals a long-term relationship between public expenditure and both trade openness and several protection indicators. We complete our analysis with several econometric techniques which reveal that the aforementioned relation is both robust and stable.

**CLASSIFICATION JEL**: F41, H11

**KEY WORDS:** trade openness, public expenditure, cointegration

## 1. INTRODUCTION

The aim of this paper is to empirically determine whether there is a relation between trade openness and public expenditure in Spain in the period 1960-2000, a relatively time period that has witnessed an accelerated process both of openness to the international markets of goods and services and of public sector growth. We begin in 1960, after the application of the Plan of Stabilization and Liberalization of 1959, which initiates the change of the rigidities of the previous autarkic system. The period contains key dates for the Spanish economy like the restoration of democracy and Spain's integration into the European Union. We want to assess whether the parallel evolution of our two variables is a coincidence or not. That is to say, we want to find out if there is really a long-term relation between the openness rates or, alternatively, trade policy decisions and the Spanish public sector.

Our starting hypothesis is based on the seminal and much cited work of Rodrik (1996, 1998). Most experts who support a positive relation between international economic integration and the public economy base their arguments on the hypothesis of compensation proposed by Rodrik. More open economies are exposed to a greater risk, as a result of the possible turbulences in the international markets, which can affect their domestic economy. As the public sector is "the safe" sector of the economy –both in terms of employment and income-, it can exert an isolation function over the external risk that affects the other sectors, increasing its participation in the whole economy. Today, this is a controversial and open subject, in spite of the many empirical studies about it.

In our opinion, the increase of international integration is a long-term dynamic process. In addition, the relation between trade openness, external risk and public expenditure may be idiosyncratic, due to the specific characteristics of each country. Thus, we believe that a time series analysis is more suitable than the usual cross-country analyses. The Spanish case in 1960-2000 might illustrate the fulfilment of the argument of Rodrik because, in this period, Spain experienced an important process of openness to the international economy. This integration involved a risk for many sectors, especially for those that had been more protected. The definitive integration came with the entry of Spain into the European Union, opening her economy to others that, for several reasons, were more developed and competitive. Given this situation, the public

budget was probably used to tackle this new situation. Furthermore, trade liberalization is also based on a "social contract". So, the political authorities had to reach agreements with the economic agents and satisfy their protection requirements.

There are several applied papers about the Spanish economy that deal with the relation between trade openness and government size. One of them was carried out by Gadea (1993), who found, through the cointegration test of Engle and Granger, a positive relation between the two variables in 1964-1991. Another is that of Molana *et al*. (2004), who used the cointegration test of Johansen. Their result was that there was no cointegration between trade openness and public expenditure on good and services in 1948-1998 and that there was no long-term causality. One of the possible reasons for this result, as Molana *et al.* explain, might be the unsuitable measurement of the variables used in their analysis, especially in the case of trade openness.

In this same line, our work is based on a bivariant analysis, to avoid the results being affected by the explanatory variables chosen. We make several contributions. First, we believe that the sample period is more adequate because it begins in 1960, when Spain really initiates the liberalizing process[1]. Second, apart from considering several measures of trade openness, we take into account an issued that is novel in the literature, namely, the link between the protection level and public expenditure[2]. Finally, we apply two tests never before used in the case of Spain. The first is a robustness analysis based on the application of Levine and Renelt (1992) of the extreme bounds test of Leamer (1983, 1985), adding other potentially explanatory variables of expenditure to the bivariant VAR. The second is a Hansen and Johansen (1993, 1999) stability analysis to reveal whether the relation is stable or affected by some structural change. We find a positive and significant long-term relation between several indicators of trade openness and public expenditure, and this relation is both robust and stable.

[1] Molana *et al.* (2004) carried out a study of 22 OECD countries apart from Spain, in which the integration process was earlier. Besides, the considered range of countries forced them to use the public expenditure on goods and services.
[2] In general, the most used measure is total trade as a percentage of GDP in current terms.

This paper is divided as follows. In the second section, we carry out a survey of the literature about the relation between trade openness and public expenditure, emphasizing arguments that have provoked an intense debate. In the third section we describe the trade liberalization and public sector growth in the Spanish economy for the period under study. The empirical results are shown in the fourth section. Finally, we sum up the main conclusions of this work.

## 2. EMPIRICAL LITERATURE

Cameron (1978) was the pioneer empirical analysis, where the author directly linked the level of openness and public sector size. The motivation for his analysis was the spectacular increase of the public sector in the developed countries, especially after the Second World War, when the welfare State began to be consolidated. One of the main results of his analysis, through a sample of 18 developed capitalist countries in 1960-1975, is that trade openness is one the most important variables to explain the public economy expansion. The reason, as Cameron (1978) said, is that open economies are very competitive and have a high industrial concentration. This higher level of specialization favours union organization, which increases social public incomes. Based on the same period -after the WWII-, Swank (1983) considers several explanations of the welfare State increase in 17 developed democracies. The aim of this author is to test the argument of Cameron (1978). He includes variables of interest groups in the reference model of Cameron, and finds that the openness variable remains positive and significant. So, the author argues, the link through which trade openness affects the welfare State may be the intervention of the State to tackle the pressures of the global market.

Schmidt (1983), through a cross-country and time series analysis in 22 developed economies, finds a positive relation between trade openness and taxes and social security contributions -as a percentage of GDP- in three different periods. The first is that of the post-war reconstruction, 1950-1960; the second is that used by Cameron, 1960-1975; and the third is that of the world economic crisis, 1974-1978. Using the panel data technique, Hicks and Swank (1992) find a positive relation between trade

openness and welfare spending in 18 developed countries in 1960-1982[3]. The same result is found in the paper of Huber *et al.* (1993), which is also applied to 18 developed economies, although they study 1956-1988.

As the papers mentioned so far that analyze the link between openness and public expenditure share a political approach and were usually carried out in countries with a high level of economic and social development (like those of the OECD).

In the seminal and much cited work of Rodrik (1996, 1998), a new view of the link between openness and expenditure through external risk was developed. The idea behind it is that more open economies are exposed to a higher external risk derived from the possible shocks in the international markets and that, to mitigate this external risk, governments increase public expenditure. Through a cross-country analysis, he finds a positive relation between the openness of the eighties (1980-89) and the public expenditure on goods and services of the early nineties (1990-92), for a sample of 103 countries[4]. As there is a wide range of explicative variables, this is not a spurious relation due to the omission of variables. The sample is very large, so this relation is not due to either to the choice or source of data. The relation holds for different periods and different measures of public sector. The analysis also includes a wide range of control variables to test the robustness of the link between openness and expenditure. Later, in larges samples but with longer periods of study, other works have supported the positive relation between trade openness and public expenditure, like those of Garrett (2001), Martínez-Mongay (2002), Shelton (2007) and Gemmell *et al.* (2008).

Because of the intense debate about this subject, it is necessary to explain the contrary or alternative arguments to the paper of Rodrik (1998). Authors like Ferris and West (1996) find a negative relation between trade openness and public expenditure in the United States between 1959 and 1986[5]. They propose that international integration involves more tax competition and, because of this, governments have less capacity to increase taxes -especially capital tax- so the size of the public sector is also restricted. In this same line, Ferris (2003) and Borcherding *et al.* (2004) support this negative link in

[3] Again in line with the postulates of Cameron (1978), that is to say, the idea of that the link openness-expenditure is derived from specialization and interest groups.
[4] The aforementioned positive relation between trade openness and public expenditure on goods and services is found in a panel data analysis as well.
[5] On the contrary, Abizadeh (2005) finds a positive relation between trade openness and public expenditure in the United States in period 1960-2000.

20 OECD countries in 1970-1997[6]. However, this idea had already been considered by Rodrik (1997) himself, who found empirical evidence -in 18 OECD countries in 1965-1991- that more economic integration moves the tax burden from mobile factors (capital) to relatively immobile factors (labour). Other authors, like Iversen and Cusack (2000), Kittel and Winner (2005) and Dreher (2006, 2008) show that there is no any relation between globalization and public sector size in OECD countries.

Another alternative argument about the theorical link between trade openness and expenditure, is derived from the work of Saunders and Klau (1985), and has to do with economies of scale in the provision of public goods and services. In Alesina and Wacziarg (1998) the idea that trade openness and public expenditure on goods and services are linked through external risk, as Rodrik (1996) suggests, is questioned. In their opinion, the link between openness and expenditure is country size. Firstly, smaller economies can not obtain benefits from access to big markets unless they adopt open trade policies. Furthermore, smaller countries that can not take advantage of scale economies in the provision of public goods have bigger public sector. They add the population variable to the reference specification of Rodrik (1996) and obtain some evidence of this idea. Nevertheless, the authors point out that there is a high level of colinearity between openness and country size, so it is difficult to draw definitive conclusions. To study the sensitivity of the relation between openness, country size and public sector size proposed by Alesina y Wacziarg (1998), Ram (2008) carries out a panel data study of 154 countries and the period 1960-2000[7]. His main result is that trade openness exerts a positive and significant effect on public expenditure on goods and services, once country size is controlled for.

In any case, as Alesina and Wacziarg (1998) state, these points of view are not necessarily contradictory. Country size may be negatively related to public expenditure on goods and services at the same time as trade openness exerts a direct effect on public transferences. The important thing, because it reconciles both points of view, is that the stabilizing role of government in open economies should be specifically analyzed through public expenditure on transfers.

[6] Álvarez, Pascual and Romero (2003) find a negative relation between trade openness and total public expenditure in the EU-15 between 1998 and 2000. Nonetheless, this empirical evidence is based on a simple analysis of coefficients of correlation.

[7] Simplifying the reference equation of Alesina and Wacziarg (1998) and Rodrik (1998), because the only control variable is GDP per capita.

## 3. PROCESS OF OPENNESS AND PUBLIC EXPENDITURE GROWTH IN SPAIN

1959 is a key date in the Spanish economy because the Plan of Stabilization and Liberalization (PEL) ended the autarkic period of Franco and initiated a liberalizing course. Within the field of trade policy, a progressive reduction of quantitative restrictions was developed, which were replaced by border taxes. From then on and until the beginning of the third stage of the Economic and Monetary Union, external openness has been growing, although with a slightly irregular path.

Between 1960 and 1975, the main trade barriers which were used to protect national production were import taxes, regimens of globalised, bilateral and State trade and the Compensation Tax of Internal Burden. The process of trade liberalization started from this very regulated trade system.

After 1975, and in a context of international economic crisis, the openness of Spanish economy underwent a reversal, with levels of protection -import taxes divided by non-energy imports- similar to those of 1966. This backward step was due to the elimination of prior measures -tariff exemptions and subsidies- in order to avoid substantial trade deficit. In 1977, adhesion to the European Economic Community (EEC) was applied for again and the Moncloa Pacts were signed, which allowed and advance in the liberalizing process. However, between 1978 and 1985, protection only decreased a little, being trade policy influenced by the preagreement to EEC access.

