Notes

Exchange Rates During and After the Napoleonic Wars: the Portuguese Case*

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ABSTRACT

The objective of this paper is to identify the variables that influenced the behavior of the Portuguese exchange rate between 1801 and 1831. This study employs a novel methodology for calculating exchange rates, utilizing a single commercial source. From 1815 onwards, a sustained depreciation of the real was observed, as evidenced by the bilateral and effective exchange rates. In other words, 1815 marked the turning point for the Portuguese exchange rate. In contrast with the effects observed in other European economies, where the Napoleonic Wars precipitated currency crises, our findings indicate that the Portuguese unit of account appreciated during the same period. Therefore, evidence has been found to support the hypothesis that the Napoleonic invasions had an impact on the relationship between the Portuguese currency and the currencies of the London, Madrid, Paris, Amsterdam and Hamburg markets. However, a different conclusion is reached when the real annual exchange rates are considered. The impact of political instability on the relationship between the Portuguese and British currencies is highlighted, but no such impact is found on the relationship between the Portuguese currency and the currencies of the Madrid, Paris, Amsterdam or Hamburg markets. Portugal is a case study because it did not experience a currency crisis during the Napoleonic invasions, which was an exception in the European context.

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1. Introduction

In the economic and historical debate on global wars as an economic shock many scholars have focused their interest essentially on their economic impacts on trade (see, e.g., Harrison, 1998; Broadberry and Harrison, 2005; Glick and Taylor, 2005; Davis and Engerman, 2006; Findlay and O´Rourke, 2007). This paper contributes to this topic by examining the impacts of the Napoleonic Wars on exchange rates. Using a new dataset, this paper analyses if war and political instability can help understand the behavior of nominal and real Portuguese exchange rates, between 1801 and 1831. This analysis takes an innovative approach by including the Portuguese case in the debate on the behavior of the international exchange rate during the first half of the 19th century, as discussed in the research, for instance, of Bordo (2004), Solomou and Catão (2000, 2005), and Lobell (2010).

We explore the implications for the exchange-rate series of the non-acceptance of the continental block (1806) and the three French wars in Portugal, in 1807-1808 (November 19th-August 30th), 1809 (March 10th-May 18th), and 1810-1811 (June 24th-May 5th), under the command of marshals Junot, Soult and Massena, respectively, as well as the intervention of the Portuguese army in the French invasions of Spain (1811-1814).

First, this study contributes to extending the debate on economics and war to European exchange rates in the context of the Napoleonic Invasions. As Reinhart & Rogoff (2009) underline, "When we look at exchange rate behavior, we can see that probably the most surprising evidence comes from the Napoleonic Wars, during which exchange rate instability escalated to a level that had not been seen before and was not to be seen again for nearly one hundred years" (p. 189). During the Napoleonic Wars, between 20% and 50% of countries had currency crises defined by nominal depreciations greater than 15%.

Second, this analysis contributes to the discussion of a variable missing in the literature on the first half of the 19th century in Portugal. The discussion has centered mainly on the consequences of the

loss of Brazil for the economic evolution of Portugal and less on other macroeconomic variables. The opening of the Brazilian ports to international trade in 1808, the treaty of trade and navigation with Britain in 1810, and Brazil's independence, with the consequent loss of colonial products for Portuguese trade, are all events that have fueled discussions on the effects of related structural changes in the Portuguese economy (Alexandre, 1986, 1989, 1991; Lains, 1989, 1991; Pedreira, 1994, Moreira, 2013). However, more recently, Costa et al. (2015) research on colonial trade have demonstrated that the impact of the empire on Portugal's economy was not big enough to boost Portuguese economic growth. Our approach does not seek to contribute to the debate on the effects of external policies on Portuguese economic performance but rather to study the influence of war on Portuguese exchange rates and consequently on macroeconomic adjustments.

According to Rogoff (1996), in the short run, movements in the nominal exchange rate led to changes in real exchange rates, which should be explained by the role of shocks to money and financial markets. This case study can serve as a good illustration of this dynamic because war and political instability can be included among such shocks. The theoretical explanation of the behavior of exchange rates in the long run is linked to the existence of transportation costs or barriers to trade (Rogoff, 1996) as well as differences in productivity primarily in the traded goods sector (Balassa, 1964; Samuelson, 1964). These explanations raise questions about the theory of purchasing power parity (PPP) used to describe exchange-rate performance.[1]

This study addresses three central research questions. The first concerns the impact of the Napoleonic invasions (1807-1811) on the Portuguese economy and the subsequent effect on the Portuguese exchange rate. The second question examines the influence of Por-

[1] PPP theory holds that the real exchange rate between two currencies should adjust to keep their prices equal when expressed in a common currency. Some empirical studies have not confirmed the PPP theory (Taylor and Taylor, 2004).

tuguese political instability between 1820 and 1831 on the behavior of the Portuguese exchange rate. The final question addresses the impact of the introduction of a legal monometallic monetary system in the UK on the pound/real exchange-rate performance. This is also the period before Portuguese adoption of the gold standard[2] and the standard's international spreading.[3]

The main source used in this paper has never been used in previous research. It is a commercial source, the handwritten "Portugal's Balance of Trade with Foreign Nations and Portuguese Colonies," which contains data regarding the monthly Portuguese nominal exchange rates for some financial centers, such as London, Paris, Madrid, Hamburg, and Amsterdam, from 1801 to 1831. This analysis focuses on bilateral rates, specifically those between Portugal and England (1793-1815), Hamburg (1806-1814), Holland (1795-1815), France (1793-1815) and Spain (1808-1814). This source has opened the possibility of obtaining monthly exchange-rate series which are similar to those used in some international studies (Lobell, 2010).

