Business cycles, credit cycles and bank holdings of sovereign bonds: historical evidence for Italy 1861-2013

by
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Abstract

We propose a joint dating of the Italian business and credit cycle on a historical horizon, by applying a local turning-point dating algorithm to the level of the variables. Along with short cycles, corresponding to traditional business cycle fluctuations, we also investigate medium cycles, because there is evidence that financial booms and busts are longer and persistent than the business cycle. After comparing our cycles with the prominent qualitative features of the Italian economy, we carry out some statistical tests for comovement between credit and business cycle and we propose a measure of asymmetry of this comovement, which proves to be weaker in recessions. We find evidence that credit and business cycle are poorly synchronized especially in the medium term, although, when credit and real contractions overlap, recessions are definitely more severe. We do not find evidence that credit leads the business cycle, both in the medium or in the short fluctuations. On the contrary, in the short cycle, we find some evidence that business cycle leads the credit one. Finally, credit and business cycle comovement increases when credit embodies public bonds held by banks, a bank financing to the public sector. However, in the post-WWII era, this financial backup to the public side of the economy has occurred at the expense of bank lending.

JEL classification: N13, N14
Keywords: financial cycle, bank credit, medium-term fluctuations

Contents

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1. Introduction[1]

The recession experienced in several advanced economies in 2008 and 2009 and still ongoing in Italy at the time we are writing, was the most severe for several decades. The economic downturn coincided with widespread tensions in financial markets and was linked to difficulties in the banking sector, the bursting of asset price bubbles, tensions on the sovereign debt market and a drop in credit growth. The financial crisis has prompted empirical and theoretical research aiming at capturing the interactions between the financial and the real side of the economy. The goal of our paper is to contribute to this literature, by investigating the empirical regularities of this interaction in a historical perspective in Italy. The relatively infrequent nature of major financial and credit distress events make a historical approach to these issues particularly useful.

More recently, a renewed interest has been registered in observing correlations between macro-variables across broad ranges of countries and time periods, as in Reinhart and Rogoff (2009) Claessens et al. (2011), Schularick and Taylor (2012) and for Italy De Bonis and Silvestrini (2014). Our work is close to these papers, but greater attention is given to all business cycles, not just those associated with crises, giving a broader picture of the relations between financial and real variables. Contrary to Claessens, Kose and Terrones and Reinhart and Rogoff, we look at one country only, so we are able to provide more details on the institutional and historical factors at work in the economy.

Historically, the study of the business cycle has focused on the behaviour of macroeconomic data with cycles lasting on average no more than eight years[2]. Although the idea of long swings in economic activity goes back to economic historians such as Kuznets and Abramovitz and Schumpeter and the idea of financial long swings was already discussed in a Minsky's early work in the American Economic Review (Minsky 1964), the renewed interest in the relationship between real and financial / credit cycle has brought out that real and financial variables actually interact at lower frequencies than those of the traditional business cycle (Aikman et al. 2014, Drehamnn et al. 2012). As in these latter papers, we want to focus on two types of cyclical patterns, namely those that have the same periodicity as the business cycle and those that have considerably longer periodicity (i.e. those for which turning points are less frequent). In fact, there is evidence that not only financial booms are longer than business cycle fluctuations and that busts in financial markets are rarer than business cycle downturns, but that these latter often result in major and long-lasting output losses. As a result, low-frequency analysis of financial fluctuations deserves special attention. Moreover, we mean to explore how comovements / causality among real and financial variables change with the definition of cycle.

Our study complements and extends the recent literature in several ways. We first propose a joint dating of Italian business and financial cycle during the last 150 years (1861-2013). Secondly, we use a local turning-point dating algorithm based on the level of variables (à la NBER). Thirdly, we carry out some statistical tests for comovement between cycles and we propose a measure of asymmetry of this comovement, which proves to be weaker in recessions. Finally, we explore how credit cycles changes by including the public debt held by banks, as a further channel of bank financing to the economy.

[1] This paper benefited from many comments and suggestions by colleagues and scholars: Alfredo Gigliobianco, Francesco Vercelli, Federico Barbiellini Amidei, Matteo Gomellini, Riccardo de Bonis, Solomos Solomou, Rui Pedro Esteves, Gianni Toniolo and Kilian Rieder. As usual, all remaining errors are ours. The views expressed do not necessarily reflect those of the Bank of Italy.

[2] This upper limit is generally accepted and shared by different scholars (A'Hearn and Woitek 2001, Zarnowitz 1992).

Overall, we find evidence that credit and the business cycle are weakly synchronized in the medium term, whereas they steadily comove in the short cycles and in this latter case, bank credit lags behind the business cycle. So, our findings suggest that the prior evolution of credit does not shape the business cycle. When private credit and public bonds held by banks are jointly taken into account, they are significantly correlated with economic activity fluctuations in the medium term. However, although the increase in public bonds help stabilize the total credit to the economy during downturns in loans, a strong negative correlation emerges between loans and public bonds in the post-war era starting from 1970's.

The rest of the paper is organized as follows. The next two sections describe the data, the dating methodology and provide the reader with some evidence of long-lasting fluctuations in the series under scrutiny. The fourth section presents the results of the turning-point analysis for GDP, credit aggregates and public bonds held by banks and describe the main features of the cycles in connection with major economic and financial facts. The fifth section, starting from a description of the degree of financial development during the observed time span, proposes a focus on some specific features of the Italian financial cycle, namely the evidence of crowding-out of loans with public bonds held by banks. Section 6 is devoted to the empirical results: the degree of synchronization / comovement[3] between real and credit cycles, the test for causality from credit to real cycle and vice versa, the impact of credit crunches on recessions. Section 7 presents the conclusion.

2. Data

In order to examine cycles over a very long period of time, data availability and consistency become a key issue. Focusing on one country at time, quality of data can be improved, especially if, as it is our case, a large set of historical statistics have recently built by some Italian Institutions to celebrate the 150th anniversary of its unification. We drew annual data on national accounts from Baffigi (2013) and bank credit from De Bonis et al. (2012)[4]. Loans include loans granted to households, non-financial corporations and general government; interbank loans are excluded. Loans have been reconstructed net of bad debts because of the difficulty of finding data in the past. As regards public bonds held by banks, we combine some series from Bank of Italy's Statistics Data Base. For the period 1861-1993, we use the series "General Government: securities held by other monetary financial institutions" (other than Bank of Italy) from Bank of Italy (2014a). This is the longest and updated series of government bonds in banks' balance sheets and it largely coincides with the amounts drawn from other sources (Cotula et al. 1996, part IV,Tab.32; Garofalo and Colonna 1999, Tab. 3). For the remaining years, we draw the series "Public sector securities held by banks" from Bank of Italy (2014b), after excluding the holdings of Cassa Depositi e Prestiti[5].

[3] These two terms are used interchangeably.

[4] Although in the first years after unification a significant proportion of total lending to the economy was granted by the banks of issue, we will not include their loan activity in our aggregates (see e.g. De Bonis and Silvestrini, 2014). Between 1861 and 1936 note-issuing banks operated with private actors, as well as with other banks, but only in the first years after unification, the support given by the issuing banks to the economy was important, mianly because of the backwardness of the commercial banks (Confaloneri 1976,1982). In particular, until the 1870's loans granted by issuing banks were higher than those of commercial banks (De Bonis et al., 2012). The role of issuing banks reduced starting from the Banking Act of 1874, thanks to the emergence of new investment banks such as Credito Mobiliare and Banca generale, and later, the institution of the Bank of Italy and the birth of universal banks.

[5] Cassa Depositi e Prestiti SpA (CDP), the Italian development bank, is a joint-stock company under public control, usually excluded in private credit series. See Bank of Italy's Financial Stability Report (Bank of Itay, 2013).

As consistent data are available for war years, we do not exclude these years from the analysis. On one hand, leaving out a bunch of years within a cycle would sound quite arbitrary as well as defying new turning points. On the other hand, excluding a whole cycle would not be feasible, when working with long-lasting cycles.

We are aware that annual data may conceal short-lived fluctuations and lead to spurious dating (Clark 1987), but, as stressed by Watson (1994), in other historical investigations, data availability enforces a trade-off between time period and frequency.

We analyze the behavior of GDP, as the representative variable for the business cycle. Credit aggregate, namely total bank loans is the key variable in our analysis. In addition, we consider the cyclical pattern of another aggregate, the public bonds held by banks, for its importance within bank balance sheets over the business and financial cycle and its interplay with credit aggregates. Along with this aggregate on its own, we built the aggregate sum of loans and public bonds held by banks, which for convenience of exposition, we will call "bank claims on the economy".[6]

The cycle of financial variables is a less well-defined concept than the business cycle. Ideally, other than credit, asset prices (house prices and equity prices) might/ should be included in the analysis (Drehmann et al. 2012)[7]. We look at credit series only, mainly because of lack of long time series for other assets. Nonetheless, this is not a serious limitation to our analysis for at least two reasons. First of all, Italy has traditionally been a financial system dominated by credit institutions compared to other advanced economy (Ciocca and Biscaini Cotula, 1994; Rajan and Zingales, 2003). Secondly, recent papers emphasized the role played by credit aggregates in providing information about the likelihood of future financial crises (Schularick and Taylor, 2012; Borio 2012, De Bonis and Silvestrini 2014).

In this paper, to date the credit/financial cycle we analyze the pattern of credit series as stock series, like in Claessens et al.(2011), rather than the credit-to-GDP ratio. We do not divide our series by GDP , for two main reasons. First of all, this ratio would not allow us to separate real and financial fluctuations. As a result, this would make more difficult to investigate the different timing of turning points (a drop in GDP might result in a peak in credit/GDP ratio). Secondly, the level of stocks of financial assets (bonds, stock market capitalization, loans) relative to GDP is mainly a measure of financial development or financial deepness rather than a indicator of (financial) cycle, both in cross-country comparisons (e.g. Mendoza et al. 2009) and in a historical perspective (Schularick and Taylor, 2012). All series are in real terms; we deflate them with GDP implicit deflator (Baffigi 2013) [8].

[6] This is only a convenient definition to make clear that we are including something other than loans in this credit aggregate.

[7] According to Drehmann et al. (2012), following the NBER approach, the best way to identify the financial cycle is a multivariate combination of series, such as , credit, credit-to-GDP ratio, asset prices and property prices. As said, at present, this latter series is not available, but for very recent years.

[8] Alternatively, a consumer price index may be used as deflator (e.g. Drehmann et al. 2012). We used the GDP implicit deflator, because this index comes from Baffigi's (2013) reconstruction of Italian National Accounts and as a result should make the real credit series consistent with the other real variable used in this exercise.

3. Business and credit cycle dating

3.1. Methodology

In order to identify business and financial cycles, we use the classical definition of a business cycle, used at NBER and introduced by Burns and Mitchell (1946) and a simple dating algorithm à la Bry and Boschan (1971), which provides an easy but effective procedure to identify turning points. The classical definition dates contractions and expansions using the level of the series, rather than the detrended series. Thus, contractions correspond to sequences of absolute declines in a series, and not to periods of slow growth relative to trend. In business-cycle jargon, the algorithm dates "business cycles" and not "growth cycles." We refer to a two-phases definition of cycle: upturn, the expansion phase and downturn, the contraction phase[-].

This approach to business cycle analysis is quite new in the literature on the Italian economy over a long time span. First, an official dating of Italian business cycle is not available for such a long period. The cyclical chronology according to NBER approach is maintained by ISCO (today ISTAT) only since 1945 (Isco, 1962, ISTAT 2011). Second, there is not a dating of Italian business cycle according to the classical approach based on annual data, except for the recent work by Jorda et al. (2012). Their analysis is similar to ours, but their historical sources are different and not as homogeneous as the recent reconstructions of GDP and credit series used here and described in section 2. Finally, in the Appendix A.1, we evaluate the goodness of our business cycle dating by comparing it to some other historical analysis of Italian business cycle, based on other approaches.

The advantages of using the classical methodology comes from the fact of being a “local” procedure. As a result, the turning points identified are robust to the inclusion of newly available data with respect to other filter-based procedures. More importantly, turning point identification relies on data around the date considered, not involving observations very far over time, as is the case of filter-based or detrending procedures (Canova, 1998). In fact, this can be questionable when data spam different historical periods, their quality inevitably changes over time and the evaluation of magnitudes over the distant past at constant prices gives rise to distortions (Fuà and Gallegati, 1996). Although these shortcomings are somehow unavoidable when long historical periods are involved, we still think that a classical approach to business cycle dating can mitigate them.

The specific cycle dating algorithm we use is that introduced by Harding and Pagan (2002a), who extend the so-called BB algorithm developed by Bry and Boschan (1971), to identify the turning points in the (log) level of a series. Here, we modify Harding and Pagan procedure, by adapting it to annual data and considering two different definition of cycle, the short and the medium cycle.

The algorithm involves two key steps: (1) the identification of local maxima and minima over a specific window; (2) the imposition of censoring rules to guarantee a minimum length of the cycle (i.e. the distance between two consecutive peaks or troughs) as well as a minimum length of each phase (i.e. from peak to trough or trough to peak). In addition, the algorithm requires peaks and troughs to alternate and a trough (peak) to be lower (higher) than the preceding peak (trough).

For the short cycle, we follow Watson (1994), who first adapted BB algorithm to annual data. The complications of the Bry-Boschan dating algorithm are not needed for annual data: contractions are defined as sequences of absolute declines in the series, and expansions are defined as sequences of

absolute increases. Being the year the minimum time unit, the minimum duration of a phase is one year and of a complete cycle (peak to peak) is 2 years.

To capture cycles that are longer than those typically considered in business cycle analysis, we also define a medium[9] cycle, by adjusting Harding and Pagan (2002a) to yearly data. We define peaks (troughs) at time t if they fulfill two conditions: (i) each cycle has a minimum length of 4 years; (ii) each phase (expansion or contraction) is at least two-years long.

