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Crises, credit booms and monetary regime

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Abstract

In theory credit booms, and the crises associated to these booms, should occur more frequently in Fiat monetary regimes than in regimes, such as the Gold Standard, where money creation is constrained. In this note, we investigate whether the importance of the credit boom factor, as an early warning indicator (EWI) of systemic financial crises, varies across monetary regimes for a sample of 17 developed countries over the 1870-2016 period. We find no evidence of a difference between monetary regime for credit-driven crises and this both for the occurrence and the severity of crises.

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1 Introduction

Since the Global Financial Crisis (GFC), the Early Warning Indicators' (EWI) literature has attempted to find crises' determinants and their link with financial cycles.[1] The determinants often put forward are capital bonanza, expansionary or loose monetary policy, easy credit, and financial deregulation and innovation (Bordo and Meissner, 2016). Rapid credit growth (i.e. credit boom) is often considered as a key determinant in these long-term perspective studies and seems to form a near-consensus in the literature (Jorda et al., 2011; Schularick and Taylor, 2012; Borio, 2014). Based on an empirical analysis covering post-war financial crises, Greenwood et al. (2020) report that rapid credit and asset price growth over the prior three years, is linked to a 40% probability of entering a financial crisis within the next three years. These authors even suggest that crises are substantially predictable. The predictable nature of crises is however debated. Bordo and Meissner (2016), and Bordo (2018) highlight indeed that crises are not all driven by credit booms and more specifically credit-driven asset price booms.

In this paper, we explore the credit boom explanation and investigate whether this determinant, as an early warning indicator, varies across monetary regimes. Indeed, although credit booms can be a potential factor for crises occurrence, the prerequisite is that the financial and monetary environment enables this boom to happen. Intuitively, the credit boom factor is more a feature of the Fiat monetary regime, as the latter is more elastic than any commodity regime. Financial deregulation, the rise of credit in the economy and the passage to the floating exchange rate are factors that sustain this hypothesis. Additionally, from the perspective of the Austrian School, more disciplined and less discretionary monetary institutions lead to less distorted interest rates and thus, reduce the likelihood of credit-boom-driven crises. According to White (2011), for example, a gold standard regime with free banking would restrain credit boom crises from happening since once demand for credit increases, interest rates would go up,[2] preventing a credit frenzy to occur and a critical bubble to be formed. Instead, in the Fiat standard, monetary expansion can keep interest rates at low levels for longer periods. This can generate credit booms leading to overconsumption and malinvestments. In either case, the main idea is that credit-driven

[1] For a survey of the literature, see Bordo and Meissner (2016).
[2] What Hayek calls "the interest brake", see Garrison (2006).

crises are, in theory, more likely to occur under the current Fiat standard, as there is no "hard money" rule to contain credit growth.

In the literature, long-term studies of crises determinants provide evidence of an average effect of credit growth over time. Little is said about this effect subject to the monetary regime in place. The exception being the study of Schularick and Taylor (2012), which distinguishes the pre-WWII period from the post-WWII one and the study of Meissner (2013), which focuses on the Classical Gold Standard (CGS).

In this paper, we examine whether the credit boom narrative holds for each monetary regime. Using Schularick and Taylor (2012)'s empirical strategy, we find no evidence of specific differences between monetary regimes with respect to the credit boom determinant. The same holds for the analyses of differences in the severity of credit-driven crises.

2 Econometric Specification

In line with the empirical strategy of Schularick and Taylor (2012), our baseline model is a logit equation. Interaction variables are used to assess differences of credit growth effect on crises occurrence across monetary regimes. The equation is as follows:

$$\textbf{Logit}\,(p_{it}) = \beta_0 + \beta_1(L)CreditGrowth_{it} + \beta_2 MonetaryRegime_{it} + \beta_3(L)(CreditGrowth_{it} \times MonetaryRegime_{it}) + \beta_4 X_{it} + \varepsilon_{it} \quad \textbf{(1)}$$

Where p_{it} is the probability that a systemic financial crisis occurs in country i at time t and logit $(p_{it}) = \log(\frac{p_{it}}{1-p_{it}})$ represents the log of the odds ratio. $CreditGrowth_{it}$ is the variation of the logarithm of total real loans to the non-financial private sector[3] in country i at time t and captures the credit growth effect. $MonetaryRegime_{it}$ is the vector of dummy variables of monetary regimes in country i at time t (Classical Gold Standard; Other Pre-14 monetary regimes; Interwar period; Bretton Woods period), with the Fiat standard as control.

