Banking, Currency, Stock Market and Debt Crises: Revisiting Reinhart & Rogoff Debt Analysis in Spain, 1850-1995

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Abstract

What type of crisis is generated when debt increases? We study the Spanish debt evolution in the 19th and 20th centuries by introducing currency and stock-market crises in the Reinhart and Rogoff (2011) framework. We find their same results for the determinants of banking and debt crises but substituting external and public debt with perpetual debt. Moreover, we find that currency crises depend strongly and positively on financial centers crises and negatively and mildly on perpetual debt. We justify the negative relationship due to an inflation tax. We also find that stock-market crises depend only positively and strongly on financial centers crises.

Keywords: Austerity, Macroeconomic Policy, Fiscal Policy, Banking Crises, Currency Crises, Stock Market Crises, Debt Crises, Financial History.

JEL classification: E44, E60, E62, F34, F44, G01, H63, N10, N20.

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1. Introduction

What type of crisis is generated when a country decides to increase its debt, and in special, different types of debt (redeemable, perpetual, external, investment bonds...)? There is an important line of research studying the determinants of different types of crises, mainly in relation to the increase in debt (see for example Reinhart and Rogoff (2009)). Reinhart and Rogoff (2011, RR (2011) from now onwards), using a sample of 70 countries, conducted univariate and bivariate logit models to study the behavior of two dependent variables: banking crises and debt crises and they found that banking crises strongly depend on the financial center crisis and mildly on past banking crises and the amount of public (and external) debt. They also found that sovereign defaults (debt crisis) depend strongly on lags of banking crisis, past debt crises and some evidence of dependence of the amount of public debt. They used data spanning over two centuries but they did not include in the analysis other factors such as currency and stock market crises. More recently, we can find many papers studying the same issue, such as for example Amann and Middleditch (2015), showing that there is no support for the view that higher levels of debt cause reductions in economic activity.

Kaminsky et al. (1998) showed that it is possible to find a large number of explanatory variables that may signal the occurrence of a crisis. However, more recently, Candelon et al. (2010) and Candelon, Dumitrescu, Hurlin and Palm (2013) showed that univariate and multivariate dynamic probit models present the advantage of yielding plausible results while being fairly parsimoniously parametrized. They found relationships of three types of financial crisis (banking, currency and sovereign debt crisis), but they focused their analysis only from 1985 onwards. This may have strong time limitations since the underlying cycle can be a half century or more long, not just 30 years (see RR (2011)). In our paper we want to extend the results of RR (2011) using a wider consideration of financial crises (including currency and stock market crises) and using data starting from 1850 onwards (improving therefore the results in Candelon, Dumitrescu, Hurlin and Palm (2013) to have a better knowledge of the underlying cycle by using two centuries of data). Moreover, in order to avoid the heterogeneity that can be observed when using panel databases of many countries, we will focus on a single country, such as Spain. We argue in Section 2 that financial crises have been more frequent in Spain than in the rest of the world from the 19th century; and from 1973 they have also been deeper and more complex. So Spain is a very interesting case for a deep study.

In more detail, our objective is to study the evolution of the Spanish debt in the 19th and 20th centuries and for that, we extend RR (2011) in two ways: first, we introduce as novelty in RR (2011) the concepts of stock market crisis and currency crisis in Spain. In Section 2.1, we explain the importance of the four type (banking, currency, debt and stock market) of crises in Spain and why we introduce them in the analysis. Reinhart and Rogoff (2014) constructed a composite index of banking, currency, debt, inflation crises, and stock market crashes (weighted by their share of world income) but in this paper we want to treat them separately to find out what type of crisis is generated by increases in debt. Second, we introduce in the analysis the concept of "perpetual debt" in Spain versus other types of debt such as external debt and public debt in RR (2011). In Section 2.2 we explain the role and the importance of perpetual debt in Spain. We analyze the impact of increasing different types of debt in Spain on different types of crises that this may generate.

The plan of the paper is as follows. In Section 2 we proceed to explain the idiosyncrasies and the specific characteristics of the Spanish debt in the 19th and 20th centuries, that forces us to

extend the RR (2011) analysis by introducing the concepts of stock market and currency crises, the special role of the perpetual debt and the inflation tax structure. Section 3 contains the definition of the variables used in the analysis. Section 4 contains our main empirical results matching the existing economic history literature in Spain given in Section 2. Finally Section 5 concludes.

2. Idiosyncrasies of the Spanish financial system in the 19th and 20th centuries

2.1 Considering a variety of crises in a context of higher frequency and severity of them in Spain

We proceed now to justify first, why we need to introduce in the empirical analysis of our paper the concepts of stock market and currency crises in the framework of RR (2011) when we want to study the Spanish case. There is a very extensive economic and financial literature studying the different types of crises all around the world. Kindleberger (2000) gave an extensive list of crises and financial shocks happening since the 17th century. Along the same lines Gooddhart and Delargy (1998) and Barro and Ursúa (2009) have given a detailed exposition of a series of stock market crises, considering their international role and their impact on economic depressions. Bordo (1986) and Eichengreen and Bordo (2003) have introduced in their analysis banking and currency crises and their general economic impact. Recently, the seminal work by Reinhart and Rogoff (2009, 2010) provides a dataset of banking and financial crises around the world from 1800, focusing on the implications of the debt and banking crises, inflation and currency crises. This literature highlights the existence of a great variety of financial crises, that in some cases they do manifest as a combination of themselves. From a historical point of view, we can find that they happen in different circumstances, periods and countries; in some cases with a limited impact and in other cases at an international level. Bordo et al. (2001) have highlighted that it is necessary to distinguish between banking, currency and twin crises; and in this way, using a wide sample of countries, they show the importance of the different types of financial crises from a historical perspective.

