WORKING PAPERS

Col.lecció d'Economia E18/385

Spain and the classical gold standard. Short-And long-Term analyses.

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UB Economics Working Papers 2018/385

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Abstract: This paper seeks to link the two theories put forward to explain (the consequences of) Spain's decision not to adopt the gold standard in the late nineteenth century, and does so by comparing the outcomes of short- and long-run approaches. The empirical results obtained from applying an autoregressive distributed lag (ARDL) and vector error correction (VEC) framework are reported. This ARDL and VEC analysis reveals that the expansionary monetary policies implemented had a positive impact on Spain's economic growth. The exchange rate was a key factor, since it helped improve the terms of trade and promoted exports in the short run. None of these options would have been available under the gold standard system. This paper provides new empirical evidence for the core-periphery debate through an analysis of a peripheral economy, and sheds important new light on the developments in Spain at the time of the classical gold standard.

JEL Codes: N15, E42, E52, E63.

Keywords: The classical gold standard, exchange rate, Spain, VECM, ARDL, monetary policy.

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Acknowledgements: I would like to thank my colleagues from the Department of Economic History, Institutions, Politics and World Economy of the University of Barcelona for their valuable suggestions and help, especially Jordi Catalan, Carles Sudria, Lluis Castañeda, Ramon Ramon, Jose Luis Peña, Yolanda Blasco, Montserrat Carbonell, Vanesa Abarca and Pere Pascual. I am very grateful for the comments made by Jonas Ljungberg and German Forero at the Workshop on the history of exchange rates, by Rui Esteves, Elena Martinez Ruiz, Albert Carreras and Isabel Sanz at Iberometrics, by Masato Shizume at the Economic History Society Conference and by Mar Cebrian at AEHE International Congress. I also acknowledge the support of the Ministry of Economy and Competitiveness project and ERDF, HAR2015-64769-P.

ISSN 1136-8365

"(...) in no way does the fall of the peseta seem to me synonymous with weakness. The freedom to allow a certain moderate slackening in the exchange rate in times of general depression affecting the rest of the world can be a valuable measure to maintain internal stability, which would otherwise be impossible."

J. M. Keynes, interviewed in El Sol by Luís de Olariaga, 10 June 1930

I. Introduction

Interest in the gold standard has grown in recent years because of the parallels that can be drawn with the euro crisis and the questions that have been raised by relinquishing monetary sovereignty (Stiglitz, 2016, p. 12). Indeed, the euro has generated the same rigidities in Europe that the gold standard once imposed on the world (Bordo and James, 2014), when the countries in Europe's southern periphery were unable to remain in that monetary system[1]. These are the same countries that today are struggling to overcome the recent economic crisis that has been played out against the broader background of the single currency (Eichengreen, 2014, pp. 12, 13 and 93).

One of the successes of the gold standard system was that it kept exchange rates stable in much of the world (Triffin, 1985, p. 12; Eichengreen, 1992, pp. 4-8). A large part of the historiography has indicated that the gold standard brought benefits, such as lower interest rates, lower fiscal deficits, lower inflation, better access to the capital market and trade channels, and lower transaction costs (Bordo and Rockoff, 1996, pp. 389-396 and López-Córdoba and Meissner, 2003, p. 344, Meissner, 2005).[2] Italy and Portugal, countries of the southern European periphery, were unable to remain on the gold standard, while Spain had a fiduciary system). As debtors in the global financial system, they were vulnerable to the withdrawal of funds in times of financial constraint (De Cecco, 1974; Temin 1995, p. 28 and Bordo Flandreau, 2003, p. 420). According to Bordo and Rogoff (1996, p. 394), adherence to the gold standard was a very difficult objective to achieve for the countries of southern Europe; their experiences were characterised by higher rates of growth of the money supply, fiscal deficits, and higher inflation than other countries. Outside the gold standard, however, they were able to use fluctuations in the exchange rate to cushion the impact of economic shocks (Bordo and Rockoff, 1996, p. 416).

Although the gold standard was actually less rigid than believed (Bloomfield, 1959; Dutton, 1984; Pippenger, 1984; Giovaninni, 1986; Davutyan and Parke, 1995; Jeanne, 1995 and Reis, 2007) a large proportion of the countries on the periphery experienced major exchange rate fluctuations and instability (Triffin, 1985, p. 128). According to Martín Aceña et al (2011), although it is known that many economies were on the gold standard without introducing money convertibility, they were nevertheless able to maintain the stability of their exchange rates. In contrast, the exchange rate of the peseta fluctuated against gold and against other currencies. Moreover, the balance of payments deficits made it difficult to remain in the international monetary system.

This paper covers the period known as the classical gold standard era, during which Spain operated a *de jure* bimetallic standard. Having said that, in the late 1880s, the country is regarded as operating a *de facto* fiduciary system, insofar as the real value of silver was lower than its face value and there was a constant outflow of gold.

The debate on Spain's decision not to adopt the gold standard in is far from being resolved. Some economists and economic historians claim that policies that the country was able to apply because it was off the gold standard served to stimulate the economy. Sardà (1948) applauded

Spain's non-adoption of the gold standard, and Solé Villalonga (1967) and Tortella (1981 and 1994a) supported Sardà's position with arguments that were more sensitive to the long term. Sardà (1987), Solé Villalonga (1964, 1967) and Tortella (1994a) all stress that adherence to the gold standard would have tied the government's hands and prevented it from taking any monetary, fiscal or exchange rate actions. For this period, Sardà (1987, pp. 196-98 and 252), Solé Villalonga (1967), pp. 41-43 and Tortella (1970, 1994b) consider the non-convertibility of the peseta to have been positive for the Spanish economy: having a flexible exchange rate and applying expansionary monetary and fiscal policies had a positive effect on Spanish GDP.

According to Sarda (1987), pp. 196-198, the favourable evolution of the Spanish economy during the final years of the nineteenth century was largely due to the country's absence from the gold standard. The monetary expansion eased the impact of the international depression and made it possible to finance the exaggerated deficits of the Spanish economy while paying lower interest rates than those that would have been applied by foreign lenders. Following Sardà (1987), p. 176, the situation in 1883 could only be resisted by increasing the money stock. Spain was able to increase its money supply by increasing fiduciary circulation. Tortella (1994a), pp. 323-24, equated the advantages of the gold standard with those later associated with the European Monetary System, highlighting that with these monetary systems no corrective measures could be taken and this forced to accept undesired situations such as gold outflows.

More recently, this belief has been supported by Cubel et al. (1998); Catalan et al. (2001); Cubel (2001); Llona (2001); Ródenas et al. (2001); and Sabaté et al. (2001), Carreras and Tafunell (2004, pp. 219-20), Serrano (2004) and Ródenas and Bru (2006).[3] Despite this, the results of previous work, published in *Peseta y Protección* (Tirado and Sudrià, 2001) are not conclusive. Llona (2001), pp. 164-169, points out that having maintained a stable exchange rate bolstered the level of economic activity by reducing the price of non-tradable goods. Sabaté, Gadea and Escario (1998) consider that the use of the interest rate was not enough to maintain gold convertibility. It should have had an impact on the money supply, which would have caused a notable recession. The interest rate of the peseta when it was convertible was higher than when it was not convertible. Serrano, Sabaté and Gadea (1998), p. 85, point out that Spain's unique monetary option had no effect on long-trade trade flows. Moreover, Herranz and Tirado (1993), p. 28 stress the advantages and feasibility of this exchange rate practice.

The main proponent of this school of thought, the "classical thesis", is Joan Sardà. I consider that its arguments are more short-term than long-term. The effects, both positive and negative, of Spain's absence from the gold standard depend largely on the time scale of the analysis. Thus, while the impact of certain instruments of economic policy may be null or negative in the long term, they may be significant and positive in the short term. Hence, the results of our analysis will depend on whether we focus on the long run or on the short run. Following Tortella (1994), the long term could be considered something of a luxury good for Spain, due to the economic problems suffered by the Spanish economy throughout the period.

Pablo Martín Aceña (1981, 1985, 1993, 1997, 2000 and 2017) questioned the validity of this thesis and his works seem to be correct if a long-term analysis is adopted. Martín Aceña (1981, 1993, 1997, 2000 and 2017) upholds a "critical thesis", considering it a mistake on the part of the Spanish government not to have adopted the gold standard. He considers that having a fiduciary system harmed the Spanish economy, causing the isolation of international capital flows and reducing investments. Martín Aceña claims that the country's growth would have been much greater under the gold standard. In his view, the flexible exchange rate, the application of an expansionary monetary policy and the lack of fiscal discipline had a negative impact on Spanish economy, and the adhesion of most countries to this monetary system is proof that the system had clear benefits (Martin Aceña, 1981, p. 267). At this point, it is important to ask whether all countries were equal and had the same needs or, whether the

effects of the monetary system differed from country to country. Martin-Aceña et al (2011) Nogues-Marco and Martínez-Ruíz (2014), and Nogues-Marco and Martinez-Ruiz (2018) stress that the Banco de España was responsible for the country's absence from the gold standard.