Finally, we add lags – 5 in total – to the credit growth variable to catch its dynamics since this variable may take time to affect the likelihood of a crisis. We also include the controls (X) as Schularick and Taylor (2012)[4] and add country fixed effects to control for countries' characteristics. We do not include time fixed effects because our time variables would be collinear with our monetary regime variables. Finally, ε_{it} represents the error term

[3] The ratio loans/broad money varies from 0.83 (Interwar) to 1.27 (Fiat).
[4] That is, loans/GDP, short-term interest rate, GDP per capita growth and inflation.

encompassing the unexplained factors influencing crises' occurrence.

In a second phase, we estimate a similar equation with crisis intensity as dependent variable to analyze if there is any difference between regimes in terms of credit-driven crisis severity. We use a Tobit estimation to deal with the omitted zero values issue. Beforehand, we added zeros for the non-crises periods.

3 Data

Data on credit, crisis occurrences and control variables are from Jorda et al. (2016).[5] The data series are made of a Panel of 17 developed countries for a period that goes from 1870 to 2016.[6] Variables of monetary regimes for each country at time *t* are constructed using different sources such as Officer's (2008) and López-Córdova and Meissner's (2003). Data on crisis intensity are from Reinhart et Rogoff (2014)[7]. Table I provides the descriptive statistics of the main variables used for each main monetary regime.

Table I: Descriptive Statistics

Variables	***Classical Gold Standard***					***Other Pre-14 regimes***					***Interwar regimes***				
In proportion	**Obs**	**Mean**	**StD**	**Min**	**Max**	**Obs**	**Mean**	**StD**	**Min**	**Max**	**Obs**	**Mean**	**StD**	**Min**	**Max**
Δlog(loans) (Credit Gr.)	493	0,05	0,07	-0,40	0,36	98	0,09	0,19	-0,26	1,32	314	0,03	0,12	-0,58	0,64
Δlog(CPI) (Inflation)	562	0,00	0,04	-0,20	0,28	169	0,01	0,07	-0,31	0,29	323	0,09	1,17	-0,22	20,78
Short term Int. Rate	508	0,04	0,01	0,01	0,12	159	0,05	0,02	0,02	0,14	304	0,05	0,02	0,00	0,11
Loans/GDP	501	0,47	0,29	0,02	1,51	106	0,14	0,11	0,00	0,54	316	0,51	0,37	0,05	1,68
Δ(Inv/GDP)	517	0,00	0,02	-0,06	0,07	125	0,00	0,02	-0,05	0,10	277	0,00	0,03	-0,21	0,13
Systemic Fin. Crisis	566	0,05	0,21	0	1	182	0,05	0,23	0	1	323	0,08	0,28	0	1
Crisis Intensity (Index)	14	15,81	10,96	2,80	48	2	7,00	0,57	6,60	7,40	26	20,60	14,01	6,20	60,60
Variables	***Bretton Woods***					***Fiat regime***									
In proportion	**Obs**	**Mean**	**StD**	**Min**	**Max**	**Obs**	**Mean**	**StD**	**Min**	**Max**					
Δlog(loans) (Credit Gr.)	404	0,09	0,08	-0,14	0,78	765	0,04	0,06	-0,19	0,30					
Δlog(CPI) (Inflation)	408	0,04	0,05	-0,19	0,56	765	0,04	0,04	-0,01	0,32					
Short term Int. Rate	396	0,04	0,02	0,00	0,12	765	0,06	0,05	-0,02	0,21					
Loans/GDP	406	0,42	0,20	0,07	1,01	765	0,84	0,32	0,20	2,05					
Δ(Inv/GDP)	397	0,00	0,02	-0,09	0,09	765	0,00	0,01	-0,08	0,07					
Systemic Fin. Crisis	408	0	0	0	0	765	0,03	0,17	0	1					
Crisis Intensity (Index)	0	N/A	N/A	N/A	N/A	13	12,69	7,23	2,10	23,30					

[5] Regarding crises occurrence, we rely on JST's data but some divergences exist in the literature. One illustration is the Canadian case. In JST's dataset, the 1907 crisis is included while Bordo, Redish, and Rockoff (2014), who are credible on this issue, state that Canada did not experience a crisis for our period of study. As a robustness check, we run the regressions without crises for Canada and the results are not sensitive to such a change. The results are available upon request.