By 1985, trade openness had increased importantly, as nominal protection had decreased from 16.5% in 1960 to 9.3%. Nevertheless, the integration of Spain into the EEC was the definitive impulse for trade liberalization, with a reduction of protection which Spain has never gone back. Agreements in the Treaty of Adhesion involved a great transformation of the protection system. First, with the extinction of the regimen of administrated trade. Second, with the extinction of border tax adjustments, that were replaced by VAT, and a more active policy of export promotion. And finally, with a dismantling of tariffs for all EEC members, who are our principal suppliers, and the adoption of a Common External Tariff applied to other countries outside the EEC, which had a lower average level than the Spanish one. From then on, trade openness

increased as never before and, in the early nineties, the process of trade liberalization was practically completed.

In a parallel process, a stage of public sector growth started in 1960, reaching similar levels to those of other developed countries at present. In 1960-1975, a slight modernization of Spanish public sector is undertaken, decreasing classic functions of the State and increasing the participation of preferential and economic goods. However, as with the expansion of openness, an institutional event, in this case the restoration of democracy caused the greatest growth in expenditure. The maximum point was achieved in 1993, when a policy of budgetary control was initiated to advance towards the euro. In this sense, we can talk about a parallel evolution of public expenditure and trade openness, as both of them started from reduced levels and then underwent a dramatic increase in a relatively short time (Figure 1). Or alternatively, we can talk about an asymmetric evolution of public expenditure over GDP and nominal protection rate (Figure 2).

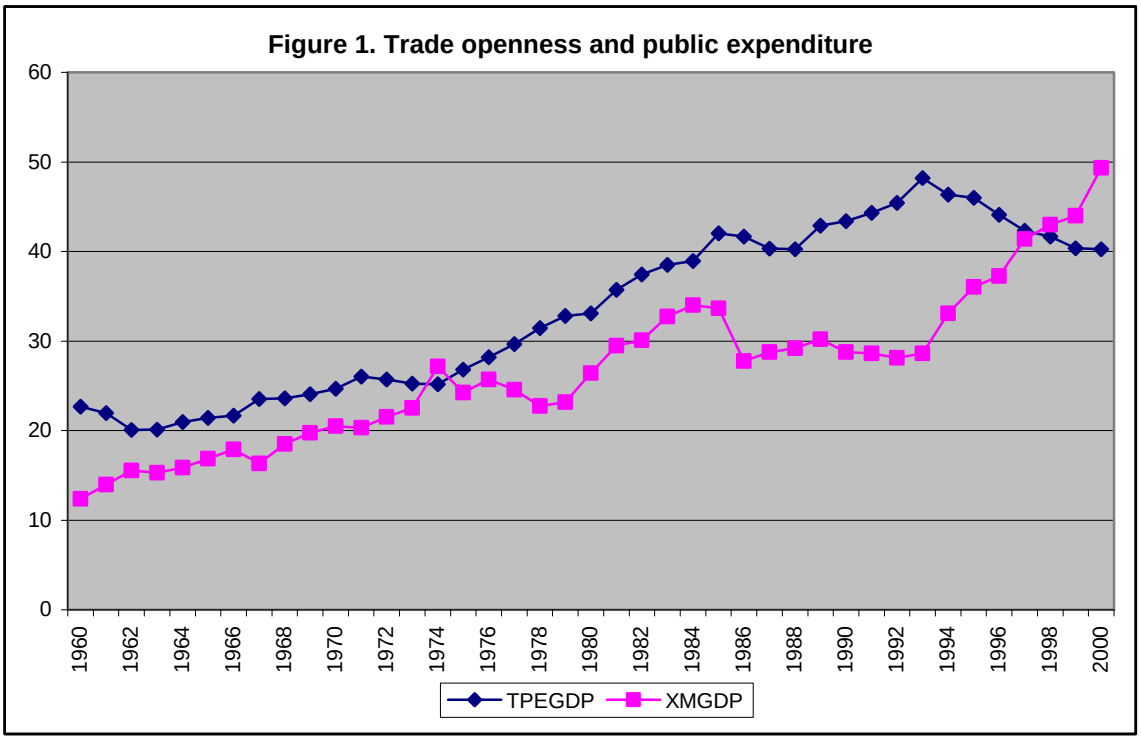


Figure 1. Trade openness and public expenditure
60
50
40
30
20
10
0
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
TPEGDP
XMGDP

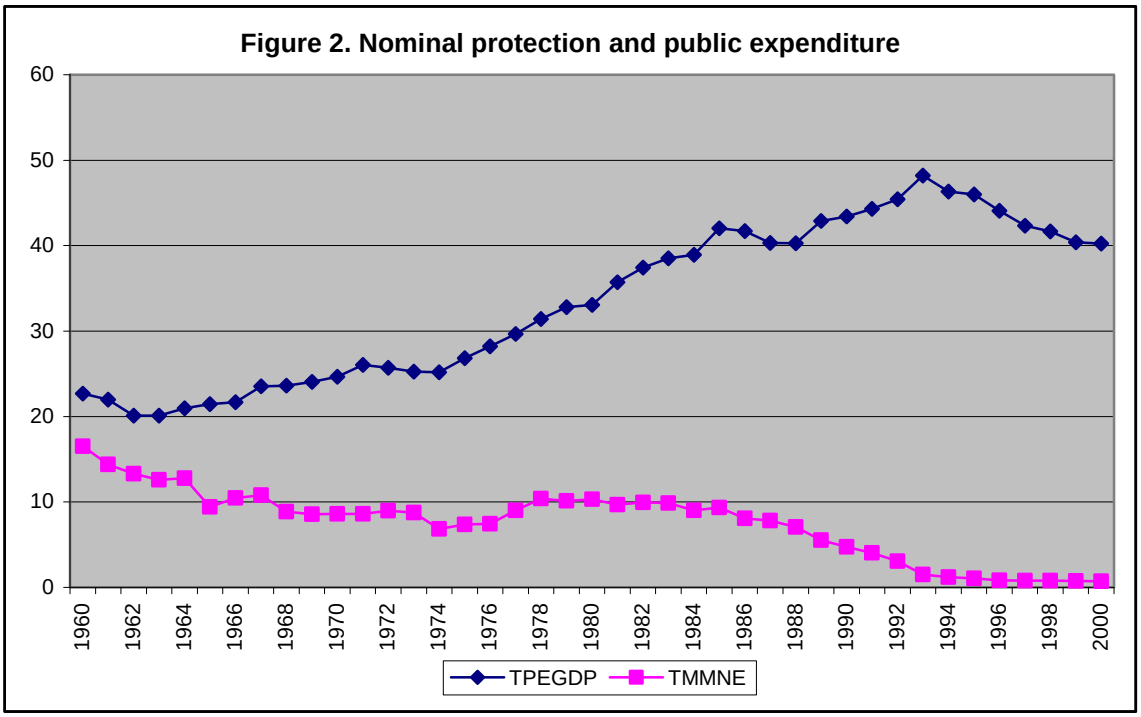


Figure 2. Nominal protection and public expenditure
60
50
40
30
20
10
0
1960
1962
1964
1966
1968
1970
1972
1974
1976
1978
1980
1982
1984
1986
1988
1990
1992
1994
1996
1998
2000
TPEGDP
TMMNE

## 4. RESULTS OF THE ECONOMETRIC ESTIMATION

A very important part of time series study is analyzing the long-term relation between variables which economic theory predicts. This is what we will tackle in this section. Having revised the literature about the relation between trade openness and public expenditure and having carried out a historic and graphic analysis of both series, we will check here if there was a stable relation in the evolution of the two variables in Spain in 1960-2000. First, we describe the variables of external openness, trade policy and public expenditure that we have used. Second, we present the methodology of cointegration used in the econometric analysis and the results derived from it. Third, we apply a robustness test to these results. Finally, we analyze the stability of the link between the two variables.

### 4.1 Variables

In order to capture trade openness we use six variables: total trade and imports of goods over GDP in current terms (XMGDP and MGDP), imports of non-energy goods relative to GDP in current terms (MNEGDP), openness of trade sector (XMGDPCOM) (X+M relative to GDP minus services, in current terms) and total trade and imports of goods relative to GDP, in real terms (XMGDPREAL and MGDPREAL).

We also propose other measures that are supposed to better reflect the protection system of a country. First, import taxes relative to non-energy imports, as an objective measure of Spanish trade policy (TMMNE). Second, we add the component of protection of the Compensation Tax of Internal Burden to the previous measure, in order to reflect the real degree of protection of the economy (TMCPMNE). Third, non tariff barriers, that include both the percentage of imports that were subjected to some sort of control (REGTRADE) (regulated trade) and exports tax deduction (XTD) as a percentage of total exports.

The variable representing government size is the traditional ratio of total public expenditure as a percentage of GDP, in current terms (TPEGDP) and social public expenditure as a percentage of GDP, in current terms (SPEGDP).

### 4.2 Analysis of cointegration

The method of cointegration used in this work is the multivariant technique of Johansen, based on the VAR model. The main advantage compared to uniequational methods is that it does not suppose that there is just one direction in the relation studied, as it is a system of equations in which all variables are endogenously fixed. We will first specify a model of two endogenous variables (openness/protection and public expenditure)[8]. The optimum length of the VAR in accordance with the AIC and SC criteria, which allows the residuals fulfil the requirements of normality, homoscedasticity and absence of correlation is one lag. The next step involves choosing one out of the five cases proposed by Johansen (1995), in order to make some suppositions about the underlying trend in the data. The analysis of integration order says that series are I(1). Nevertheless, taking into account the arguments of Juselius (2006)[9], the graphic analysis of the variables in levels leads us to consider two possibilities. The first is that they have no trend (model 2) and the second is that the have a stochastic trend (model 3). The SC and AIC criteria select model 2 for XMGDPREAL, MGDPREAL and MNEGDP and model 3 for XMGDP, MGDP and XMGDPCOM.

With the purpose of establishing the number of cointegration vectors, the method of Johansen considers trace and eigenvalue tests. Results of these are shown in Table 1. In the case of XMGDPREAL, MGDPREAL and MNEGDP both trace and eigenvalue tests reject the null hypothesis of no cointegration in favour of a relation of cointegration, since the result is higher than the critical value. However, for XMGDP, MPIBGDP and XMGDPCOM, there is no cointegration.

[8] Previously, we carry out a stationarity analysis through unit root tests, which reveal that all of the indicators used are I(1).