More formally,
Short cycle (SC) implies

- SC peak in Y_t if $\Delta Y_t>0$ *and* $\Delta Y_{t+1}<0$[10]
- SC trough in Y_t if $\Delta Y_t<0$ *and* $\Delta Y_{t+1}>0$
- Minimum length of the cycle: 2 years
- Minimum length of each phase: 1 year

Medium cycle (MC) implies

- MC peak in Y_t if $\Delta Y_t>0$, $\Delta^2 Y_t>0$ *and* $\Delta Y_{t+1}<0$, $\Delta^2 Y_{t+2}<0$
- MC trough in Y_t if $\Delta Y_t<0$, $\Delta^2 Y_t<0$ *and* $\Delta Y_{t+1}>0$, $\Delta^2 Y_{t+2}>0$
- Minimum length of the cycle: 4 years
- Minimum length of each phase: 2 years

It is important to remark that these two definitions of cycle are only apparently arbitrary. Not only is the procedure consistent with practice at NBER but also, given the frequency of the data, is the short cycle the shortest that can be identified with annual data (Watson 1994). Similarly, once short cycle is defined, the medium cycle is the closest one in terms of (minimum) length of the phase (1 in the short cycle, 2 in the medium cycle). In other words, given these two cycles, it is not possible to identify a cycle in between. Finally, one or more short cycles are exactly nested in each medium cycle, as a result of the relative minimum / maximum criterion: a turning point of a medium cycle is always also the turning point of a short cycle.

The main characteristics of cyclical phases are their duration, amplitude, and slope. The duration of a downturn is the number of years between a peak and the next trough. Likewise, the duration of an upturn, is the number of years from the trough to the subsequent peak . The amplitude measures the percentage change from a peak to the next trough (downturn) or from a peak to the previous trough (upturn). Finally, the slope is the annual average (geometric) growth rate . Thus, the slope measures the intensity of the recovery or the violence of a recession.

3.2. Evidence of medium-term fluctuations

Comin and Gelter (1996) and Blanchard (1997) pointed out that over the postwar period, many industrialized countries, Italy included, have tended to oscillate between phases of robust growth and relative stagnation, featuring longer oscillations typically not considered in conventional business cycle analysis. They proved the importance of the medium-term component of fluctuations of GDP, exceeding

[9] As it is made clear in the next paragraph, we follow the literature, by using the label "medium" to point out a cycle longer than the usual business cycle.

[10] *Δ is the usual difference* operator X_t-X_{t-1}; Δ^2 *instead generates* X_t-X_{t-2}.

the short-term component[11]. Finally, they underlined that conventional business cycle de-trending methods tend to sweep these kind of oscillations into a linear trend, which instead exhibit considerable variation, reflecting the presence of significant cyclical activity at the medium frequencies[12].

Recently, Aikman et al. (2014) have presented some empirical evidence across countries (Italy among them) in the last 150 years, stressing how credit cycles (measured by variation in the ratio of bank lending to GDP) are distinct from the business cycle in their frequency and amplitude, because fluctuations in credit to output operate over the medium term, that is beyond business cycle frequency, with peak-to-trough cycles completed over the course of a decade or more. Finally, Drehmann et al. (2012) have shown that the medium-term component of fluctuations is more important in (the joint behaviour of) credit and property prices than in GDP.

With reference to our real and credit series, we provide some evidence of the role played by medium-term fluctuations in our data. Following Aikman et al. (2014), we compute the spectral density of GDP and the credit series available to us. This analysis, based on a simple tool, evaluates the weight of the fluctuations at different frequencies in accounting for variability (variance) over time of our series. However, spectral analysis requires stationary process and this raises the issue of detrending, which, as mentioned above, is not irrelevant for the cyclical properties of resulting series. As it is standard in literature, we analyze the spectrum of difference-stationary series (growth rates) in order to emphasize the differences in the cyclical properties of real and credit variables, still bearing in mind that our cyclical dating is drawn from the level of the series[13].

Figure 1 plots the estimates of the spectral density of growth rates of GDP and the credit series. On the horizontal axis we have the frequency (ϕ) ,normalized between 0 and 1, and on the vertical axis the weight of each frequency is given. The area under the spectral density in the interval $(\phi+d\phi)$ is the fraction of the variance of the process than can be attributed to the frequencies in the interval $(\phi+d\phi)$. The frequency (ϕ) indicates also the period (length) of the corresponding cycle because it is simply the reciprocal of the period (p) of a cycle according to the formula $p=2/\phi$. Hence, at the highest frequency (1) is associated a period of 2 years, the smallest cycle observable with annual data. A roughly flat spectrum means that every frequency contributes the variance of the series (absence of cycles), whereas when a specific frequency or range of frequencies account for the spectrum more than others, it features a peak at those frequencies, which define the period of the underlying cycle.

Despite of the limited sample size, the spectral density is suggestive of the empirical relevance of medium-term variations in our series. In all cases peaks lie close to 0 frequency, which implies the presence of long-lasting cyclical components, while the contribution of short cycles is generally very low. In particular, the peak in GDP spectrum is at frequency $\phi=0.17$, which entails a period of $2(\pi)/\phi=13$ years[14]. Overall, credit

[11] In a growth cycle approach, they call short-term cycles the fluctuations lasting up to 8 years, the medium cycles those between 8 and 50 years.

[12] Similarly, Harding and Pagan (2002a) measure the contribution of the ''stochastic trend'' in generating the classical cycle and conclude that it is not possible to separate the stochastic trend from the cycle.

[13] A useful reference in the case of historical time series is A'Hearn and Woitek (2001). As a robustness check, we also carried out the analysis on the transformed binary series of expansions and recessions, which are stationary, although in this case, periodicity of fluctuations is partly imposed by construction. Results confirm the main results of growth rate analysis.

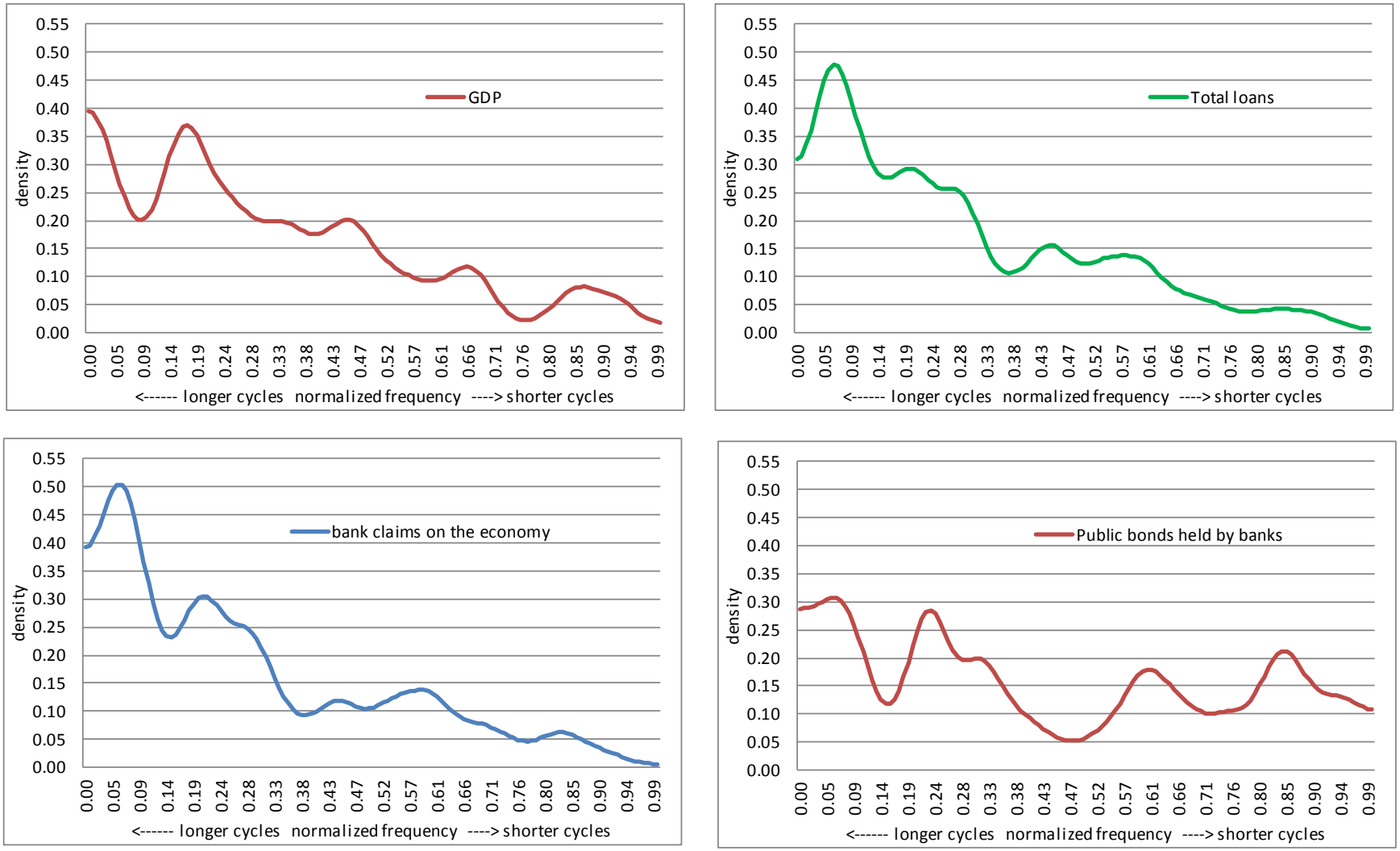
[14] We neglect the peak at the zero frequency, because it refers to the variance explained by the non-stationary component of the series (Cochrane 1988).

variables show even longer cyclical components, with peaks in the spectra at frequencies less than 0.1. In these cases, the main cyclical components are all about 30-35 years. The only exception is the series of public debt held by banks, where no clear peak emerges and the contribution of shorter fluctuations is not negligible and shorter-lasting fluctuations seem to characterize the (net) subscription of government bonds.

From this preliminary analysis of cyclical properties, three main regularities emerge. First and foremost, long-lasting fluctuations are the main cyclical component in our annual centenarian time series, both in the real and in financial series and they are much longer than those studied in standard business cycle analysis[15]. This evidence underlies our focus on medium-term cycles along with the usual business cycles. Second, business and financial cycles feature different cyclical regularities. Credit fluctuations are generally longer than business cycles and the contribution of shorter fluctuations, 4 years or less (f=0.5 or more), is modest compared to GDP ones. Third, public debt holdings by banks plausibly respond to different (shorter-term) investment needs compared to - loans, and this is reflected in a very peculiar pattern in their cyclical fluctuations.

[15] It is useful to remind that this shift towards lower frequencies of fluctuations is also due to the use fo yearly times series. Temporal aggregation by construction sweeps out higher frequencies of monthly/ quarterly series, usually underlying standard business cycle dating.

Figure 1. Standardized spectral density (growth rates)



Note: Standardized spectral density, obtained by smoothing the sample periodogram of growth rates. Smoothing with a Parzen window with lag parameter=35.

4. Business and credit cycles

4.1. The business cycle

Table 1 reports the main cyclical features (according to the method described above) of the Italian business cycle over the period 1861-2013[16]. Figure 2 shows the pattern of GDP (in logs); years denote the peaks and troughs of the medium cycles. Table and figure make clear the importance of long-lasting fluctuations of the GDP, stressing the 41 years of growth (1872-1913) for the first medium cycle, the 8-year expansion of the medium cycle 3 (1921 - 28 and 1931-39), and the 62-year "phase" of recovery in the medium cycle 5 (1945-2007). The figure shows the importance of the medium cycles which, in fact, with their features clearly include the trend of the GDP.

Medium cycles range from 4 to 68 years, while short cycles last between 3 and 35 years. Upturns are generally much longer than downturns, both in the short-term and in the medium cycle: expansions last up to 62 years as in the post-WWII cycle, while recessions do not exceed 6 years. While there is not a clear tendency in medium cycle duration, it seems that the length of the short cycles has increased, as witnessed by the fact that in the 80 years before WWII, Italian economy went through 12 different cycles, but 5 only in the next 70 years[17].

The first medium cycle runs from 1866 to year before the outbreak of the World War I, with a minimum peak in 1872, and an expansion lasting up to 1913. The beginning of the downturn was quite violent, as evidenced by the first short cycle, with a contraction of 7.8 per cent related to the war with Austria-Hungary, a negative agricultural harvest, as well as the fall in the manufacturing sector (Toniolo 1978). The following period of strong recovery, mainly in the industrial sector is linked to the “Giolittian era”, particularly driven by the global recovery (short cycle 5). In the period considered there is a huge potential for growth: during the 41 years of expansions (1872-1913), real GDP grew by 107 per cent, at an annual rate of 1.8. This growth shows a surprising stability[18] when analyzed within 5 short cycles that make up this long period. Finally, the average intensity of downturn, less than 1 per cent, is the lowest value recorded overall the medium cycles examined.

The second historical period, which includes medium cycles 2,3 and 4, is particularly complex for a number of factors such as the economic effects of the First World War, the rise of Fascism, the spread of the Great Depression and the massive intervention of government in the economy. All this factors undermined the credibility of the Gold Standard and affected trade flows. The duration of the cycles is reduced and their slope (downturns and upturns alike) becomes more violent.

[16] Although there is not an official dating to look at, since our dating procedure is new as well as the amplitude of the time period taken into account, in the Appendix A.1 we compare our turning points for GDP to some of those find out in the literature.

[17] This evidence is common across all main industrialised countries, although there is debate about the underlying reasons (see Watson 1994, Kowalski and Shachmurove 2011).