Our study covers part of the long Kondratieff wave from 1787 to 1842, which includes a "depression from the Napoleonic Wars into the forties" (Schumpeter, 1967, p. 183), a period of international and Portuguese instability. Between 1799 and 1815, the Napoleonic Wars were the main reason for that instability, while between 1820 and 1831, the domestic struggle between absolutists and liberals shaped political uncertainty. In the latter phase, Portugal underwent a liberal revolution (1822) and a civil war (1821-1831). Consequently, we believe that the case of Portugal offers a valuable opportunity to examine the influence of the international environment and of the domestic political changeability on exchange rate behavior.

We find evidence of the impact of the Napoleonic invasions on the relation of the Portuguese currency with the currencies of the London, Madrid, Paris, Amsterdam and Hamburg markets. How-

[2] Portugal joined the gold standard in July 1854 (see Reis, 1996; Sousa, 2004, 2019).
[3] Its dissemination was after the 1870s (Eichengreen, Flandreau, 1996).

ever, the conclusion is not the same if we consider real annual exchange rates. We find evidence of the impact of political instability on the relationship between the Portuguese and British currencies, but we do not find evidence in real terms of such an impact on the relation with the currencies of the Madrid, Paris, Amsterdam or Hamburg markets.

The paper is organized as follows. Section 2 presents the data sources for the Portuguese exchange rates and the behavior of the exchange-rate series. Section 3 presents the methodology used and discusses the empirical analysis. Section 4 contains the conclusions.

2. Portuguese Exchange Rates

2.1. Data Source

The data source used is "Portugal's Balance of Trade with Foreign Nations and Portuguese Colonies" produced by the *Erário Régio* (Royal Treasury). It is a foreign trade official statistic that provides data on exports and imports between 1775 and 1831 (Moreira, 2015). What is important and interesting about this source is that it also provides monthly exchange rates for the main Portuguese trade external markets – London, Paris, Amsterdam, Hamburg, and Madrid.[4] The time span of these monthly reports goes from 1801 to 1831, although, except for England, the source lacks data for the period of the Napoleonic invasions (1808-14) and Madrid had only data for the periods 1803-07, 1809-21, 1823-31.

This Portuguese trade source provides for two kinds of information. First is the so-called political par or arbitrage price, which is the exchange rate for remittances. To yield a profit, the current ex-

[4] See *TradeNetworks*, https://tradenetworks.eeg.uminho.pt/ (Moreira, 2021). The source includes other markets, namely, Cadiz, Seville, Genova, Trieste, Naples and Venice, but the monthly data for these markets are scarce. This also means less need for information, since the markets with exchange rates accounted for between 60% and 80% of Portuguese foreign trade between 1801 and 1831. Hence, in our analysis we include only five markets.

change rate cannot be equal to the political par (Guerra, 1837: 32). The exchange rate quotations are usually in mil *réis* (= 1,000 *réis*) and cruzados (= 400 *réis*). In our source, the prices were presented in several other ways in relation to each foreign market, namely, 67,5 *pounds* to 1,000 *réis* for London, 41 11/16 *dinheiros grossos* to 400 *réis* for Hamburg, 50 *dinheiros grossos* to 400 *réis* for Amsterdam, *dobrão* of 4 *pesos* to 2,400 *réis* for Madrid and *escudo* of 3 *francos* to 480 *réis* for Paris.[5] For each market, the political par was unchanged during the entire period. As the Portuguese gold mint price changed in 1822 and the silver mint price only in 1835, we can conclude that this fixity in the political par can only be explained because the exchange rates are defined according to the silver par.

In addition to the arbitrage price, the source includes the monthly bilateral exchange rates, which were the current price. This allows us to study the tax peg (political par) in relation to tax floating (current price).

The relations established between these six trade partners involved economies characterized by different monetary regimes. Although England had been on the gold standard since the 18th century, it adopted *de jure* this monetary regime only in 1821, and before that on July 1st, 1817, a new gold coin, the sovereign at 20 shillings, was proclaimed so that the unit of account coincided with the actual monetary unit. In Hamburg, a silver standard was introduced in 1771. Stabilized this way, the Hamburg Bank money survived the crises of the Napoleonic era. In Amsterdam, changes in the currency system did not occur until the eras of the Batavian Republic (1795-1806), the Kingdom of Holland (1806-1810) and the occupation by the French Empire, but the way of quoting exchange rates remained stable during these periods. By the Coin Act of September 28th, 1816, the Dutch 100 cents guilder weighting 9.613 grams of fine silver or 0.6056 grams of fine gold was declared national currency in the new Kingdom of the Netherlands (Denzel,

[5] There are some ghost coins in these definitions, but the political par is an arbitrage price.