Fraile (1991), Tena (1992), and Prados de la Escosura (1997) all highlight the negative consequences of Spanish protectionism and the depreciation of the peseta for the allocation of resources in the long term. Despite his defence of the gold standard mentioned above, Martin Aceña (1993), 472, considered that membership would have come at a high cost for Spain. Tortella was more forceful saying that the costs of being on the gold standard would have been too high for a backward country like Spain (Tortella, 1997, p.24). Martín Aceña also thinks that movements in the exchange rate were mainly due to changes in expectations. However, researchers closer to the classical thesis (Sabaté, Gadea and Escario, 2006) defend that Spain suffered fiscal dominance. Could the exchange rate have been affected by the increase in the money supply? I will also try to answer this question in this paper. In my view, while the classical thesis focuses on the short-run, the critical thesis analysis is characterised by what is primarily a long-run approach.

In the light of the above, my aim in this study is to test and compare the critical and the classical theories. I hope to determine which theory provides a more faithful reflection of the repercussions of not adopting the gold standard, considering a new perspective. In so doing, I study the short-term and the long-term separately in an effort to establish a point of union between the two theories. Finally, I aim to analyse the impact of macroeconomic policies on economic growth and to examine causality between the different policies. To do this I use a methodology incorporating two time series that permits me to distinguish between the short and the long term: VEC (vector error correction) and ARDL (autoregressive distributed lag). I do not intend to say if it was better to adopt the gold standard or not: I only mean to analyse what happened and to assess the impact of having a fiduciary system (thus, of having a flexible exchange rate).

Spain was the only western country that never joined the gold standard. Academics and policymakers do not have access to any quantitative or empirical studies of the impact of being outside the gold standard on Spain's economic growth at the end of the nineteenth century and the beginning of the twentieth. This is what I intend to provide in this paper, by unifying the two existing theories on the matter. The importance of researching this topic has been underlined by various economic historians, among them Pedro Lains;[4] Martin Aceña, Reis and Llona (2000) p. 3 affirm that "the debate on the feasibility and the costs and benefits for peripheral economies of being on the gold standard is still far from closed".[5] For García-Iglesias (2005), neither theory can be confirmed or rejected. In recent years, several articles have dealt either directly or indirectly with this topic.[6] Martín Aceña et al. (2011) say that "Spain's historic detachment from the world monetary system cost the country dearly in terms of both its debt burden and GDP growth, two questions that warrant further research". Recent papers and books on the subject include Martin-Aceña (2017 and 2018) and Nogues-Marco and Martínez-Ruiz (2018).

The study confirms how adjustments to the exchange rate played a prominent short-run role in Spain's economic development. However, in the long run, the exchange rate had a negative and significant impact on Spanish GDP. Thus, both theories are correct if a distinction is made between the long and the short term.

The rest of the paper is organised as follows: section 2 describes the historical context; section 3 presents the theoretical framework and the methodology employed; section 4 explains the data; section 5 reports the empirical results and the robustness check; section 6 discusses these results in relation to the previous literature; and, finally, section 7 offers my conclusions.

II. The Spanish economy during the classical gold standard

The decree of October 19, 1868, with Laureano Figuerola as finance minister, unified the monetary system. The peseta was chosen as the official monetary unit of the State because of its similarity to the franc. The objective was to align the national system with that of the countries with which Spain maintained the greatest volume of trade. Spain adopted the operating requirements of the Latin Monetary Union, but never formed part of it. The Echegaray Decree of March 19, 1874 granted the monopoly of the Bank of Spain's issuance of notes due to the State's financial difficulties at the time. From 1874, the state was able to increase the number of banknotes in circulation (Figure 1) to solve its treasury problems (Sardà, 1987, p. 180). What were the government's objectives? What was the situation in Spain?

There was certainly an interest in Spain in joining the gold standard. The possibility was officially raised in 1876 by the Consultative Board of the Currency (Serrano, 2004). At the beginning of the twentieth century a further attempt was made. However, there was a constant fear that the country would not be strong enough to stay on the gold standard and, together with problems concerning the budget and the balance of payments, this led to the decision not to adopt the monetary system. A wait-and-see policy was applied (Serrano, 2004) or, in the words of García-Iglesias (2005), a policy of low risk and low profitability. The government did not demand any guarantee of convertibility. For its part, considering that the conversion was an exclusively internal matter, the Bank of Spain rationed the cash it had in its coffers (Serrano, 2004). The bank never had an obligation to convert banknotes into gold; in fact, it never had to account to anyone (Serrano, 2004).

Martin Aceña et al. (2011) and Nogues-Marco and Martinez-Ruiz (2018) stress that the Bank of Spain was responsible for the country's inability to join the gold standard, in spite of the desire in some circles to do so. However, for Sabaté et al. (2006) the problem was the constant fiscal deficit that generated a large volume of public debt and made monetary policy a slave of the State in its efforts to avoid bankruptcy. The situation in 1883 could only be resisted by increasing the money stock (Sardà, 1987, p. 176); seignoriage was essential in order to guarantee government solvency in the long run. Escario et al. (2011) observe a strong causality and a long term relationship between the budget and changes in the monetary base between 1875 and 1998. Sabaté et al. (2014) attempt to unite the two points of view: they consider that the degree of fiscal dominance changed over time, and try to link these changes with the changes in the intensity of institutional constraints. Spain had no trade surplus, and the level of debt was unsustainable over a large part of the period (Comin, 2012, pp. 13-15, and 2016). One might wonder whether the role of the Bank of Spain was so decisive, because there were countries like Portugal where the state bank carried out the responsibilities corresponding to it and defended the national interest, but the country also ended off the gold standard.

In 1882, the Finance Minister Camacho converted the Spanish debt, due to the impossibility of facing payments (Comin and Martorell, 2006, pp. 389-391). The issue of banknotes increased notably after 1879 (Sarda, 1987, p. 175 and Tortella, 1994, p.177). The *Banque de Lyon et de la Loire* collapsed in 1882 and the Spanish banks were exposed to cash withdrawals, outright failure, and dwindling gold reserves. The crisis in France affected Spain, draining the gold reserves and precluding the conversion of Spanish banknotes into gold (Sardà, 1987, p. 179; Martín Aceña, 1993, pp. 135, 137 and 189; Tortella, 1994a, pp. 139, 177 and 480-481; Bordo and Schwartz, 1999, p. 32 Martín Aceña et al., 2011, p. 3 and Catalan and Sánchez, 2013, p. 96). There were also constant outflows of gold (Martin Aceña, 2017). In 1883, Spain had a de facto fiduciary system with a flexible exchange rate. The effect of Gresham's law left the Spanish economy without any gold: between 1891 and 1892, gold disappeared from circulation (Sarda, 1987, p.183). Nogues and Martinez Ruiz considered that Spain was in the shadow of the gold standard

until the early 1890s, p. 24, despite its de facto fiduciary system. At that point, a flotation stage began. The exchange rate broke the band of gold points in 1889 and began a more pronounced upward trend in 1891. Due to insufficient resources rather than to a lack of will, the peseta became a floating currency (Serrano, 2004); the floating exchange rate was an automatic mechanism for correcting economic cycles. Moreover, the agricultural depression compounded the financial slump and made the crisis the longest one of the period.

The decree of July 14 1891 raised the limit on the issue of banknotes to 1500 million pesetas (Sardà, 1987, p. 180). In 1891, the peseta depreciated, coinciding with the application of the Cánovas tariff and improving the economic situation (Carreras, Prados de la Escosura and Roses, 2005, p.1341). In 1892, with the earlier crisis still not entirely overcome, a new economic crisis emerged: the Cuban insurrection again increased the deficits from 1895, causing debt to rise from 800 million to 3000 million pesetas. This debt was monetized, thus increasing the money supply in circulation. Between 1893 and 1898, the depreciation of the peseta was the highest in the period (Figure 1) because of the constant deficits and the strong increase in debt. Subsequently, in 1898, the issue limit was again increased, this time to 2500 million pesetas[7]. This was an economic crisis of considerable breadth (Sardà, 1987, p. 223). Moreover, the Méline tariff levied by the French placed insurmountable entry conditions on alcoholic beverages from the Iberian Peninsula, curtailing all wine exports (Serrano, 2011, p. 641). The loss of the French market intensified the slump, and the outbreak of phylloxera throughout the Iberian Peninsula exacerbated the situation still further.