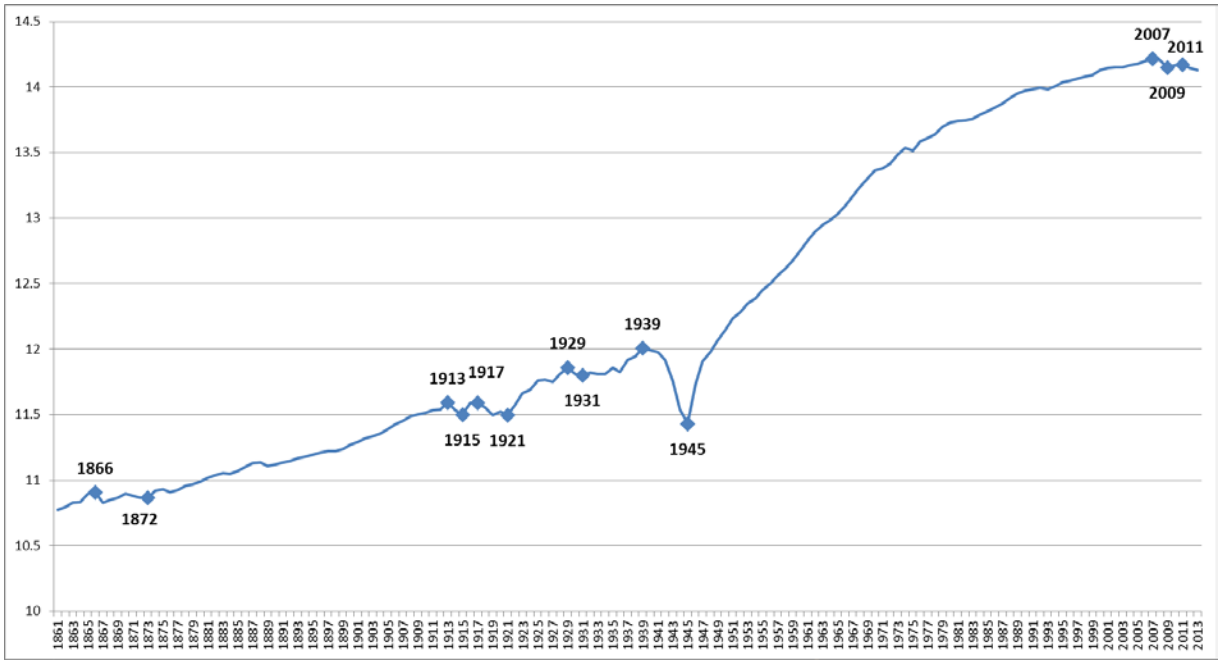
[18] As explained in Baffigi (2013), GDP pattern in this period is based on Fenoaltea's (2006) reconstruction of industrial data. Before this reconstruction, Italian industrialization was considered the result of a structural break occurring at the end of the 19th century, the effects of which spanned the Giolitti period (1898-1913). This new series instead presents a regular pattern, although an acceleration occurs during the Giolitti period.

Table 1. GDP (2005 prices), Basic features of medium and short cycles

Cycles	Turning Points			Duration (years) (1)			Amplitude (2)		Slope (3)	
	Peak 1	Peak 2	Trough	Downturns	Upturns	Cycle	Downturns	Upturns	Downturns	Upturns
Medium Cycle 1	**1866**	**1913**	**1872**	**6**	**41**	**47**	**-4.1**	**106.9**	**-0.7**	**1.8**
short 1	1866	1870	1867	1	3	4	-7.8	7.5	-7.8	2.4
short 2	1870	1875	1872	2	3	5	-3.2	6.7	-1.6	2.2
short 3	1875	1883	1876	1	7	8	-1.9	15.6	-1.9	2.1
short 4	1883	1888	1884	1	4	5	-0.8	9.1	-0.8	2.2
short 5	1888	1913	1889	1	24	25	-2.5	62.3	-2.5	2.0
Medium Cycle 2	**1913**	**1917**	**1915**	**2**	**2**	**4**	**-8.9**	**9.5**	**-4.5**	**4.6**
short 6	1913	1917	1915	2	2	4	-8.9	9.5	-4.5	4.6
Medium Cycle 3	**1917**	**1929**	**1921**	**4**	**8**	**12**	**-9.0**	**43.7**	**-2.3**	**4.6**
short 7	1917	1920	1919	2	1	3	-8.7	2.7	-4.4	2.7
short 8	1920	1926	1921	1	5	6	-2.9	31.2	-2.9	5.6
short 9	1926	1929	1927	1	2	3	-1.9	11.6	-1.9	5.7
Medium Cycle 4	**1929**	**1939**	**1931**	**2**	**8**	**10**	**-5.7**	**23.0**	**-2.9**	**2.6**
short 10	1929	1932	1931	2	1	3	-5.7	2.1	-2.9	2.1
short 11	1932	1935	1934	2	1	3	-1.4	5.4	-0.7	5.4
short 12	1935	1939	1936	1	3	4	-3.5	20.1	-3.5	6.3
Medium Cycle 5	**1939**	**2007**	**1945**	**6**	**62**	**68**	**-43.9**	**1522.3**	**-9.2**	**4.6**
short 13	1939	1974	1945	6	29	35	-43.9	721.9	-9.2	7.5
short 14	1974	1992	1975	1	17	18	-2.1	61.3	-2.1	2.9
short 15	1992	2002	1993	1	9	10	-0.9	18.2	-0.9	1.9
short 16	2002	2007	2003	1	4	5	0.0	6.7	0.0	1.6
Medium Cycle 6	**2007**	**2011**	**2009**	**2**	**2**	**4**	**-6.6**	**2.2**	**-3.3**	**1.1**
short 17	2007	2011	2009	2	2	4	-6.6	2.2	-3.3	1.1

Notes: (1) The duration of the full cycle is measured from peak to peak. (2) Percentage change from trough to peak (downturns) of peak to trough (upturns). (3) The slope is the average (geometric) growth rate in the phase.

Figure 2. The medium cycles of GDP (2005 prices, logs), 1861-2013



Note: Turning points based on the methodology described in Section 3.1.

As to the short cycles, we note that during the first phase of fascist period, economic growth is particularly strong, with the expansion years of the short cycle 8 (1921-26) that records a cumulative increase in GDP of over 31 per cent with annual rates exceeding 5.5 per cent. In the successive short cycles, the economy slows down (short cycle 9), and then suffers a sharp contraction linked to the fall in consumption, the revaluation of the lira and autarkic measures (short cycle 10).

At the eve of the Great Depression, the Italian economy already suffered a crisis in 1926-27 due to the strong revaluation of the lira (the so called "quota '90") and the consequent return to the Gold Standard, which was followed by a temporary recovery only in 1928. In 1929 the economy appeared particularly vulnerable to the new shocks from abroad. The level of the exchange rate at which the lira was stabilized (quota '90), along with a restrictive monetary policy with higher interest rates, brought to a fall of foreign trade and a loss of competitiveness of the Italian Industry. The economic policies led to a deflation (1927-1933) which worsened the financial problems of firms, whose debts increased in real terms (Cotula and Spaventa 2003). [19] It was only with the invasion of Ethiopia in 1935 that the Italian economy received the stimulus for a rapid recovery (Toniolo, 1980).

The medium cycle 5 shows an amplitude of recessions wider than the other cycles, because of the collapse of the economy due to the massive destruction of capital and labour during WWII (the GDP fell by 44 per cent in 1939-1945, short cycle 13). The subsequent short cycles instead include shorter and less intense recessions than those in the pre-war period, witnessing an increasing stability of the economy.

Figure 2 and Table 1 highlight the exceptional expansion that began at the end of World War II and continued for 62 years, during which real GDP grew by 15 times at an average rate of 4.6 per cent (medium cycle 5, 1939-2007). In this period relevant political events and real and financial aspects interact, shaping this very long cyclical phase. In this respect, the expansion started with the post-war capital reconstruction supported by substantial international aid, which led to the so-called 20-year lasting "Economic Miracle" from 1958 to 1963. Subsequently, in the decades 1970-80 the collapse of the Bretton Woods agreements and the exchange rate fluctuations, along with the oil shocks and stagflation, led to competitive devaluations. Finally, starting from the late eighties, central banks and governments played a central role in stabilizing the economy - bringing it to the EMU. This medium cycle encompasses four short cycles with a strong heterogeneity in terms of duration and amplitude of upturns and downturns: the strong recovery 1945-74, the oil recession 1974-75 and the debt-fuelled growth 1975-92 (17 years of upturn with slope of about 3 per cent, short 14); the 1992-93 financial crisis and the pre-EMU stabilization period 1993-2002 (9 years of upturn with a slope of 2 per cent) and, finally, the 2002-2003 stagnation and the 2003-2007 last period of fiscal consolidation before the burst of the financial crisis[20] (4 years of upturn with slope 1.6 per cent, short cycle 16).

The last medium cycle (2007-2011) is marked by a restrictive fiscal policy, very slow growth and increasingly severe debt stabilization policies. Compared to the previous medium cycle, the duration of expansion has

[19] For different interpretations of the role played by financial and real factors on the economy in those years, see, amongst others, Toniolo (1978; 2013); Ciocca and Toniolo (1976). For a detailed analysis of different thesis about the Great Depression in Italy see Ferri and Garofalo (1993).

[20] Contrary to the previous period of debt-fuelled growth, as fiscal consolidation had started when the debt ratio had peaked in 1994, a significant fiscal contraction was needed just to start off debt reduction. The heavy tax increases and capital spending reduction have likely hampered the growth performance of the economy in the two cycles of 1993-2007, (Balassone et al., 2013)

reduced and the amplitude of recession has increased, while Italy's competitiveness has eroded[21] and productivity growth has been sluggish.

4.2. The credit cycle

In Table 2 we summarize the cyclical properties of bank lending to the economy, while Figure 3 plots the level of the series along with turning-point years. In the figure, the shaded parts correspond to the periods of recession of the economic activity as calculated in GDP medium cycles. Credit medium cycles range from 17 to 40 years, while short cycles last between 2 and 15 years, except for the short cycle 12, which includes WWII, after which an exceptionally long credit expansion started (1945-73).

Cycle characteristics have been quite homogeneous over the examined period, although the intensity of the downturns in medium cycles, since the 1970s, seems to have declined. In medium cycles the duration of the contraction phase (downturn) is always shorter than the expansionary one and a similar evidence emerges for amplitude and slope. However, when looking at the short cycles, the are some exceptions to these regularities (namely short cycles 3 and 4 , 10 and 11 and 13-14).

The first banking lending medium cycle, 1888-1913, is quite procyclical and, therefore, consistent with the GDP medium cycle 1866-1913, with an increase of total loans by 130 per cent, and a GDP growth of about 107 per cent[22].

However, the years 1888-1892 (short cycle 3) were characterized by the largest contraction in real credit recorded before the World War I, which was subsequent to an extraordinary expansion of credit occurred during the period 1880-88 (+125%). This contraction in real credit was due to the burst of the construction bubble (James and O' Rourke, 2013).

An additional factor that in those years has had an impact on the credit contraction was the trade war with France, which played a central role in financial markets and had a negative impact on Italy's financial system, generating a crisis of confidence in the international capital markets and forcing the Italian banks to reduce their exposition to the industry, particularly to the construction sector.[23]

[21] This is particularly true when real exchange rate is built on labor costs, although a moderate gain is revealed by the indicator based on producer prices (Giordano and Zollino, 2013).

[22] To better understand the dynamics of credit cycle during this period it is important to consider the effect of the gold standard on interest rates and international investments (Fenoaltea 2006; Bloomfield 1968). In Italy, the gold standard was resumed in 1883, and together with a better organization of the financial system thanks to the new banking law of 1874, had a positive impact on the inflow of foreign capitals, which financed an important surge in economic growth, especially in the construction sector (James and O' Rourke 2013).

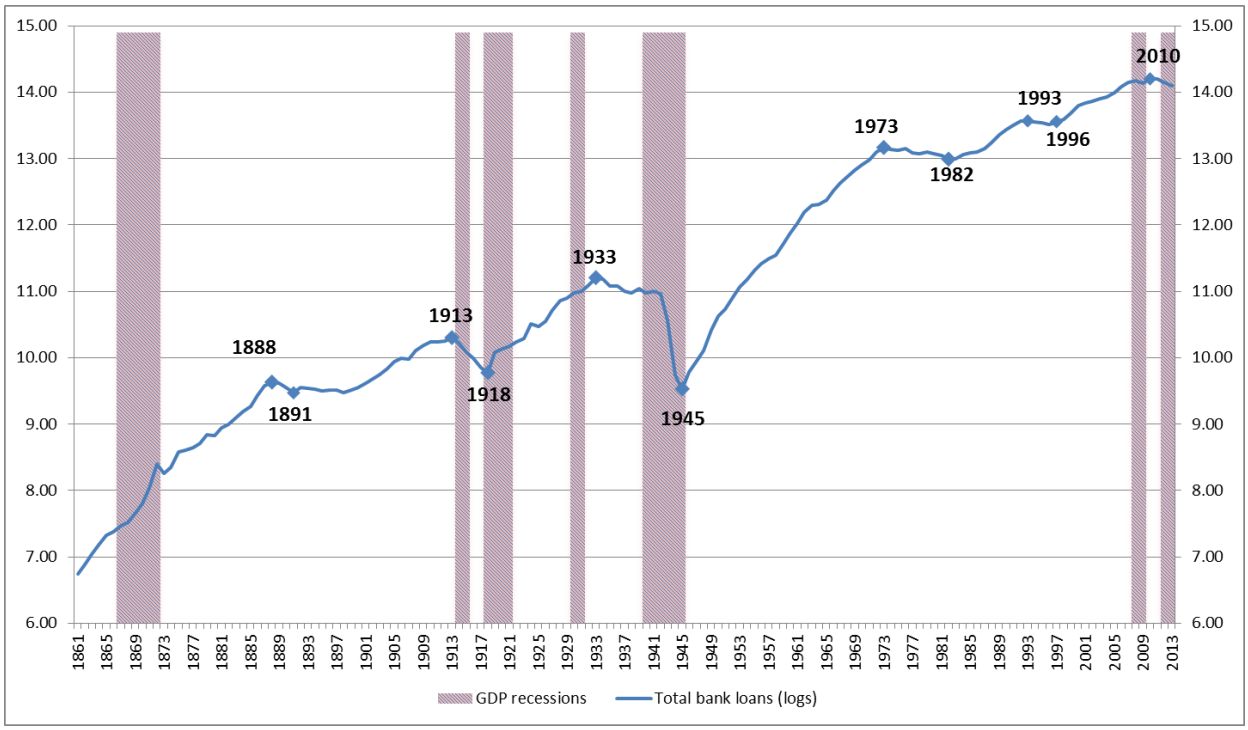
[23] The increasing gold outflow made it difficult for the six issuing banks to manage the gold parity (Toniolo, 2013). This led to a crisis of confidence in the bank system, especially after the scandal of the Banca Romana. The two largest commercial banks, the Credito Mobiliare and the Banca Generale, failed respectively in 1893 and 1894. A new organization of the banking system was required. A major reform in 1893 reduced the number of issuing banks, from six to three and led to the foundation of the Bank of Italy, which had the monopoly of note issue together with Banco di Napoli and Banco di Sicilia. See Gigliobianco et al. (2009) and Gigliobianco (2006).