In the Spanish case, Betrán, Martín-Aceña and Pons (2012) show that for a deep and accurate knowledge of the Spanish financial crises, we need to consider a wide variety of them. They show how these crises have been more frequent in Spain than in the rest of the world from the 19th century, and from 1973 they have also been deeper and more complex. We can also observe this trend in the crisis starting on 2007. These authors offer us a framework from the economic history to develop our empirical analysis in Section 4: identifying and classifying for us the different types of crises and their categories, their frequency, duration and intensity. The number and severity of the financial crises experienced by Spain from 1850 to 1995[3], justifies our need to incorporate more types of crises (apart from debt and banking) to the RR (2011) analysis if we want to study the Spanish case. In short, RR (2011) used a sample of 70 countries to study general relationships of debt and banking crises on average for those countries; but if we want to carry out a deeper analysis, we can do so by reducing the number of countries

[3] Analyzed period by Betrán et al (2012).

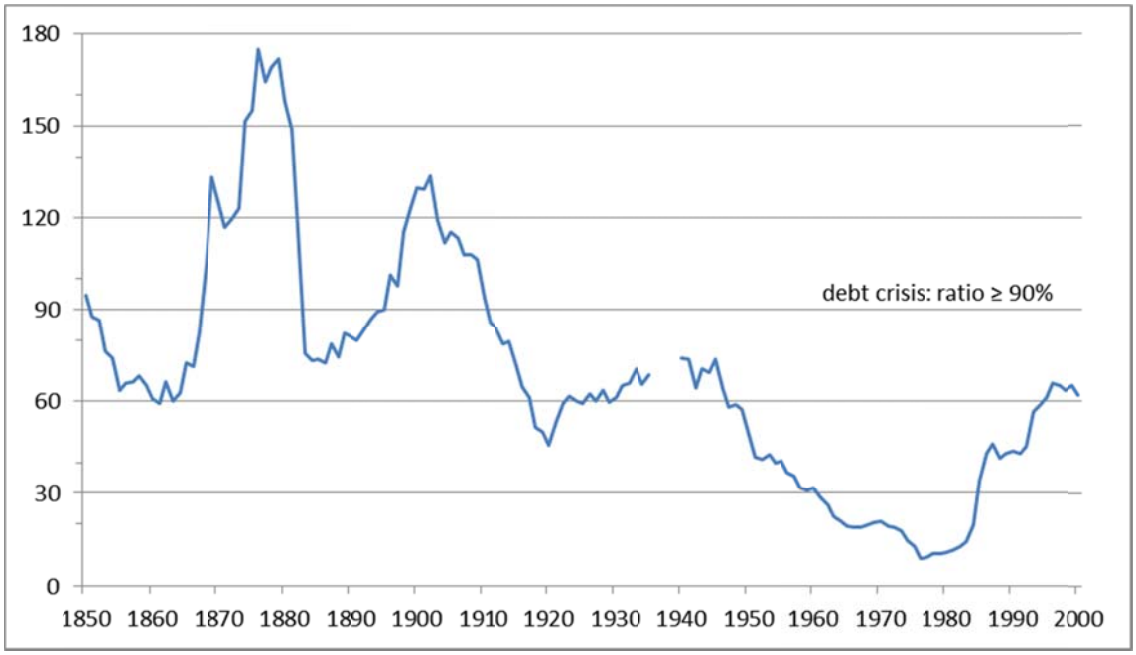
analyzed. This reason justifies our study in Section 4 that focuses on the analysis of the Spanish case, a country that, as Betrán et al (2012) show, it is unique in the world in terms of the nature of its crises.

2.2 The public debt structure in Spain. The role of interior perpetual debt

Our objective in this section is to justify why we expect that the role of interior perpetual debt will be very important in the empirical analysis of the Spanish debt. Comín (2012) confirms the main hypothesis of Reinhart and Rogoff (2009) for the Spanish case, although it states that they have underestimated a number of debt crises, their duration and depth. In Spain, debt crises were solved historically in four ways: default, rescheduling, inflation tax and financial repression. These government policies, in special the last two measures, characterized very specifically the behavior of the Spanish debt in the 20th century[4]. Significantly, these very subtle ways of non-payment were used during the years of the dictatorship of the general Franco (1939-1975) and they explain the non-existence of debt crises during those years.

In the long run, periods where public debt had a higher weight as percentage of the Gross Domestic Product (GDP) were in the second half of the 19th century and in the first third of the 20th century (see Figure 1). Later, Spain did not have debt crisis ratios higher than 90% (what represents a high probability of no-payment) until very recently, in the Greek crisis framework. In 2007, the year previous to the Great Recession, public debt was 35.5 % of the GDP, however, at the end of 2014 it was 99.3 % and at the end of 2015, it was slightly above 100% (data given by the Bank of Spain).