With the approval of the Law of budgets of 1899-1900, the situation of the Treasury was restored until 1909 and the limit on the issue of banknotes was lowered. These measures achieved a budget surplus and for a few years the State was able to finance itself without having to issue banknotes. Finally, in a last attempt to improve the price of the peseta on the international market and reduce public debt, the limit was lowered to 2000 million pesetas because of a more contractionary monetary policy than in the preceding years[8]. Between 1902 and 1906 Spain entered another period of crisis, when pc GDP fell twice as a consequence of swingeing budget adjustments. The effects of this restrictive policy can be judged as positive even though the economy showed symptoms of depression (Sardà, 1987, p.207). In this period it could have entered into the gold standard but did not do so, because it wanted to return to the parity of 1868 instead of entering at a depreciated parity (Serrano, 2004).

Figure 1. The evolution of Spanish economy.
Source: see main text.

The monetary policy of this period was characterized by a lack of national objectives and a constant tension between the government and the Bank of Spain (Nogues, Martinez Ruiz, p.21 2014). It was unclear which of the two institutions was in charge of exercising the functions of monetary authority. According to Sardà, the monetary policy was not as expansive as might be imagined since in part the outflows of gold were replaced by banknotes. Despite having a fiduciary system, governments endeavoured to maintain a certain discipline in macroeconomic policy. For Tortella (1994a, p. 177), these were years of slow but steady growth in the Spanish economy.

Figure 1. Behaviour of the main economic variables

III. Theoretical framework and data

To test my hypothesis, I will follow the model developed in Kandil and Mirzaie (2002) and Bahmani-Oskooee and Kandil (2010). The cited papers find that real output depends on movements in the exchange rate, money supply and government spending. But, instead of using government spending as a dependent variable I opt to use the fiscal balance.[9] First, because while a state may have high expenditure, its taxes may also be high, yet by only considering public spending, we cannot take into consideration the whole of the state's fiscal policy. Second, by focusing on fiscal policy it is possible to verify the causalities between macroeconomic policies that have been studied elsewhere in the literature (most notably by Sabaté et al., 2006, pp. 310, 321 and 328 and by Escario et al., 2011, pp. 271-272). The impact of the three macroeconomic policies on national production is then analysed using the empirical model derived from a reduced form of the theoretical model proposed by Kandil and Mirzaie (2002):

$$(1)\quad lypc_t = a + bf_t + clmsn_t + dlreer_t$$

where l is the logarithm of the variables and ypc is real output which varies according to the three policy types. The logarithm of money supply is $lmsn_t$ and this approximates the monetary policy. Fiscal policy, f_t, is measured by the fiscal balance over GDP and the real effective exchange rate is denoted by $lreer_t$.[10] An increment in the exchange rate results in depreciation. If the exchange rate coefficient presents a positive sign, depreciation helps raise GDP. Otherwise, if the effect is contractionary, the sign is negative.[11] If f_t coefficient is positive then fiscal budget stability and surplus have a positive impact on GDP. Positive estimates of c and d indicate that expansionary monetary policy and depreciation could boost real output growth.[12]

Due to the absence of quarterly or monthly data for some of the variables, I draw on a sample of annual data between 1868 and 1913. I start in 1871 because it is the end of the Franco Prussian war and it is considered the year when European countries went onto the gold standard.[13] Following Kandil and Mirzaie (2002), Bahmani-Oskooee and Kandil (2010) and Shibamoto and Shizume (2014), I employ four macroeconomic variables: pc GDP, budget balance, money supply (M1) and real effective exchange rate. The data come from secondary sources as follows: the $ypcr_t$ is real pc GDP measured using GDP calculations from Prados de la Escosura (2003) and population statistics from Nicolau (2005) deflated by GDP deflator (Prados de la Escosura, 2003), f_t is the fiscal balance over GDP obtained from Comín and Díaz (2005), $lreer_t$ is the real effective exchange rate, whose own calculation is explained below, and $lmsn_t$ is the money supply measured by Martín Aceña (2018).[14] Here all the variables have been converted into logarithms except for the fiscal balance.[15]

The real effective exchange rate takes account of the average weight of the exchange rate against the pound sterling, the French franc and the US dollar. I have calculated my own real effective exchange rate as follows. The calculation of the real effective exchange rate draws on the CPI reported by Maluquer (2012) for Spain, the CPI reported by Mitchell (2007) for the other three countries, and the peseta exchange rate from Martín Aceña and Pons (2005) and Martinez-Ruiz and Nogues-Marco (2014). The weight of foreign trade to the respective countries is obtained from Prados de la Escosura (1982, p. 42), using fixed weightings updated every five years. The weightings account for more than 60% of total foreign trade over the entire period.

IV. Methodology

In this section I describe the econometric tools used, in line with Bahmani-Oskooee and Kandil (2010), who analyse the effect of exchange rate fluctuations on real output growth, controlling for monetary and fiscal policies for the case of Iran using a vector error correction (VEC) framework as we can find in other papers. Unlike other studies, they base their analysis on the theoretical model developed by Kandil and Mirzaie (2002). We can find more papers using this methodology. Matesinni and Quintieri (1997) analyse the impact of macroeconomic policies on

Italian GDP to understand the recovery from the Great Depression. Cha (2003) conducts the same analysis for Japan, using a structural vector autoregressive (S-VAR). Shibamoto and Shizume (2014) study how three macroeconomic policies (monetary, fiscal stimulus and exchange rate adjustment) and expected inflation affected Japanse GDP during the Great Depression.

The main objective of this paper is to distinguish between the short and the long run. Due to the number of observations, I run an ARDL model and compare the results with a VECM. ARDL is a time series model that allows the adoption of a similar approach to that of the VEC model while obtaining better results for a small sample, in this instance 44 observations, considering the two different temporal approaches.[16] A vector error correction model (VECM) is a restricted VAR used with non-stationary series that have a cointegration relationship.[17] Johansen and Juselius (1990) use a system of equations to estimate the long run relationship while the ARDL model uses a single equation (Pesaran and Shin, 1995).[18] The ARDL model does not deal with problems of endogeneity. It is unlikely that this problem will arise as long as the errors are not serially correlated because regressors tend to be lagged in levels or differences. If there is cointegration, OLS is a superconsistent estimation. In a VEC, there is no independent variable. A VECM considers that all variables are endogenous.

A further advantage of ARDL is that the variables can be I(0) or I(1): they do not have to be integrated of order 1. One can also run a VECM, when the variables are cointegrated, even, if there is one stationary variable (Lutkepohl and Kratzig, 2004). According to these authors, it is sometimes useful to consider systems with both I(1) and I(0) variables. Here, I study the impact of the flexible exchange rate and monetary and fiscal policy on domestic output using an empirical model that replicates the reduced-form solution of the theoretical model in Kandil and Mirzaie (2002, 2005). As such, my paper seeks to verify the respective claims of Martín Aceña (1981, 1993, 2000 and 2017) and Sardà (1936).

The bound test procedure developed by Pesaran et al. (2001) is based on the estimation of the unrestricted error correction model (ECM) by OLS, which can be applied to regressors with I(0) or I(1). To implement the bounds testing procedure the following ARDL model is estimated.

$$(2)\ \Delta lypcr_t = \alpha_0 + \sum_{i=1}^{n} \phi_i \Delta lypcr_{t-i} + \sum_{i=1}^{p} \vartheta_i \Delta f_{t-i} + \sum_{i=1}^{l} \partial_i \Delta lmsn_{t-i} + \sum_{i=1}^{m} \varphi_i \Delta lreer_{t-i} + \lambda_1 lypcr_{t-1} + + \lambda_2 f_{t-1} + \lambda_3 lmsn_{t-1} + \lambda_4 lreer_{t-1} + e_t$$

where all variables are as previously defined, Δ is the difference operator and e_t is the error term. The next step involves estimations of the long-run relationship coefficients and of the error correction term of the ARDL model, determining the speed of adjustment to equilibrium. ECT is the residual obtained from the estimated cointegration model of equation 2. If the null hypothesis of no cointegration is rejected, we can estimate the following short run ARDL error correction model. For the specification above, the error correction versions of the ARDL model in the variables $ypcr_t, f_t, msn_t$ and $reer_t$ are given by:

$$(3)\ \Delta lypcr_t = \alpha_0 + \sum_{i=1}^{n} \phi_i \Delta lypcr_{t-i} + \sum_{i=1}^{p} \vartheta_i \Delta f_{t-i} + \sum_{i=1}^{l} \partial_i \Delta lmsn_{t-i} + \sum_{i=1}^{m} \varphi_i \Delta lreer_{t-i} + + \delta ECT_{t-1} + \mu_t$$