Table 2. Bank loans(2005 prices). Basic features of medium and short cycles

Cycles	Turning Points			Duration (years) (1)			Amplitude (2)		Slope (3)	
	Peak 1	Peak 2	Trough	Downturns	Upturns	Cycle	Downturns	Upturns	Downturns	Upturns
short 1	1872	1879	1873	1	6	7	-13.2	79.6	-13.2	10.2
short 2	1879	1888	1880	1	8	9	-1.7	125.1	-1.7	10.7
Medium Cycle 1	**1888**	**1913**	**1891**	**3**	**22**	**25**	**-14.9**	**129.6**	**-5.2**	**3.8**
short 3	1888	1892	1891	3	1	4	-14.9	8.4	-5.2	8.4
short 4	1892	1897	1895	3	2	5	-5.0	0.8	-1.7	0.4
short 5	1897	1906	1898	1	8	9	-3.0	66.9	-3.0	6.6
short 6	1906	1910	1907	1	3	4	-1.2	30.2	-1.2	9.2
short 7	1910	1913	1911	1	2	3	-0.5	6.8	-0.5	3.3
Medium Cycle 2	**1913**	**1933**	**1918**	**5**	**15**	**20**	**-41.1**	**319.1**	**-10.0**	**10.0**
short 8	1913	1924	1918	5	6	11	-41.1	108.7	-10.0	13.0
short 9	1924	1933	1925	1	8	9	-3.3	107.8	-3.3	9.6
Medium Cycle 3	**1933**	**1973**	**1945**	**12**	**28**	**40.0**	**-81.3**	**3697.7**	**-13.0**	**13.9**
short 10	1933	1939	1938	5	1	6	-20.8	6.7	-4.6	6.7
short 11	1939	1941	1940	1	1	2	-6.5	3.0	-6.5	3.0
short 12	1941	1973	1945	4	28	32	-77.0	3697.7	-30.8	13.9
Medium Cycle 4	**1973**	**1993**	**1982**	**9**	**11**	**20.0**	**-16.0**	**77.8**	**-1.9**	**5.4**
short 13	1973	1976	1975	2	1	3	-3.9	1.6	-2.0	1.6
short 14	1976	1979	1978	2	1	3	-7.1	2.4	-3.6	2.4
short 15	1979	1993	1982	3	11	14	-9.6	77.8	-3.3	5.4
Medium Cycle 5	**1993**	**2010**	**1996**	**3**	**14**	**17.0**	**-5.5**	**99.4**	**-1.9**	**5.1**
short 16	1993	2008	1996	3	12	15	-5.5	93.3	-1.9	5.6
short 17	2008	2010	2009	1	1	2	-3.5	6.9	-3.5	6.9

Notes: (1) The duration of the full cycle is measured from peak to peak. (2) Percentage change from trough to peak (downturns) of peak to trough (upturns). (3) The slope is the average (geometric) growth rate in the phase.

Figure 3. The medium cycle of bank loans (2005 prices, logs) and GDP recessions, 1861-2013



Note: Turning points based on the methodology described in Section 3.1.

The next two medium cycles include a dramatic and difficult period, from the eve of the First World War to the end of the Second World War), followed by the reconstruction of the economy and the "economic miracle", until the fall of the Bretton Woods system. The medium cycle 2 ranges from 1913 to 1933 and includes only two short cycles. This period shows an increased amplitude both for contractions and expansions of total loans. Since the end of World War I to 1933, in the 15 years of upturns, the annual growth rate of credit to the economy has been 10 per cent on average. The economy of war and reconstruction between the two wars have prompted a substantial injection of credit to the economy and in particular to firms which, in various phases of the First World War and the fascist period, have been able to increase profit margins. Moreover, a new banking reform, in 1926, gave to the Bank of Italy the monopoly of note issue and introduced new rules such as capital requirements and capital-deposit ratio for banks.

As to the medium cycle 3, 1933-73, there are three strong credit contractions, namely 1933-38 (short cycle 10), 1939-40 (short cycle 11), and 1941-45 (short cycle 12). The first two are more intense than the corresponding expansion while the third, as it is clearly shown in Figure 3, is the most intense contraction of the last 150 years: in 4 years, the decline has averaged over 30% per year. During the short cycle 10, the credit contraction (-20,8%) is the consequence of the great depression, while the dynamic of short cycle 12 (-77%) is connected to the war economy, since it occurred during the World War II.

As a consequence of the financial and economic crisis of the early 1930s, the process of banking reform which led to the 1936 banking law, put an end to the system of universal bank (*banca mista*), establishing a separation between short-term and long-term credit institutions, according to the maturity of their liabilities (Barbiellini Amidei and Giordano, 2014).[24] In 1931 the Istituto Mobiliare Italiano (IMI) was created, a state-owned credit institution, specialized in long-term credit to industry. After the establishment of the Institute for Industrial Reconstruction (IRI) in 1933, the state took over control of the major banks and a good chunk of the industrial system[25].

As show by Figure 3, this credit medium cycle is rather procyclical, in line with the cyclical phase of the reconstruction and the subsequent economic boom: a long phase of 25 years of upturn (short cycle 12) with a strong expansion of total loans to the economy to sustain the remarkable growth in production and consumption. Battilossi et al. (2013), amongst others, argue that Italian banks supported the real economy effectively in the 1948-1970 period, when the industrial production increased annually by about 8 percent and Italy could converge toward more advanced economies, recording the highest growth rates of loans to GDP (on average 6,9% per year).[26]

The medium cycle 1973-93 is characterized by rather divergent fiscal and monetary policies. On one hand, the nominal income grows, pulled by public spending, consumption and inflation; on the other hand, monetary policy, using the intermediate target of the total domestic credit, becomes restrictive. In a context of wage indexation to prices and a strong depreciation of the lira, governments have continued to create budget deficits pushing consumption and inflation. Comparing Tables 1 and 2, appears that during

[24] The Banking law was also accompanied by a massive secondary legislation, mainly instruments at the Bank of Italy's disposal included: authorization of loans; authorization to issue bonds; caps on interest rates; reserve requirements; rules on the composition of the banks' bond portfolios (Barbiellini et al. 2012)

[25] On the structure and finance of the state-owned banks and industries , see also Piluso (1999); Conte and Piluso (2011); Conti (1999).

[26] For a deeper analysis of short term and long term credit growth in Italy's economic sectors, see Barbiellini Amidei et al (2014).

this medium cycle, a negative comovement between credit and economic activity prevails. As already commented in section 4.1, apart from the 1975 recession, GDP had been growing steadily since 1945. Conversely, short credit cycles 13-14 show sharp loan contractions during the period 1973-78 (with the exception of 1976).

In this period, monetary policy was not independent from the fiscal one: the creation of monetary base through the Treasury generated high inflationary pressures and a further weakening of the currency. To cope with the external balance equilibrium, monetary authorities had to resort to administrative controls to limit credit expansion (credit ceilings),in order to control inflation and stabilize the exchange rate. These administrative measures had the direct consequence of reducing loans to the private sector, but also the additional effect to ease the placement of government bonds, keeping the burden of debt low. While real interest rates were negative for most of the 70s (see Cotula, 1989), the subscription of government bonds was guaranteed only through administrative measures, by compelling banks to hold them in their portfolios.

Hence, the contraction in the stock of real credit experienced during the period 1973-1982 is due to two order of reasons: first, the administrative controls on credit expansion; second, the very strong rise in prices.[27] The credit ceiling was in place from 1973 to 1975, then, after a suspension during the period 1975(march)-76 (October), a new ceiling to private sector loans was effective until 1983.

The last medium cycle (1993-2010) is characterized by an initial sharp contraction of credit (1993-96), a particularly fragile period for the Italian economy, which started to face the imminent arrangement of the euro-zone along with a crisis linked to the fiscal imbalance and exchange-inflation relationship. Moreover, in these years Italian banking system was affected by massive loan losses stemming from the deterioration of corporate finances in 1992 and 1993 and the long stagnation of the southern economy, after the termination of the programme of extraordinary measures for this area.

Later, also thanks to the large reforms introduced in the Italian banking system during the 1990s, the banking system succeeded in overcoming these difficulties and in the following years of upturn credit growth was brilliant, with an average of 5 %[28].

[27] The dynamic of prices, at the beginning of the decade, showed changes of about 7% and rose to 17%-19% in 1974-77. The explosion of the inflationary process may well have destroyed the confidence in the experience acquired in the 1950s and '60s. Along with the instability in financial markets and the increased cost of labour per unit of product, the inflationary process has certainly affected the rate of investment, that during the examined period (1973-8) was modest and recorded a negative peak of -5% in 1975. See Nardozzi (1980) and Valli (1979) amongst others.

[28]During the 1990s the banking system experienced a large reform, spurred by European directives. With Law 218/1990 on the reform of public sector banks, a process of consolidation and reallocation of ownership of banks begun, which was accompanied by increases in efficiency and competitiveness; a new comprehensive banking law in 1993 (*Testo Unico Bancario)* introduced the principle of competitive equality among all banks, by eliminating operational specialization; the Consolidated Law on Financial Intermediation permitted a high degree of diversification among asset management products and made individual and collective portfolio management more flexible (Ciocca 2000; Messori 2002).

4.3. The public debt held by banks and the bank claims on the economy

The credit cycle commented in previous section may overlook an important channel through which banks provide credit to the economy, namely the subscription of government bonds[29]. In advanced economies, banks often have sizeable exposures to the home sovereign, and generally have a strong home bias in their sovereign portfolios. Moreover, holdings of domestic government bonds as a percentage of bank capital tend to be larger in countries with high public debt (CGFS 2011).[30]

There are a number of incentives for banks to operate with massive investments in government bonds, mainly because, given the official nature of the issuer, sovereign obligations were often considered as risk-free assets (Eaton and Fernandez, 1995; Shleifer, 2003), at least until recently[31]. The subscription of government bonds were one of the main areas of investment banking, during the first half of nineteenth century along with the financing of railway construction and industrial activities (Cameron 1972).

Banks also hold large amounts of government debt on their balance sheets as liquid assets and collateral. In Italy domestic banks have always held a considerable fraction of total public debt[32], although for most of the time interest rates on government assets has been lower than that on other assets.

In Table 3 we report the cyclical features of the time series of the banks' public debt holdings. First, as stressed by the spectral density analysis in section 3.2, we observe that the number of cycles, either medium and short, increases compared to that of bank loans. Precisely, we identify 23 short cycles and 10 medium cycles. Second, before WWII, increases in the bank loan to the State are hardly related to periods of growth of public debt. In Figure 4 the medium cycles of bank holdings of public bonds and debt/GDP ratio are compared[33]. Before WWII (peak at 1942), they are almost uncorrelated (0.079), while in the most recent years, their cycles tend to be more alike (correlation grows to 0.28)[34]. For instance, the strong increases in banks' investment in government bonds in the first two short cycles (1870-1873 and 1874-

[29] As we are talking about the behavior of private banks, we do not refer to the subscription of government bonds by monetary authorities, which brings about a creation of money (monetary base). This distinction quite obvious nowadays, is to be made with reference to the first decades from unification, when a relevant share of credit to the economy and the State came from banks of issue, which operated also as a private banks, although they were the only entitled to issue money. See also footnote 3.

[30] Although the rapid growth of debt was a relatively recent phenomenon, one century ago Italy already had one of the highest debt/GDP ratio. According to Flandreau and Zumer (2004), in 1913 debt/GDP was 78 per cent, the highest among the main advanced economies (45 per cent on average).

[31] The situation has dramatically changed with the recent financial crisis. As CGFS (2011) points out "On the asset side, until recently, investors have paid little attention to diversifying their portfolios of government bonds of advanced countries, as these bonds were considered virtually riskless. This situation has changed: some sovereign securities have already lost their risk-free status, while others may do so in the future. Looking forward, banks' risk management systems will likely take fully into account sovereign risk and its correlation with the risk on private sector claims. This may result in banks further diversifying the country composition of their sovereign portfolio to contain their overexposure to the home sovereign".

[32] International comparisons are available only for recent times. According to ECB data, in 1999, 10.5 per cent of Italian banks' assets were Italian Government bonds, a share much higher than the average of euro area banks (5.2 per cent). After some years of decline, this share rose again during the financial crisis: in 2013, these share were 10.0 and 4.3 per cent respectively (Affinito et al. 2014).

[33] For the dynamics of public debt in Italy, see amongst others, the recent Bartoletto et al. (2014) and the references therein. Medium cycles of Debt/GDP ratio are worked out as described in section 3.2.

[34] This is a relatively high degree of correlation, when compared to those of other binary cyclical variables (see Section 6.2).

1884) occur once when debt to GDP is decreasing from 90 to 80 per cent of GDP in just three years[35], and subsequently during a recovery phase of debt that grows to get closer to 110 per cent.

However, it is worth reminding that, in both cases, the spread between the average yield on government bonds and the average yield resulting from lending to the economy is positive (Figure 5). In the first period, 1870-1873, the difference in yield is on average 200 basis points, while in the second cycle considered, though positive in the first years, the spread is reduced gradually and turns negative in the first '80s of XIX century. This a peculiarity of these periods at the end of the nineteenth century, when rates of return on government bonds are higher than those of other assets. In fact, in the early years of unification, the funding needs to complete and consolidate national unity and for high military spending, led Italian governments to a series of issues of government securities at particularly high yields (higher than the rates prevailing in the private credit market), mainly to attract capital from abroad, especially from France, where interest rates were much lower (Fratianni and Spinelli 2001; Homer and Sylla, 1991). All of this created an incentive for banks to hold a considerable share of government securities in their portfolios.