[9] We should think that out time series are stationary because, being ratios, they are bounded and, thus, have no trend. However, it is also very important to take into account temporal dimension when carrying out a macroeconomic study. If the perspective is long-term -for example a century-, the series are usually stationary. But in medium and short-term, most macroeconomic variables have a trend, because there has not been time for the deviations to adjust to adjust to the average. Such non stationary behaviour should be taken into account in statistical analysis so as not to reach mistaken conclusions. According to Juselius (2006), considering these variables as non stationary also offers a good empirical approximation so as to be able to use the properties of cointegration technique.

| Table 1. Cointegration test of Johansen: Total public expenditure and trade openness, 1960-2000 | | | | | |
|---|---|---|---|---|---|
| **Cointegration based on max eigenvalues:** | | | | | |
| **Endogenous Variable** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistic** | **Critical Value 5%** | **Probability** |
| XMGDP | r=0 | r≥1 | 3.45 | 14.26 | 0.91 |
| MGDP | r=0 | r≥1 | 9.76 | 14.26 | 0.23 |
| XMGDPCOM | r=0 | r≥1 | 1.48 | 14.26 | 0.99 |
| XMGDPREAL | r=0 | r≥1 | 58.03 | 15.89 | 0.00 |
| | r≤1 | r=2 | 0.86 | 9.16 | 0.97 |
| MGDPREAL | r=0 | r≥1 | 46.72 | 15.89 | 0.00 |
| | r≤1 | r=2 | 1.88 | 9.16 | 0.80 |
| MNEGDP | r=0 | r≥1 | 36.03 | 15.67 | 0.00 |
| | r≤1 | r=2 | 1.32 | 9.24 | 0.90 |
| **Cointegration based on trace of stochastic matrix** | | | | | |
| **Endogenous Variable** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistic** | **Critical Value 5%** | **Probability** |
| XMGDP | r=0 | r≥1 | 4.72 | 15.49 | 0.84 |
| MGDP | r=0 | r≥1 | 12.69 | 15.49 | 0.13 |
| XMGDPCOM | r=0 | r≥1 | 1.93 | 15.49 | 0.99 |
| XMGDPREAL | r=0 | r≥1 | 58.88 | 20.26 | 0.00 |
| | r≤1 | r=2 | 0.86 | 9.16 | 0.97 |
| MGDPREAL | r=0 | r≥1 | 48.59 | 20.26 | 0.00 |
| | r≤1 | r=2 | 1.88 | 9.16 | 0.80 |
| MNEGDP | r=0 | r≥1 | 37.35 | 20.26 | 0.00 |
| | r≤1 | r=2 | 1.32 | 9.16 | 0.90 |

The relation between the cointegrated variables adjusts, according to the first vector of the cointegration test, to the following terms:

$$\underset{(1,98)}{LTPEGDP = -2,71} + \underset{(2,57)}{1,10LXMGDPREAL}$$

$$\underset{(2,31)}{LTPEGDP = -2,35} + \underset{(4,18)}{1,56LMGDPREAL}$$

$$\underset{(2,56)}{LTPEGDP = -5,19} + \underset{(3,55)}{2,82LMNEGDP}$$

with t-ratios in brackets.

Of the variables in current terms, only the non-energy imports (MNEGDP) present cointegration. On the contrary, total trade and imports in real terms (XMGDPREAL and MGDPREAL) have a long-term relation with public expenditure and, in addition, their coefficients are significant and have the expected sign. We have determined, therefore, that there is a positive and long-term relation between trade openness and public

expenditure. Nevertheless, as can be seen in Table 2, the positive sign of the coefficient of the error correction term makes this cointegration relation doubtful.

**Table 2. Coefficients of adjustment in equation ΔGPTPIB ($\alpha_2$)**

| XMGDPREAL | MGDPREAL | MNEGDP |
|---|---|---|
| 0.005<br>(2.36) | 0.008<br>(2.21) | 0.008<br>(2.24) |

All these results are supported when the measures of openness are replaced by measures of trade policy. Table 3 shows the results of the test of Johansen, where we can see that with both statistics there is a relation of cointegration between public expenditure and all the measures of trade policy.

**Table 3. Cointegration test of Johansen:**
**Total public expenditure and measures of trade policy, 1960-2000**

**Cointegration based on max eigenvalues:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| TMMNE | r=0<br>r≤1 | r≥1<br>r=2 | 19.05<br>6.37 | 15.89<br>9.16 | 0.02<br>0.16 |
| TMCPMNE | r=0<br>r≤1 | r≥1<br>r=2 | 21.91<br>8.58 | 15.89<br>9.16 | 0.01<br>0.06 |
| REGTRADE | r=0<br>r≤1 | r≥1<br>r=2 | 18.37<br>2.32 | 15.89<br>9.16 | 0.02<br>0.71 |
| XTD | r=0<br>r≤1 | r≥1<br>r=2 | 23.13<br>5.62 | 15.89<br>9.16 | 0.00<br>0.22 |

**Cointegration based on trace of stochastic matrix**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| TMMNE | r=0<br>r≤1 | r≥1<br>r=2 | 25.42<br>6,37 | 20.26<br>9.16 | 0.01<br>0.16 |
| TMCPMNE | r=0<br>r≤1 | r≥1<br>r=2 | 30.49<br>8.58 | 20.26<br>9.16 | 0.00<br>0.06 |
| REGTRADE | r=0<br>r≤1 | r≥1<br>r=2 | 20.69<br>2.32 | 20.26<br>9.16 | 0.04<br>0.71 |
| XTD | r=0<br>r≤1 | r≥1<br>r=2 | 28.75<br>5.62 | 20.26<br>9.16 | 0.00<br>0.22 |

The relation between the cointegrated variables, according to the first vector of the cointegration test, is the following:

LTPEGDP = 3.45 - 0.26LTMMNE
(14.92) (2.21)

LTPEGDP = 3.50 - 0.21LTMCPMNE
(20.42) (2.55)

LTPEGDP = 3.77 - 0.22LREGTRADE
(48.59) (7.34)

LTPEGDP = 3.82 - 0.36LXTD
(32.81) (5.91)

Their coefficients are significant and have the expected negative sign. According to Table 4, as with openness, the correction term is positive.

**Table 4. Coefficients of adjustment in equation ΔGPTPIB ($\alpha_2$)**

| TMMNE | TMCPMNE | REGTRADE | XTD |
|---|---|---|---|
| 0.04<br>(2.60) | 0.04<br>(2.52) | 0.06<br>(2.35) | 0.05<br>(3.81) |

Because of these results, we decided to assess the possibility that by not having considered the important institutional change of the restoration of democracy in 1977, the estimation was distorted. For this reason, we decided to repeat the earlier analysis, adding a dummy variable (DEMO), which takes value 0 for any year between 1960 and 1977 and value 1 from 1978 on. With this we try to capture the effect of the restoration of democracy on the growth of expenditure. When introducing this dummy, the results of the test of Johansen remain the same, that is to say, XMGDPREAL, MGDPREAL and MNEGDP are the variables that have a relation of cointegration with expenditure, as can be seen in Table 5.

| Table 5. Cointegration test of Johansen: Total public expenditure, trade openness and democracy, 1960-2000 | | | | | |
|---|---|---|---|---|---|
| **Cointegration based on max eigenvalues:** | | | | | |
| **Endogenous Variable** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistic** | **Critical Value 5%** | **Probability** |
| XMGDP | r=0 | r≥1 | 6.38 | 14.26 | 0.57 |
| MGDP | r=0 | r≥1 | 11.45 | 14.26 | 0.13 |
| XMGDPCOM | r=0 | r≥1 | 5.11 | 14.26 | 0.73 |
| XMGDPREAL | r=0 | r≥1 | 39.00 | 15.89 | 0.00 |
| | r≤1 | r=2 | 3.67 | 9.16 | 0.46 |
| MGDPREAL | r=0 | r≥1 | 34.40 | 15.89 | 0.00 |
| | r≤1 | r=2 | 5.08 | 9.16 | 0.27 |
| MNEGDP | r=0 | r≥1 | 23.68 | 15.89 | 0.00 |
| | r≤1 | r=2 | 3.96 | 9.16 | 042 |
| **Cointegration based on trace of stochastic matrix** | | | | | |
| **Endogenous Variable** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistic** | **Critical Value 5%** | **Probability** |
| XMGDP | r=0 | r≥1 | 7.69 | 15.49 | 0.49 |
| MGDP | r=0 | r≥1 | 16.57 | 15.49 | 0.03 |
| | r≤1 | r=2 | 5.12 | 3.84 | 0.02 |
| XMGDPCOM | r=0 | r≥1 | 5.81 | 15.49 | 0.72 |
| XMGDPREAL | r=0 | r≥1 | 42.68 | 20.26 | 0.00 |
| | r≤1 | r=2 | 3.67 | 9.16 | 0.46 |
| MGDPREAL | r=0 | r≥1 | 39.49 | 20.26 | 0.00 |
| | r≤1 | r=2 | 5.08 | 9.16 | 0.27 |
| MNEGDP | r=0 | r≥1 | 27.64 | 20.26 | 0.00 |
| | r≤1 | r=2 | 3.96 | 9.16 | 0.42 |

LTPEGDP = 11.41 - 1.42LXMGDPREAL
(3.86) (1.29)

LTPEGDP = 13.79 - 2,90LMGDPREAL
(5.29) (2.62)

LTPEGDP = 10.56 - 2.43LMNEGDP
(4.66) (2.58)

However, the relation between expenditure and openness is negative, in contrast to the positive nexus found previously. In the case of the protection measures, only tax deduction maintains its relation of equilibrium. And, although the sign of this variable is the expected one and causality runs from protection to expenditure, the adjustment coefficient is positive.

The following step was to investigate whether this lack of influence was due to the relation having undergone significant changes during those four decades. The procedure consists of elaborating graphs of the coefficients of the significant variables derived from a recursive estimation, that is to say, a repeated estimation that uses ever wider subsamples from the sample period. If these coefficients fluctuate a lot, it will be an indication of a possible instability. Figures 3, 4 and 5 show the evolution of the coefficient that relates different measures of openness to expenditure, without considering the institutional change of 1977. The results point to a clear lack of stability, which could be related to the unexpected sign of the error correction term. With the inclusion of the variable DEMO in Figures 6, 7 and 8, a stable relation between the two variables is found until the mid nineties. From then on, there is an instability that seems to be the cause of the aforementioned negative sign.