To achieve this aim, and to analyse the dynamic relationship between macroeconomic variables, the VEC is constructed from the following reduced form standard VEC model using the variables of output (y_t), fiscal balance (f_t), money stock (m_t) and exchange rate (e_t):

$$\Delta \mathbf{Yt} = \boldsymbol{\mu}\mathbf{D_t} + \boldsymbol{\Gamma}_1\Delta\mathbf{Y_{t-1}} + \ldots + \boldsymbol{\Gamma}_{p-1}\Delta\mathbf{Y_{t-p+1}} + \boldsymbol{\Pi}\mathbf{Y_{t-1}} + \boldsymbol{\varepsilon_t}$$

Where Y_t is an endogenous variable $(lypcr_t\ f_t, lmsn_t, lreer_t)$ vector (kX1), D_t is a vector of deterministic terms (constant), μ is the matrix associated with the deterministic terms (D_t), Γ are (KxK) matrixes of short run parameters $(i = 1, \ldots, p-1)$ where p is the number of lags, Π is the (KxK) matrix of the long run parameters (so, it is the lagged error correction term, $\alpha\beta' y_{t-1}$) and ε_t is a (Kx1) vector of disturbances assumed to be independent and identically distributed with zero mean white noise process. The cointegration coefficients characterize long-run relationships between levels and variables, and the ECM coefficients describe changes that help to restore an equilibrium market position.

V. Empirical results

This section describes the results obtained from the estimation of the ARDL and VECM. I proceed in three phases. The first considers the order of integration of the variables, which is essential for implementing the Granger causality test; the second examines whether the variables are cointegrated; and, the third studies the short- and long-term approaches.

Unit root test

The first step is to test the stationarity of the variables. For this purpose, the Augmented Dickey Fuller - ADF (Dickey and Fuller, 1979) and Phillips-Perron - PP (Phillips and Perron, 1988) tests are applied. The null hypothesis of the variable is that all include a unit root as opposed to the alternative hypothesis of stationarity. As shown in Table 1, the variables tested with a constant and constant and trend are non-stationary at levels, but stationary at first difference.[19]

Table 1. Unit root test

Selection of lag length

ARDL models may have a different number of optimal lags for each variable (Pesaran and Shin, 1998). Pesaran and Shin (1999) and Narayan (2004) state that the maximum lag length for annual data is two lags. The optimal number of lags is determined by SBC because it is better for small samples. Moreover, we need to rule out the possibility of serial correlation. The SCB indicate (2,1,0,1) as being optimum for the main model. The optimal lag length for VECM is 1 and it is also determined by SCB.

Cointegration test and long-run relationship

The cointegration test shows if there is a long-run relationship between the variables. To test for the existence of cointegration in an ARDL, we use an estimation procedure developed by Pesaran and Shin (1999). Here, I use bounds testing approach to estimate the long-run relationship between the variables and Narayan (2004) critical values for a small sample. The null hypothesis is the non-existence of the long-run relationship between $ypcr_t, f_t, msn_t$ and $reer_t$ $(\lambda_1 = \lambda_2 = \lambda_3 = \lambda_4 = 0)$. The alternative hypothesis is defined by $\lambda_1 \neq \lambda_2 \neq \lambda_3 \neq \lambda_4 \neq 0$. The F-statistics calculated for testing the joint null critical value bounds are shown in Table 3. The upper critical bounds are the critical values for I(1) and the lower critical values are for I(0). If the F-statistic value is below the lower critical bound, then the variables do not have a cointegration relationship. If the upper critical bound is lower than the F-statistic calculated, the no-cointegration hypothesis is rejected. To test cointegration in a VECM, I use Johansen's method of cointegration based on the tests of the trace and maximum eigenvalue. To perform the cointegration test I choose the option that allows the variables to have a stochastic tendency but does not include the trend in the cointegration relationship. Table 2 shows that the null

hypothesis of there being at most one cointegrating vector can be rejected at the 5% level of significance.

Table 2. Cointegration test

Having established that an ARDL and VECM long-run cointegration relationship exists, the next stage of the procedure is to examine the coefficients of the long-run relationship among the variables. The long-run coefficients are shown in Table 3.

In the VECM, the exchange rate had a significant and negative impact in the long run while monetary policy had a positive and significant effect. [20] Fiscal policy appears as positive and significant both with ARDL and VECM. Money supply remains positive and significant in the long run ARDL estimation while exchange rate appears as a non-significant variable.

Table 3. Long-run relationship

The effect of currency depreciation on the cost of production results in a decrease in real growth in the long run. This means that there is an increase in import costs in the long term. The positive effect of money supply could be due to the financial innovations during this period. We will discuss more in section VI. The estimation passes the different diagnostic tests. The absence of serial correlation is reported in Table 7. As such, the ARDL estimations are reliable.

Short-run relationship

To further confirm the long-run relationship, I estimate the error correction model. The error correction coefficient presents for both methodologies the expected negative sign and is highly significant. Hence, cointegration is further confirmed. The existence of a long-term stable relationship is further confirmed if the error correction term is highly significant. The ECM coefficient is -0. 5092 which implies that deviation from the long-term growth rate in GDP is corrected by 50.92% after 1 year with ARDL methodology.

In Table 4 significant coefficients for the differenced values indicates that the exchange rate was an important determinant of fluctuations in real output. Depreciation of the exchange rate has an expansionary effect on real output growth in the short run. Producers take advantage of the real depreciation reflected in the increase in profits in domestic currency and so have greater incentives to produce and promote exports. Transitory currency depreciation stimulates growth via cheaper cost of exports in the short run. The fiscal policy measured as fiscal balance appears as non-significant. So, it did not have any effect on GDP.

For VECM, the cointegration equation shows that the error correction term of equation D (LYPCR) was significantly different from zero and negative, which means that this equation contributes to the restoration of long-term equilibrium. Equation D (LYPCR) corrects the imbalance by 57.87% each year while equation D (LER4) also contributes to returning the variables to the equilibrium in the long term by 40.24%.

Table 4. Short run relationship

To understand the responses of the variables in the short run, we analyse the effects of structural shocks. Variables with no long-term effects on output may have large-scale temporary impacts on pc GDP. Therefore, using Generalized Impulse Response Functions I analyse the dynamic characteristics of our model. I use these functions because they are invariant to the

ordering of the variables in the VAR (Lutkepohl, 1991). Pesaran and Shin (1998) present the approach for a cointegrated VAR model, and show how the maximum likelihood structure of the generalized impulse response is T-consistent and asymptotically normally distributed.[21] Considering that I have a small sample, I also present the results of the local impulse response projections following Jordà (2005).

The impulse response function traces the effect of a shock of one standard deviation on the current and future values of the endogenous variables, causing them to increase or decrease before finally stabilising. [22] Figure 2 sets out the impulse response functions for each variable following Pesaran and Shin (1998).[23] The graph shows the responses of GDP to shocks on each variable. I also compare the results with local IRF; they only change for fiscal policy.

Figure 2. Impulse response function

According to the impulse response functions, both monetary policies and exchange rate had a positive effect on GDP independently of whether local impulse response projections or the VAR impulse response function is used. With an expansionary monetary policy, GDP rose.[24] A depreciating exchange rate implied an increase in pc GDP. When the budget balance decreased, the GDP rose according to VAR impulse response function results. The result differs considering the local impulse response projection: when the fiscal balance improves, the GDP increases.

Granger causality

The causal link between the variables is examined using the Granger causality test (Engle and Granger, 1987). Correlation is not an indication of causality, which is why the Granger causality test is estimated. If X helps in the prediction of Y, then Y is said to be Granger-caused by X (that is, the coefficients of the backward estimation are statistically significant). The null hypothesis is that X does not cause Y.

In the specific case of the Spanish economy, we expect monetary policy to respond to fiscal needs (Escario et al., 2011, pp. 271-272 and Sabaté et al., 2006) and that the exchange rate will, in turn, respond to changes in the money stock. The estimation results of Granger causality between the variables are presented in Table 5. Granger causality runs one-way from the real exchange rate to pc GDP at the 5% level of significance. The past values of the exchange rate were able to affect the present values of GDP. There was Granger causality between pc GDP and fiscal policy. Moreover, the past values of monetary policy helped to explain the present values of fiscal policy. The Granger causality analysis of the variables shows, monetary policy did not accommodate the state's fiscal needs (Escario et al., 2011, pp. 271-272 and Sabaté et al., 2006, pp. 310, 321 and 328).[25] Finally, the monetary policy Granger-caused the exchange rate. We could say that the increase in the money supply affected the present values of exchange rate. There was not causality from fiscal policy to exchange rate. Thus, changes in the expectations that the different fiscal decisions generated did not appears as important as it was said by Martin Aceña (1981, 1987,1993, 2000 and 2017).