[6] The data are available at their website: https://www.macrohistory.net/database/

[7] Originally from an unpublished work of Harris et al. (2014).

The CGS exhibits the lowest average inflation but remains the one with the highest variability.[8] By contrast, the CGS exhibits the lowest variability in short-term interest as most countries played, to some extent, by the "rules of the game".

The Fiat regime displays the highest level of debt to GDP as economies have the highest degree of financialization in that period. Change in the level of investment to GDP is quite similar across monetary regimes. The frequency of financial systemic crisis is the highest in the Interwar period. The 1929 crisis explains this result, as it spread on most developed countries.

In proportion, crises are more frequent in the CGS than in the Fiat regime. This relates to the absence of deposit insurance scheme, causing more bank runs compared to post-WWII periods.[9] In addition, most countries experienced more or as many episodes of crises during the CGS than in the Fiat standard (Graph 2). Furthermore, the high yearly frequency of crises in the CGS (Graph 1) suggests that crises were more contagious in this era. Interestingly, the average crisis intensity gap between the CGS and the Fiat regime remains quite small. The smaller proportion of the financial sector in the economy during the CGS and the higher fiscal costs to mitigate crises during the Fiat period help explaining this finding.[10]

Credit growth is slightly higher during the CGS relative to the Fiat regime. Nonetheless, these credit growths do not necessarily fuel assets-booms that led to crises. As an illustration, Meissner (2013) shows that the early 1880s, the period 1894-1895 and the years circa 1900 were all periods with high money growth in most countries, but with a small number of crises. Graph 1 shows corroborating results, as we observe credit growth peaks with low frequency of crises for these periods.

Interestingly, the Bretton Woods period exhibits, on average, the highest credit growth, but no systemic financial crises occurred. Capital controls and pegged exchange rates, applied during this system, explain this relative stability. The former enables member countries to avoid speculative attacks while the latter allowed them to alter their parity to gold and the dollar to offset important disequilibrium (Bordo and Schwartz, 1999).

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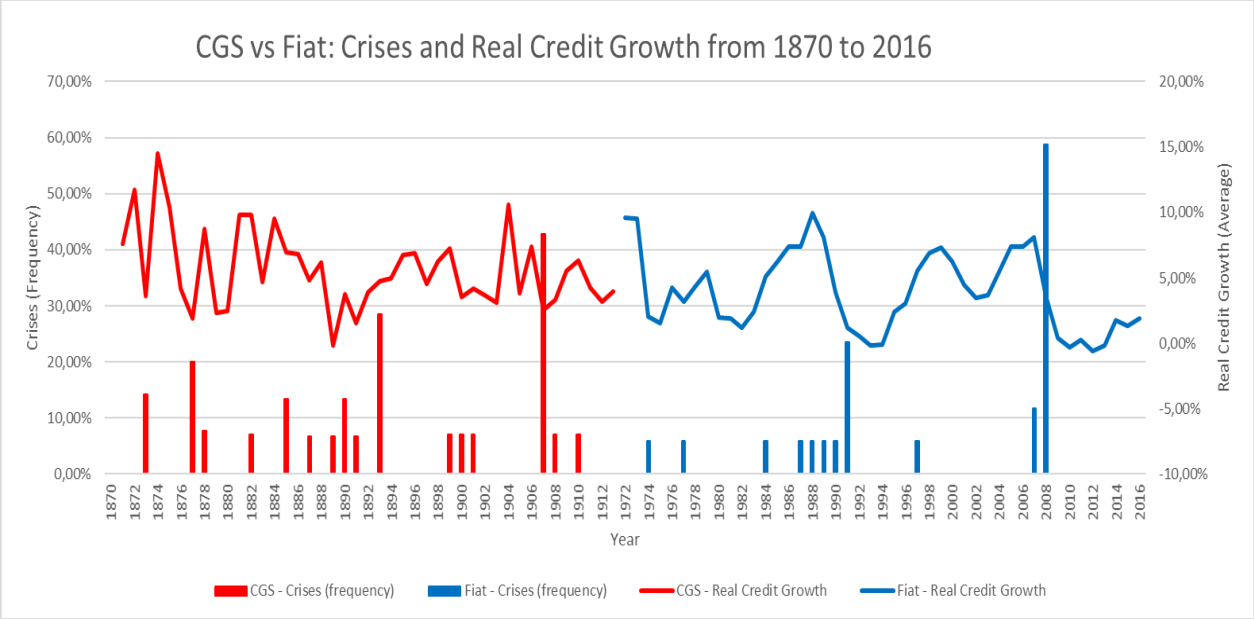
[8] See Bordo and Schwartz (1999).
[9] See Schularick and Taylor (2012).
[10] See Bordo and Meissner (2016).