In the period 1920-1934, the stock of debt decreased from about 160 to 90 per cent of GDP, while banks were increasing their portfolio of bonds to a growth rate of 11 per cent per annum (more than 16 per cent from 1925 to 1934, short cycle 10). In this period the yield spread turned negative, as it should be with a riskless asset, with loans interest rates increasing steadily more than bonds, up to a lead of 2.5-2.7 percentage points. From the post-war period until the economic miracle (medium cycle 4), the banks continued to invest in government bonds at annual rates of 14 per cent (upturn slope in Table 3) in the presence of a substantial stability of the debt that ranges from 25 to 31% of GDP with a negative yields spread. A significant impact on the share of public debt held by banks, had the introduction of reserve requirement ("riserva obbligatoria") in 1926, which imposed to invest a share of deposits in cash or government bonds[36] . With the Einaudi's credit crunch ("stretta creditizia") in 1947 the minimum share of government bonds was increased (Bianchi, 2013). Subsequently, other reforms (1962, 1965, 1975, 1982) have modified the mechanism of reserve (Zautzik, 1989)[37].

A remarkable expansion of bonds in banks' balance sheets is observed during the 1970s, when the average growth rate reached 19 per cent per year (medium cycle 6). That was the result of administrative controls on credit, which compel banks to limit credit to the private sector as well as to subscribe (buy) a share of issued government bonds. Banks' contribution to public spending financing was necessary to curb inflation in a period of growing public spending not offset by tax collection.

In these years public debt growth reflects the structural growth in public spending (health care and retirement systems, the institution of the Regions as local administrations in 1972) and large transfers to households and firms. During the period considered, the stock of debt begins its run to exceed 50% of GDP

[35] The fall in the debt/to GDP ratio between 1870 and 1873 is not due to a reduction of debt, but to an increase in GDP at current prices. The declaration of *corso forzoso* in 1866 and consequently the increase of paper money in circulation during the years 1870-1873 resulted in a substantial increase in GDP at current prices at a higher rate than the real and nominal interest rates (Zamagni, 1992).

[36] According to the 1926 Banking Law Banks had to invest the excess deposits over twenty times the sum of capital plus reserves in government bonds or government guaranteed by the State or deposit them into an account at the Bank of Italy (Galanti et al., 2012, p.69).

[37] In 1947 15 per cent of reserve requirement was hold in government bonds; in 1965 this ratio had grew to 86 per cent (Garofalo and Colonna, 1999, Tav. 3).

whereas the yield spread continues to be negative and unfavorable to government bonds, which fall as much as 5 percentage points with respect to the yield on loans.

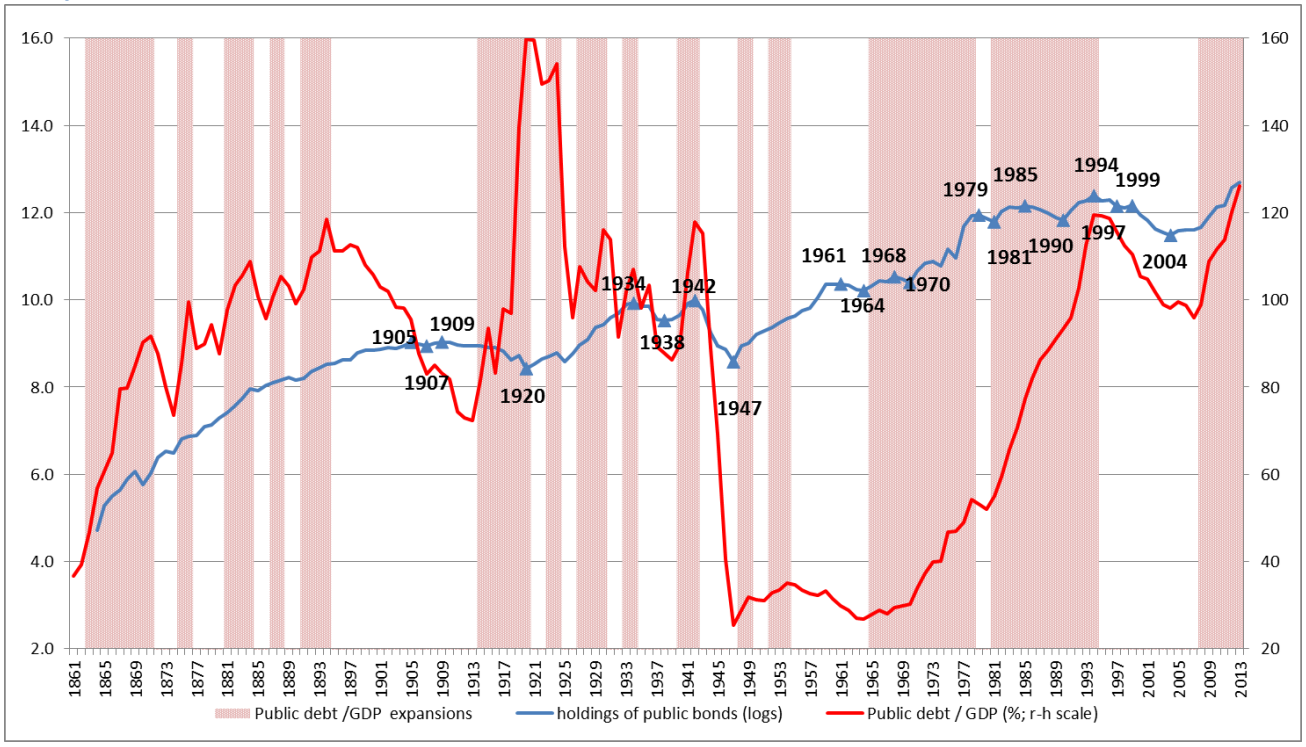
Finally, a further strong increase in public securities “absorbed” by the banks takes place in the early '90s (Medium Cycle 8) with a growth of 15% per year in the period 1990-1994. In this period, the public debt / GDP ratio continues to grow in a sustained manner (even though, at the end of 1991, the Maastricht treaty was signed for the adoption of the single currency by the end of the decade), from just under 100 percent of GDP at the end of 1991 to 105 a year later, still at 116 a year later, to more than 120 percent at the end of 1994. The prevailing reason is that interest payments are now very heavy, (more than 12 per cent of GDP in 1993), also because of the rise in interest rates associated with the travails of the lira in the foreign exchange market, which ended up with September 1992 currency crisis and Italian lira and pound pushed out of the European Monetary System.

The last Medium Cycle reported in the Table, starting in 1999 and involving the ongoing economic and financial crisis is not complete (growth in public bonds has not picked up yet), but clearly it witnesses another tremendous expansion of government bonds held by the banking system since 2004[38].

In Table 4 and Figure 6 we show the cyclical properties of the bank claims on the economy. The series differs from that commented upon in Table 2 because now credit includes also government bonds held by the banking system. The two series are almost perfectly synchronized, especially as regards the medium cycles, but with some major differences. First, credit downturn in the 1970s is much shorter, since the crunch starts only in 1980 (bank loans to private sector drop in 1974) during the second oil shock. Moreover, differently from Table 2, here upturn phases are always longer than contractions, with the only exception of the short-term contraction during the WWI (short cycle 6) and during the great depression (short cycle 9).

[38] In Section 5.2, we are going to study the relationship between bank loans government bonds held by banks.

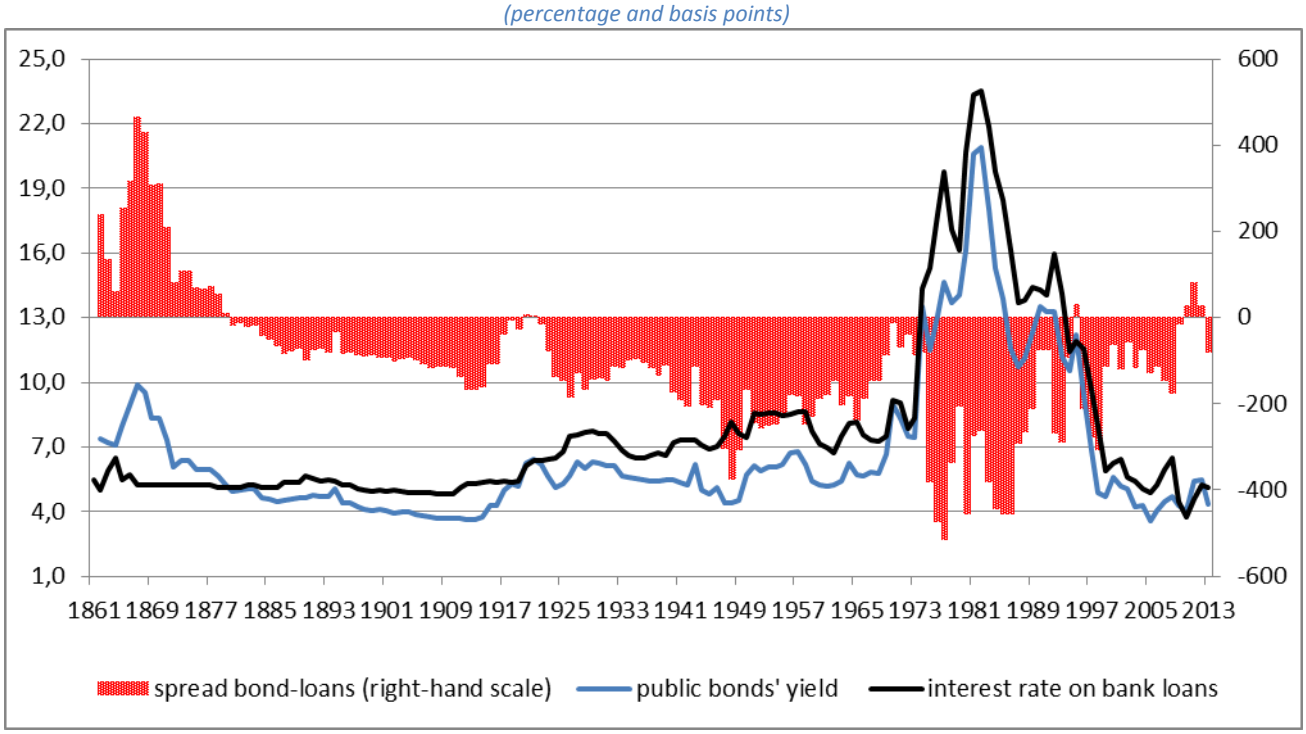
Figure 4. The medium cycle of holdings of government bonds by banks (2005 prices, logs) and public debt over GDP.



Source: see Section 2 and Bartoletto et al (2014, updated) Turning points based on section 3.1. Shaded areas represent Debt/GDP growth phases.

Figure 5. Interest rates on bank loans and public bonds' yield and their spread, 1861-2013

(percentage and basis points)



Source: Bianchi (1979); Homer and Sylla (1991); De Bonis et al. 2012; IFS (International Monetary Fund).

Table 3. Public bonds held by banks (2005 prices). Basic features of medium and short cycles

Cycles	Turning Points			Duration (years) (1)			Amplitude (2)		Slope (3)	
	Peak 1	Peak 2	Trough	Downturns	Upturns	Cycle	Downturns	Upturns	Downturns	Upturns
short 1	1869	1873	1870	1	3	4	-25.7	114.6	-25.7	29.0
short 2	1873	1884	1874	1	10	11	-3.5	334.2	-3.5	15.8
short 3	1884	1889	1885	1	4	5	-3.4	34.2	-3.4	7.6
short 4	1889	1902	1890	1	12	13	-5.3	110.4	-5.3	6.4
short 5	1902	1905	1903	1	2	3	-1.0	14.6	-1.0	7.1
Medium Cycle 1	**1905**	**1909**	**1907**	**2**	**2**	**4**	**-8.5**	**9.7**	**-4.3**	**4.7**
short 6	1905	1909	1907	2	2	4	-8.5	9.7	-4.3	4.7
Medium Cycle 2	**1909**	**1934**	**1920**	**11**	**14**	**25**	**-45.5**	**348.5**	**-5.4**	**11.3**
short 7	1909	1914	1913	4	1	5	-9.1	0.7	-2.4	0.7
short 8	1914	1919	1918	4	1	5	-27.8	11.6	-7.8	11.6
short 9	1919	1924	1920	1	4	5	-26.2	43.7	-26.2	9.5
short 10	1924	1934	1925	1	9	10	-18.3	282.1	-18.3	16.1
Medium Cycle 3	**1934**	**1942**	**1938**	**4**	**4**	**8**	**-32.8**	**57.7**	**-9.5**	**12.1**
short 11	1934	1942	1938	4	4	8	-32.8	57.7	-9.5	12.1
Medium Cycle 4	**1942**	**1961**	**1947**	**5**	**14**	**19**	**-75.5**	**496.1**	**-24.5**	**13.6**
short 12	1942	1961	1947	5	14	19	-75.5	496.1	-24.5	13.6
Medium Cycle 5	**1961**	**1968**	**1964**	**3**	**4**	**7**	**-14.2**	**37.2**	**-5.0**	**8.2**
short 13	1961	1966	1964	3	2	5	-14.2	25.8	-5.0	12.2
short 14	1966	1968	1967	1	1	2	-2.2	11.5	-2.2	11.5
Medium Cycle 6	**1968**	**1979**	**1970**	**2**	**9**	**11**	**-11.8**	**367.9**	**-6.1**	**18.7**
short 15	1968	1973	1970	2	3	5	-11.8	60.0	-6.1	17.0
short 16	1973	1975	1974	1	1	2	-9.6	47.0	-9.6	47.0
short 17	1975	1979	1976	1	3	4	-18.1	168.5	-18.1	39.0
Medium Cycle 7	**1979**	**1985**	**1981**	**2**	**4**	**6**	**-14.3**	**43.9**	**-7.4**	**9.5**
short 18	1979	1983	1981	2	2	4	-14.3	39.1	-7.4	17.9
short 19	1983	1985	1984	1	1	2	-1.2	4.7	-1.2	4.7
Medium Cycle 8	**1985**	**1994**	**1990**	**5**	**4**	**9**	**-27.9**	**74.8**	**-6.3**	**15.0**
short 20	1985	1994	1990	5	4	9	-27.9	74.8	-6.3	15.0
Medium Cycle 9	**1994**	**1999**	**1997**	**3**	**2**	**5**	**-21.7**	**-0.9**	**-7.8**	**-0.5**
short 21	1994	1996	1995	1	1	2	-11.8	3.3	-11.8	3.3
short 22	1996	1999	1998	2	1	3	-18.6	4.6	-9.8	4.6
Medium Cycle 10	**1999**		**2004**	**5**			**-52.0**		**-13.7**	
short 23	1999	2006	2004	5	2	7	-52.0	23.5	-13.7	11.1