When we estimate the Granger causality with the nominal effective exchange rate, we find, in addition to the previous results, that there is Granger causality between fiscal and monetary policy. In short, there was fiscal dominance and, so, Spain's monetary policy was affected by the fiscal needs of its government. Moreover, when we consider the nominal effective exchange rate, the past values of fiscal policy helped to explain the present values of pc GDP. This means that not only the exchange rate was able to affect the output but also the fiscal policy.

Table 5. Granger causality

VECM and ARDL robustness check

ARDL was subjected to several diagnostic tests. The diagnostic test in Table 6 shows that there is no evidence of autocorrelation in the model. The null hypothesis of no correlation in the Breusch-Godfrey test cannot be rejected. The equations are in their correct functional form (Ramsey RESET test).

Table 6. Autocorrelation and heteroscedasticity test.

To analyse the parameter stability of the ARDL model, we employ the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ) statistics based on the recursive regression residuals (Pesaran and Pesaran, 1997). They are plotted against the critical bound of the 5% significance level. When the graph of these statistics remains within the critical values of 5% significance, the estimated coefficients are stable. Neither CUSUM nor CUSUMSQ plots cross the critical bounds, indicating no evidence of any significant structural instability (Figure 3). The parameters of the equation are stable enough to estimate the long-and short-run causalities in the study.

Figure 3. CUSUM and CUSUMSQ

For the VECM model, the serial correlation of residuals is tested with LM and Portmanteau Autocorrelation tests (Table 7). The multivariate Lagrange Multiplier (LM) test and the Portmanteau test for autocorrelation indicate the absence of autocorrelation at all lags. There are no heteroskedascity problems (Table 8).

Table 7. Autocorrelation tests

Table 8. Heteroskedacity test

The root characteristic polynomial is used to test the stability of the model (Figure 4). One unit root was imposed by the VEC model, and the VAR stability condition check does not present a root outside the unit circle besides the first unit root of 1.[26] If the model satisfies the VAR stability condition, inferences can be made. The study verifies and validates the model through the diagnostic test and stability checks.

Figure 4. VAR roots

VI. Discussion

In the period under study, the maintenance of the gold standard was an essential requirement to guarantee prosperity. As such, the system was not readily applicable to countries on the southern periphery of Europe, such as Spain. One of the main causes of the internal instability experienced up to 1913 in these countries under the classical gold standard was largely a result, therefore, of the subordination of their economic policies to external objectives. Spanish policies in the late nineteenth and early twentieth centuries were not devised strategically, but were adjusted in accordance with circumstances[27]. The adoption of the gold standard would have prevented the Spanish government from using instruments to address the specific problems that the economy faced at particular moments (Tortella, 1994a, p.331, Herranz & Tirado, 1996, p.32, Catalan et al., 2001, p.25, García-Iglesias, 2005, p.15 and Martínez Ruíz and Nogues, 2014, pp. 19 and 94).

Some of the results reported here are consistent with those published in previous non-quantitative studies. Martín Aceña stresses that using an expansionary monetary policy has no long-term implications, since changes in the quantity of money have insignificant effects on long-term real income growth.[28] We find that the monetary policy applied in this period had a

positive effect on GDP. According to the results, the role played by the monetary policy is not the one described by Martin Aceña, and is more closely in line with the thesis defended by Sardà. The positive coefficient obtained for monetary policy shows that this policy helped increase Spanish output in the long run.[29] It is expected that monetary policy will positively affect real GDP because an increase in the amount of real money causes an increase in equilibrium output through a variety of mechanisms such as the exchange rate, through which monetary policy has an effect on the real economy. That is we have found in the impulse response function and in the VECM and ARDL long-run relationship. The long-run positive sign could also be explained by the financial innovations during the late 19th century. As it was said by Castañeda (2001) and Castañeda and Tafunell (1993), the new bank transfers acquired a primary importance. Comparing the volume of transfers with respect to the Spanish GDP, this importance is highlighted. In 1885, transfers accounted for 6% of GDP and in 1900, for 31% of GDP. Monetary policy measured in terms of the number of banknotes in circulation (Martin Aceña, 2018) is also positive and significant, which reinforces the results obtained. Although there was monetary expansion, it was controlled and not allowed to reach unsustainable levels.

In contrast, Martin Aceña (1883, 1887, 1993) was right to say that having a flexible exchange rate could have damaged the Spanish economy. Our results show how the fluctuations of the exchange rate had a negative long-term impact on GDP using VEC model and a negative but non-significant impact on GDP running an ARDL model. This result is also supported when we run the estimation with a nominal effective exchange rate. While depreciation increases exports, it also raises production costs by increasing import prices. Depending on the effects of these two actions on the economy, depreciation will have either a positive or negative impact. A depreciation is considered successful when it succeeds in modifying demand and quantity in the right direction (Guitian, 1976; Dornbusch, 1988). Its success also depends on the ability of the economy to meet additional demand by producing more goods. The structuralist school emphasizes the contractionary effects of devaluation (Meade, 1951).

However in the short run, a flexible exchange rate helped the economy. The flexible exchange rate is an important element of transmission of monetary policy. Taylor (1995) and Obstfeld (1995) emphasize the importance of the exchange rate channel of monetary transmission. An increase in the money supply causes the national currency to depreciate in the currency market, which increases income. Serrano (2004, p. 163) concludes that “the exchange rate acted as an occasional alarm by exerting an impulse towards moderation and a return to equilibrium that prevented great divergences”. Cubel (2001, p. 187) indicates that not being on the gold standard allowed Spain to reduce the disturbances in its economy; the cost of staying on the gold standard would have been too high for a backward country. Llona (2001, p. 172) stresses that the Spanish authorities were forced to adopt a flexible exchange rate that would accelerate the adjustment to equilibrium. Tortella (1994a) claims that gold in a poor country like Spain should be used to buy food, technology, and so on, and that it would have been wasteful to use it as circulating money; he regards the gold standard as a "luxury good" for Spain.[30] The depreciation of the peseta seems to be crucial in increasing output in the short run during the period under study.[31]

An improvement in the budget balance represented an increase of GDP, while a worsening of the budget balance generated a decline in output. The Spanish Treasury obtained the financing it needed by monetising public debt (Sardà, 1987, pp. 186, 190 and 199; Escario et al., 2011, pp. 271-272 and Sabaté et al., 2006, pp. 310, 321 and 328). The causality between fiscal and monetary policy is only shown by the nominal effective exchange rate results of the Granger causality analysis. We also find that the past values of monetary policy helped to explain the present values of the exchange rate. So, the value of the exchange rate was due to the increase in the circulation of banknotes, but not to the effect of the expansionary fiscal policy on expectations abroad. Finally, it is important to stress that exchange rate fluctuations helped to

explain the evolution of GDP.[32] The prior commitment to the gold standard would have ruled out the possibility of using monetary policy.

VII. Conclusion

The paper analyses the Spanish economy between 1868 and 1913. By conducting both short- and long-run analyses, I have been able to combine the classical and critical theories, even though they appear to be opposites. The ARDL and VECM analysis reported here shows that exchange rate adjustments played an important role in the short run. This suggests that the real exchange rate was a useful policy tool in the short term, as Sardà claimed in 1936. Here, the exchange rate level seems to have been vital as it helped improve the terms of trade and promoted exports; however, the results obtained support Martin Aceña's claims that having a flexible exchange rate could have had a negative impact on long-term economic growth. The study also finds a connection between monetary policy and fiscal policies and identifies the exchange rate as a transmission mechanism of monetary policy. This last result will need further research. I also show how the past values of exchange rate were able to affect the present values of GDP. The results in this paper provide new empirical evidence for the core-periphery debate at the time of the classical gold standard. Both schools of thought are therefore correct if we consider the temporal approaches taken: the tools of macroeconomic policy were good for the Spanish economy in the short term, but they could have had detrimental effects in the long run.