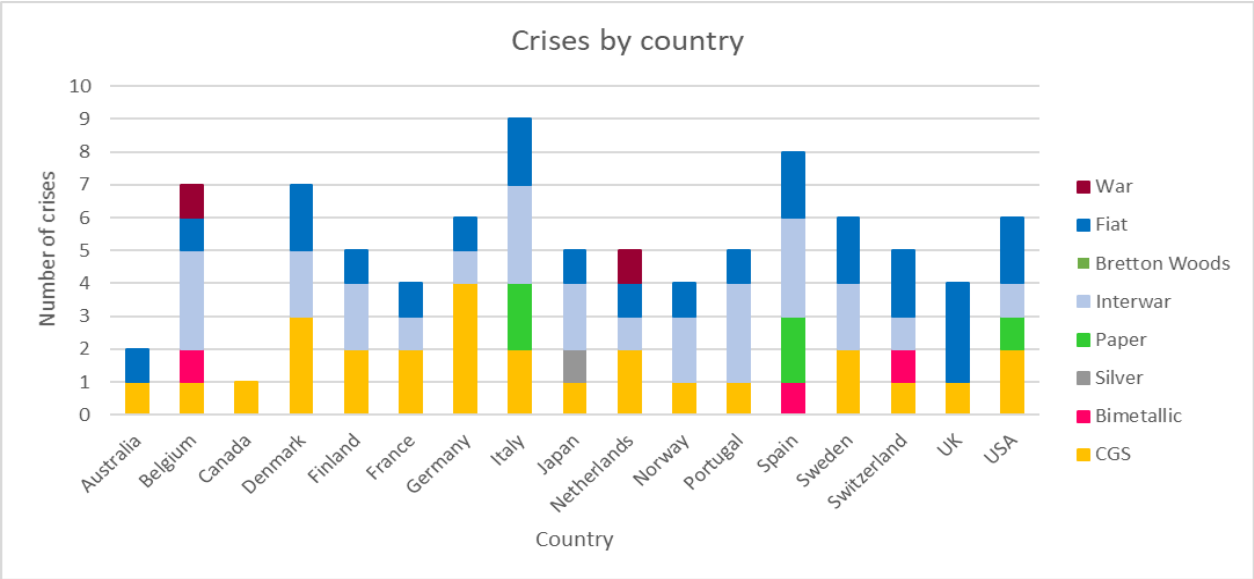
Graph 1: Credit-Driven Crises: Classical Gold Standard vs Fiat Standard

Notes: In this graph, whether we look at the CGS or the Fiat Standard, the decline of credit growth is followed by a crisis in an interval of less than 5 years, at least for the widespread crises.



Graph 2: Crises by country and Monetary regime

Notes: This graph shows the number of crises by country. The crises are grouped by the monetary regime in place. Apart for Switzerland and the UK, all countries that were once on gold standard had more or as much episodes of crises during the CGS than in the Fiat standard.



4 Estimation results and discussion

Table II reports the logit estimation results and the average effect of the credit boom throughout the whole sample. The overall effect[11] of the credit growth on the probability of crisis occurrence is significant and positive, in line with the findings of the literature for the 3 specifications. Consistent with the result of Schularick and Taylor (2012), out of the five lags, only the second one is significant and positive, and can be interpreted as the time when the variable has the strongest effect. This corroborates the study of Greenwood et al. (2020) which shows that rapid credit and asset price growth over the past three years, is linked with a 40% probability of entering a financial crisis within the next three years.

In Table III, as we add interaction terms to take into account the different monetary regimes, the credit growth variable and its lags are related to the control group (i.e. the Fiat standard). Since the sum of the lag coefficients of the control group are significant,[12] we confirm the overall effect of credit growth on the probability of crisis occurrence. In addition, the first lag of credit growth rather than the second one is positive and significant, indicating that credit-driven crises are triggered more abruptly under the Fiat regime than on average for the whole sample period.