2010: 59). As to Paris, after the founding of the Banque de France in 1800 and the gradual establishment of the franc, on April 7th, the charter was enacted for the so-called franc-germinal, according to which the silver franc was meant to correspond to 4.50 grams of fine silver and the gold franc to 0.2903 grams of fine gold. This bimetallic system remained the basis of the French currency system for the whole of the 19th century (Denzel, 2010: 280). As to Madrid, in the first half of the 19th century the legal basis of the Spanish currency system was the law of May 29th, 1772, which fixed the peso duro at 24.43 grams of fine silver. Until the mid-19th century, the peso and the *doblón de plata* antigua were used as the basis for fixing the exchange rates on and from Spanish imaginary units of account in cashless payment (Denzel, 2010, p. 307). As to Portugal, there were two main changes that affected the country during the period between 1801 and 1831.[6] One occurred in 1797, when Portugal had its first issues of paper money as legal tender. This paper money was accepted for state payments, but its circulation was limited to the largest cities – Lisbon and Porto (Sousa, 2012). Hence, in 1801 Portugal was under a regime of bimetallism with the circulation of paper money rather than of inconvertible paper currency. Second, in 1822, the mint price of the real (Portuguese unit of account) in terms of gold rose after more than a century of stability. The *real* was fixed at 1.753 milligrams of fine gold and 28.046 milligrams of fine silver.[7] The non-circulation of Portuguese gold coins, which were hoarded and/or exported, explains the adjustment of the gold mint price (Sousa, 2012). Moreover, it is notable that Portugal did not establish its first banking institution, Banco de Lisboa, until 1821. Consequently, for the three-decade period in question, there was no active exchange policy.

If we compare our source with other available sources, namely, the Portuguese merchant manuals published after the mid-18th cen-

[6] On the monetary regime of Portugal during the first half of the 19th century, see Sousa, 2012, 2019.
[7] The mint price for silver changed only in 1835.

tury, we can also gather some data about exchange rates. However, the data are scarce and lack monthly information. Among these manuals, the best known is the one written by Manoel Teixeira Cabral de Mendonça, *O Guarda-Livros Moderno* (1823).[8]

In terms of international sources, Posthumus (1946) features monthly exchange rates; however, it quotes only the rate for the Amsterdam market. The relevant data published by Markus Denzel in the *Handbook of World Exchange Rates, 1590-1914*, does not cover the exchange rates for the *real*/Dutch guilder, *real*/mark or *real*/franc for the period between 1809/1810 and 1813.

If we cross the Portuguese annual exchange rates with data from the *Handbook* for the nominal *real*/pound sterling exchange rate, the results are quite similar (see Table 1). Therefore, we assume the reliability of our data. Concerning the maturities of the bills of trade, we use the time span of the *Handbook*.[9] Hence, for the London market, "the exchange markets of Lisbon had the usance of 60 days' sight up to 1850" (Denzel, 2010, p. 11). In the Hamburg and Amsterdam exchange markets, the maturity was three months (Denzel, 2010, p. 219), and in the Paris market, 90 days.

The data used in this study is drawn from official foreign trade statistics, which include information on arbitrage prices and the tax-floating of the Portuguese unit of account with different economic centers. Furthermore, the inclusion of monthly bilateral exchange rates confers an additional advantage. As demonstrated by Flandreau and Jobst (2006), currency and trade are complementary. Our source indicates that Portuguese traders had access to reliable information on exchange rates for international transactions.

[8] This book presents a series of theoretical and practical lessons for traders on a variety of topics, including exchange rates.

[9] We have information from a document written in 1799 confirming the time of maturity for the Hamburg market as between 1½ and three months (*Parecer sobre a discussão …*, 1799, BNL, Caixa 236, número 169).

Table 1
Comparing sources: Exchange rate pounds per 1,000 réis

Year	Real /Pound[1]	Real/Pound[2]	Year	Real /Pound[1]	Real/Pound[2]
1801	63.10	65.25	1817	58.07	58.48
1802	68.90	69.06	1818	59.63	59.31
1803	65.05	65.46	1819	56.17	56.71
1804	62.10	62.88	1820	51.27	51.38
1805	61.78	62.85	1821	50.49	50.94
1806	61.93	62.94	1822	52.24	–
1807	64.00	65.11	1823	52.78	52.60
1808	63.10	–	1824	51.80	51.77
1809	66.41	65.63	1825	51.98	52.27
1810	67.34	68.46	1826	50.76	51.17
1811	68.66	70.00	1827	49.95	49.69
1812	69.93	71.00	1828	46.85	46.77
1813	77.41	78.30	1829	45.93	46.19
1814	70.44	71.71	1830	44.93	45.40
1815	67.76	67.29	1831	47.34	47.67
1816	57.88	57.98	–	–	–

[1] Denzel, 2010.
[2] Portugal's Balance of Trade with Foreign Nations and Portuguese Colonies.

2.2. Exchange Rates

Three indicators are used to analyze the behavior of Portuguese exchange rates: the monthly nominal exchange rate, the annual nominal effective exchange rate and the annual real effective exchange rate.

First, for all indicators, we consider the following markets: London, Hamburg, Amsterdam, Paris, and Madrid. For the period between 1807 and 1814, London is the only market studied due to the lack of monthly data for the other markets. This is because it was the period of the Napoleonic Wars, when trade relations were the cause of most of the problems. However, Portugal maintained commercial relations with England.