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Figures and tables

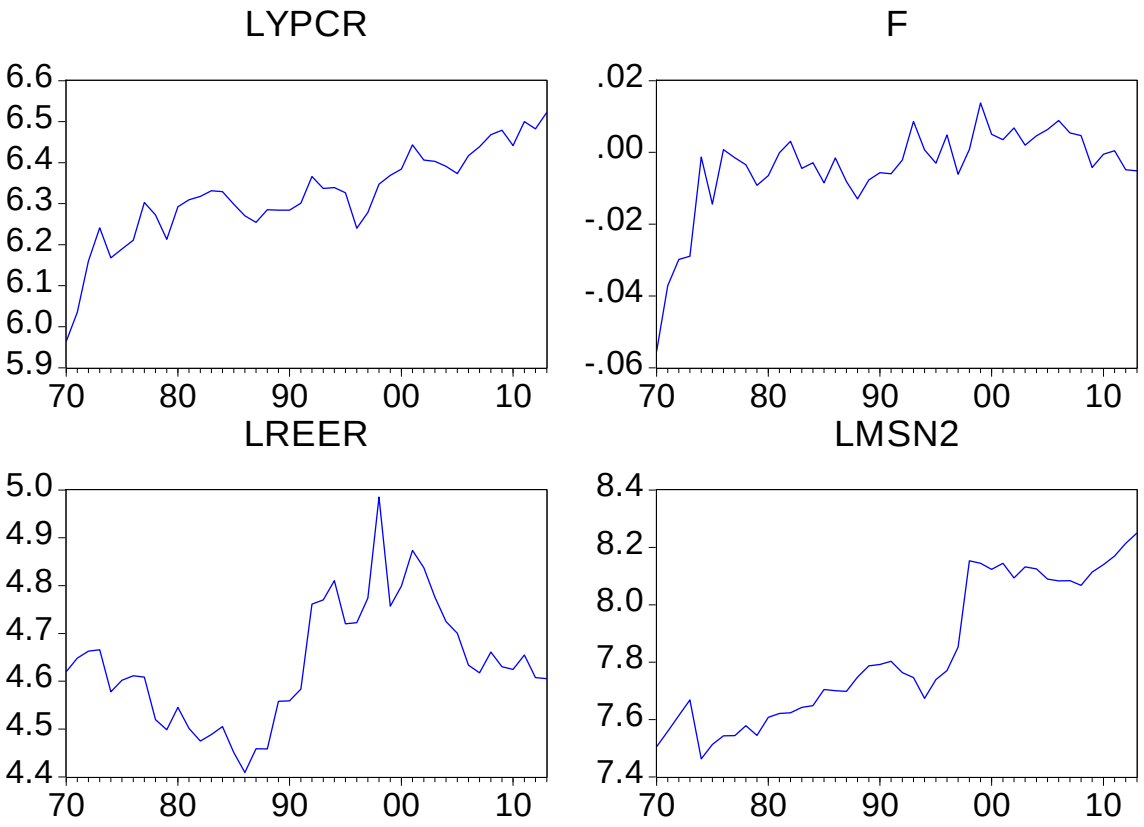

Figure 1.

Source: main text

Null hypothesis:	LYPCR has a unit root		D(LYPCR) has a unit root		F has a unit root		D(F) has a unit root	
Exogenous	constant	trend	constant	trend	constant	trend	constant	trend
ADF test t-statistic	-1.268	-3.005	-7.618	-7.613	-2.344258	-2.657414	-6.840	-7.870
Prob.	0.637	0.142	0.000	0.000	0.1631	0.2584	0.013	0.000
PP test statistic	-0.7067	-2.9239	-7.959	-8.221	-2.159252	-2.624361	-9.253	-10.377
Prob.	0.8347	0.165	0.000	0.000	0.2235	0.272	0.000	0.000
	LMSN has a unit root		D(LMSN) has a unit root		LREER has a unit root		D(LREER) has a unit root	
ADF test t-statistic	-0.7132	-2.5752	-6.4498	-6.3783	-1.9158	-1.9628	-8.1486	-8.0466
Prob.	0.8330	0.2929	0.0000	0.0000	0.3223	0.6053	0.0000	0.0000
PP test statistic	-0.723339	-2.765327	-6.4495	-6.3783	-1.811344	-1.792672	-8.1667	-8.0636
Prob.	0.8304	0.2171	0.0000	0.0000	0.3704	0.6917	0.0000	0.0000

Table 1.

Source: own calculation

ARDL

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	8.332559	10%	2.37	3.2
k	3	5%	2.79	3.67
		2.50%	3.15	4.08
		1%	3.65	4.66
Actual Sample Size	43		Finite Sample: n=45	
		10%	2.56	3.428
		5%	3.078	4.022
		1%	4.27	5.412
			Finite Sample: n=40	
		10%	2.592	3.454
		5%	3.1	4.088
		1%	4.31	5.544

VECM

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized No. of CE(s)	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.518048	49.46	47.85613	0.0351
At most 1	0.286893	18.07	29.79707	0.5608
At most 2	0.053801	3.532	15.49471	0.9376
At most 3	0.026472	1.154	3.841466	0.2828
Trace test indicates 1 cointegrating eqn(s) at the 0.05 level				
Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized No. of CE(s)	Eigenvalue	Max-Eige Statistic	0.05 Critical Value	Prob.**
None *	0.518048	31.39	27.58434	0.0154
At most 1	0.286893	14.54	21.13162	0.3225
At most 2	0.053801	2.378	14.2646	0.9793
At most 3	0.026472	1.154	3.841466	0.2828
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Table 2.

Source: own calculation

VECM

Cointegrating Eq:	CointEq1
LYPCR(-1)	1
F(-1)	-0.000167
	-0.00012
	[-1.37833]
LMSN(-1)	-0.338814
	-0.05097
	[-6.64786]***
LREER(-1)	0.17087
	-0.08361
	[2.04361]**
C	-4.462548
Standard errors in ( ) t-statistics in [ ]	
*p<0.10, **p<0.05, ***p<0.01	

ARDL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
F	0.000187	0.000182	1.027345	0.3113
LMSN	0.347302	0.05664	6.131787	0.0000
LREER	-0.164715	0.108589	-1.516868	0.1383
C	4.391949	0.539616	8.139033	0
EC = LYPCR - (0.0002*F + 0.3473*LMSN -0.1647*LREER + 4.3919)				

Table 3.

Source: own calculation

ARDL

ECM Regression				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(F)	-0.000109	6.77E-05	-1.613498	0.1156
D(LREER)	0.118858	0.070061	1.696494	0.0987
D(LREER(-1))	0.19207	0.069845	2.749944	0.0094
CointEq(-1)*	-0.472253	0.069311	-6.813535	0.0000
R-squared	0.594971	Akaike info criterion		-4.114834
Adjusted R-squared	0.563815	Schwarz criterion		-3.951002
Durbin-Watson stat	1.621976			
* p-value incompatible with t-Bounds distribution.				

VECM

Error Correction:	D(LYPCR)	D(F)	D(LMSN)	D(LREER)
CointEq1	-0.563921	-169.343	-0.306798	-0.456574
	-0.10295	-173.252	-0.19198	-0.1942
	[-5.47739]***	[-0.97744]	[-1.59810]	[-2.35104]**
*p<0.10, **p<0.05, ***p<0.01				

Table 4.