**Figure 3. Recursive estimation of XMGDPREAL**

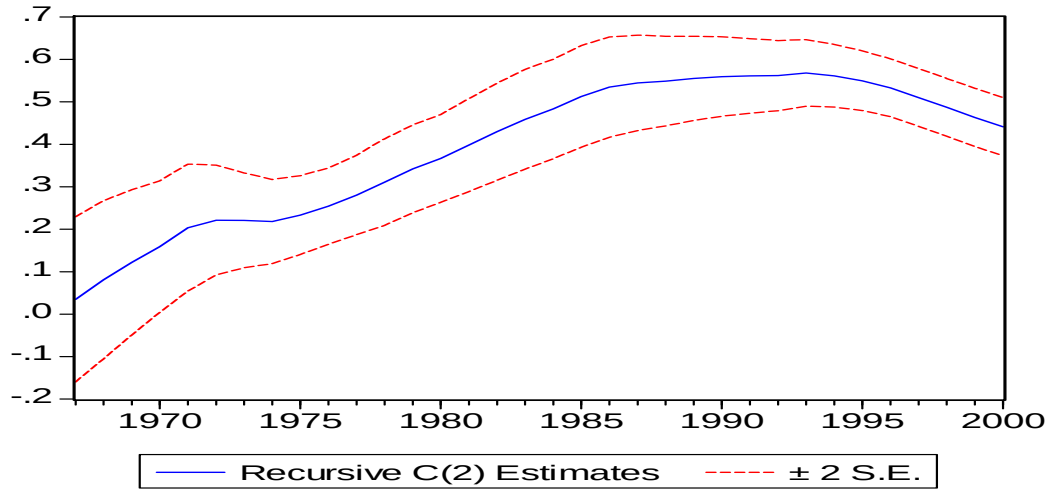



**Figure 4. Recursive estimation of MGDPREAL**

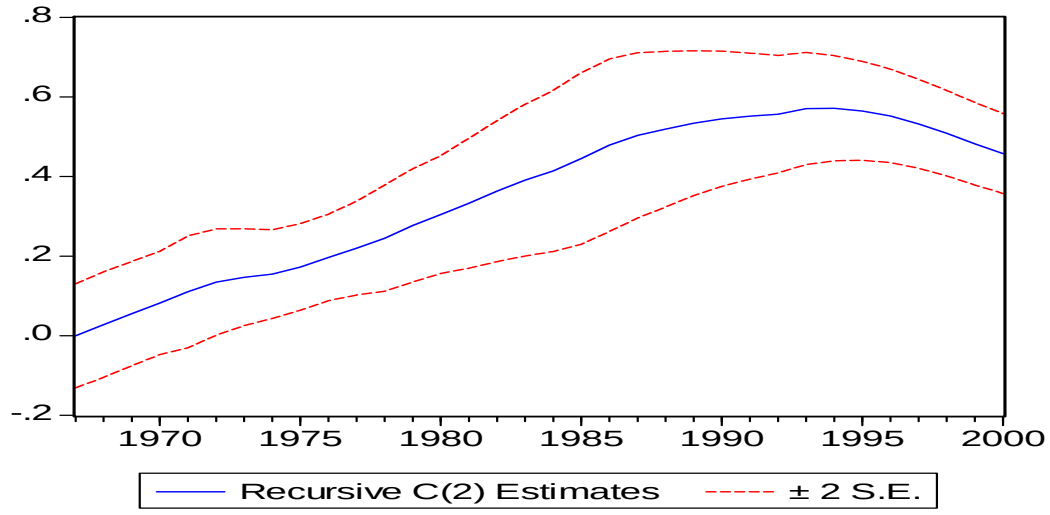



**Figure 5. Recursive estimation of MNEGDP**

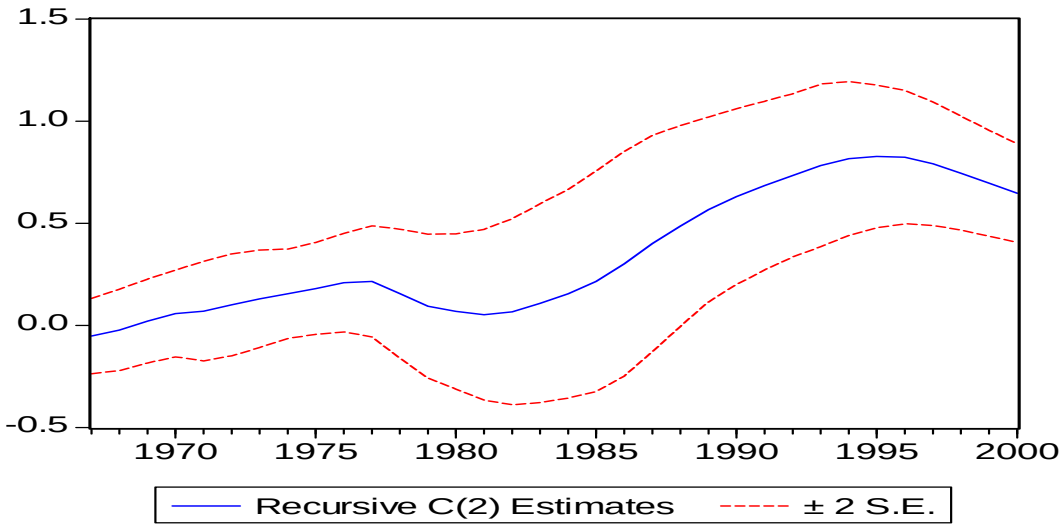


**Figure 6. Recursive estimation of XMGDPREAL (including DEMO)**

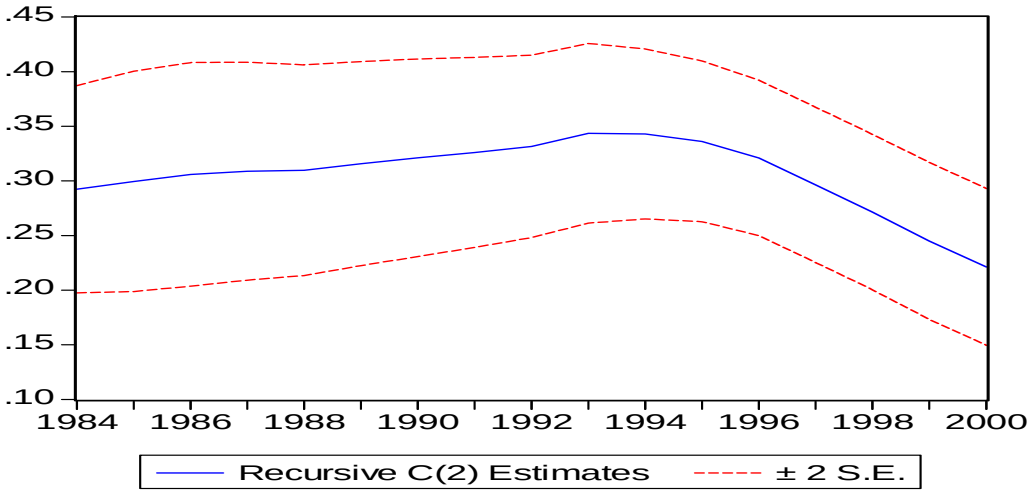



**Figure 7. Recursive estimation of MGDPREAL (including DEMO)**

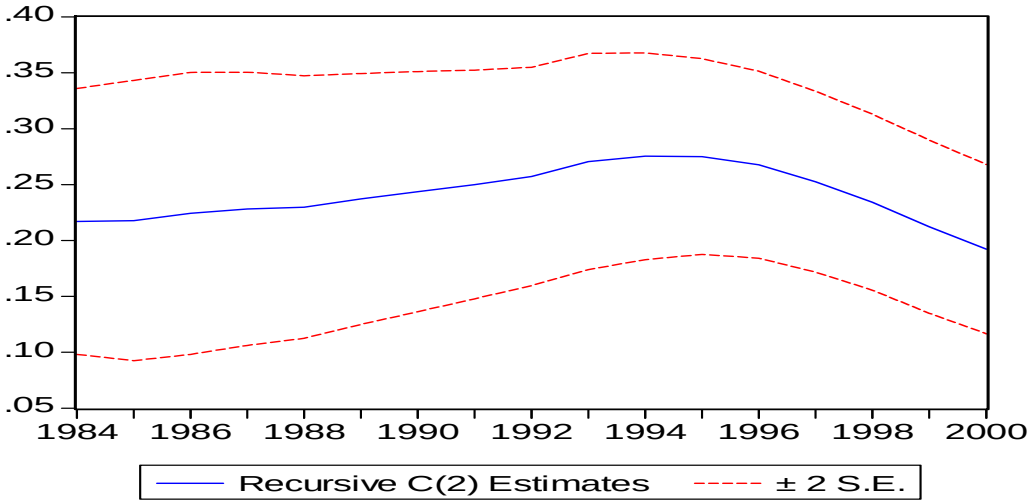
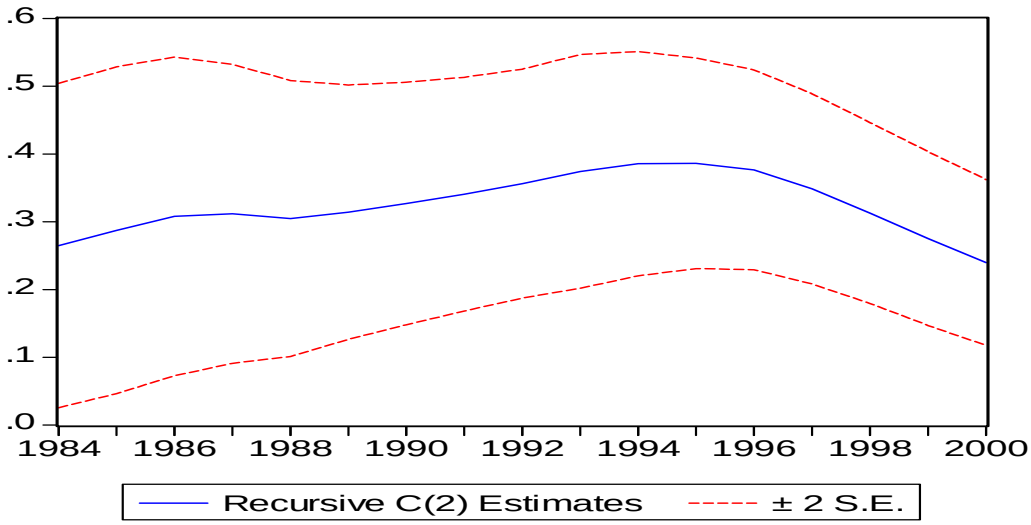



**Figure 8. Recursive estimation of MNEGDP (including DEMO)**



These results are confirmed if we repeat all the analysis for the period 1960-1993. The final year has been chosen because of both the complete trade integration of Spain into the EU and the beginning of an intense period of budgetary consolidation, with a view towards integration into the EMU. We repeat the analysis of cointegration including the dummy in the VAR and maintaining the optimal length, although, in this case, the information criteria choose model 3 for all the measures of openness and protection. The institutional coherence of this analysis is also reflected in econometric terms. Now all the measures of openness show cointegration with public expenditure (as can be seen in Table 6).