The weighted-average exchange-rate value of a currency is the nominal effective exchange rate. Therefore, we obtain the nominal effective exchange rate by multiplying the nominal annual exchange rate by the shares of trade (imports plus exports) of the five foreign markets (see Table A1 in the Appendix, while Table A2 reports the summary statistics).[10] We should stress the high weight of these markets in total foreign trade, which is also relevant to the robustness of this exercise.

To obtain the real effective annual exchange rate, we divide the annual nominal exchange rate by data on the annual consumer price index (CPI). This data was collected from different sources: for Great Britain and the Netherlands (Bob Allen), France (Ridolfi, 2019), Germany (Reinhart, Rogoff, 2010), Spain (Álvarez-Nogal, Escosura, 2013), and Portugal (Palma, Reis, 2019).

The real annual effective exchange rate is obtained by multiplying the real annual exchange rate by the shares of the five foreign markets of Portugal's total external trade (Catão, Solomou, 2000).

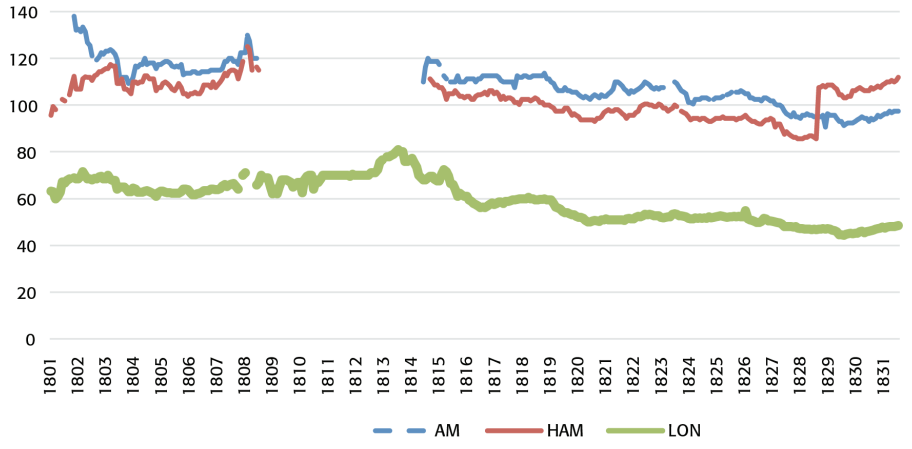
Figures 1 and 2 depict the nominal monthly exchange rates for the five markets. During the Peninsula Wars (1807-1814), Portugal had no trade relations with Paris, Hamburg (except in 1807, 1808 and 1814) or Amsterdam (with the exception of 1807, 1808 and 1814), which explains the absence of exchange rates for these markets in the Portuguese source.

As to the London market (Figure 1), until 1807, the nominal exchange rate was stable, except for 1801, 1802 and for the period between 1807 and 1813, when the *real* appreciated. After 1813, the *real* depreciated sharply until 1817. The devaluation during this period was 75%, i.e., 19% per year, which can be seen as a currency crisis according to the Rogoff criterion (Reinhart, Rogoff, 2009). After 1829, the real appreciated moderately.

In Hamburg, the *real* began to depreciate after 1817, with the trend reversing almost completely in 1829, in the period of a political turmoil in Netherlands. The lowest point of the devaluation oc-

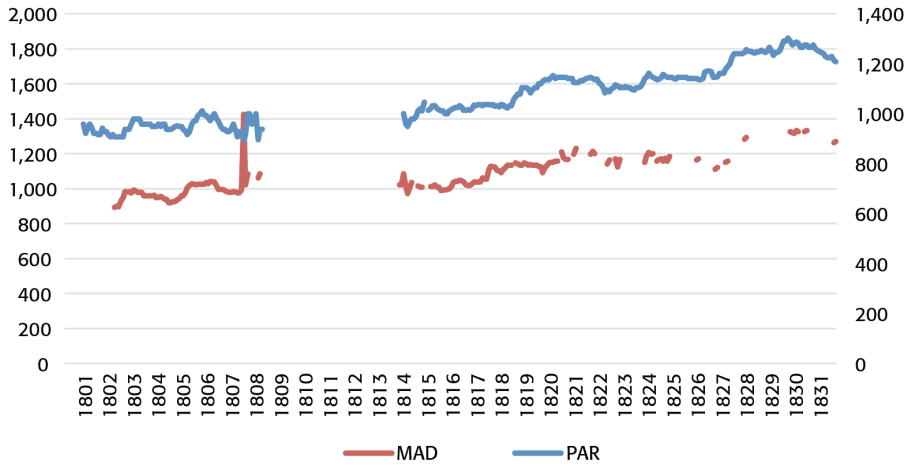
[10] We use the same methodology as Catão and Solomou (2000).

Figure 1
Nominal Monthly Exchange Rates (Foreign unit per 1,000 réis)
(Amsterdam, Hamburg, London)



Source: "Portugal's Balance of Trade with Foreign Nations and Portuguese Colonies".

Figure 2
Nominal Monthly Exchange Rates (Foreign unit per 1,000 réis)
(Paris, Madrid)



Source: "Portugal's Balance of Trade with Foreign Nations and Portuguese Colonies".

curred in 1828 with a 21% depreciation in relation to the exchange at par. The exchange rate with Amsterdam was systematically unfavorable to the Portuguese currency, which presented a sliding devaluation.