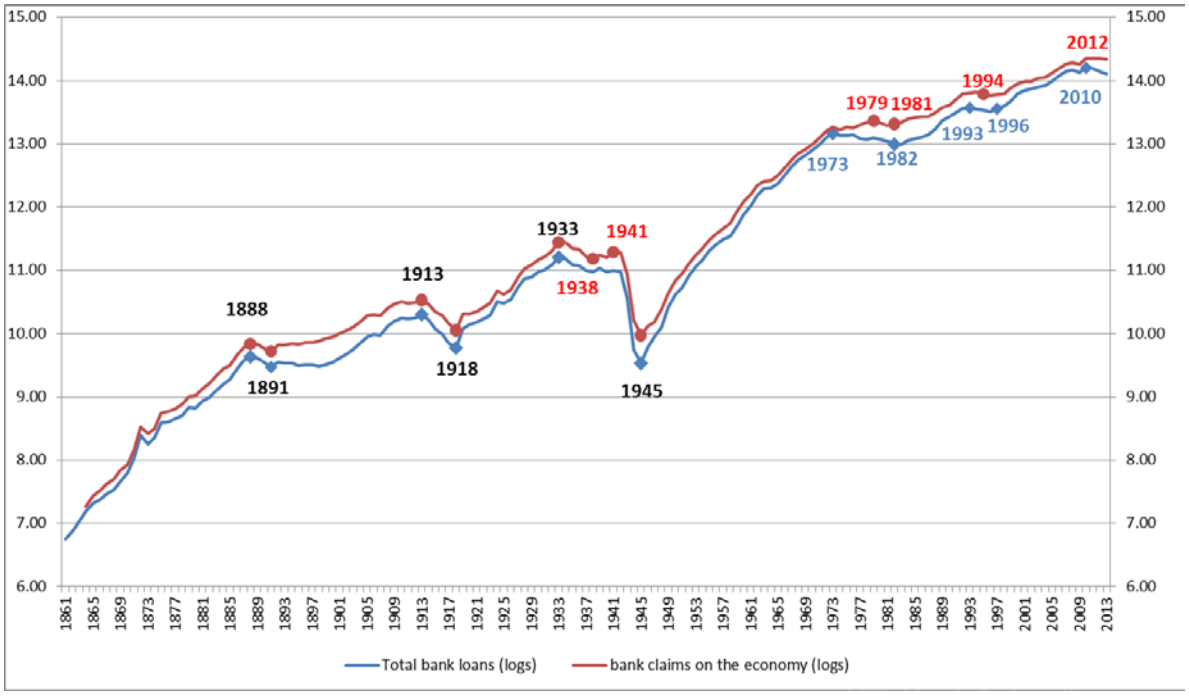
Notes: (1) The duration of the full cycle is measured from peak to peak. (2) Percentage change from trough to peak (downturns) of peak to trough (upturns). (3) The slope is the average (geometric) growth rate in the phase.

Table 4. Bank claims on the economy (2005 prices). Basic features of medium and short cycles

Cycles	Turning Points			Duration (years) (1)			Amplitude (2)		Slope (3)	
	Peak 1	Peak 2	Trough	Downturns	Upturns	Cycle	Downturns	Upturns	Downturns	Upturns
Medium Cycle 1	**1888**	**1913**	**1891**	**3**	**22**	**25**	**-11.1**	**124.8**	**-3.8**	**3.8**
short 1	1872	1888	1873	1	15	16	-9.9	314.4	-9.9	9.9
short 2	1888	1894	1891	3	3	6	-11.1	13.0	-3.8	4.2
short 3	1894	1906	1895	1	11	12	-1.6	60.8	-1.6	4.4
short 4	1906	1910	1907	1	3	4	-1.9	24.5	-1.9	7.6
short 5	1910	1913	1911	1	2	3	-1.9	4.9	-1.9	2.4
Medium Cycle 2	**1913**	**1933**	**1918**	**5**	**15**	**20**	**-38.3**	**304.4**	**-9.2**	**9.8**
short 6	1913	1919	1918	5	1	6	-38.3	30.1	-9.2	30.1
short 7	1919	1924	1920	1	4	5	-0.6	44.7	-0.6	9.7
short 8	1924	1933	1925	1	8	9	-5.6	129.1	-5.6	10.9
Medium Cycle 3	**1933**	**1941**	**1938**	**5**	**3**	**8**	**-22.9**	**10.9**	**-5.1**	**3.5**
short 9	1933	1939	1938	5	1	6	-22.9	6.0	-5.1	6.0
short 10	1939	1941	1940	1	1	2	-3.6	8.6	-3.6	8.6
Medium Cycle 4	**1941**	**1979**	**1945**	**4**	**34**	**38**	**-73.2**	**2887.3**	**-28.0**	**10.5**
short 11	1941	1973	1945	4	28	32	-73.2	2587.4	-28.0	12.5
short 12	1973	1975	1974	1	1	2	-3.6	3.2	-3.6	3.2
short 13	1975	1979	1976	1	3	4	-0.8	12.7	-0.8	4.1
Medium Cycle 6	**1979**	**1994**	**1981**	**2**	**13**	**15**	**-7.3**	**69.7**	**-3.7**	**4.2**
short 14	1979	1994	1981	2	13	15	-7.3	69.7	-3.7	4.2
Medium Cycle 7	**1994**	**2012**	**1996**	**2**	**16**	**18**	**-4.9**	**75.1**	**-2.5**	**3.6**
short 15	1994	2008	1996	2	12	14	-4.9	61.3	-2.5	4.1
short 16	2008	2010	2009	1	1	2	-1.2	8.6	-1.2	8.6
short 17	2010	2012	2011	1	1	2	-0.2	1.4	-0.2	1.4

Notes: (1) The duration of the full cycle is measured from peak to peak. (2) Percentage change from trough to peak (downturns) of peak to trough (upturns). (3) The slope is the average (geometric) growth rate in the phase.

Figure 6. Bank claims on the economy and bank loans, (stock , 2005 prices, logs), 1861-2013



Notes: Turning points based on the methodology described in Section 3.1. Common turning points in black; in blue turning points in bank loans only; in red turning points in the bank claims on the economy only.

5. Some peculiar features of credit dynamics in Italy

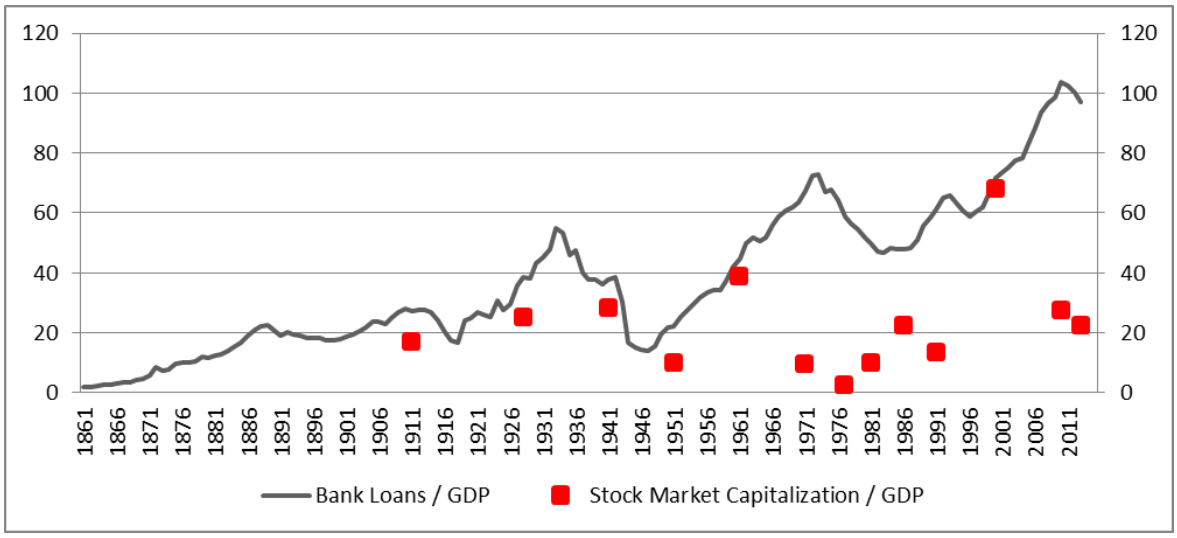
In order to study the relationship between credit and economic activity in the different phases of the cycle and with different types of cycle, it is important to remember a few characteristics of the Italian banking system, the centrality of the banking system in the Italian financial system (5.1) and the evolution of the relationship between public bonds in banks' balance sheet and private credit (5.2).

5.1. Financial development

When it comes to measuring financial development (financial deepness), researchers often have focused on the ratio of private credit to GDP. Much of the empirical evidence on financial system's role in economic development uses variations of this measure. Although looking only at private credit does not provide a sufficient basis for assessing financial development, this measure is particularly appropriate in Italy, where the financial system has always been a bank oriented one, with capital markets playing a limited role even in times of greatest expansion (Ciocca and Biscaini Cotula, 1994; Rajan and Zingales 2003).

Like in other advanced economies, the weight of credit market has shown a growing trend, while that of stock market has remained quite modest (Figure 7). However, before WWII, credit to GDPs ratio trend slope was modest, with the exception of intra-war period, when the momentum was yet interrupted by the 1930s global credit crunch. In that epoch, (broad) money growth and credit growth were essentially two sides of the same coin. The same was not true in the era after WW2, "the second era of finance capitalism" in Schularick and Taylor's (2012) words, when loans and assets both started growing on a long uptrend. Especially in the aftermath of the end of Bretton Woods system, credit in all the Western economies (Italy included) began to decouple from broad money and grew rapidly in a combination of increased leverage and augmented funding via non-monetary liabilities.

Figure 7. Bank loans and stock market capitalization (% of GDP)



Source: De Bonis and Silvestrini (2014); Consob (2011), Italian Stock Exchange, (http://www.borsaitaliana.it).

As shown in Table 5, the ratio of loans to GDP was about 21 per cent on average in the pre-WWII period 1861-1939: 15% during the pre-war I period; more than doubled during the Inter-war period (33%). Finally, it reached its highest levels (55%) during the post-war II period. The predominance of the agricultural sector and the slow industrialization process during the Pre-WW2 period were the main causes of low levels of credit to GDP ratio.

However, as underlined by Rajan and Zingales (2003), although demand for financial instrument (measured as level of industrialization or economic development) is a prime driver of financial development, it cannot be the only explanation. Otherwise, we couldn't explain why countries at similar level of economic development, differ so much in the level of their financial development. An important role is also played by the institutional and regulatory set-up[39].

Table 5. Share of value added by sectors and Loans to GDP

Period	Agriculture	Industry	Services	Loans/GDP
Pre-war I (1861-1913)	43.8	22.3	33.9	15.1
Pre-WW2 (1861-1939)	40.5	23.6	35.9	21.4
Post-war II (1945-2011)	11.0	32.9	56.1	55.4

Source: Our Calculations based on Baffigi (2013) and De Bonis and Silvestrini (2014).

5.2.Evidence of crowding out of loans

Following the start of the global financial crisis in 2008, Eurozone countries experienced a run-up in public debt issuance. This expanding sovereign debt was increasingly absorbed by the banking sector. According to Eurostat, between 2007 and 2012, government debt held by the domestic financial sector increased from 26% to 39% of GDP (Becker and Ivashima, 2014). The shift toward reliance on the domestic banking sector was largest for countries with the highest sovereign risk (Greece, Ireland, Italy, Portugal, and Spain). When government through banks absorb a lot of saving, credit to the private sector may be negatively affected and a classical crowding out effect arise. In some periods, as during the 70s of XX century in Italy (section 4.2 and 4.3), banks are even forced to invest in public debt securities, under some limit (ceiling) to credit expansion or portfolio constraint. In this case the crowding out is the result of "financial repression", term originally coined by Shaw(1973) and McKinnon (1973) to refer to measures by governments that distort domestic financial markets, by channeling funds to their own debt – and recalled by Reinhart (2012) and Reinhart and Sbrancia (2011) with reference to the recent sovereign debt crisis. Finally, as in the recent crisis, the higher is the share of public bonds in banks' balance sheets, the more rises sovereign risk adversely affect banks' funding costs and lending activity (CGFS 2011; Albertazzi et al. 2012). In all these cases one observes a negative relationship between the holdings of public bonds and bank loans in banks' balance sheets[40].

In this section, we explore this relationship over different credit cycles. We know what happened during the 1970s, but what was the relationship at the earlier stages of Italian financial development?.

We are aware that with few time series it is practically impossible to disentangle the different mechanisms underlying the demand for public bonds and the credit supply by banks. For instance, during periods of crisis, investment opportunities—the demand for corporate loans—might contract and so lead banks to

[39] As regards Italy, see, among others, Gigliobianco et al. (2009); Barbiellini Amidei et al. (2012); Battilossi et al. (2013).

[40] See also Popov and Van Horen (2013), De Bonis and Stacchini (2013), Affinito et al. (2014) and Bank of Italy (2013).

increase their holdings of sovereign debt. To demonstrate that sovereign debt on bank balance sheets crowds out corporate credit, we should show a contraction in the bank credit supply to corporate borrowers (Becker and Ivashima, 2014), not simply a drop in credit stock. Here, we can only investigate the relationship between bank credit and public bonds in banks' balance sheets over the credit cycles.

Although there is a weak positive correlation between the cycles of bank loans and public bonds (about 0.15) both in medium and in short cycles, comparing annual growth rates of holdings of public bonds during credit recessions over medium cycles (Table 6), a quite clear pattern can be picked up: holdings of public bonds increase during credit recessions, especially in the post WWII era, starting from 1970s, when the increase of public bonds almost offsets the drop in loans (although the share of public bonds is much smaller than that of loans in banks' balance sheets). This phenomenon is remarkable in the recent crisis (2010-2013), with the largest decline in total loans since the end of World War II (-3.4% per year[41]) and a striking annual growth rate of the public bonds (21%). Thus, the recent financial crisis has been accompanied by a strong increase in the weight of the public securities in the portfolio of banks, bringing the share of Italian government bonds on the total assets in the banking system to over 10 percent in 2014 (see Affinito et al. 2014 and footnote 26).