**Table 6. Cointegration test of Johansen:**
**Total public expenditure, trade openness and democracy, 1960-1993**

**Cointegration based on max eigenvalues:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| XMGDP | r=0 | r≥1 | 13.92 | 14.26 | 0.06 |
| MGDP | r=0 | r≥1 | 24.33 | 14.26 | 0.00 |
| | r≤1 | r=2 | 2.63 | 3.84 | 0.11 |
| XMGDPCOM | r=0 | r≥1 | 18.64 | 14.26 | 0.01 |
| | r≤1 | r=2 | 2.70 | 3.84 | 0.10 |
| XMGDPREAL | r=0 | r≥1 | 18.19 | 14.26 | 0.01 |
| | r≤1 | r=2 | 1.37 | 3.84 | 0.24 |
| MGDPREAL | r=0 | r≥1 | 19.52 | 14.26 | 0.01 |
| | r≤1 | r=2 | 1.66 | 3.84 | 0.19 |
| MNEGDP | r=0 | r≥1 | 16.13 | 14.26 | 0.02 |
| | r≤1 | r=2 | 1.65 | 3.84 | 0.19 |

**Cointegration based on trace of stochastic matrix:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| XMGDP | r=0 | r≥1 | 15.60 | 15.49 | 0.04 |
| | r≤1 | r=2 | 1.68 | 3.84 | 0.19 |
| MGDP | r=0 | r≥1 | 26.96 | 15.49 | 0.00 |
| | r≤1 | r=2 | 2.62 | 3.84 | 0.10 |
| XMGDPCOM | r=0 | r≥1 | 21.34 | 15.49 | 0.01 |
| | | r=2 | 2.70 | 3.84 | 0.10 |
| XMGDPREAL | r=0 | r≥1 | 19.56 | 15.49 | 0.01 |
| | r≤1 | r=2 | 1.37 | 3.84 | 0.24 |
| MGDPREAL | r=0 | r≥1 | 21.18 | 15.49 | 0.01 |
| | r≤1 | r=2 | 1.66 | 3.84 | 0.19 |
| MNEGDP | r=0 | r≥1 | 17.78 | 15.49 | 0.02 |
| | r≤1 | r=2 | 1.65 | 3.84 | 0.19 |

LTPEGDP = 0.96LXMGDP
(5.37)

LTPEGDP = 1.41LMGDP
(6.69)

LTPEGDP = 0.67LXMGDPCOM
(7.94)

LTPEGDP = 0.49LXMGDPREAL
(7.92)

LTPEGDP = 0.59LMGDPREAL
(6.65)

LTPEGDP = 1.06LMNEGDP
(5.58)

All the variables of openness have the predicted sign and are significant. In addition, the sign of the error correction mechanism supports the cointegration relation (Table 7).

**Table 7. Coefficients of adjustment in equation ΔGPTPIB ($\alpha_2$)**

| XMGDP | MGDP | XMGDPCOM | XMGDPREAL | MGDPREAL | MNEGDP |
|---|---|---|---|---|---|
| -0.16<br>(3.62) | -0.11<br>(4.54) | -0.27<br>(4.50) | -0.29<br>(4.55) | -0.17<br>(4.04) | -0.12<br>(3.20) |

In the case of measures of protection, only taxes on imports have a long-term relation with expenditure.

LTPEGDP = -0.65LTMMNE
(5.61)

But this variable also has the same characteristics as the measures of openness in terms of the expected sign of the coefficient and the error correction term.

We have, therefore, determined that there is a positive long-term relation between trade openness and government expenditure. The following step will be to establish the direction of causality between the two variables, since cointegration does not establish the direction. The causality concept was initially proposed by Granger (1969), considering that a variable *x* causes another variable *y* if the present and past behaviour of *x* allows us to predict the behaviour of *y*. This analysis can be carried out with autoregressive vectors (VAR) through Wald tests. Nevertheless, in cointegrated VAR,

the usual tests of causality can lead to erroneous results, since they were initially considered for stationary series. Extended tests of causality (of long-term) of Granger (1988) arose from the theory of cointegration and its relation to the Error Correction Model:

$$\Delta OP_t = \mu_1 + \alpha_1 ECM + \sum_{i=1}^{k} \gamma_i \Delta OP_{t-i} + \sum_{i=1}^{k} \phi_i \Delta \mathrm{PE}_{t-i} + \varepsilon_{1t}$$

$$\Delta GP_t = \mu_2 + \alpha_2 ECM + \sum_{i=1}^{k} \gamma_i \Delta \mathrm{PE}_{t-i} + \sum_{i=1}^{k} \phi_i \Delta \mathrm{OP}_{t-i} + \varepsilon_{2t}$$

where ECM stands for the error correction mechanism, which is the lagged residual of the cointegration relation. The coefficients of this term ($\alpha_1$ and $\alpha_2$) reflect short-term adjustments towards long-term equilibrium. For there to be long-term causality between the variables, the coefficients $\alpha_i$ will have to be significantly different from zero[10]. Otherwise, there will only be weak or short-term causality. In our case, the Error Correction Model is the following[11]:

$$\Delta OP_t = \alpha_1 [\mathrm{PE}_{t-1} - (\rho_0 \beta OP_{t-1})] + \varepsilon_{1t}$$

$$\Delta \mathrm{PE}_t = \alpha_2 [\mathrm{PE}_{t-1} - (\rho_0 \beta OP_{t-1})] + \varepsilon_{2t}$$

in which we test the null hypothesis $\alpha_i = 0$, that is to say, non causality. In particular, if $\alpha_1 = 0$ and $\alpha_2 \neq 0$, we will say that trade openness causes public expenditure in the long-term in the Granger sense; if $\alpha_1 \neq 0$ and $\alpha_2 = 0$, we will say that public expenditure causes trade openness in the long-term in the Granger sense; and if $\alpha_1 \neq 0$ and $\alpha_2 \neq 0$, we will say that both variables cause each other in the long-term in the Granger sense.

As we can see, long-term causality runs in both directions (Tables 8-13) although, in general, it is stronger from openness to expenditure.

[10] In econometric terms, the analysis of long-term causality is equivalent to the analysis of weak exogeneity of Johansen (1992).
[11] Since we start with a VAR of one lag, the Error Correction Model has zero lags.

| Table 8. Causality test between TPEGDP and XMGDP* | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 4.26 | 0.04 |
| $\alpha_2$ | 10.55 | 0.00 |

* LR test with a rank of cointegration = 1

| Table 9. Causality test between TPEGDP and MGDP | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 14.62 | 0.00 |
| $\alpha_2$ | 15.57 | 0.00 |

| Table 10. Causality test between TPEGDP and XMGDPCOM | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 2.93 | 0.09 |
| $\alpha_2$ | 14.61 | 0.00 |

| Table 11. Causality test between TPEGDP and XMGDPREAL | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 6.15 | 0.01 |
| $\alpha_2$ | 16.02 | 0.00 |

| Table 12. Causality test between TPEGDP and MGDPREAL | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 14.58 | 0.00 |
| $\alpha_2$ | 13.19 | 0.00 |

| Table 13. Causality test between TPEGDP and MNEGDP | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 14.17 | 0.00 |
| $\alpha_2$ | 8.80 | 0.00 |

Furthermore, when we use social public expenditure and the variable DEMO, we also find cointegration with openness in 1960-1993 (Table 14) although, in this case, only with total trade in real terms (XMGDPREAL)[12]. The magnitude of the openness variable is very similar to that of total public expenditure. The sign of the openness variable and of the error correction term are as expected and causality is also bidirectional (Tables 15 and 16).

**Table 14. Cointegration test of Johansen:**
**Social public expenditure, trade openness and democracy, 1960-1993**

**Cointegration based on max eigenvalues:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| XMGDP | r=0 | r≥1 | 11.46 | 14.26 | 0.13 |
| MGDP | r=0 | r≥1 | 21.13 | 14.26 | 0.00 |
| | r≤1 | r=2 | 5.40 | 3.84 | 0.02 |
| XMGDPCOM | r=0 | r≥1 | 11.26 | 14.26 | 0.14 |
| XMGDPREAL | r=0 | r≥1 | 46.16 | 15.89 | 0.00 |
| | r≤1 | r=2 | 7.00 | 9.16 | 0.13 |
| MGDPREAL | r=0 | r≥1 | 48.67 | 15.89 | 0.01 |
| | r≤1 | r=2 | 11.08 | 9.16 | 0.02 |
| MNEGDP | r=0 | r≥1 | 47.88 | 15.89 | 0.00 |
| | r≤1 | r=2 | 9.23 | 9.16 | 0.05 |

**Cointegration based on trace of stochastic matrix**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| XMGDP | r=0 | r≥1 | 13.02 | 15.49 | 0.11 |
| MGDP | r=0 | r≥1 | 26.53 | 15.49 | 0.00 |
| | r≤1 | r=2 | 5.40 | 3.84 | 0.02 |
| XMGDPCOM | r=0 | r≥1 | 12.41 | 15.49 | 0.14 |
| XMGDPREAL | r=0 | r≥1 | 53.16 | 20.26 | 0.00 |
| | r≤1 | r=2 | 7.00 | 9.16 | 0.13 |
| MGDPREAL | r=0 | r≥1 | 59.74 | 20.26 | 0.01 |
| | r≤1 | r=2 | 11.07 | 9.16 | 0.02 |
| MNEGDP | r=0 | r≥1 | 57.10 | 20.26 | 0.00 |
| | r≤1 | r=2 | 9.23 | 9.16 | 0.05 |

$$\underset{}{LSPEGDP} = \underset{(7.45)}{1.67} + \underset{(5.18)}{0.44}LXMGDPREAL$$

[12] The same analysis, with and without including DEMO in 1960-2000, show very similar results when using social public expenditure. These results appear in the Annex.

| Table 15. Causality test between SPEGDP and XMGDPREAL* | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 18.04 | 0.00 |
| $\alpha_2$ | 17.83 | 0.00 |

* LR test with a rank of cointegration = 1

| Table 16. Coefficients of adjustment in equation ΔGPTPIB ($\alpha_2$) | | | | | |
|---|---|---|---|---|---|
| XMGDP | MGDP | XMGDPCOM | XMGDPREAL | MGDPREAL | MNEGDP |
| | | | -0.14<br>(5.06) | | |

### 4.3 Analysis of robustness and stability

*4.3.1 Robustness*

Our analysis of the bivariant VAR has shown the existence of a relation of cointegration between diverse measures of trade openness/protection and public sector size measured as total expenditure over GDP. Nevertheless, many other variables have been employed to explain public expenditure growth. So, it is important to take into account that, in our case, other factors may have taken part in this growth.

In this section we aim, therefore, to analyze the robustness of the previous results. In order to carry out this exercise, we start from the test of extreme bounds of Leamer (1983, 1985), applied in the much-cited paper of Levine and Renelt (1992) to discriminate between the explanatory factors of economic growth. The methodology consists of estimating of the following equations:

$$\gamma = \alpha_j + \beta_{yj} * y + \beta_{zj} * z + \beta_{xj} * x_j + \varepsilon$$

where $y$ is a vector of fixed variables that always appears in regressions, $z$ is the interest variable and $x_j$ is a vector of up to three variables taken from a set $X$ of possible control variables. This model is estimated for the $M$ possible combinations of $x_j \in X$. For each model j, both $\beta_{zj}$ and the corresponding standard deviation, $\sigma_{zj}$, are estimated. The inferior extreme bound is defined as the smallest value of $\beta_{zj}$ - 2 $\sigma_{zj}$ and the superior

extreme bound as the highest value of $\beta_{zj} + 2\ \sigma_{zj}$. If the inferior bound is negative and the superior bound is positive, then variable $z$ is not robust.

Sala-i-Martin (1997) considers that this methodology is very strict, because, if in one regression the sign of the coefficient $\beta_{zj}$ changes or is not significant, the variable is not robust. So, he considers the complete distribution of the estimators of $\beta_z$. In our case, in line with Fölster and Henrekson (2001), we have calculated the percentage of regressions in which the coefficient of openness/protection has the expected sign, is significant and, in addition, displays cointegration with public expenditure.