Figure 1. Public Debt (% of GDP), 1850-2000

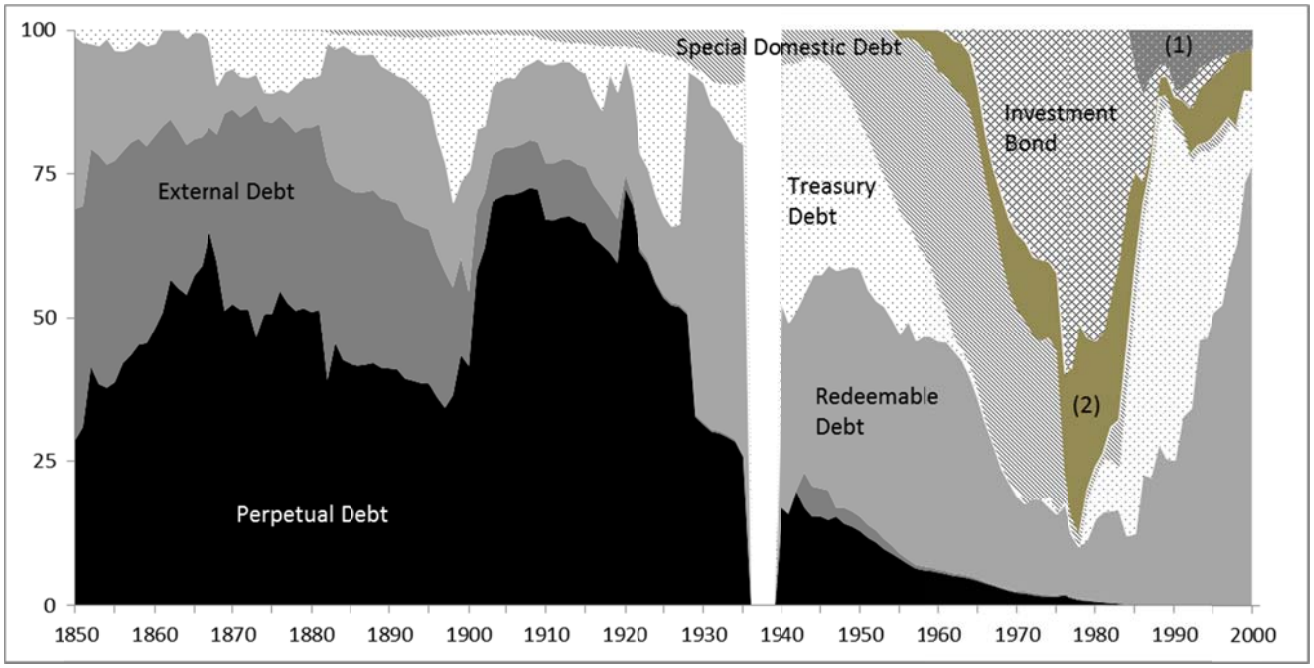


Note: no data for Civil War period, 1936-1939. Sources: Comín and Diaz (2005), Bank of Spain, and Prados (2003).

[4] See also Reinhart and Sbrancia (2011) for financial repression in US and UK following WW2, and Reinhart (2012) debt reduction in Italy and Australia from the financial repression `tax'.

Historically in Spain, perpetual debt (i.e. consols), understood as irredeemable debt (a debt that has no specific redemption date or maturity period), had a very important role in the total public debt (total debt liabilities of the government with both domestic and foreign creditors). From the 19th century until the civil war years, it had a weight between the 25% and 73% approximately in the public debt (see Figure 2). Moreover, due to the characteristics and the weak development of the financial markets in Spain (see Maixe-Altés and Iglesias (2009) and Pons (2012)), we can consider that perpetual debt had a role of a security regulating the Spanish stock exchange markets (Madrid and Barcelona in special). Perpetual debt had such an hegemonic role that even its price was dependent of brokers making significant profits or losses in the given period (see Tafunell 2005); and in fact, it is the best indicator of the long-run capital cost when the government finances its deficit under market conditions. After the civil war, this situation was changing, since this type of debt lost its weight in the Spanish public debt as a whole and, moreover, the structure of the securities quoted on the Spanish stock exchange markets changed due to the massive presence of corporate bonds of public utilities companies. This special role of perpetual debt will be evident in our empirical results in Section 4, both with univariate and multivariate models.

Figure 2. Spanish public debt structure, 1850-2000



Notes: (1) Bank of Spain debt. (2) Credits from abroad [guaranteed by the State]. No data for Civil War period, 1936-1939. Source: Comín and Díaz (2005), 960-963 and Bank of Spain.

2.3 Inflation tax and currency crisis

In this section we justify again the importance of introducing in our Spanish empirical analysis the concept of currency crisis in the RR (2011) study and why we expect to find in Section 4 that an increase of debt will decrease the existence of currency crises due to the own characteristics of Spain. This situation is widely documented in many papers such as in Drehen, Herz and Karb (2006, see page 309, section 2.4 and the results of their Table 2 in page 315).

They show that there are cases where, due to the government´s budget constraint of a country, we can find negative relationships between debt and currency crises. If the budgetary position of the government is strained, the government has several options, but one of them is that the government may create a monetary expansion (printing money) which induces inflation and it produces a currency crisis (therefore the government does not need to increase its debt). So if in the previous period the government has increased its perpetual debt, this may reduce the pressure of the government for the need of a monetary expansion and it is less likely the existence of a currency crisis. We proceed to show now how this budgetary situation exists in Spain in the 19th and 20th centuries.

The establishment of the Bank of Spain as the unique issuing bank of currency in 1874 had as a compensation, its commitment with the lending to the Treasure. The new monopoly given to a private bank was used by the Finance Ministers as a very attractive instrument, since they were able to finance their deficits by printing money, and therefore using the inflation tax that was reducing the real value of the debt and their interests (Comín 2012). The achievements of this type of policy was also supported by the huge fall in the external debt, until its practically non-existence at the beginning of the 20th century, and the progressive impact of the interior debt (see figure 2). In short, the use of the indirect monetization of the budget deficit was consolidated through pledgeable debt. Banks were taking this type of debt that later was discounted in the Central Bank (Bank of Spain), and from 1913 private debt holders were incorporated into this mechanism (see Martín-Aceña (1985)). This became the main mechanism to finance budget deficits in Spain, and it avoided to have to turn to the traditional rescheduling as the unique way to overcome debt crises.

During Franco´s time, this instrument was applied until de Stabilitation Plan of 1959. Banks and savings banks were intensively regulated by the government (financial repression) in order to finance their economic growth policy, avoiding in this way increasing their public deficit. They policy was accompanied by the inflation tax. Both instruments made that depositors and holders of public debt were the main supporters of this financial policy, whose economic consequences were harmful for the savers[5].

A very relevant consequence of these policies since the end of the 19th century was its impact on the monetary policy. Notes and current accounts in banks started to prevail over the metallic coin in the composition of money supply (see Martín Aceña and Pons, 2005). These changes happened in a context of monetary expansion facilitated through the above-mentioned policies that were allowing governments to reduce their liabilities through inflation. Escario, Sabaté and Gadea (2011) found a dynamic causal relationship of the budget balance with monetary growth since 1874 confirming this hypothesis. This relationship weakens from the 1990`s decade onwards as a result of the effort of nominal convergence that happened before the integration towards the euro. In short, the above-mentioned policies caused an increase in the monetary base and simultaneously, they generated inflation and monetary depreciation. These circumstances appear reflected in our empirical analysis in Section 4, where we find a negative estimated sign showing that an increase in the perpetual debt variable produces a smaller probability of currency crises in Spain.