Regarding the markets that did not trade with Portugal during the Peninsula War (Figure 2), and beginning with Paris, the year 1815 marks a turning point in the relationship between the *real* and the French franc. If until 1815 the *real* was smoothly valued very close to the political par (*escudo de três francos* per 480 *réis*), especially during the Napoleonic wars, after that date the devaluation of the real was almost continuous. In 1830, the exchange rate had a devaluation of 27% against the tax peg.

In Madrid, from 1809 onward, the real depreciated against the Spanish *pezo*. This happened during the war in Spain, under the domain of Joseph Bonaparte, Napoleon Bonaparte's brother, after Napoleon forced Charles IV's abdication on March 16th, 1808. The peak of the devaluation occurs in 1830, reaching approximately 33%.

In summary, considering the behavior of the nominal monthly exchange rates, we conclude that vis-à-vis the London market, the real appreciated moderately until 1813 and depreciated after the Napoleonic Wars. For the money markets of Amsterdam and Hamburg, the trend is similar. Regarding Madrid and Paris, the real depreciated during most of the period.

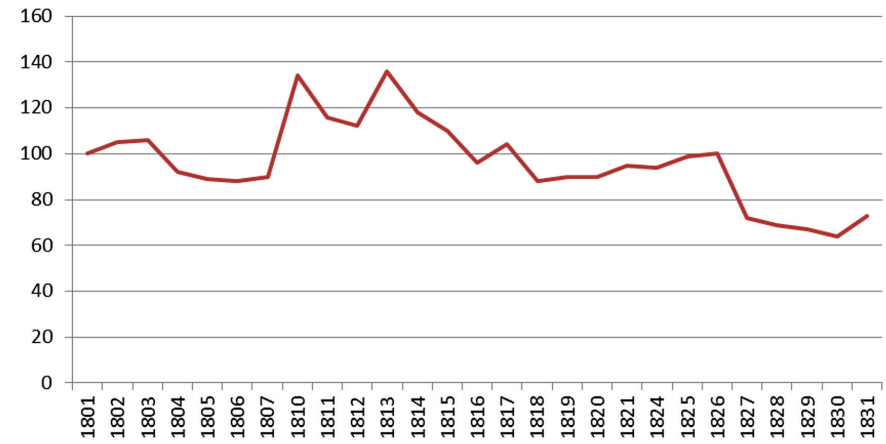
During the Napoleonic invasions, the appreciation of the *real* can be explained by the financial support and continuity of relations with England (Moreira et al., 2022). After the end of the Napoleonic Wars a negative balance of external trade can explain the depreciation of the Portuguese unit of account. Portugal saw its external trade situation deteriorate, with exports standing at 151.1% of imports in 1807 and 212% in 1808 but falling to 77.5% in 1814 and to their lowest rate of 17.9% in 1811. From 1810 onward, Portuguese exports were always below 100% of imports, showing a continuous deficit situation with all the country's trading partners (Moreira, 2013).

To analyze trends in bilateral exchange rates, it is also necessary

to study nominal effective exchange rates. This exchange rate, although also nominal, helps to explain the contribution of exchange rates to an economy's competitiveness, as the indicator eliminates possible influences from the behavior of a particular currency when the study is simply bilateral.

Based on the calculation of the relative weight of external trade with the five foreign markets (Table A1 in the Appendix), the effective nominal rate is transformed into the index number, with 1801 = 100 (Figure 3).

Figure 3
Nominal Effective Exchange Rate (1801 = 100)



In an analysis regarding the considered sub-periods, we find that between 1801 and 1807, the *real* tended initially toward a slight appreciation, followed by a devaluation after 1804. In 1810 and 1813, that is during the Napoleonic Wars, the real appreciated almost by 40%. After 1815 and coinciding with the third sub-period, the Portuguese currency tended toward a slight depreciation that became clearly more pronounced after 1827.

It can be demonstrated that the period of the Napoleonic invasions corresponds to a period of appreciation of the real and a reversal of the Portuguese foreign trade balance. It can be concluded that

it was only in the last triennium of the 1820s that the real suffered a significant devaluation in the exchange market, corresponding to a period of decline in Portuguese external trade of almost 60%. The decline in external trade, coupled with the commercial deficit, provides an explanation for the behavior of the Portuguese unit of account.

3. Empirical analysis

For the empirical assessment, we applied the following specification for each set of exchange rates:

$$Et = \alpha + \beta . Et - 1 + \delta . Nt + \phi . Pt + \gamma . Mt + \varepsilon t \qquad (1)$$

where *Et* is the dependent variable and can be the monthly nominal exchange rate, the annual nominal effective exchange rate or the annual real effective exchange rate. The model considers as independent variables the lagged dependent variable, $Et - 1$, and three dummy variables: *Nt*, to flag the period of the Napoleonic Invasions of Portugal; *Pt*, to signal the period of political instability in Portugal;[11] *Mt*, to proxy the monometallic monetary system period in the UK. As usual, εt is a disturbance term satisfying standard assumptions of zero mean and constant variance.