Sala-i-Martin (1997) includes three fixed variables and a set of control variables taken in groups of three, arguing that in the literature, the usual regression of growth has seven variables. Here we consider that it is not necessary to include the fixed variables, but we do introduce the groups of three. Gadea (1993) and Jaén and Palma (2004) have demonstrated the existence of four types of explanatory factors of the growth of the Spanish public expenditure: structural, demographic, institutional and economic. Of these variables, with the purpose of carrying out an exercise of robustness, we have chosen six control variables (Table 17). These six variables, combined in groups of three -in order not to lose many degrees of freedom- involve the estimation of 20 equations.

**Table 17. VARIABLES OF CONTROL**

| | | |
|---|---|---|
| GDPPC | GDP per capita in real terms | Economic Factors |
| POP | Total population | Demographic Factors |
| P65 | Percentage of population over 65 | Demographic Factors |
| EA | Percentage of workers employed in the agricultural sector | Structural Factors |
| DPE | Deflator of public expenditure on goods and services over deflator of GDP | Structural Factors |
| DIRTAX | Direct taxes over total taxes | Institutional Factors |

Following the previous steps, we verified that the optimum length of the VAR is still one lag and chose model 3. According to the results of the test (Table 18), the main conclusion is that we can accept that the studied relation is robust, except in the case of total trade in current terms. Results are especially satisfactory for XMGDPCOM, XMGDPREAL and MNEGDP. If we choose criterion B, the relation for import taxes is not robust. However, the criterion applied here is much stricter than the one applied in studies of economic growth due to the econometric methodology of time series where, in addition to the expected sign and significance of the variable of interest, cointegration is also presumed. Therefore, it can be concluded that with measures of openness there is a long-term relation, with the expected sign and robust.

**Table 18. TEST OF ROBUSTNESS*:**
**Total public expenditure, openness/protection and democracy, 1960-1993**

| | Percentages | |
|---|---|---|
| Variables | A | B |
| XMGDP | 30 | 30 |
| MGDP | 45 | 45 |
| XMGDPCOM | 85 | 85 |
| XMGDPREAL | 50 | 45 |
| MGDPREAL | 45 | 40 |
| MNEGDP | 55 | 55 |
| TMMNE | 45 | 25 |

*All equations include total public expenditure and demo.
A Percentage of total equations (20) in which there is cointegration and the sign of openness/protection is expected and significant.
B Percentage of total equations (20) in which there is cointegration, the sign of openness/protection is expected and significant and the coefficient of adjustment fulfils the cointegration requirements.

The best behaviour of the expected sign of considered factors corresponds to the structural variables, but the demographic effect and direct taxes are also important. GDPPC, on the other hand, has a negative coefficient. We should also highlight that we do not find clear evidence that openness is catching the effect of the variable population on expenditure.

We repeat the same analysis for the relation of cointegration found between social public expenditure and total trade in real terms. In this case, the relation is no robust (Table 19).

| Table 19. TEST OF ROBUSTNESS*: Social public expenditure, openness/protection and democracy, 1960-1993 | | |
|---|---|---|
| | Percentages | |
| Variables | A | B |
| XMGDPREAL | 35 | 35 |

*4.3.2 Stability*

The question of structural changes is very usual in a time series context and has been studied by many authors from the point of view of unit roots[13]. Nevertheless, tests proposed in the econometrical literature to study the stability of the relation of cointegration between variables are more recent. A simple way to analyze the stability of parameters through the OLS model is to apply the classic test of Chow (1960), that is to say, dividing the sample into two groups and test whether there are important differences in estimated equations. Other more complex tests, also based on uniequational models, are those developed by Hansen (1992) and Gregory and Hansen (1996). The first is based on the FM estimator of residuals and the second is an extension of the test of cointegration of Engle and Granger (1987). Both of them allow us to find the point in time at which the structural change occurs.

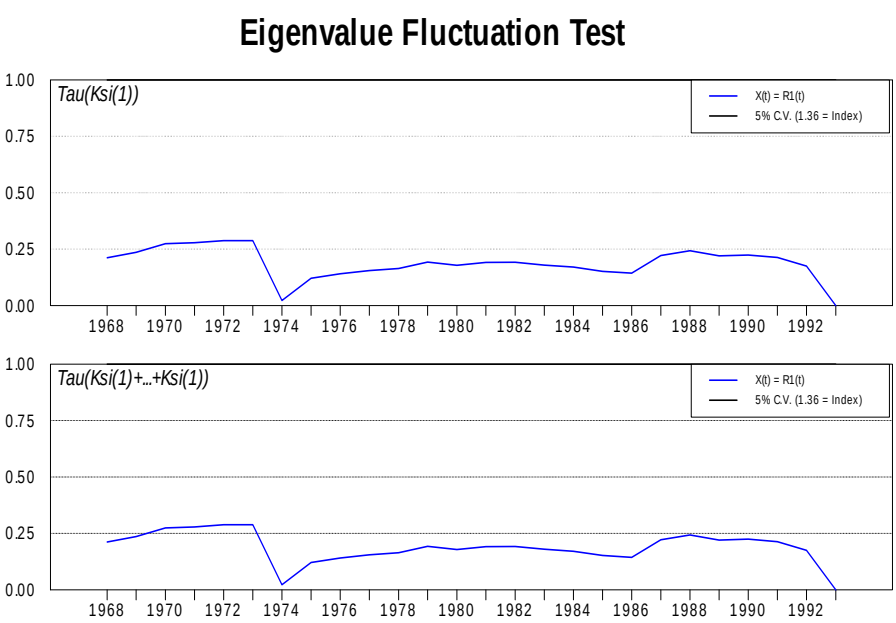
In our case, the considered break point is the restoration of democracy, as it makes possible the materialization of demands of public expenditure through the voting mechanism. After including the dummy variable DEMO in the VAR and restricting the end of the sample period to 1993, the results of the analysis are satisfactory in terms of cointegration and robustness. We then continue testing the stability of the estimated parameters[14]. Given the approach followed, namely, that of a cointegrated VAR, we apply recursive estimation of Hansen and Johansen (1993, 1999). This method starts from a base period, 1... $T_0$, from which eigenvalues, parameters and statistics are recursively estimated in increasing subsamples 1.... ,n with n = $T_0$... ,T. Calculations are carried out in two ways: allowing all parameters to vary (X-Model) and restimating only the long-term parameters (R-Model). In general, the scale of the test statistics is the critical value of 5%, so a value greater than one is significant and indicates non-stability.

[13] Perron (1989), Zivot and Andrews (1992) and Lee and Strazicich (2003), among others.
[14] In 1960-1993 and for robust indicators.

In Figure 9, we show the results of the test of fluctuation of both the transformed eigenvalues and their sum. Dennis (2006) indicates that this test is considered to be quite conservative, so its rejection is a strong indication of the non-constancy of eigenvalues. As can be observed, according to the results of this test, the hypothesis of stability is clearly accepted for the robust indicators of openness.

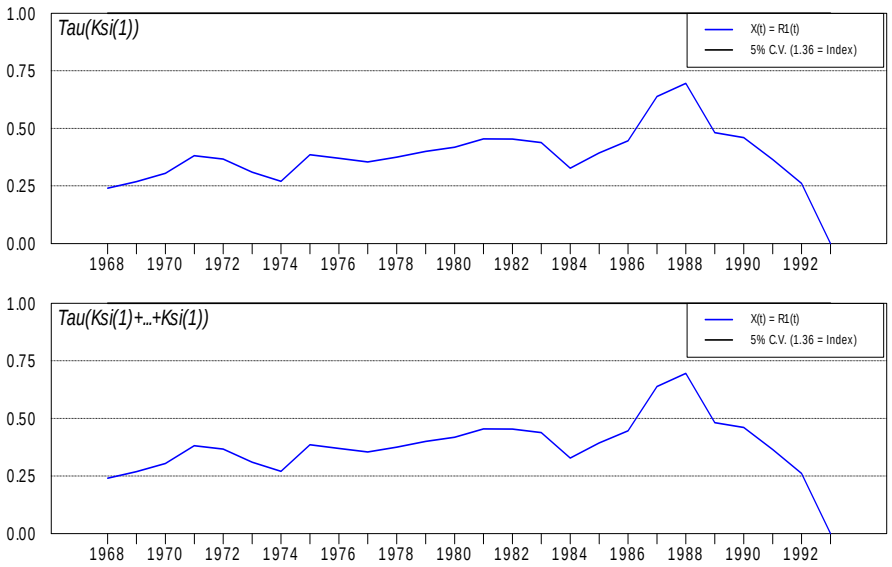
**Figure 9. Transformed eigenvalue fluctuation test**