[5] See Reinhart and Rogoff (2009): 76, 101 in relation to these type of policies at the international level. See also Juselius and Toro (2005) and Escario, Sabaté and Gadea (2011) for Spain.

3. Definition of variables used in the empirical analysis

Betrán, Martín-Aceña and Pons (2012) has been our main source to obtain the dating of banking crises (see Betrán et al (2012), Table 1 in pages 422-423), currency crises (see Betrán et al (2012), Table 2 in page 426), stock market crises (see Betrán et al (2012), Table 5 in pages 435-436) and crises of financial centers (see Betrán et al (2012), Table 5 in pages 435-436) in Spain from 1850 to 1995. That is the reason why we analyze the sample period 1850-1995, since this is the one used in Betrán, Martín-Aceña and Pons (2012) where they offer a very clear and homogeneous picture of the dating of the financial crises in Spain. Following Betrán, Martín-Aceña and Pons (2012), we removed the civil war years (1935-1939) from our analysis. In order to create our dummy variables, 1 is related to the existence of a crisis. We obtain the dating of the debt crises in Spain from the sovereign defaults stated in Reinhart and Rogoff (2009) for this country[6].

Data on different types of debt (redeemable, perpetual, external and the treasury) are obtained from Carreras and Tafunell (2005). We also use two types of aggregates of these types of debt in Appendix 1: (1) "State debt" that equals to the sum of redeemable debt, perpetual, external debt and investment bonds and (2) "public debt" that is the sum of state debt, treasury debt, special domestic debt, credits from abroad (guaranteed by the State) and Bank of Spain debt (see also Figure 2). Following RR (2011) we computed ratios of the different types of debt versus the GDP as regressors (see our Appendices 1 and 2). All types of debt and the GDP are measured in millions of pesetas in our analysis.

RR (2011) used univariate and bivariate-logit models while Candelon et al. (2010) and Candelon et al (2013) focused their results on multivariate probit models. We show in Section 4 that our results are robust to using logit and probit models and of different dimensions (univariate and multivariate models).

4. Empirical Results

4.1 Univariate models

Following RR (2011, below their Figures 3, 4, 9 and 14), we start with a univariate analysis with regressions of our four types of crises using different independent variables one by one of the different types of lagged ratios of debt described in Section 3 in relation to the GDP. Results are given in Appendix 1[7] where we have estimated all models by ordinary least squares (OLS) and using logit models with robust standard errors (as in RR (2011)). We show in bold the statistical significant relationships with probability values (p-values) less than 0.1 in all Tables. We have kept a constant estimated in all models. If we run the same regressions using probit models, all results from logit models are confirmed.

We found in Appendix 1 (see Table 3) that the only ratio with one lag that affects both banking and debt crises is perpetual debt/GDP (in our Tables, we name it "Perpetual

[6] See also Comin (2012) and https://en.wikipedia.org/wiki/Sovereign_default where the sovereign defaults in Spain are during the years 1809, 1820, 1831, 1834, 1851, 1867, 1872, 1882, 1936--1939.

[7] All univariate models have been estimated and tested in STATA (2013).

Debt/GDP(t-1)"). That ratio affects strongly at banking crises (both estimated with OLS and with logit models) and mildly to debt crises (we only find a strong relationship with the logit model with a p-value of 0.019 and a p-value of 0.123 with OLS). All the rest of the debt ratios in Appendix 1 (including ratios where we sum perpetual debt and treasure bonds and perpetual with redeemable debt) do not appear to be statistically significant to explain the different types of crises. Only the ratio of perpetual and redeemable debt seems to have a mild relationship with a p-value of 0.086 with banking crises, but still, this relationship is less strong than with the ratio of perpetual debt. That is why we choose the ratio of "Perpetual Debt/GDP(t-1)" as the representative ratio of debt in Spain in section 4.2. We have tried different lags of debt ratios apart from the first one, but they were not statistically significant.

Note that we find a mild relationship of currency crises with the perpetual debt ratio that is negative (with a p-value of 0.175 and 0.257 for the OLS and the logit model in Table 3) that will be important to explain later the results from the multivariate section that follows. This type of negative relationship has already been documented in Section 2.3.

4.2 Multivariate models

Following RR (2011, Tables 1-3) we proceed to a multivariate analysis. RR (2011) only showed the results of a bivariate logit model (since they only focused on two types -banking and debt- of crises). We start with a multivariate probit model with 4 dependent variables (currency, debt, banking and stock market crises). Later in order to show the robustness of our results, we will show that our conclusions are robust to using as well tri-variate probit models and also bi-variate logit (as RR (2011)) and bivariate probit models[8]. Given that our sample size is not very large, our strategy is not to choose a unique model but to check the robustness of our results by estimating multiple multivariate and univariate probit and logit models (this is a very common strategy in practice such as in RR (2011) with bivariate logit models).

Results are given in Appendix 2. We show in bold the statistical significant relationships with a p-value less than 0.1. Since we cannot introduce more than one variable related to debt (among those of Appendix 1) at the same time as an independent regressor in order to avoid multicollinearity, we chose to introduce the ratio "Interior Perpetual Debt/GDP(t-1)" in the multivariate analysis since we found in Appendix 1 that this is the ratio that affects both banking and debt crises.

We start estimating a multivariate probit model with 4 dependent variables (currency, debt, banking and stock market crises) in Table 6, and in the spirit of RR (2011), we introduce as independent variables the first lag of the ratio of perpetual debt/GDP, the first lag of banking crises and crises in financial centers (we introduced more lags and combinations of them as in RR (2011) but they were no statistically significant). We see how we can only find a very strong statistical significant relationship between crises in financial centers with banking, currency and

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[8] Recent developments of econometric packages such as the estimation of bivariate Logit models with the R program ZeligChoice by Lau, Imai, and King (2015) and multivariate Probit models estimated by maximum likelihood with the R program mvProbit of Henningsen (2015) have allowed us to carry out our empirical results. Bivariate probit models have also been estimated and tested in STATA (2013).

stock market crises with the expected positive estimated signs. In RR (2011) this happened only with banking crises in their Tables 1-3 (since they did not consider the other two types of crises). Since a four-dimensional probit model has many parameters to estimate and our sample size is not very large, we proceed the analysis estimating tri-variate and bi-variate probit models to check that our conclusions are robust.