Source: own calculation

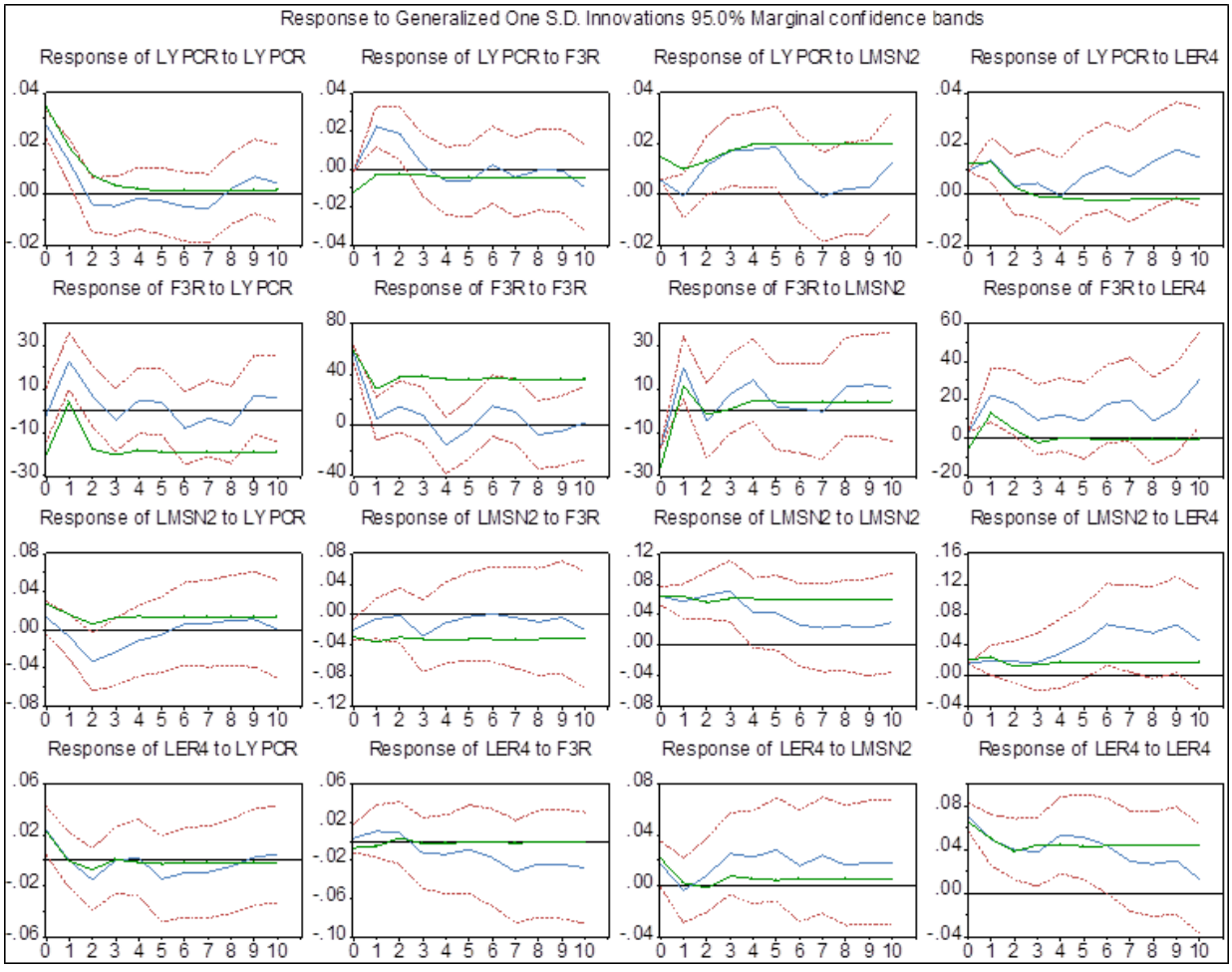

Figure 2.

Source: own calculation

VEC Granger Causality/Block Exogeneity Wald Tests			
Dependent variable: D(LYPCR)			
Excluded	Chi-sq	df	Prob.
D(F)	0.021277	1	0.884
D(LMSN)	2.275287	1	0.1315
D(LREER)	4.858613	1	0.0275
All	5.679816	3	0.1283
Dependent variable: D(F)			
Excluded	Chi-sq	df	Prob.
D(LYPCR)	1.935979	1	0.1641
D(LMSN)	4.083373	1	0.0433
D(LREER)	0.838115	1	0.3599
All	15.35477	3	0.0015
Dependent variable: D(LMSN)			
Excluded	Chi-sq	df	Prob.
D(LYPCR)	0.72403	1	0.3948
D(F)	3.36372	1	0.0666
D(LREER)	1.19281	1	0.2748
All	4.805512	3	0.1866
Dependent variable: D(LREER)			
Excluded	Chi-sq	df	Prob.
D(LYPCR)	0.185961	1	0.6663
D(F)	3.554048	1	0.0594
D(LMSN)	4.080088	1	0.0434
All	7.04077	3	0.0706

Table 5.

Source: own calculation

Breusch-Godfrey Serial Correlation LM Test:			
F-statistic	0.518247	Prob. F(6,29)	0.7896
Obs*R-squared	4.164117	Prob. Chi-Square(6)	0.6545

Heteroskedasticity Test: Breusch-Pagan-Godfrey			
F-statistic	0.587455	Prob. F(7,35)	0.7615
Obs*R-squared	4.52094	Prob. Chi-Square(7)	0.7182
Scaled explained SS	2.218597	Prob. Chi-Square(7)	0.9468

Table 6.

Source: own calculation

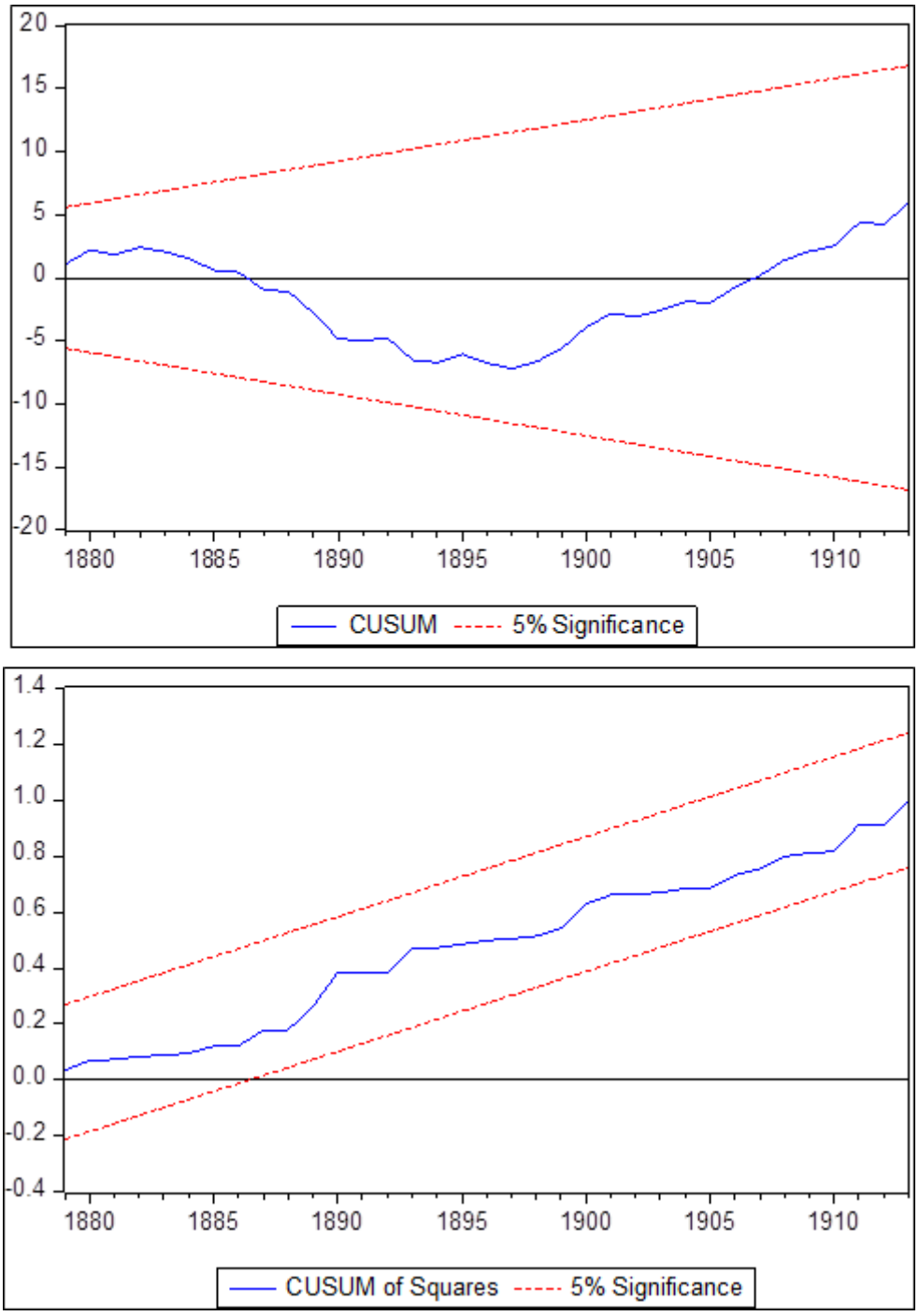

Figure 3.

Source: own calculation

VEC Residual Serial Correlation LM Tests				
Null hypothesis: No serial correlation at lag h				
Lag	LRE* stat	Prob.	Rao F-stat	Prob.
1	7.236935	0.9684	0.436121	0.9687
2	11.81535	0.7566	0.728907	0.758
3	9.889492	0.8723	0.604103	0.8732
4	20.42914	0.2015	1.317721	0.2035
5	9.377683	0.897	0.57134	0.8977
6	24.82843	0.0729	1.638737	0.0741
Null hypothesis: No serial correlation at lags 1 to h				
Lag	LRE* stat	Prob.	Rao F-stat	Prob.
1	7.236935	0.9684	0.436121	0.9687
2	17.84689	0.9794	0.523796	0.9802
3	36.52967	0.8869	0.713775	0.8984
4	52.66349	0.8433	0.751703	0.8775
5	64.33648	0.8991	0.681554	0.9439
6	120.9099	0.0437	1.265143	0.1982
*Edgeworth expansion corrected likelihood ratio statistic.				