By testing the sum of the lags for the interaction terms corresponding to the overall difference between monetary regimes, we find no significant differences. Only the Other Pre-14 monetary regimes[13] exhibit a significant difference (for the 1st and 2nd specification of Table III). This negative coefficient is mainly driven by the 1913 Spanish crisis where credit growth increased one year before the crisis. At the time, Spain had a non-convertible currency.

Table III shows that the strongest effect for the Bretton Woods occurs in the fifth lag rather than the first one and the lags are jointly significant, suggesting a difference in the timing of the credit impact. However, no crises occurred during Bretton Woods and the sum of the lags (i.e. the overall effect) is not significant either.[14]

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[11] We test whether the sum of these five lags is statistically significant and also perform a joint significance test. The test-statistics and the p-value of these tests are reported at the bottom of Table II.

[12] For space reason, we report only this test for the interaction terms.

[13] As data is less abundant and sparse for Inconvertible, Bimetallic and Silver Standards, we regroup them in this variable.

[14] If we rely, instead of crises occurrence, on recessions occurrence, the only sum of lags significant is for the Bretton Wood regime. The sum is negative, suggesting a lower impact of credit growth compared to the Fiat regime. This corroborates the remark on Bretton Woods on the data section. The results are available upon request.

Turning to the intensity of crises, we examine whether there is a difference between monetary regimes. Our motivation is to assess whether credit-driven bursts are less severe under the CGS in comparison with the Fiat regime. We could argue that, under the CGS, the rise of the discount rate after inflationary pressure can shorten the life-cycle of the credit bubble, therefore diminishing its impact. Table IV shows this is not the case. The overall effect of the credit growth interaction term with the CGS, that is when we test for the sum of the lags of this interaction term, is not significant by using the left-censoring Tobit. Notice that the model with OLS, in column 1, is not significant.

However, in Table V, by investigating the crisis' impact, irrespective of its origin, that is originating from a credit boom or not, the results are more nuanced. Indeed, during the Fiat regime, the real GDP per capita dropped a cumulative 11 percent below the trend (on 5 years span after a crisis) accompanied by a cumulative fall of real credit of 36 percent relative to trend. The impact is less strong for the CGS with a cumulative drop, for real GDP, of 4% relative to trend and a decline of real credit of 20 percent below the trend.

5 Conclusion

To conclude with White (2011)'s hypothesis, our results are not sufficient to corroborate it and confirm that a credit-driven crisis is more a Fiat regime feature rather than a CGS one. The results are identical when we analyze potential differences in credit-driven crises severity. These results need, however, to be tempered. Indeed, in the same vein as Bordo (2018, p.341), by comparing output losses by monetary regime, we find that the Classical Gold Standard is the significantly least affected by crises in terms of GDP per capita loss. However, this comparison of output losses is irrespective of the crisis' origin while our focus is on credit-driven crises. An area that needs to be explored is the inclusion of peripheral/developing countries to have a bigger picture of differences between monetary regimes with respect to credit-driven crises.

Table II: Credit growth effect on crisis occurrence: Average effect[15]

VARIABLES	(1) Crisis Logit	(2) Crisis Logit	(3) Crisis Logit
L.CreditGrowth	0.106	0.0777	1.400
	(1.830)	(1.971)	(2.928)
L2.CreditGrowth	5.741***	6.455***	8.599***
	(1.510)	(1.709)	(2.457)
L3.CreditGrowth	0.924	1.073	2.182
	(1.297)	(1.567)	(3.334)
L4.CreditGrowth	-1.001	-1.164	4.284**
	(1.138)	(1.182)	(2.165)
L5.CreditGrowth	1.089	1.131	-2.078
	(1.038)	(1.174)	(2.257)
Controls[16]	No	No	Yes
Country fixed effects	No	Yes	Yes
Observations	1820	1820	1651
Test all lags equal zero (χ^2)	28.01	22.26	29.67
P-value	0.000	0.001	0.000
Test Country FE equal zero (χ^2)	N/A	9.74	13.31
P-value	N/A	0.880	0.578
Test all coefficients equal zero (χ^2)	28.01	37.83	116.9
P-value	0.000	0.014	0.000
Test sum of lag coefficients (Z-test)	4.13	3.66	4.09
P-value	0.000	0.000	0.000
Pseudo R-squared	0.035	0.056	0.161

Credit growth variable is presented with its 5 lags to ensure that we catch the effect of a whole cycle. The coefficients are not marginal effects of the independent variables but rather describe the rate of change in the log of the odds ratio following a variation of X. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. For the tests at the end of the table, the values of the test statistics and p-values are shown instead.