We proceed estimating the four possible tri-variate probit models we can have with our four dependent variables. Results are given in Tables 7-10. These results confirm the results of Table 6 and also the univariate results from Appendix 1.

We proceed now to estimate the six possible bi-variate probit models that we can construct with our four dependent variables to check the robustness of our conclusions. Results are given in Tables 11-16 and again, these results confirm those of Table 6 and also the univariate results from Appendix 1. In special, our Table 11 coincides with the two dependent variables logit model analyzed in RR (2011). Moreover, we show that our results are also robust if we use estimated bi-variate probit or bi-variate logit models. Note that in Tables 11-16 there are some variables that are only mildly statistically significant in the results (for example the ratio "Perpetual Debt/GDP(t-1)" as determinant of debt crisis in Tables 11 and 15), but we keep those variables in the model because the estimated value of the log-likelihood function decreases if we remove it (also note how RR (2011, see Tables 1-3) also have kept some independent variables in their chosen bivariate logit model that were not statistically significant).

Our main conclusions are as follows:

1. Banking crises depend (1) strongly on lags of the ratio of perpetual debt versus the GDP (see our Tables 10, 11 and 12) and (2) strongly on crises in financial centers (see Tables 6-16). We obtain the same estimated expected positive signs as in RR (2011) for both variables.
2. Debt crises depend (1) strongly on lags of banking crises (see Tables 11, 15 and 16), and (2) mildly on lags of the ratio of perpetual debt versus the GDP (see only Table 16. In Tables 11 and 15 we find only a mild relationship). We obtain again the same estimated positive expected signs as in RR (2011).
3. Currency crises depend (1) strongly on crises in financial centers (see Tables 6-16) and (2) mildly on lags of the ratio of perpetual debt versus the GDP (see only Table 14. In Tables 12 and 15 we can only find a p-value around 0.14). We obtain the estimated and expected positive sign for crises in financial centers but in relation to the second variable, we find that a decrease in perpetual interior debt accompanies currency crises in Spain. This empirical finding is justified from the historical point of view in Section 2.3.
4. Stock market crises depend only strongly and positively on crises in financial centers (see Tables 6-16).
5. Note also that crises in financial centers always present the largest estimated value as determinant of banking, currency and stock market crises (see Tables 6-15). Therefore, we find that this is the main factor to explain the different types of crises in Spain.

Our conclusions in relation to the determinants of banking and debt crises confirm the results of RR (2011) introducing the role of the perpetual debt in the analysis. Our results extend those of RR (2011) by finding also determinants of currency and stock market crises.

5. Conclusions

We study the evolution of the Spanish debt in the 19th and 20th centuries and for that, we extend RR (2011) in two ways: first, we introduce as novelty in RR (2011) the concepts of stock market and currency crises in Spain. Second, we introduce in the analysis the concept of perpetual debt in Spain versus external debt and public debt in RR (2011). We find that the results of RR (2011) remain the same for the determinants of banking and debt crises but where we need to replace lags of external debt and public debt with lags of interior perpetual debt in order to get statistical significant relationships. Moreover, we find determinants of currency and stock market crises as follows: (1) Currency crises depend strongly on crisis in financial centers and mildly on lags of interior perpetual debt. We find the estimated expected positive sign for crises in financial centers. But in relation to the second variable, we find that a decrease in perpetual interior debt accompany currency crises in Spain. This empirical finding is justified in Section 2.3 from the historical point of view. (2) Stock market crises depend only positively and strongly on the crisis in financial centers.

In short, what is our main contribution to the open debate initiated by the seminal work of RR? In our analysis, we have stayed outside the implications between debt and economic growth, probably the most polemic aspect of their argument. We have decided to treat an issue that it is not pheripheral at all and that it is in the center of the debate: to offer a deeper study of the causality relationships between different types of crises and the role of different types of debts in this context. Our results confirm the conclusions of RR (2011) for banking and debt crises even when we introduce a wider variety of types of debt and types of crises in the analysis. However, referring to the idea given by Bordo, Eichengreen, Klingebiel and Martínez-Peria (2001) "History thus confirms that there is something different and disturbing about our age", and as a result of what we find in our paper, we can highlight two issues:

(1) Idiosyncrasies of national economies are a very important determinant of the morphology of the crises (different types of debt, different ways of instrumenting monetary policies, regulation and inflation tax) and the way that each economy interacts with the exterior crises (crises in financial centers).

(2) The analysis should be multivariate and quite complex if we want to get deeper in the issue (since debt crises are not required to have a central role and countries can experience much more types of different crises). Once we proceed in our analysis looking for causal relationships, we find that the debt role is relativized. Studying the case of Spain, we find that monetary policies, financial repression and the inflation tax have a crucial role as mechanisms to hide the budget deficit and the debt burden; aspects that are also treated in the RR framework.

We believe that it is important simultaneously not only to study data coming from panels of many (heterogenous) countries, but also to analyze individual countries allowing for deeper studies and with a larger number of variables that can be based on the particularities of each country. We may also analyze panels with smaller groups of countries that can share similar characteristics (and therefore, less aggregated panels). This may be the object of future research.

References

Amann, J. and P. Middleditch (2015), Revisiting Reinhart & Rogoff after the Crisis: A Time Series Perspective, Preprint submitted to *CGBCR Working Paper Series.*

Barro J. R. and Ursúa, J. F. (2008), Macroeconomic Crisis since 1870, National Bureau of Economic Research, WP, 13940.

Betrán, C., P. Martín-Aceña and M. A. Pons (2012), Financial Crisis in Spain: Lessons from the Last 150 Years, *Revista de Historia Económica* 30, 3, 417-446.