This effect is less evident before 1945, mainly because two of the three credit recessions coincide with war periods and in these extreme circumstances credit drops and Governments mainly resort to seignorage to finance debt. On the contrary, in normal times (1888-1891), bond holdings by banks actually increased.

In order to overcome the confounding influences at war times, we measure correlations in annual growth rates of credit and public bonds, during the same credit recessions (Table 7). By so doing, we are measuring the year-by-year correlation, rather than comparing the overall change over a medium cycle and the war years carry lower weight. Although the correlation over the whole period 1861-2013 is positive (0.28), correlation becomes strongly negative in the post-war era with an increasing trend. Correlation is instead positive in the pre-WWII period and in this case it is also during 1888-1891 recession. This result seems to suggest that crowding out is mainly a recent phenomenon.

This result is in line with the evidence of Section 4.3 about the increased (positive) correlation between public debt growth and holdings of public bonds by banks after WWII: since then government debt has increased and hence its impact on banks' balance sheets and credit.

During a recession, crowding out could be the result of a "flight to quality" by banks, which substitute more and more risky credit with safer government bonds. To give a try to isolate this effect, we compare credit and public bonds dynamics, during expansions in medium cycles of public bonds, which are not necessarily periods of credit downturns. Growth rates (peak to trough) are compared with growth rates in bank loans in the same years. Figure 8 features some negative correlation (-0.31): when holdings of public bonds increases, credit sector slows down.

[41] It is not pointless to remind that we are talking about a drop in real terms.

Table 6. Public bonds held by banks in credit recessions

(average annual growth rates,%; from peak from trough)

credit (loans) recessions	Total loans	Public bonds held by banks	Bank claims on the economy
1888-1891	-5.2	1.8	-3.8
1913-1918	-10.0	-6.2	-9.2
1933-1945	-13.0	-7.6	-11.6
1973-1982	-1.9	13.7	0.6
1993-1996	-1.9	0.7	-1.3
2010-2013	-3.4	21.0	-0.1

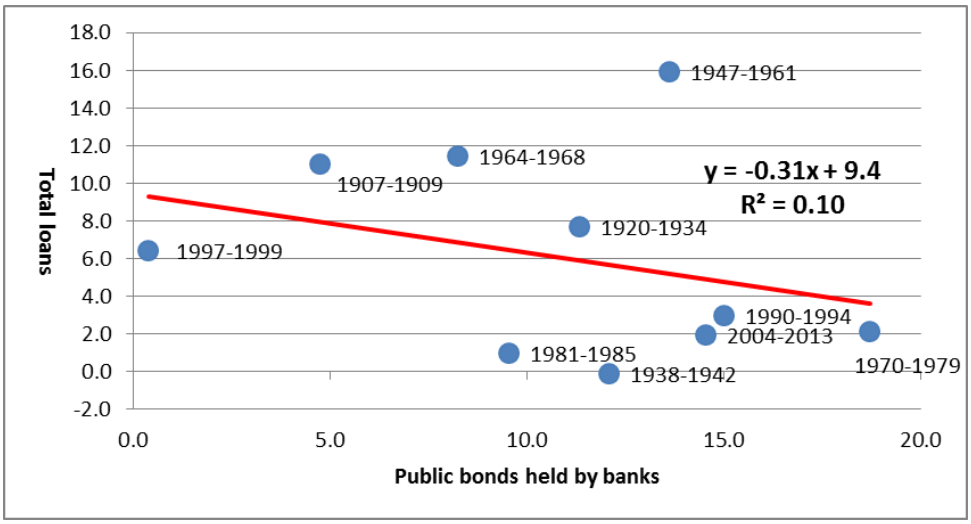
Table 7. Public bonds held by banks in credit recessions

(correlation in annual growth rates,%)

credit recessions	correlation
pre-WWII	
1889-1891	0.47
1914-1918	0.23
1934-1945	0.64
post-WWII	
1974-1982	-0.56
1994-1996	-0.62
2011-2013	-0.73
overall	
1861-2013	0.28

Figure 8. Loans and holdings of public bonds components during expansionary phases in public bonds held by banks

(average annual growth rates %)



6. Empirical results

6.1. Comparing business and credit cycles.

Cycles can be described both by their individual characteristics and by their relations to each other. In this section we compare cycle characteristics and peak up some statistical regularities. Table 8 reports the median[42] of duration, amplitude and slope of cycles for the whole historical period and for two main sub-periods, pre and post WWII[43].

Looking at the medium cycle in the whole sample (Table 8a), first of all, some differences between credit and business cycles emerge: fluctuations of loans last (on average) 20 years (18 for the broader aggregate of bank claims), longer than those of GDP (11 years). In addition, downturns and expansions of bank loans are more intense than those of GDP.

Second, there is a strong asymmetry between downturns and upturns both in GDP and in credit cycles, since downturns are much shorter and also less deep than expansion phases. The median amplitude of a typical downturn episode is about a 8 per cent decline in GDP, while during expansions the median amplitude reaches 33 per cent. Asymmetry is even stronger for credit series (-16 and 130 per cent respectively).

It is important to note that what really makes different expansions and recessions is their length. In fact, the differences in amplitude are due to different length, because the slope of contractions and recessions looks quite the same both in business and in credit cycles (except for the public bonds held by banks, whose the distinctive behavior will be discussed at the end of the section) [44]. Thus, the GDP grows by 3.6% (per year) in the expansionary phases and drops by 3.1% in the downturns and bank claims on the economy drops by 3.8% in recession and grows by 3.8% in expansionary phases. Also the bank loans keep the same intensity (slope), both in recessions and in expansions (around 5% annual growth rate in absolute value).

In short cycles, credit and business cycles are more alike in terms of length (6 years for the credit variables, 5 years for GDP), but recessions and expansions of credit variables remain more intense than those of GDP.

Moreover, fluctuations are more symmetric in terms of duration and the observed asymmetry in amplitude (expansions are larger than recessions) is also the result of more intense (slope) expansive phases.

Comparing pre and post-war periods (we focus on shorts cycles only due to sample dimension, Table 8b), it emerges clearly that expansions are much longer than recessions in the pre-war period, while they tend to be alike in the most recent period, with the notable exception of GDP, of which the expansionary phase lasts 3 time (9 years) that of the pre-war period (3 years).

Public bonds held by banks have a peculiar dynamics: in the whole sample (net) purchases and sales of bonds by banks are carried out for roughly the same duration over medium cycles; what makes expansions

[42] Asymmetry in the distribution of changes suggests using the median rather than the mean (e.g. Classens et al. 2011, Drehamnn et al. 2012).

[43] To keep the medium cycles complete within each subperiod, the threshold year, which separates the two subperiods changes with the series: 1939 for GDP, 1933 for bank loans, 1941 for bank claims on the economy, 1942 for public bonds held by banks (see the corresponding tables). Pre / post WWII is then a convenient definition. Finally, notice that statistics are based on the complete medium and short cycles, years out of these cycles are not included.

[44] From a statistical standpoint, this asymmetry between expansions and recessions is the result of working with series in levels. If series are, in a very basic time series model, random walk with a (positive) drift, this latter introduces a (stochastic) trend in the data, which makes negative drops in the level of the series less frequent (see the discussion in Harding and Pagan 2002a).

more intense is the slope. In the short cycles instead, purchase phases tend to last more than selling periods, but only in the pre-war period. Again, upturn phases are broader than the downturn ones, because of a more intense growth of purchases during expansions.

Finally, both in the short and in medium term, credit cycles are always more volatile in terms of amplitude than GDP cycles: this is true in the whole sample as well as in the pre-war era.

Table 8. Cycle Characteristics

a) Medium and Short Cycles

Variable	Duration (1) (2)			Amplitude (3)		Slope (4)	
	Downturns	Upturns	Cycle	Downturns	Upturns	Downturns	Upturns
			Medium Cycles				
GDP	3.0	8.0	11.0	-7.7	33.4	-3.1	3.6
Bank loans	5.0	15.0	20.0	-16.0	130.0	-5.2	5.4
Public bonds held by banks	3.5	4.0	7.5	-24.5	50.8	-6.3	10.4
Bank claims on the economy	3.0	15.0	18.0	-11.1	75.3	-3.8	3.8
			Short Cycles				
GDP	1.0	3.0	5.0	-2.9	9.5	-2.5	2.4
Bank loans	2.0	3.0	6.0	-5.5	30.2	-3.3	6.7
Public bonds held by banks	1.0	2.0	5.0	-14.2	39.1	-7.4	11.6
Bank claims on the economy	1.0	3.0	6.0	-3.6	24.5	-3.6	6.0

b) Short Cycles over time

Variable	Duration (1) (2)			Amplitude (3)		Slope (4)	
	Downturns	Upturns	Cycle	Downturns	Upturns	Downturns	Upturns
			Pre-WWII				
GDP	1.0	3.0	5.0	-2.9	9.5	-2.5	2.4
Bank loans	1.0	6.0	7.0	-3.3	67.0	-3.0	9.2
Public bonds held by banks	1.0	4.0	5.0	-9.1	43.7	-5.3	9.5
Bank claims on the economy	1.0	3.0	6.0	-4.6	27.3	-3.7	8.1
			Post-WWII				
GDP	1.0	9.0	10.0	-2.1	18.2	-2.1	1.9
Bank loans	2.0	1.0	3.0	-6.0	6.7	-3.5	5.4
Public bonds held by banks	2.0	1.5	3.5	-14.3	32.5	-8.3	12.9
Bank claims on the economy	1.0	2.0	3.0	-2.4	10.6	-1.8	4.1

Note: For the definition of subperiods pre-post WWII, see footnote 41. (1) Durations are measured in years. (2) The duration of the full cycle is measured from peak to peak. (3) Percentage change from trough to peak (downturns) of peak to trough (upturns). (4) The slope is the average (geometric) growth rate in the phase.

6.2. Business and credit cycles: evidence about synchronization

Having defined the cycle in terms of the turning points of a series, this section uses parametric and non-parametric method to assess the degree of synchronization between credit aggregates and GDP cycles (short and medium), by using the concept of *concordance* defined by Harding and Pagan (2002a, 2006) and other correlation measures.

Financial system is procyclical and bank lending tends to increase more during economic booms than during downturns. This is a crucial issue policy, since a robust credit expansion would be necessary just in the early stages of recession, when firms' capacity to self-financing investment shrinks as well as potential collateral. This is the explanation of procyclicality resting on an accelerator scheme (e.g. Bernanke et al. 1999). A further explanation, stressed by models of credit rationing is based on credit quality and risk over the cycle. In these models, loans are procyclical because financial market participants behave as if risk were countercyclical. Lenders impose nominal quantity limits on the amount of credit they are willing to provide to borrowers, regardless of the price that the latters are willing to pay, and these limits fluctuate as the financial fundamentals of lenders and borrowers change over the cycle. Stiglitz and Weiss (1981) and Kiyotaki and Moore (1997) developed the two main models to justify the credit ceiling. As a result, bank loan standards tend to be most lax during economic booms (Lown et al. 2000) and banking supervisors have historically been most vigilant during downturns (Syron 1991). Also empirical analyses tend to confirm a rise in risk during recessions. Bangia et al. (2002), amongst others, shows that estimated credit losses are much higher in a contraction relative to an expansion, stressing the significance of the procyclicality of credit quality changes. Situations where borrowers are less creditworthy can lead to a sudden contraction of credit.

The historical narrative in Section 4, and in particular in Tables 1 and 2, show that there is a relationship between credit and economic cycle, but also that the subject is not easy to synthesize, and the impression is that the variables in question were often influenced by different forces and factors in different periods. In some (few) cases, their phases overlap, bringing about long-stable periods of growth as well as deep and lasting recessions, in other phases of the relationship is more obscure (see Figure 3). This section set out some measures to test for synchronization (comovement) between credit and business cycles in order to single out some statistical regularities.

To give an insight of synchronization of credit and real cycle, we first represent the two cycles (medium and short) graphically (Figure 9). The recession periods are depicted as downward bars; expansions are upward bars. The different length of the bars is a convenient way to better differentiate the two series, when they overlap. Figure 9 highlights some degree of synchronization of turning points, higher between short cycles and in the post WWII period.

To examine the extent of synchronization across cycles, we use different indexes. To start with, we use the concordance index developed by Harding and Pagan (2002a, 2006). This is a measure of how often two cyclical variables are in the same phase of the cycle. Denote a binary variable S_{yt}, such that $S_{yt}=1$ when the series Y_t is in an expansion and $S_{yt}=0$ during the time spent in contraction . Then the concordance CI_{xy} between X and Y is defined as

$$CI_{xy} = \frac{1}{n}\left[\sum I\left(S_{y,t}=1; S_{x,t}=1\right) + \sum I\left(S_{y,t}=0; S_{x,t}=0\right)\right] \quad (1)$$

where *I(.)* is an indicator function, taking value 1, when the expression in parentheses is true. Two series are perfectly procyclical (countercyclical) if the index is equal to unity (zero). This concordance index is the sample analog of Prob ($S_{xt}=S_{yt}$). An advantage of the index is that it is a well-defined quantity even if the variables Y_t and X_t are integrated series, while standard comovement measures are defined between covariance stationary variables.

Although $C_{xy}=1$ implies perfect synchronization of phases and $C_{xy}=0$ implies perfect countercyclicality, C_{xy} does not take a unique value in case of perfect non synchronization or independence, because its value depends on the asymmetry of the phases. Actually, $C_{xy}=0.5$ under the independence hypothesis, only if expansions and recessions last the same period of time. However, Harding and Pagan suggest that if the two series are independent then the expected concordance is

$$E(C_{xy}) = E(S_{y,t})E(S_{x,t}) + \left(1 - E(S_{y,t})\right)\left(1 - E(S_{x,t})\right) \quad (2)$$

Hence, an actual concordance higher than the expected one indicates procyclicality and a lower concordance indicates countercyclicality.

While the concordance index provides useful information about the interaction between financial cycles and business cycles, it masks the fact that, as in our sample, the relationship between financial variables and real activity is considerably stronger during expansions than during recessions. To address this issue, we compute concordance indexes, conditional on being GDP in expansion $CI_{xy}(S_y=1)$ or recession $CI_{xy}(S_y=1)$. The conditional concordance index of, say, credit and GDP, is then the probability that credit is rising during an output expansion, and falling during a contraction. Moreover, if concordance index varies with the phases, we then might test if this difference is statistically significant or whether concordance is symmetric over the cycle.[45] Our concordance asymmetry index (CI_{asym}) is computed as

$$CI_{asym} = CI_{xy}\left(S_y = 1\right) - CI_{xy}\left(S_y = 0\right) \quad (3)$$

This index varies in 0-1; we also test if this difference is statistically significant[46].