[15] That is, by taking the whole sample without the inclusion of interaction terms with monetary regimes.

[16] For space reason, we present only the regression with all the controls (loans/GDP, GDP per capita growth, short-term interest rate, inflation). The results are similar if we pair loans/GDP to each of them as Schularick and Taylor (2012)'s methodology.

Table III: Credit growth effect on crisis occurrence: Differences between Classical Gold Standard/Other Pre-14 Regimes/Interwar Regimes/Bretton Woods vs Fiat Regime

VARIABLES	(1) Crisis: Logit	(2) Crisis: Logit	(3) Crisis: Logit
L.CreditGrowth	6.009	7.409*	13.97***
	(3.702)	(4.113)	(4.678)
L2.CreditGrowth	2.978	2.661	-2.744
	(4.240)	(4.635)	(5.525)
L3.CreditGrowth	6.121	7.026	4.287
	(5.159)	(5.538)	(7.202)
L4.CreditGrowth	7.589	8.551	9.554
	(5.563)	(5.990)	(8.680)
L5.CreditGrowth	-5.967	-5.278	-7.564
	(4.183)	(4.349)	(5.300)
L.CreditGrowth×ClassicalGoldStandard	-3.403	-4.400	-13.79**
	(5.338)	(6.020)	(6.872)
L5.CreditGrowth×ClassicalGoldStandard	8.786*	8.712*	11.97*
	(4.683)	(4.954)	(6.113)
L.CreditGrowth×OtherPre14Regimes	-11.80*	-15.00**	-21.49***
	(6.637)	(6.986)	(7.204)
L2.CreditGrowth×OtherPre14Regime	1.298	2.239	15.77**
	(5.638)	(6.068)	(6.851)
L. CreditGrowth×Interwar	-3.303	-4.183	-11.48**
	(4.030)	(4.398)	(5.481)
L2.CreditGrowth×Interwar	4.334	5.531	12.36*
	(4.866)	(5.364)	(7.118)
L5.CreditGrowth×Interwar	8.760*	7.779	8.041
	(4.545)	(4.793)	(6.299)
L3. CreditGrowth×BrettonWoods	10.73*	11.65*	22.98**
	(5.563)	(6.017)	(8.961)
L5.CreditGrowth×BrettonWoods[17]	-21.04*	-22.25**	-23.91**
	(10.82)	(10.24)	(10.29)
Monetary Regime binaries (except Fiat)	Yes	Yes	Yes
Controls[18]	No	No	Yes
Country fixed effects	No	Yes	Yes
Observations	1467	1467	1335
Test Country FE equal zero (χ^2)	N/A	14.48	20.83
P-value	N/A	0.563	0.142
Test all coefficients equal zero (χ^2)	91.61	135.8	146.3
P-value	0.000	0.000	0.000
Test sum of lag of interaction terms (Z-test):	-0.28	-0.45	0.06
Classical Gold Standard. P-value:	0.783	0.655	0.949
Test sum of lag of interaction terms (Z-test):	-3.41	-3.39	-0.60
Other Pre14 Regimes. P-value:	0.001	0.001	0.551
Test sum of lag of interaction terms (Z-test):	-0.47	-0.71	-0.07
Interwar Regimes. P-value:	0.638	0.478	0.945
Test sum of lag of interaction terms (Z-test):	-0.81	-0.70	0.23
Bretton Woods. P-value:	0.418	0.485	0.816
Pseudo R-squared	0.097	0.127	0.214

The credit growth variable is presented with its 5 lags to ensure that we catch the effect of a whole cycle. This variable, alone, refers to the Fiat credit growth as this is the control group. Notice that coefficients are not marginal effects of the independent variables but rather describe the rate of change in the log of the odds ratio following a variation of X. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 For the tests at the end of the table, the values of the test statistics and p-values are shown instead.

[17] For space reason, we do not show the lags that are not significant, but they are well included in the regressions.