Bordo, M. (1986), Financial crises, banking crises, stock market crashes and the money supply: some international evidence, 1870-1933, in F. Capie and G.E. Wood (eds), *Financial crises and the world banking system*. London, Macmillan.

Bordo, M., Eichengreen, B., Klingebiel, D. and Martinez-Peria, M.S. (2001): Financial crises. Lessons from the last 120 years. Is the crisis problem growing more severe?, *Economic Policy* 16, 32, 53-82.

Candelon, B., Dumitrescu, E.-I., C. Hurlin (2010), Currency Crises Early Warning Systems: Why They Should Be Dynamic, *METEOR Research memorandum RM/10/047.*

Candelon, B., Dumitrescu, E.-I., C. Hurlin and F. C. Palm (2013), Multivariate Dynamic Probit Models: An Application to Financial Crises Mutation, in Thomas B. Fomby , Lutz Kilian , Anthony Murphy (ed.) VAR Models in Macroeconomics -- *New Developments and Applications: Essays in Honor of Christopher A. Sims* (Advances in Econometrics, Volume 32, Emerald Group Publishing Limited, 395 - 427.

Carreras, A. and Tafunell, X. (coords.) (2005), *Estadística históricas de España. Siglos XIX y XX*. Bilbao, Fundación BBVA.

Comín, F. (2012), Default, rescheduling and inflation: public debt crises in Spain during the 19th and 20th centuries, *Revista de Historia Económica* 30, 3, 353-390.

Comín, F. and Díaz, D. (2005), "Sector público administrativo y estado del bienestar", in A. Carreras and X. Tafunell (coords.), *Estadísticas históricas de España,* vol. 2. Bilbao, Fundación BBVA, pp. 873-964.

Drehen, A, B. Herz and V. Karb (2006), Is there a Causal Link Between Currency and Debt Crisis?, *International Journal of Finance and Economics* 11, 305-325.

Eichengreen, B. and Bordo, M. (2003), Crises now and then: what lesson from the last era of financial globalization, in P. Mitzen (ed), *Monetary history, exchange rates and financial markets. Essays in honour of Charles Goodhart*. Edward Elgar.

Escario, R., Sabaté, M. and Gadea, M.D. (2011), Monetary shadow of deficit, Spain 1874-1998, *Investigaciones de Historia Económica* 7, 1, 151-181.

Goodhart, Ch. and Delargy, P.J.R (1998), Financial crises: plus ça change, plus c´est la même chose, *International Finance* 1, 2, 261-287.

Henningsen, A. (2015), Package `mvProbit'in R, in repository CRAN.

Juselius, K. and Toro, J. (2005), Monetary transmission mechanisms in Spain: The effect of monetization, financial deregulation, and the EMS, *Journal of International Money and Finance* 24, 3, 509-531.

Kaminsky J., Lizondo J.and Reinhart C. (1998), Leading Indicators of Currency Crisis, IMF Staff Papers 45, 1, 1-48.

Kindleberger, Ch. P. (2000, 4th ed.), Manias, panics and crashes: a history of financial crises. Chichester, John Wiley.

Lau L., K. Imai, and G. King. (2015), Zelig: Everyone's Statistical Software,

http://gking.harvard.edu/zelig

Maixé-Altés, J. C. and E. M. Iglesias (2009), Monetary transfers and the Integration of Markets in Spain (1775-1885), *Journal of International Money and Finance* 28, 3, 496-521.

Martín-Aceña, P. (1985), Déficit público y política monetaria en la Restauración, 1874-1913, in Martín-Aceña, P. and Prados de la Escosura, L. (eds.), La nueva historia económica en España, Madrid, Tecnos, 262-284.

Martín-Aceña, P. and Pons, M.A. (2005), Sistema monetario y financiero, in A. Carreras and X. Tafunell (coords.), *Estadísticas históricas de España*, vol. 2. Bilbao, Fundación BBVA, 645-706.

Pons, M. A. (2012), The Main Reforms of the Spanish Financial System, in J. L. Malo de Molina and P. Martín-Aceña, *The Spanish financial system. Growth and development since 1900*, Houndmills, Palgrave Macmillan, 71-98.

Prados, L. (2003), El progreso económico de España (1850-2000), Bilbao, Fundación BBVA.

Reinhart, C. M. (2012), The return of financial repression, *Banque de France - Financial Stability Review* 16, 37-48.

Reinhart, C. M. and K. S. Rogoff (2009). This Time It's Different: Eight Centuries of Financial Folly. Princeton: Princeton University Press.

Reinhart, C. M. and K. S. Rogoff (2010). Growth in a Time of Debt. NBER Working Papers 15639.

Reinhart, C. M. and K. S. Rogoff (2011), From Financial Crash to Debt Crisis, *American Economic Review* 101, 1676-1706.

Reinhart, C. M, and K. S. Rogoff (2014), Financial and Sovereign Debt Crises: Some Lessons Learned and Those Forgotten, edited by S. Claessens, M.A. Kose, L. Laeven, and F. Valencia. Financial Crises: Causes, Consequences, and Policy Responses, IMF.

Reinhart, C. M. and M. B. Sbrancia (2011), The liquidation of Government Debt. NBER Working Paper 16893.

STATA. (2013), Stata Statistical Software: Release 13, College Station, TX: StataCorp LP.

Tafunell, X. (2005), Empresa y bolsa, in A. Carreras and X. Tafunell (coords.), Estadísticas históricas de España, vol. 2. Bilbao, Fundación BBVA, 707-833.

Appendix 1: Tables. Univariate Analysis

Table 1: Regressions of the four types of crises using different independent variables one by one. Sample: 1850-1995.