**TPEGDP AND MGDP**




*Tau(Ksi) = C(T)||Ksi(t)-Ksi(T)||*

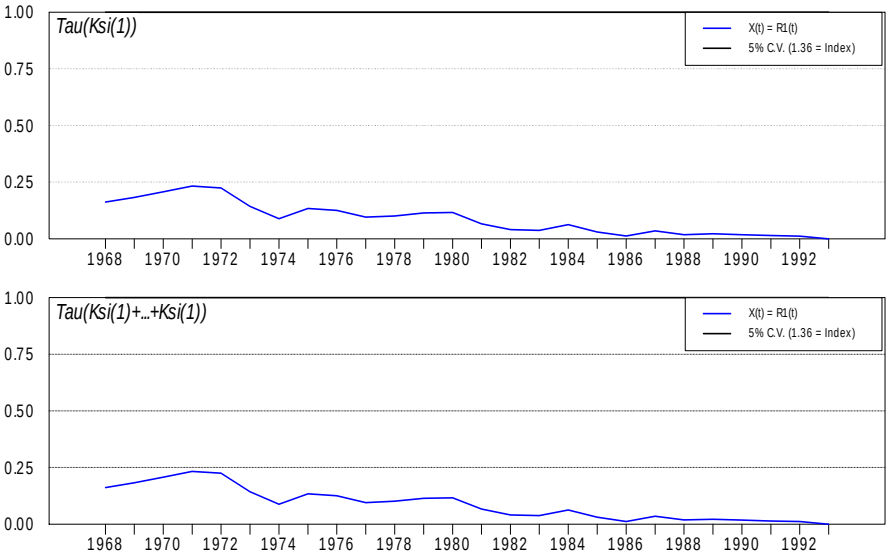
**TPEGDP AND XMGDPCOM**




*Tau(Ksi) = C(T)||Ksi(t)-Ksi(T)||*

## TPEGDP AND XMGDPREAL

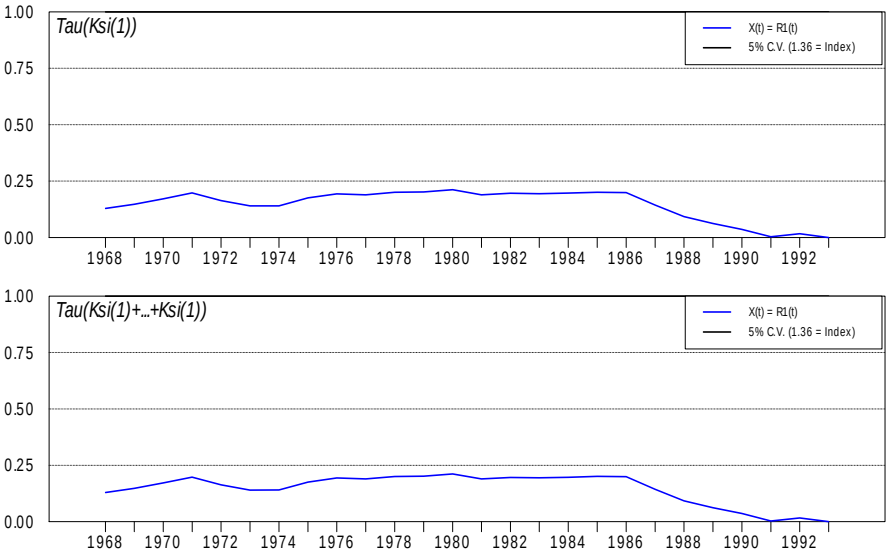
### Eigenvalue Fluctuation Test




*Tau(Ksi) = C(T)||Ksi(t)-Ksi(T)||*

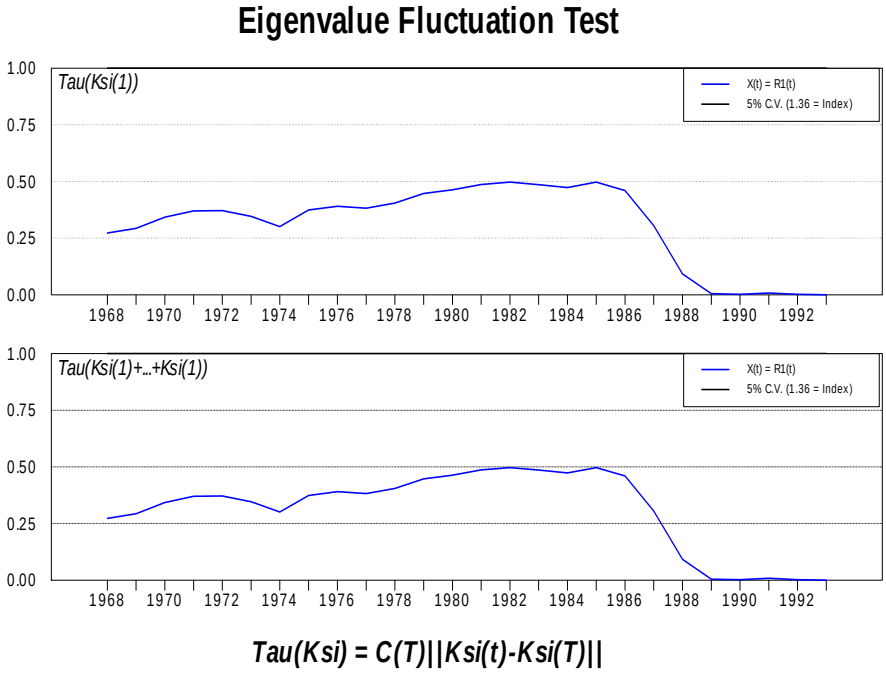
## TPEGDP AND MGDPREAL

### Eigenvalue Fluctuation Test




*Tau(Ksi) = C(T)||Ksi(t)-Ksi(T)||*

**TPEGDP AND MNEGDP**

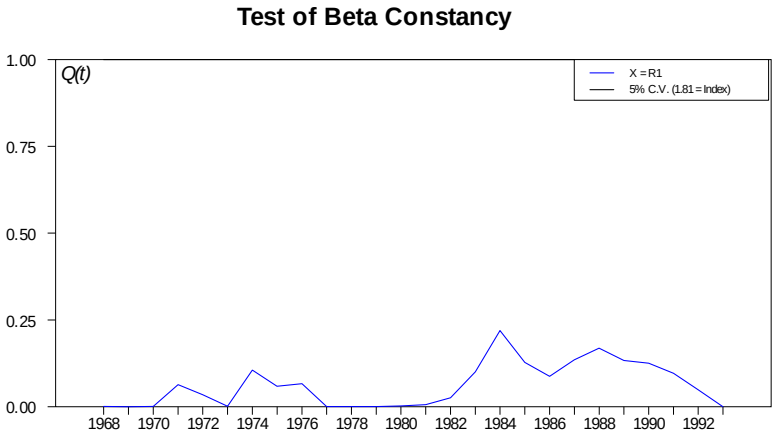



In Figure 10, we show the results of the test of stability of the cointegration space (β). It is based on the difference between $\beta^{(n)}$ and $\beta^{(T)}$[15] and, like the previous test, is also considered to be conservative. In this case, we also observe a stable behaviour of the model.

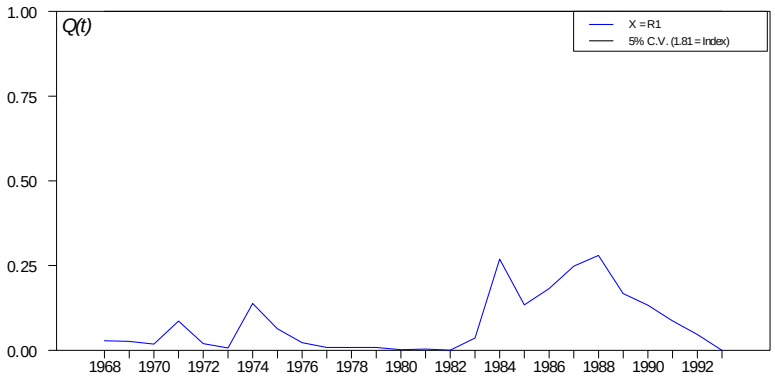
[15] With $n = T_0, \ldots, T$.

**Figure 10. Test Max of constancy of β**

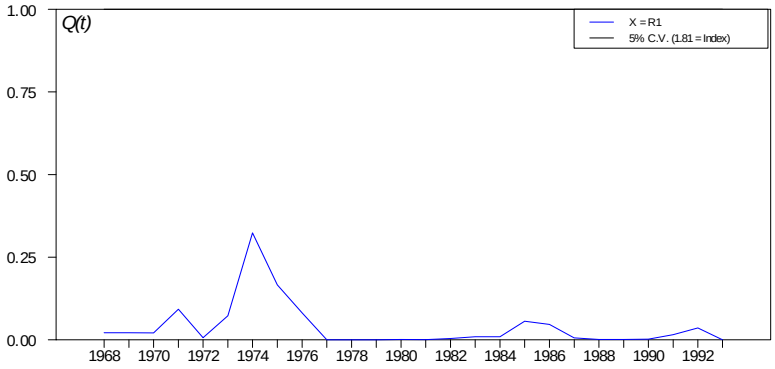
## TPEGDP AND MGDP



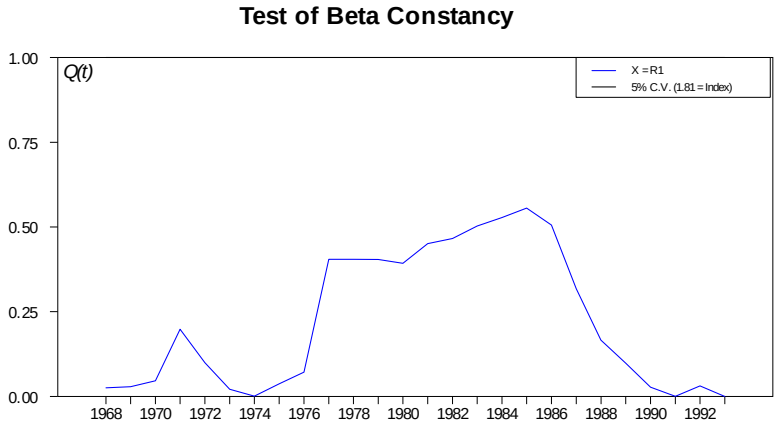

## TPEGDP AND XMGDPCOM



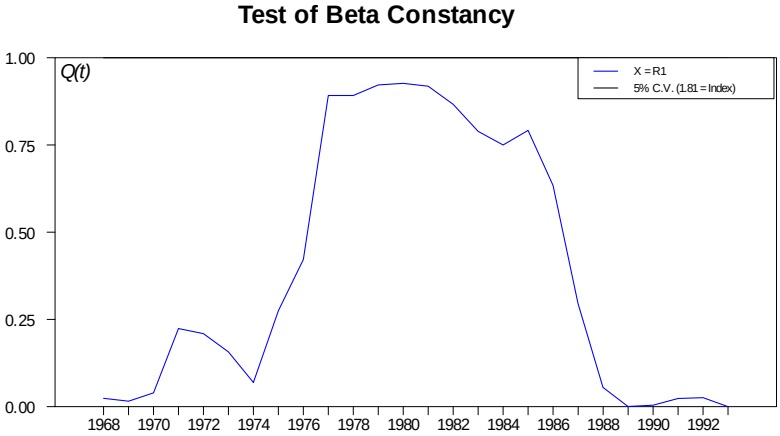

## TPEGDP AND XMGDPREAL



## TPEGDP AND MGDPREAL




## TPEGDP AND MNEGDP




In summary, after including the variable DEMO, the robust relation of cointegration found between total public expenditure and several indicators of openness in 1960-1993 is stable, according to most conservative tests of recursive estimation of Hansen and Johansen (1993, 1999), so we can accept the conclusions derived from this relation.

## 5. CONCLUSIONS

The time series analysis for the Spanish economy in the period 1960-2000, based on the cointegration test of Johansen, reveals a long-term relationship between public expenditure and both trade openness and several protection indicators. However, the Error Correction Model (ECM) is not coherent with the cointegration theory because the correction term is positive. For this reason, we incorporate a very important variable for public expenditure growth in Spain, namely, a dummy that captures the effect of the restoration of democracy in 1977. With this new variable, measures of trade openness show contradictory results, so, after carrying out a simple recursive analysis, we end the study period in 1993 -maintaining the democracy dummy in the model-. We have chosen this year for two institutional reasons: the end of the intense trade openness process after integration into the EU and the beginning of a budgetary restriction stage in order to get access to the European Monetary Union. If we consider the period 1960-1993, the cointegration analysis shows that there is a long-term relation between all the trade openness measures and one of the protection indicators and the total public expenditure. Now, openness has the expected sign, and the correction term of ECM fulfils the cointegration requirements. We complete our analysis with several econometric techniques which reveal that the aforementioned relation is both robust and stable.

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**ANNEX**

We repeat the same analysis using the variable social public expenditure.

- Period 1960-2000

Results of the Johansen test are shown in Table 1.