[18] We present only the regression with all the controls (loans/GDP, GDP per capita growth, short-term interest rate, inflation). The results are similar if we pair loans/GDP to each of them as Schularick and Taylor (2012)'s methodology. Results are available upon request.

Table IV: Credit-Driven Crises Intensities: Differences between Classical Gold Standard/Other Pre-14 Regimes/Interwar Regimes/Bretton Woods vs Fiat Regime

VARIABLES	(1) Crisis Intensity OLS with zero values	(2) Crisis Intensity Tobit left-censored
L.CreditGrowth	2.674*	39.04
	(1.473)	(63.93)
L2.CreditGrowth	0.191	-63.58
	(1.480)	(78.31)
L3.CreditGrowth	3.356	216.5*
	(2.495)	(121.3)
L4.CreditGrowth	0.995	-1.724
	(1.756)	(167.2)
L5.CreditGrowth	-0.494	-51.34
	(1.552)	(103.4)
L2.CreditGrowth×OtherPre14Regimes	-0.664	180.4*
	(2.054)	(97.17)
L3.CreditGrowth×OtherPre14Regimes	-3.706	-257.7*
	(2.812)	(137.7)
L2.CreditGrowth×Interwar	17.24**	170.2*
	(8.095)	(93.37)
L3.CreditGrowth×Interwar	-8.846*	-299.3**
	(4.541)	(139.5)
L4.CreditGrowth×BrettonWoods	1.701	-2,696***
	(1.719)	(306.8)
L5.CreditGrowth×BrettonWoods[19]	0.434	-2,274***
	(1.755)	(551.8)
Monetary Regime binaries (except Fiat)	Yes	Yes
Controls[20]	Yes	Yes
Country fixed effects	Yes	Yes
Observations	1715	1715
Test country fixed effects (F-test)	1.400	3.540
P-value	0.131	0.000
Test for all coefficients equal zero (F-test)	0.670	-[21]
P-value	0.977	-
Test sum of lag of interaction terms (t-test):	-0.59	-0.34
Classical Gold Standard. P-value:	0.554	0.735
Test sum of lag of interaction terms (t-test):	-2.14	-0.80
Other Pre14 Regimes. P-value:	0.033	0.425
Test sum of lag of interaction terms (t-test):	1.41	0.26
Interwar Regimes. P-value:	0.160	0.794
Test sum of lag of interaction terms (t-test):	-0.42	-8.60
Bretton Woods. P-value:	0.674	0.000
R-squared/Pseudo R-squared	0.120	0.187

The credit growth variable is presented with its 5 lags to ensure that we catch the effect of a whole cycle. This variable, alone, refers to the Fiat credit growth as this is the reference group. Notice that the coefficients for the Tobit estimation are not marginal effects. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1. For the tests at the end of the table, the values of the test statistics and p-values are shown instead.

[19] For space reason, we do not show the lags that are not significant, but they are well included in the regressions. The significance of the interaction terms depends on the controls included in the regression. However, the sign of these coefficients is usually similar regardless of the controls applied. Results are available upon request.

[20] We present only the regression with all the controls (loans/GDP, GDP per capita growth, short-term interest rate, inflation).

[21] The F-stat is not reported when we add all controls, however, with other group of controls, the F-stat is high and significant at 1%.

Table V: Cumulative Δlog effect on a 5 years window after a crisis vs non-crisis trend

Cumulative Δlog level effect on a 5 years window after a crisis vs non-crisis trend of:	(1) Classical Gold Standard	(2) Other Pre14 Regimes	(3) Interwar regimes	(4) Bretton Woods	(5) Fiat Regime
Credit growth : Δlog(credit)	-0.200*** (0.042)	-0.732*** (0.279)	-0.429*** (0.085)	0.130* (0.070)	-0.364*** (0.035)
Real GDP per capita growth: Δlog(rgdppc)	-0.039* (0.021)	0.021 (0.042)	-0.092* (0.048)	-0.021 (0.025)	-0.113*** (0.012)
Real GDP growth: Δlog(rgdp)	-0.034 (0.021)	0.021 (0.048)	-0.120** (0.048)	0.022 (0.025)	-0.097*** (0.012)

Country fixed effect applied for each regression. Standard errors in parentheses. *** p<0.01, ** p<0.05, *p<0.1

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