Our research questions are threefold:

- RQ1: Was the Peninsular War a determinant of Portuguese exchange-rate performance in that period (1801-1831)?
- RQ2: Was Portuguese political instability after the Napoleonic War a determinant of Portuguese exchange-rate performance during that period (1801-1831)?
- RQ3: Was the introduction of the monometallic monetary system in the UK a determinant of the pound (UK)/real (Portugal) exchange-rate performance in that period (1801-1831)?

[11] We tried to use a more direct measure of instability, namely, the number of times in a year that a new prime minister is named, or half the cabinet is changed. Nevertheless, the results had no statistical significance.

The econometric analysis focuses on the results for nominal monthly exchange rates. Due to the low number of observations (21 and 26) for nominal effective annual exchange rates and real effective annual exchange rates, the results at annual frequency are less robust (see the Appendix).

Our findings (see Table 2) allow us to conclude that the Peninsular War and the Portuguese political instability variables explain the trend line of the evolution of the nominal monthly real exchange rate in the case of the UK and Amsterdam. In both cases, the first variable displays a positive impact in the model (0.467 for the UK and 0.461 for Amsterdam), indicating an appreciation of the real. Portuguese political instability also displays a negative impact on both markets (-0.485 for the UK and -0.381 for Amsterdam), revealing a depreciation of the *real*. This results also show a positive impact (103.5) of Portuguese political instability on the exchange rate between Lisbon and Madrid, indicating an appreciation of the *real*, with a high statistical significance. With a less statistical significance, the Napoleonic invasions variable also negatively impacts the exchange rate with the French currency, implying a Portuguese cur-

TABLE 2
Nominal Monthly Float Exchange Rates (OLS)

	London/ Portugal (1801-1831)	Amsterdam/ Portugal (1801-1831)	Madrid/ Portugal (1801-1831)	Paris/ Portugal (1801-1831)	Hamburg/ Portugal (1801-1831)
Constant	2.684	(0.971)***	3.530	(0.776)***	620.992
	(129.565)***	13.852	(7.031)**	2.185	(0.861)**
Et – 1 – Exchange Rate t – 1	0.955	(0.015)***	0.921	(0.016)***	0.748
	(0.05)***	0.972	(0.014)***	0.948	(0.020)***
Nt – Napoleonic Invasions (= 1 if 1807-1814)	0.467	(0.184)**	0.461	(0.142)***	3.017
	(25.668)	-2.491	(1.417)	0.086	(0.209)
Pt – Portuguese Political Instability (= 1 if 1820-1831)	-0.485	(0.236) **	-0.381	(0.122) ***	103.594
	(29.899)***	2.077	(1.561)	-0.118	(0.118)
Adjusted R^2	0.985	0.971	0.781	0.984	0.935
N.	360	271	161	292	285

Note: Standard errors clustered at the country level in parentheses.
*, **, *** denote statistical significance at the 10, 5 and 1% levels.

rency depreciation. For the other markets, the variables in the model are not statistically significant.

If we consider annual exchange rates, we have far fewer observations. Nevertheless, the behavior of the nominal annual exchange rate (Appendix Tables A2 and A3) with London, Amsterdam, Madrid and Paris can be explained by the variables for the Napoleonic invasions and political instability. The exchange rates with the Hamburg market are not explained by these variables (R2 = 47,3%).

The results for the real exchange rate (Table A3) reveal that only the analysis for the Paris market provides robust results (R2 = 86,7%). For the other markets, the behavior of the Portuguese exchange rate cannot be explained by the Napoleonic invasion and political instability variables.

Finally, we obtain no evidence of the impact of the introduction of the gold standard in Britain on the pound/real relation in either nominal terms or real terms or on the alteration of the foreign trade profile and, therefore, the nominal effective exchange rate. This conclusion can be explained by the fact that the United Kingdom had been in the gold standard since the 18th century. The legal adoption in 1821 had no impact on either the bilateral rates or trade.

Contrary to what happened in other European economies where the Napoleonic wars caused currency crises (Reinhart, Rogoff, 2009), we conclude that the Portuguese unit of account appreciated mainly against the pound and the hanseatic mark during the same period. This paradox can perhaps be explained by the British military and financial support to the Portuguese economy until 1815 (Moreira et al., 2022). The aid was both in kind and in cash, and Portugal was one of thirty states to receive it from Britain. Nevertheless, Portugal was the economy that received the largest amount per capita. This prevented the Napoleonic invasions from exerting a greater financial impact on the Portuguese economy. In reverse "from 1808 to 1820 it [Portugal] was a British protectorate, strongly influenced by Tory officers and diplomats who favored the "old order" and wished to postpone "any serious attempt at renewed revolution" (Moreira et al., 2022, p. 235).

The continuation of the war in the form of a civil conflict had a more destructive impact on the Portuguese economy. As it has been demonstrated, this political instability was reflected in the currency market with the devaluation of the real against the pound and the hanseatic mark. The persistent deficit situation with all its trading partners during this period may also explain the behavior of the Portuguese unit of account.

4. Conclusion

Until now, discussions on the performance of the Portuguese economy in the first three decades of the 19th century have focused mainly on the study of the effects of the loss of the Brazilian colonial space and of the Napoleonic invasions on prosperity. The problem involves knowing whether the line of prosperity was broken before or after Napoleon entered the Portuguese territory.