Independent variables	State Debt/GDP(t-1)		Public Debt/GDP(t-1)	
Dependent variable	OLS (robust errors)	Logit (robust errors)	OLS (robust errors)	Logit (robust errors)
Banking Crisis	0.074	0.964	0.051	0.671
p-value	0.220	0.174	0.413	0.374
R^2	0.012	0.020	0.006	0.010
Currency Crisis	-0.061	-1.156	-0.033	-0.586
p-value	0.301	0.349	0.587	0.606
R^2	0.009	0.022	0.003	0.006
Debt Crisis	**0.085**	**2.799**	0.074	**2.274**
p-value	**0.070**	**0.001**	0.101	**0.006**
R^2	0.040	0.140	0.030	0.101
Stock Market Crisis	0.037	0.422	0.024	0.279
p-value	0.561	0.544	0.692	0.681
R^2	0.002	0.004	0.001	0.002

Table 2: Regressions of the four types of crises using different independent variables one by one. Sample: 1850-1995.

Independent variables	Public Debt/(GDPper capita)(t-1)		Redeemable Debt/GDP(t-1)	
Dependent variable	OLS (robust errors)	Logit (robust errors)	OLS (robust errors)	Logit (robust errors)
Banking Crisis	1.50e-09	2.06e-08	-0.034	-0.477
p-value	0.710	0.704	0.900	0.901
R^2	0.001	0.002	0.000	0.000
Currency Crisis	1.53e-09	2.52e-08	0.138	2.169
p-value	0.717	0.710	0.660	0.638
R^2	0.001	0.003	0.002	0.004
Debt Crisis	2.46e-09	8.59e-08	0.052	1.772
p-value	0.310	0.237	0.746	0.729
R^2	0.008	0.029	0.001	0.003
Stock Market Crisis	9.62e-09	1.14e-08	0.044	0.515
p-value	0.797	0.795	0.879	0.877
R^2	0.001	0.001	0.000	0.000

Table 3: Regressions of the fourtypes of crises using different independent variables one by one. Sample: 1850-1995.

Independent variables	Perpetual Debt/GDP(t-1)		External Debt/GDP(t-1)	
Dependent variable	OLS (robust errors)	Logit (robust errors)	OLS (robust errors)	Logit (robust errors)
Banking Crisis	**0.139**	**1.767**	0.081	1.039
p-value	**0.094**	**0.047**	0.632	0.602
R^2	0.0019	0.033	0.002	0.004
Currency Crisis	-0.108	-2.251	-0.116	-2.409
p-value	0.175	0.257	0.412	0.506
R^2	0.014	0.034	0.005	0.013
Debt Crisis	0.088	**2.815**	**0.273**	**7.227**
p-value	0.123	**0.019**	**0.065**	**0.001**
R^2	0.020	0.070	0.065	0.191
Stock Market Crisis	0.053	0.606	0.083	0.929
p-value	0.564	0.544	0.637	0.611
R^2	0.002	0.004	0.002	0.003

Table 4: Regressions of the three types of crises using different independent variables one by one. Sample: 1850-1995.

Independent variables	Treasury Debt/GDP(t-1)		(Perpetual+Treassure) Debt/GDP(t-1)	
Dependent variable	OLS (robust errors)	Logit (robust errors)	OLS (robust errors)	Logit (robust errors)
Banking Crisis	-0.245	-4.069	0.095	1.212
p-value	0.156	0.205	0.208	0.154
R^2	0.007	0.014	0.011	0.018
Currency Crisis	0.422	5.875	-0.051	-0.942
p-value	0.194	0.118	0.488	0.520
R^2	0.0024	0.044	0.004	0.008
Debt Crisis	-0.108	-4.974	0.065	**2.055**
p-value	0.291	0.348	0.198	**0.079**
R^2	0.003	0.015	0.013	0.045
Stock Market Crisis	-0.175	-2.297	0.028	0.327
p-value	0.463	0.500	0.718	0.709
R^2	0.003	0.005	0.001	0.001

Table 5: Regressions of the three types of crises using different independent variables one by one. Sample: 1850-1995.

Independent variables	(Perpetual+Redeemable) Debt/GDP(t-1)	
Dependent variable	OLS (robust errors)	Logit (robust errors)
Banking Crisis	0.121	**1.654**
p-value	0.117	**0.086**
R^2	0.016	0.029
Currency Crisis	-0.084	-1.504
p-value	0.271	0.285
R^2	0.010	0.021
Debt Crisis	**0.083**	**3.036**
p-value	**0.084**	**0.003**
R^2	0.020	0.077
Stock Market Crisis	0.050	0.596
p-value	0.539	0.529
R^2	0.003	0.004

Appendix 2: Tables. Multivariate Analysis

Four dependent variables

Table 6: Multivariate probit with 4 dependent variables. P-values are given in parenthesis. Sample: 1850-1995.

	Dependent variables			
Independent variables	Banking Crisis	Currency Crisis	Stock Market Crisis	Debt Crisis
Intercept	**-2.112 (0.000)**	**-1.728 (0.008)**	**-1.847 (0.000)**	-3.646 (0.582)
Perpetual Debt/GDP(t-1)	1.062 (0.219)	-1.115 (0.775)	0.452 (0.682)	2.296 (0.817)
First lag of Banking crisis	0.525 (0.673)	-0.445 (0.988)	0.337 (0.937)	1.556 (0.534)
Financial Center Crisis	**1.472 (0.025)**	**2.103 (0.006)**	**1.866 (0.011)**	0.802 (0.977)

Three dependent variables

Table 7: Trivariate probit. P-values are given in parenthesis. Sample: 1850-1995.

	Dependent variables		
Independent variables	Banking Crisis	Currency Crisis	Stock Market Crisis
Intercept	**-2.115 (0.000)**	**-2.085 (0.000)**	**-1.954 (0.000)**
Perpetual Debt/GDP(t-1)	1.108 (0.138)	0.008 (0.996)	0.795 (0.330)
First lag of Banking crisis	0.524 (0.340)	-1.002 (0.400)	0.314 (0.798)
Financial Center Crisis	**1.370 (0.007)**	**2.346 (0.000)**	**1.916 (0.000)**

Table 8: Trivariate probit. P-values are given in parenthesis. Sample: 1850-1995.