VEC Residual Portmanteau Tests for Autocorrelations				
Lags	Q-Stat	Prob.*	Adj Q-Stat	Prob.*
1	1.620657	---	1.659244	---
2	13.22744	0.9918	13.83222	0.9883
3	21.333	0.9984	22.54569	0.997
4	42.7771	0.9547	46.18918	0.905
5	50.53244	0.9893	54.96496	0.9671
6	74.59224	0.9073	82.92635	0.7398
*Test is valid only for lags larger than the VAR lag order. df is degrees of freedom for (approximate) chi-square distribution afteradjustment for VEC estimation (Bruggemann, et al. 2005)				

Table 7.

Source: own calculation

VEC Residual Heteroskedasticity Tests (Levels and Squares)		
Joint test:		
Chi-sq	df	Prob.
94.49257	100	0.6366
VEC Residual Heteroskedasticity Tests (Includes Cross		
Joint test:		
Chi-sq	df	Prob.
201.8026	200	0.451

Table 8.

Source: own calculation

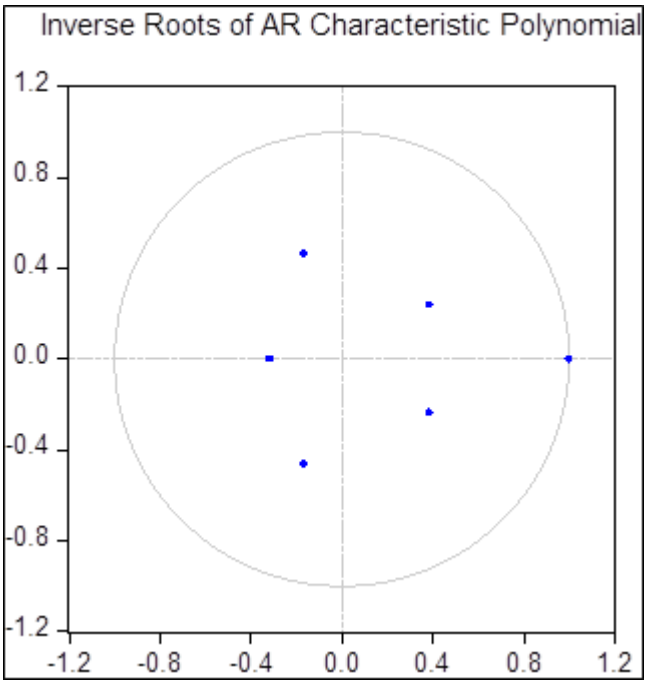

Figure 4.

Source: main calculation

[1] For the Italian case, see Fratianni and Spinelli (1984), Cipolla (1995), Tattara (1997, 2000 and 2003), Bordo (1999, p. 328) and Fratianni and Spinelli (2012). For the Portuguese case, see Mata (1987), Reis (1996, 2000 and 2007), Valerio (1998) and Bordo (1999, p. 329). For an analysis of the gold standard in Greece, see Lazaretou (1995 and 2005).

[2] More about the gold standard in Eichengreen (1992 and 1996)

[3] More about rigidity in Morys (2007).

[4] Lains (2006), p. 185.

[5] Martín Aceña, Reis y Llona (2000) p. 3

[6] Martín Aceña, Nogués-Marco, Martínez-Ruíz (2011), Sabaté, Gadea and Escario (2006), Martín Aceña (2017 and 2018).

[7] The Cuban uprising forced the Ministry of Overseas Territories to resort to the issue of banknotes, Sardà (1987, p. 190).

[8] These tighter policies are associated with Raimundo Fernández Villaverde, finance minister in 1899-1900 and 1902-1903 and later prime minister in 1903 and 1905. His policies involved financial restructuring to put the system on a sound footing again and to halt the depreciation of the currency. In 1908, these policies were abandoned when signs of domestic slump appeared (Sardà, 1987, p. 202).

[9] My results do not change if I use the government expenditure instead of the fiscal balance.

[10] The exchange rate calculation is explained in section 3.

[11] For more information about the effects of monetary policy, see Mishkin (1995). Taylor (1995) emphasizes the importance of the exchange rate channel of monetary transmission. Taylor (1995) stresses the effects of monetary policy on the economy (Mishkin, 1995, p.5). For more about the impact of exchange rates see Alexander (1952), Dornsbusch and Krugman (1976, p. 551), Krugman and Taylor (1978), Bahmani-Oskooee and Anker (2001), Bahmani-Oskooee and Kandil (2010). For more about fiscal effects on economic growth, see Blanchard and Perotti (2002).

[12] For more information about the model look the reference.

[13] I can start on 1871 thanks to the work done by Martín Aceña (2018) who constructed a new money supply serie for the years before the Banco de España monopoly of issuing

[14] I have considered different definitions of the money supply to determine the relationship between money stock and real output. When the estimation is made with the number of banknotes in circulation (mbn_t) as a proxy for monetary policy, the results are unchanged. Likewise, the results remain the same if real government expenditure

(gr_t) is used, in line with Bahmani-Oskooee and Kandil (2010). The results here are unchanged when estimating the model with total GDP.[14] The signs of my results do not change plotting the following four measures of the exchange rate: the real effective exchange rate ($reer_t$), the nominal effective exchange rate ($neer_t$) and the bilateral nominal and real exchange rates (en_t and er_t), both defined as the number of pesetas to the pound sterling. The results also still the same when real exchange rate is calculated with WPI from Sardà (1948, p. 302-305). I have also run the estimation adding capital flows variable and the significance and signs of the coefficients do not change. When I run the estimation considering de capital flows, the results are maintained. All the coefficients remain with the same sign and exchange rate still being significant and positive in the short run. The coefficient of capital flows variable appears as negative and significant in the long-run analysis.

[15] This is the same procedure followed by Shibamoto and Shizume (2014). Because the fiscal balance has negative values, it cannot be converted into logarithms. As a result, the variable is used without conversion.

[16] Juselius, 2009 and Colander (2009)

[17] For more information, see Lutkepohl and Kilian (2017), chapter 3 and Lütkepohl, (2005).

[18] Simple equation methods, such as fully modified and dynamic ordinary least squares (FMOLS and DOLS), have been used to analyse the long term and cointegration between variables, producing similar results. Here, the results of ARDL, DOLS and FMOLS were also very similar.

[19] ADF can lose reliability in small samples. Thus, we examine the correlograms of the variables and observe that all behave as I (1). Although according to the theoretical framework, the budget deficit and the exchange rate should be stationary variables, Figure 1 shows the opposite. This can be attributable to the fact that Spain was a country with a tendency to budgetary deficits during the entire period studied, only achieving a period of surplus during the first years of the twentieth century. The exchange rate suffered a general depreciation (increase) after 1883, reaching a maximum in 1898, depreciating by around 40%.

[20] The normalization process implies reversing the signs of the coefficients.

[21] When Cholesky decomposition is used all the figures show the same pattern. The results coincide with GIRF. The exception is in the response of pc GDP to an exchange rate innovation. Cholesky decomposition shows a negative response since the first year while GIRF shows a positive response the first year and it turns negative the following years.

[22] A shock is considered as a positive impact. Standard deviations are preferred because they offer the responses in the correct order of magnitude.

[23] I test the results with generalized impulses and with Cholesky factorization and observe that the results do not change.

[24] Peripheral countries used depreciation recurrently in order to overcome crises. Matthias Morys (2013), p. 221, shows that these countries paid little attention to variations in the exchange rate and a great deal of attention to the bank coverage ratio.

[25] Likewise, the authors stress the importance of preserving monetary sovereignty.

[26] This means that the eigenvalues of the respective matrix are exactly one or less.

[27] Olariaga, 1933/1977, p. 137, takes the view that Spain's policy was ad hoc rather than consciously designed to regulate the economic cycle.

[28] Martín Aceña (1981), pp. 284-285, in an argument based on Friedman (1970), p. 217.

[29] That is, when we dispose of sufficient lags to study the coefficients.

[30] Tortella (1974), pp. 480-481 and Tortella (1994), p. 177.

[31] For more on the Spanish case, see Olariaga, (1933), Tortella (1974), Sardà (1987), Martín Aceña (1981, 1993, 1997, 2000), Catalan et al. (2001) and Catalan and Sánchez (2013). For other cases, see Temin (1995), Bernanke (1995), Eichengreen and Temin (2010), Bordo and Rockoff (1996), Shibamoto and Shizume (2014), Eichengreen and Sachs (1986).

[32] The results are maintained when we use banknotes in circulation instead of money supply or nominal exchange rate instead of real exchange rate.