From 1810 onward, Portugal's export rate was always below 100% of its import rate, which indicates a persistent trade deficit. If 1810 is the relevant year for the change in external trade, then in terms of the studied exchange rates, the end of the Napoleonic invasions delimits the behavior of the real exchange rate with respect to the currencies of Portugal's main trading markets – London, Paris, Madrid, Hamburg and Amsterdam. The devaluation of the real began in 1815, as shown both in bilateral and effective exchange rates. Therefore, the year 1815 is the year of inflexion of the behavior of the Portuguese exchange rate.

Portugal's effective exchange rate during the Napoleonic invasion has been thought to be linked to the beginning of the trade deficit. The value of external trade must have also suffered from the effect of this currency appreciation, which would have made exports more expensive and imports cheaper. From 1815, the Portuguese currency began to depreciate, yet the trade deficit persisted despite the decline in the relative prices of exports. Portuguese coinage experienced a loss of value in exchange markets. Despite the adapta-

tion of the internal price of gold to the market price, the political par did not react to this change.

Considering each variable in the empirical model, we find evidence of the impact of the Napoleonic invasions on the relation between the Portuguese currency and the currencies of the markets of London, Madrid, Paris, Amsterdam and Hamburg. However, the conclusion is not the same if we consider real annual exchange rates. As for Madrid, there was the low volatility of the Spanish against the Portuguese currency and, as to the three other Countries, we must consider the absence of data for the periods in question; hence, this result is probably explained by the fall in foreign trade with these markets.

We find evidence of the impact of political instability on the relationship between the Portuguese and the British currency in both nominal and real terms and even on the change in the profile of Portuguese foreign trade and, therefore, the exchange rate of the Portuguese currency. We do not find real terms evidence of an impact of political instability on the relation of the Portuguese currency with the currencies of the Madrid, Paris, Amsterdam or Hamburg markets.

In this sense, the Portuguese case can be considered as an interesting case study, because exchange rates remained stable or appreciate during the global war (1801-1815) and depreciated afterwards (1815-831). Internal conditions seem to be more important than external conditions in explaining the behavior of exchange rates. Portugal belongs to the cases indicated by Rogoff as not having had a currency crisis during the Napoleonic invasions and from this perspective it was an exception in the European context.

APPENDIX

TABLE A1
Share of Foreign Markets in Portuguese External Trade (%)

Year	TOTAL	England	Hamburg	Netherland	France	Spain
1801	70.5	32.7	28.4	2.2	3.5	3.7
1802	75.3	38.5	15.2	4.8	12.5	4.3
1803	74.9	44.0	13.8	3.1	8.8	5.1
1804	74.5	34.0	14.8	8.0	13.7	4.0
1805	73.6	34.7	14.3	5.0	14.6	4.9
1806	75.6	37.3	9.9	4.9	16.8	6.7
1807	75.9	38.4	7.2	5.4	18.3	6.7
1808	91.5	32.4	0.6	0.0	43.4	15.1
1809	78.4	63.5	0.0	0.0	0.0	14.9
1810	80.0	66.9	0.0	0.0	0.0	13.1
1811	62.9	56.7	0.0	0.0	0.0	6.1
1812	60.8	54.1	0.0	0.0	0.0	6.7
1813	74.7	59.5	0.0	0.0	0.0	15.2
1814	82.0	50.3	3.6	6.1	11.1	10.9
1815	77.8	46.9	6.4	7.8	9.5	7.1
1816	77.3	41.5	11.9	8.8	8.6	6.6
1817	79.2	48.3	11.6	5.4	4.3	9.5
1818	69.3	40.2	10.2	5.0	5.2	8.7
1819	73.9	44.6	9.6	4.2	3.7	11.7
1820	78.4	48.1	11.7	4.3	2.7	11.7
1821	79.0	52.3	10.8	4.0	2.6	9.2
1822	84.5	56.4	9.2	5.5	3.4	9.9
1823	84.4	59.2	6.8	3.6	2.1	12.8
1824	82.0	54.3	7.3	3.3	2.1	15.0
1825	84.3	59.3	4.6	2.9	2.7	14.8
1826	81.3	59.8	6.1	3.5	3.3	8.5
1827	57.6	44.4	4.3	2.3	1.5	5.2
1828	60.2	46.5	3.1	2.1	1.3	7.3
1829	60.5	44.9	2.2	3.3	1.5	8.6
1830	57.8	44.0	2.9	1.8	1.6	7.5
1831	62.7	48.3	3.1	1.8	1.6	7.8

Source: Own calculations based on "Portugal's Balance of Trade with Foreign Nations and Portuguese Colonies".