	Dependent variables		
Independent variables	Banking Crisis	Currency Crisis	Debt Crisis
Intercept	**-2.109 (0.000)**	**-1.711 (0.000)**	-3.462 (0.580)
Perpetual Debt/GDP(t-1)	1.032 (0.185)	-1.157 (0.607)	2.036 (0.828)
First lag of Banking crisis	0.471 (0.448)	-0.473 (0.958)	1.496 (0.549)
Financial Center Crisis	**1.471 (0.007)**	**2.087 (0.000)**	0.750 (0.941)

Table 9: Trivariate probit. P-values are given in parenthesis. Sample: 1850-1995.

	Dependent variables		
Independent variables	Banking Crisis	Stock Market Crisis	Debt Crisis
Intercept	**-2.111 (0.000)**	**-1.848 (0.000)**	-3.803 (0.430)
Perpetual Debt/GDP(t-1)	1.053 (0.189)	0.441 (0.543)	2.530 (0.744)
First lag of Banking crisis	0.509 (0.526)	0.392 (0.824)	1.589 (0.442)
Financial Center Crisis	**1.472 (0.010)**	**1.871 (0.001)**	0.628 (0.940)

Table 10: Trivariate probit. P-values are given in parenthesis. Sample: 1850-1995.

	Dependent variables		
Independent variables	Currency Crisis	Stock Market Crisis	Debt Crisis
Intercept	**-1.718 (0.001)**	**-1.845 (0.000)**	-3.515 (0.646)
Perpetual Debt/GDP(t-1)	-1.142 (0.610)	0.421 (0.615)	2.095 (0.843)
First lag of Banking crisis	-0.411 (0.924)	0.177 (0.944)	1.523 (0.702)
Financial Center Crisis	**2.095 (0.001)**	**1.864 (0.004)**	0.682 (0.963)

Two dependent variables

Table 11: Bivariate probit and logit. P-values are given in parenthesis. Sample: 1850-1995.

	Logit model		Probit model	
	Dependent variables		Dependent variables	
Independent variables	Banking Crisis	Debt Crisis	Banking Crisis	Debt Crisis
Intercept	**-4.021 (0.024)**	**-8.650 (0.022)**	**-2.091 (0.000)**	**-3.723 (0.002)**
Perpetual Debt/GDP(t-1)	2.571 (0.294)	6.765 (0.137)	**1.156 (0.064)**	2.540 (0.114)
First lag of Banking crisis	-	**4.455 (0.022)**	-	**1.750 (0.018)**
Financial Center Crisis	**3.017 (0.007)**	-	**1.571 (0.000)**	-

Table 12: Bivariate probit and logit. P-values are given in parenthesis. Sample: 1850-1995.

	Logit model		Probit model	
	Dependent variables		Dependent variables	
Independent variables	Banking Crisis	Currency Crisis	Banking Crisis	Currency Crisis
Intercept	**-3.993 (0.024)**	**-3.084 (0.000)**	**-2.087 (0.000)**	**-1.707 (0.000)**
Perpetual Debt/GDP(t-1)	**2.534 (0.048)**	-3.160 (0.141)	**1.149 (0.066)**	-1.258 (0.199)
First lag of Banking crisis	-	-	-	-
Financial Center Crisis	**2.998 (0.000)**	**3.883 (0.000)**	**1.564 (0.000)**	**2.041 (0.000)**

Table 13: Bivariate probit and logit. P-values are given in parenthesis. Sample: 1850-1995.

	Logit model		Probit model	
	Dependent variables		Dependent variables	
Independent variables	Banking Crisis	Stock Market Crisis	Banking Crisis	Stock Market Crisis
Intercept	**-3.943 (0.000)**	**-3.013 (0.000)**	**-2.079 (0.000)**	**-1.674 (0.000)**
Perpetual Debt/GDP(t-1)	**2.422 (0.057)**	-	**1.135 (0.068)**	-
First lag of Banking crisis	-	-	-	-
Financial Center Crisis	**2.965 (0.000)**	**3.347 (0.000)**	**1.562 (0.000)**	**1.886 (0.000)**

Table 14: Bivariate probit and logit. P-values are given in parenthesis. Sample: 1850-1995.

	Logit model		Probit model	
	Dependent variables		Dependent variables	
Independent variables	Currency Crisis	Stock Market Crisis	Currency Crisis	Stock Market Crisis
Intercept	**-2.902 (0.000)**	**-3.020 (0.000)**	**-1.645 (0.000)**	**-1.681 (0.000)**
Perpetual Debt/GDP(t-1)	**-4.378 (0.054)**	-	-1.549 (0.120)	-
First lag of Banking crisis	-	-	-	-
Financial Center Crisis	**4.035 (0.000)**	**3.356 (0.000)**	**2.058 (0.000)**	**1.892 (0.000)**

Table 15: Bivariate probit and logit. P-values are given in parenthesis. Sample: 1850-1995.

	Logit model		Probit model	
	Dependent variables		Dependent variables	
Independent variables	Currency Crisis	Debt Crisis	Currency Crisis	Debt Crisis
Intercept	**-3.084 (0.000)**	**-6.923 (0.002)**	**-1.667 (0.000)**	**-3.444 (0.000)**
Perpetual Debt/GDP(t-1)	-3.077 (0.140)	4.413 (0.142)	-1.415 (0.150)	2.141 (0.117)
First lag of Banking crisis	-	**3.427 (0.013)**	-	**1.610 (0.013)**
Financial Center Crisis	**3.883 (0.000)**	-	**2.030 (0.000)**	-

Table 16: Bivariate probit and logit. P-values are given in parenthesis. Sample: 1850-1995.

	Logit model		Probit model	
	Dependent variables		Dependent variables	
Independent variables	Stock Market Crisis	Debt Crisis	Stock Market Crisis	Debt Crisis
Intercept	**-3.017 (0.000)**	**-8.787 (0.006)**	**-1.680 (0.000)**	**-2.678 (0.000)**
Perpetual Debt/GDP(t-1)	-	**7.049 (0.074)**	-	1.341 (0.167)
First lag of Banking crisis	-	**4.547 (0.007)**	-	**1.214 (0.028)**
Financial Center Crisis	**3.408 (0.000)**	-	**1.893 (0.000)**	-