**Table 1. Cointegration test of Johansen: Social public expenditure and trade openness, 1960-2000**

**Cointegration based on max eigenvalues:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| XMGDP | r=0 | r≥1 | 8.83 | 14.26 | 0.30 |
| MGDP | r=0 | r≥1 | 14.13 | 14.26 | 0.05 |
| XMGDPCOM | r=0 | r≥1 | 8.23 | 14.26 | 0.36 |
| XMGDPREAL | r=0 | r≥1 | 62.53 | 15.89 | 0.00 |
| | r≤1 | r=2 | 2.38 | 9.16 | 0.70 |
| MDPREAL | r=0 | r≥1 | 56.87 | 15.89 | 0.00 |
| | r≤1 | r=2 | 0.92 | 9.16 | 0.96 |
| MNEGDP | r=0 | r≥1 | 59.79 | 15.67 | 0.00 |
| | r≤1 | r=2 | 1.28 | 9.24 | 0.91 |

**Cointegration based on trace of stochastic matrix**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| XMGDP | r=0 | r≥1 | 10.56 | 15.49 | 0.24 |
| MGDP | r=0 | r≥1 | 21.07 | 15.49 | 0.01 |
| | r≤1 | r=2 | 6.94 | 3.84 | 0.01 |
| XMGDPCOM | r=0 | r≥1 | 8.72 | 15.49 | 0.39 |
| XMGDPREAL | r=0 | r≥1 | 64.91 | 20.26 | 0.00 |
| | r≤1 | r=2 | 2.38 | 9.16 | 0.70 |
| MDPREAL | r=0 | r≥1 | 57.80 | 20.26 | 0.00 |
| | r≤1 | r=2 | 0.92 | 9.16 | 0.96 |
| MNEGDP | r=0 | r≥1 | 61.07 | 20.26 | 0.00 |
| | r≤1 | r=2 | 1.28 | 9.16 | 0.91 |

$$LSPEGDP = 4.99 - 0.15LXMGDPREAL$$
$$(6.30) \quad (0.59)$$

$$LSPEGDP = 4.43 - 0.21LMGDPREAL$$
$$(8.28) \quad (1.06)$$

$$LSPEGDP = 6.05 - 0.80LMNEGDP$$
$$(6.07) \quad (2.05)$$

As in total expenditure, there is cointegration with XMGDPREAL, MGDPREAL and MNEGDP. However, their coefficients do not have the expected sign and the variables in real terms lose their significance.

Table 2 shows the results of Johansen's test for the measures of trade policy. It can be seen that, with both statistics there is a cointegration relation between public expenditure and all the measures the trade policy.

**Table 2. Cointegration test of Johansen:**
**Social public expenditure and measures of trade policy, 1960-2000**

**Cointegration based on max eigenvalues:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| TMMNE | r=0 | r≥1 | 25.80 | 15.89 | 0.00 |
| | r≤1 | r=2 | 7.80 | 9.16 | 0.09 |
| TMCPMNE | r=0 | r≥1 | 26.69 | 15.89 | 0.00 |
| | r≤1 | r=2 | 10.31 | 9.16 | 0.03 |
| REGTRADE | r=0 | r≥1 | 26.88 | 15.89 | 0.00 |
| | r≤1 | r=2 | 3.45 | 9.16 | 0.50 |
| XTD | r=0 | r≥1 | 24.98 | 15.89 | 0.00 |
| | r≤1 | r=2 | 7.86 | 9.16 | 0.09 |

**Cointegration based on trace of stochastic matrix**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| TMMNE | r=0 | r≥1 | 33.60 | 20.26 | 0.00 |
| | r≤1 | r=2 | 7.80 | 9.16 | 0.09 |
| TMCPMNE | r=0 | r≥1 | 37.00 | 20.26 | 0.00 |
| | r≤1 | r=2 | 10.31 | 9.16 | 0.03 |
| REGTRADE | r=0 | r≥1 | 30.33 | 20.26 | 0.00 |
| | r≤1 | r=2 | 3.45 | 9.16 | 0.50 |
| XTD | r=0 | r≥1 | 32.84 | 20.26 | 0.00 |
| | r≤1 | r=2 | 7.86 | 9.16 | 0.09 |

$$LSPEGDP = 4.76 + 1.82LTMMNE$$
$$(2,37) \quad (1.80)$$

$$LSPEGDP = 3.08 - 0.81LREGTRADE$$
$$(6,49) \quad (4,34)$$

$$LSPEGDP = 3.18 + 1.38LXTD$$
$$(3.92) \quad (3.21)$$

In this case, only REGTRADE has the expected negative sign and, although the t-ratio decreases, the variable remains significant. As can be deduced from Table 3, causality is also unidirectional, running from protection to expenditure. Furthermore, as in total expenditure, the error correction term is positive (Table 4).

| Table 3. Causality test between SPEGDP and REGTRADE | | |
|---|---|---|
| **$H_0$: $\alpha_i = 0$** | **$\chi^2(1)$** | **Probability** |
| $\alpha_1$ | 3.50 | 0.06 |
| $\alpha_2$ | 16.57 | 0.00 |

| Table 4. Coefficients of adjustment in equation ΔGPTPIB ($\alpha_2$) | | | |
|---|---|---|---|
| TMMNE | TMCPMNE | REGTRADE | XTD |
| | | 0,02<br>(4,83) | |

- Period 1960-2000, including DEMO

Results of Johansen's test are shown in Table 5.

| Table 5. Cointegration test of Johansen: Social public expenditure, trade openness and democracy, 1960-2000 | | | | | |
|---|---|---|---|---|---|
| **Cointegration based on max eigenvalues:** | | | | | |
| **Endogenous Variable** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistic** | **Critical Value 5%** | **Probability** |
| XMGDP | r=0 | r≥1 | 3.90 | 14.26 | 0.87 |
| MGDP | r=0 | r≥1 | 9.33 | 14.26 | 0.26 |
| XMGDPCOM | r=0 | r≥1 | 5.11 | 14.26 | 0.73 |
| XMGDPREAL | r=0<br>r≤1 | r≥1<br>r=2 | 50.45<br>0.45 | 15.89<br>9.16 | 0.00<br>0.99 |
| MDPREAL | r=0<br>r≤1 | r≥1<br>r=2 | 54.63<br>0.52 | 15.89<br>9.16 | 0.00<br>0.99 |
| MNEGDP | r=0<br>r≤1 | r≥1<br>r=2 | 56.52<br>0.87 | 15.67<br>9.24 | 0.00<br>0.97 |
| **Cointegration based on trace of stochastic matrix** | | | | | |
| **Endogenous Variable** | **Null Hypothesis** | **Alternative Hypothesis** | **Statistic** | **Critical Value 5%** | **Probability** |
| XMGDP | r=0 | r≥1 | 5.65 | 15.49 | 0.74 |
| MGDP | r=0 | r≥1 | 15.75<br>6.42 | 15.49<br>3.84 | 0.04<br>0.01 |
| XMGDPCOM | r=0 | r≥1 | 5.25 | 15.49 | 0.78 |
| XMGDPREAL | r=0<br>r≤1 | r≥1<br>r=2 | 50.89<br>0.45 | 20.26<br>9.16 | 0.00<br>0.99 |
| MDPREAL | r=0<br>r≤1 | r≥1<br>r=2 | 55.16<br>0.52 | 20.26<br>9.16 | 0.00<br>0.99 |
| MNEGDP | r=0<br>r≤1 | r≥1<br>r=2 | 57.39<br>0.87 | 20.26<br>9.16 | 0.00<br>0.97 |

LSPEGDP = 3.32 + 0.02LXMGDPREAL
(7.29) (0.10)

LSPEGDP = 2.87 + 0.05LMGDPREAL
(13.54) (0.57)

LSPEGDP = 3.39 - 0.13LMNEGDP
(9.02) (0.85)

The variables XMGDPREAL and MGDPREAL have the expected sign, but they are not significant. The error correction term is negative and significant and long-term causality is bidirectional (Tables 6, 7 and 8).

**Table 6. Causality test between SPEGDP and XMGDPREAL**

| $H_0: \alpha_i = 0$ | $\chi^2(1)$ | Probability |
|---|---|---|
| $\alpha_1$ | 23.36 | 0.00 |
| $\alpha_2$ | 16.66 | 0.00 |

**Table 7. Causality test between SPEGDP and MGDPREAL**

| $H_0: \alpha_i = 0$ | $\chi^2(1)$ | Probability |
|---|---|---|
| $\alpha_1$ | 15.38 | 0.00 |
| $\alpha_2$ | 16.88 | 0.00 |

**Table 8. Coefficients of adjustment in equation ΔGPTPIB ($\alpha_2$)**

| XMGDP | MGDP | XMGDPCOM | XMGDPREAL | MGDPREAL | MNEGDP |
|---|---|---|---|---|---|
| | | | -0.05<br>(4.45) | -0.08<br>(4.48) | |

Trade policy measures (Table 9).

**Table 9. Cointegration test of Johansen:**
**Social public expenditure, measures of trade policy and democracy, 1960-2000**

**Cointegration based on max eigenvalues:**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| TMMNE | r=0 | r≥1 | 20.34 | 15.89 | 0.03 |
| | r≤1 | r=2 | 1.01 | 9.16 | 0.95 |
| TMCPMNE | r=0 | r≥1 | 20.73 | 15.89 | 0.01 |
| | r≤1 | r=2 | 1.30 | 9.16 | 0.91 |
| REGTRADE | r=0 | r≥1 | 23.53 | 15.89 | 0.00 |
| | r≤1 | r=2 | 3.15 | 9.16 | 0.55 |
| XTD | r=0 | r≥1 | 22.97 | 15.89 | 0.00 |
| | r≤1 | r=2 | 6.38 | 9.16 | 0.16 |

**Cointegration based on trace of stochastic matrix**

| Endogenous Variable | Null Hypothesis | Alternative Hypothesis | Statistic | Critical Value 5% | Probability |
|---|---|---|---|---|---|
| TMMNE | r=0 | r≥1 | 21.34 | 20.26 | 0.03 |
| | r≤1 | r=2 | 1.01 | 9.16 | 0.95 |
| TMCPMNE | r=0 | r≥1 | 22.04 | 20.26 | 0.03 |
| | r≤1 | r=2 | 1,30 | 9.16 | 0.91 |
| REGTRADE | r=0 | r≥1 | 26.68 | 20.26 | 0.01 |
| | r≤1 | r=2 | 3,15 | 9.16 | 0.55 |
| XTD | r=0 | r≥1 | 29.35 | 20.26 | 0.00 |
| | r≤1 | r=2 | 6.38 | 9.16 | 0.16 |

LSPEGDP = 2.95 + 0.57LTMMNE
(3.63) (1.78)

LSPEGDP = 2.78 + 0.59LTMCPMNE
(3.40) (2.00)

LSPEGDP = 1.56 + 1.28LREGTRADE
(0.93) (2.82)

LSPEGDP = 2.64 + 0.30LXTD
(9.41) (2.86)

In this case, none of the measures of protection has the expected negative sign.