TABLE A2
Summary Statistics

	London	Hamburg	Amsterdam	France	Madrid	Portugal
Nominal exchange rates						
Average	59.4	102.4	108.6	1077.7	1080.7	
Max	81	125.0	138.1	1302.1	1425.0	
Min	44.2	85.6	90.6	895.8	891.6	
Stdev	8.4	7.7	9.2	111.9	543.7	
Price indices (1801 = 100)						
Average	83.3	163.4	100.1	97.9	101.4	104.3
Max	111.7	295.5	125.1	131.9	223.8	167.8
Min	68.9	100.0	84.7	83.8	56.5	75.2
Stdev	11.9	43.2	10.4	10.8	33.8	20.7

TABLE A3
Nominal Annual Exchange Rates (OLS)

	London/Portugal (1801-1831)		Amsterdam/Portugal (1801-1831)	
	1	2	3	4
Const	26.306	24.597	10.372	8.990
	(8.597)***	(9.201)**	(7.065)	(7.577)
Et – 1 – Exchange Rate t – 1	0.562	0.588	0.763	0.792
	(0.133)***	(0.143)***	(0.515)***	(0.161)***
Nt – Napoleonic Invasions (= 1 if 1807-1814)	5.454	5.311	0.661	0.643
	(1.611)***	(1.653)***	(1.515)	(1.546)
Pt – Portuguese Political Instability (= 1 if 1820-1831)	-5.309	-6.611	-1.061	1.744
	(2.208)**	(3.154)**	(1.132)	(1.635)
Mt – Monometallic Monetary System (= 1 if 1821-1831)	–	1.850	–	0.960
		(3.155)		(1.631)
R^2 adjusted	0.910	0.907	0.846	0.840
N.	26	26	21	21

Note: Standard errors clustered at the country level in parentheses.
*, **, *** denote statistical significance at the 10, 5 and 1% levels.

TABLE A4
Nominal Annual Exchange Rates (OLS)

	Hamburg/ Portugal (1801-1831)	Madrid/ Portugal (1801-1831)	Paris/ Portugal (1801-1831)
	1	2	3
Const	18.593	4.49E-05	0.000
	(10.865)	(6.05E-05)	(0.000)
Et – 1 – Exchange Rate t – 1	0.558	0.876	0.819
	(0.253)**	(0.144)***	(0.158)***
Nt – Napoleonic Invasions (= 1 if 1807-1814)	2.482	5.31E-06	9.49E-05
	(2.318)	(8.65E-06)	(6.53E-05)
Pt – Portuguese Political Instability (= 1 if 1820-1831)	-1.191	-7.44E-06	-6.69E-05
	(1.450)	(1.18E-05)	(6.11E-05)
Mt – Monometallic Monetary System (= 1 if 1821-1831)	–	–	–
Adjusted R^2	0.473	0.858	0.908
N.	21	26	21

Note: Standard errors clustered at the country level in parentheses.
*, **, *** denote statistical significance at the 10, 5 and 1% levels.

TABLE A5
Real Annual Float Exchange Rates (OLS)

	London/ Portugal (1801-1831)	Amsterdam/ Portugal (1801-1831)	Hamburg/ Portugal (1801-1831)	Madrid/ Portugal (1801-1831)	Paris/ Portugal (1801-1831)
	1	2	3	4	5
Const	49.462	18.005	24.678	29.870	11.550
	(14.855)**	(13.971)	(11.292)**	(6.864)***	(4.189)**
Et – 1 – Exchange Rate	0.322	0.793	0.552	0.120	0.418
	(0.202)	(0.134)***	(0.150)***	(0.203)	(0.193)*
Nt – Napoleonic Invasions (= 1 if 1807-1814)	-1.916	0.784	32.838	-5.623	-5.615
	(3.736)	(7.704)	(12.588)**	(3.651)	(3.319)*
Pt – Portuguese Political Instability (= 1 if 1820-1831)	-5.987	1.783	4.641	7.492	-0.821
	(3.411)*	(3.325)	(5.414)	(3.830)*	(2.476)
Mt – Monometallic Monetary System (= 1 if 1821-1831)	–	–	–	–	–
Adjusted R^2	0.216	0.619	0.461	0.379	0.368
N.	26	21	21	25	25

Note: Standard errors clustered at the country level in parentheses.
*, **, *** denote statistical significance at the 10, 5 and 1% levels.

TABLE A6
Real Annual Float Exchange Rates (OLS)

	London/ Portugal (1801-1831)	Amsterdam/ Portugal (1801-1831)	Hamburg/ Portugal (1801-1831)	Madrid/ Portugal (1801-1831)	Paris/ Portugal (1801-1831)
	1	2	3	4	5
Const	55.303	18.112	42.954	29.843	9.961
	(3.73) ***	(1.25)	(3.31)***	(4.23)***	(2.58)**
Et-1 – Exchange Rate	0.245	0.791	0.501	0.124	0.356
	(1.21)	(5.65)***	(3.66)***	(0.58)	(2.01)*
Nt – Napoleonic Invasions (= 1 if 1807-1814)	1.084	1.073	25.66	-5.852	-5.370
	(0.26)	(0.16)	(2.56)**	(-1.28)	(-1.78)*
Pt – Portuguese Political Instability (= 1 if 1820-1831)	-5.102	1.892	-8.41	7.53	1.977
	(-1.52)	(0.52)	(-1.11)	(1.91)*	(0.775)
CAt – Trade balance (% of GDP)	0.888	-0.814	-16.988	-0.297	3.854
	(1.58)	(-0.09)	(-2.25) **	(-0.09)	(2.33)**
Adjusted R^2	0.265716	0.595123	0.5649	0.385773	0.4790
N.	26	21	21	24	25

Note: Standard errors clustered at the country level in parentheses.
*, **, *** denote statistical significance at the 10, 5 and 1% levels.

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