The concordance index is linked to other measures of synchronization as the common (Pearson's) coefficient correlation. Harding and Pagan (2006) showed that the following relationship holds

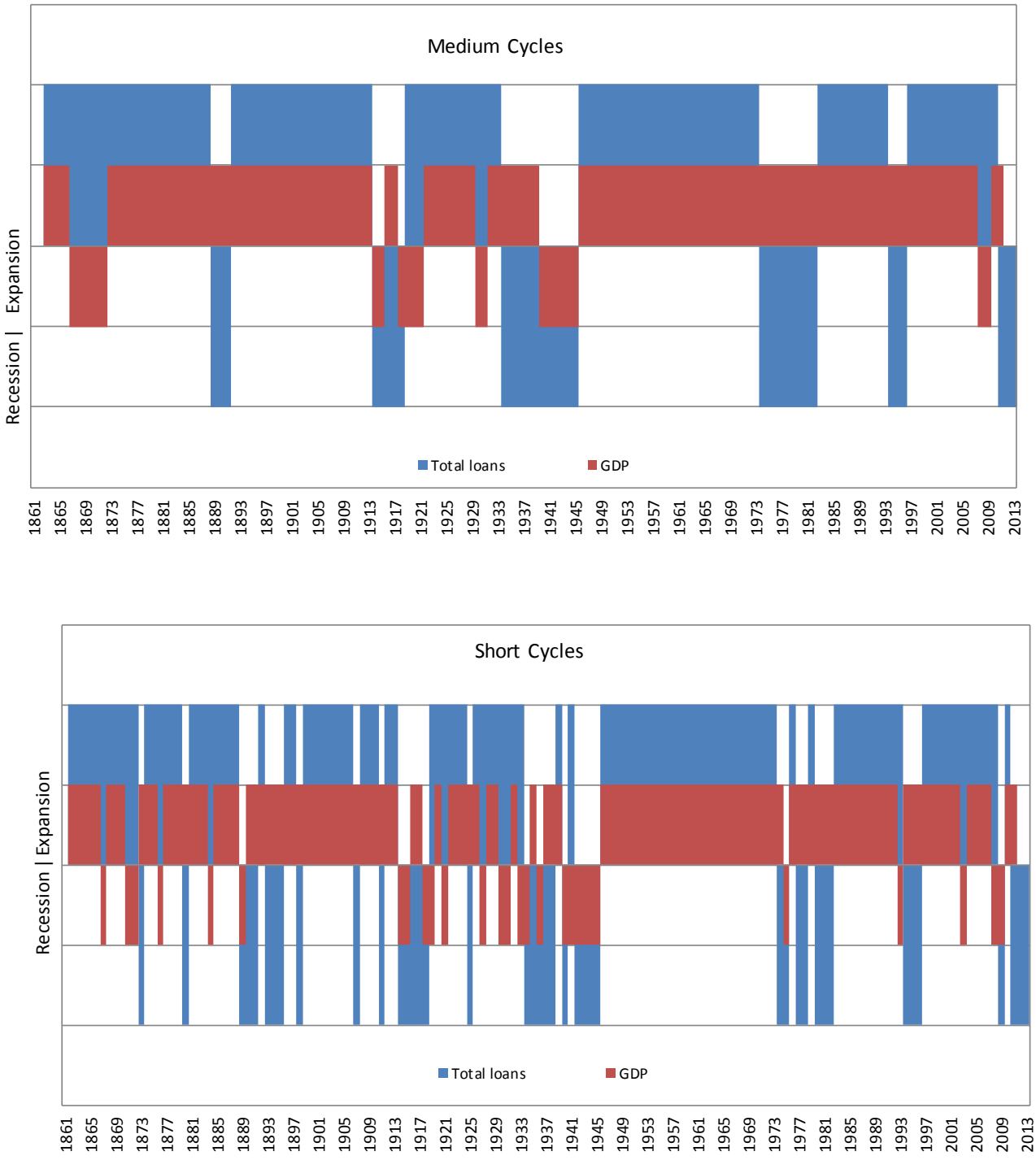
$$CI_{xy} = 1 + 2\rho\left(\mu(S_x)(1-\mu(S_x))\right)^{1/2}\left(\mu(S_y)(1-\mu(S_y))\right)^{1/2} + 2\mu(S_x)\mu(S_y) - \mu(S_x) - \mu(S_y) \quad (4)$$

where μ stands for the sample average, ρ is the estimated correlation coefficient between S_x and S_y and we neglect the index *t* for simplicity. This regression-based approach for ρ provide us easily with a standard error for the significance of correlation.

[45] This issue has been relatively little-studied in business cycle literature; see Haavio (2012) for a similar approach.

[46] See the Appendix A.2 for the derivation of the index as well as the test for asymmetry.

Figure 9. Medium and short cycles: GDP and bank loans



Note: For each binary series (recession/expansion) the recession periods are depicted as downward bars; expansions are upward bars. The different length of the bars is a convenient way to better differentiate the two series, when they overlap.

Finally, being S(.) variables binary variables, we also report the corrected contingency coefficient suggested by Artis et al. (1997). For two binary cyclical variables of N observations each, the corrected contingency coefficient is

$$C = \left\{ \frac{\sqrt{\frac{\chi^2}{N+\chi^2}}}{\sqrt{0.5}} \right\} * 100 \qquad (5)$$

which lies between 0 and 100 and is equal to 0 (χ^2 =0) in case of independence and equal to 1 in case of perfect association. In our context, independence indicates that there is no contemporaneous relationship between the two cycles. In Table 9 we refer to the standard likelihood-ratio chi-squared test for independence, although we are aware that cyclical variables are not iid, but serially correlated. Doing so, we are underestimating the probability of independence; besides, a response of independence is a lower bound probability for the null.

Table 9a reports the credit unconditional concordance (CI), the expected concordance index (E(CI)), which is crucial to define whether two series underlying the cycles are independent, the two conditional (on GDP phase) concordance indexes and their difference (CI asymmetry), along with the contingent coefficient (CC) and the (Pearson's) correlation. All the three credit aggregates are taken into account: total loans, government securities held by the banking sector is considered on its own and in addition to total loans to make up the bank claims on the economy. Finally, synchronization across cycles has been assessed for two sub-periods 1861-1939 (Table 9b) and 1939-2013 (Table 9c), where the threshold year 1939 comes from GDP turning points. Table 9 provides a number of elements that deserve attention:

1) Throughout the period examined, Table 9a shows a certain degree of synchronization between total loans and GDP for both short-term and medium cycles. The concordance index, which is respectively, 0.73 and 0.75, being higher than their expected values (0.64 and 0.68) implies procyclicality. Concordance is more pronounced in GDP upswings (0.80 or above), while during business cycle recessions indexes for medium and short cycles are 0.46 and 0.50 respectively, below the expected value and so countercyclical. Finally, this asymmetry in concordance is always strongly significant.

2) Government securities held by banks appear slightly procyclical in the medium cycles (0.67 and 0.65 under independence) and slightly countercyclical in the short cycles (0.55 against an expected value of 0.60). Looking at conditional concordance, in both type of cycles, the bonds held by the banking sector are weakly procyclical in expansions, but strongly countercyclical in recessions with a strong asymmetry.

3) The bank claims on the economy commove with business cycle more than bank loans, both in the short and in medium cycles. Again, concordance is much higher in the expansionary phases than in recessions.

Table 9. Comovements of business and credit cycle 1861-2013: measures of synchronization

Measures of synchronization	Total loans	Public bonds held by banks	Bank claims on the economy
		a) 1861-2013	
		Medium cycle	
CI	0.75	0.67	0.80
E(CI)	0.68	0.65	0.74
CI expansion	0.81	0.72	0.89
CI downturn	0.46	0.33	0.33
CI asimmetry	0.35***	0.39***	0.56***
CC	32.1***	7.3	31.9***
Correlation	0.20	0.04	0.23*
Correlation at t-1 (leading if the highest)	0.21*	0.04	0.14
Correlation at t+1 (lagging if the highest)	0.09	0.05	0.19
		Short cycle	
CI	0.73	0.55	0.76
E(CI)	0.64	0.60	0.67
CI expansion	0.79	0.62	0.84
CI downturn	0.50	0.23	0.43
CI asimmetry	0.29***	0.39***	0.4***
CC	35.2***	15.8	35.6***
Correlation	0.23**	-0.1	0.25***
Correlation at t-1 (leading if the highest)	0.10	0.02	0.18*
Correlation at t+1 (lagging if the highest)	0.20**	0.09	0.33***
		b) 1861-1939	
		Medium cycle	
CI	0.71	0.72	0.73
E(CI)	0.70	0.68	0.71
CI expansion	0.83	0.79	0.84
CI downturn	0.21	0.36	0.21
CI asimmetry	0.61***	0.44***	0.63***
CC	5.6	21.3	8.1
Correlation	0.03	0.14	0.05
		Short cycle	
CI	0.65	0.58	0.69
E(CI)	0.62	0.63	0.64
CI expansion	0.74	0.67	0.79
CI downturn	0.35	0.18	0.35
CI asimmetry	0.38***	0.50***	0.43***
CC	11.7	16.8	18.8
Correlation	0.07	-0.11	0.12
		c) 1939-2013	
		Medium cycle	
CI	0.80	0.61	0.88
E(CI)	0.66	0.62	0.78
CI expansion	0.80	0.66	0.94
CI downturn	0.80	0.30	0.50
CI asimmetry	0	0.36**	0.44***
CC	58.3***	4.5	58.8***
Correlation	0.34*	0.02	0.47**
		Short cycle	
CI	0.81	0.53	0.82
E(CI)	0.66	0.56	0.70
CI expansion	0.84	0.57	0.89
CI downturn	0.69	0.31	0.54
CI asimmetry	0.14	0.27*	0.35***
CC	59.1***	12.9	53.8***
Correlation	0.40**	-0.07	0.4**

Notes: Business cycle is represented by real GDP cycle. CI=concordance index; E(CI)= expexted concordance index; CC=corrected contingency coefficient.

4) Looking at the contingency index (CC), the table shows that in the medium cycles, among credit components, bank loans and the bank claims on the economy are significantly synchronized with business cycle; but only for bank claims on the economy the correlation is also significant. On the contrary, in the short cycles, CC and correlation are strongly significant for both credit aggregates. It is then likely that in the medium cycles the relationship between GDP and the two components of credit is affected by different long-term changes underlying the real and the financial side of the economy: the evolution of preferences and technology on one side, the financial development, the regulatory frameworks, the international financial set-up on the other side. On the contrary, in the short cycles, credit aggregates and GDP react more similarly to aggregate shocks, and, hence, their phases are more synchronized, since, as stressed by the financial accelerator literature (Bernanke and Gertler, 1989; Greenwald and Stiglitz, 1993; Kiyotaki and Moore, 1997) in presence of asymmetric information, financial propagation mechanisms work to amplify business fluctuations.

Finally, banks' holdings of public bonds always turn out not to be synchronized at all with business cycle.

5) Table 9a reports also correlations between GDP and the other variables, one year earlier (t-1) and one year ahead (t+1)[47]. In the medium cycles, they are generally lower than the contemporaneous one and no lead / lag relationship arises between GDP and credit. However, in the short cycles, the bank claims on the economy presents a very significant and higher correlation with past GDP, which means that GDP leads this broader credit aggregate.

Table 9b) and 9c), shows the same analysis decomposed in two sub-periods: from the unification of Italy to the eve of World War II (1861-1939) and from 1939 to 2013. This time split turns out to be very informative about how synchronization between real and financial have changed over time:

a) Although the degree of concordance is alike between the two periods, contingency (CC) and correlation between the credit and the business cycle both in medium and in short cycles are much stronger and significant in the recent decades.

b) Similarly, compared to the expected concordance, credit aggregates are much more procyclical in the post-war period. Moreover, while in the first period 1861-1939 there is a strong asymmetry in conditional concordance between expansions and recessions, in the more recent decades concordance of loans turns symmetric.

c) The absence of a significant correlation and contingency (CC) between credit series and GDP (medium and short cycles alike) in the pre-war period may partly be due to measurement errors. The importance of measurement errors in long historical time series and business cycle analysis is well-known (e.g. Watson 1994, Romer 1989) [48]. We also checked that this lack of procyclicality is not because of excluding loans to private sector by banks of issue until 1936[49].

[47] We also tried a time shift of 2 years; the results are generally weaker.

[48] Another statistical reason for a lower statistical significance is that, in both sub-periods, the smaller sample size increases standard errors of estimates.

[49] As explained in footnote 3, we excluded these loans from our credit series. By including them, correlation between credit and GDP cycle turns negative. This may be the result of the structural nature of many of these loans, granted in special circumstances such as wars, financial and economic crises (Confaloneri 1976,1982).

d) Finally, the government securities held by the banking sector turn out again to be uncorrelated with business cycles, even in the recent years, where they are slightly (but not significantly) anticyclical, as shown by the concordance indexes and the negative correlation.[50]

6.3. GDP and loans: a Granger causality analysis

In this section, we go into the dynamic relationships between credit and real activity and we ask whether downturns in loans cause future drop in GDP, or instead, if cyclical credit activity is caused by the business cycle. To the best of our knowledge, these questions have been hardly answered in the classical analysis of business cycle and, despite of the importance this issue might assume in the light of the present crisis, few papers have addressed it[51]. We then run a Granger causality-test, which in our case implies to test whether lagged cycle states of x help predict the (probability of) future cycle values of y, conditional on past y. If x is leading for y, that is y(t) and x(t-1) are (significantly) correlated, this might be due to a common shock affecting the two variables at different times. The lagged values of y in the Granger causality tests allow to control for these common shocks. Instead of the usual linear specification, we use a logit regression, being the cycle a binary variable. Moreover, we use only one lag, which is the specification that minimizes the AIC /BIC information criteria. Standard errors are robust to account for autocorrelations of residuals. The regressions are as follows

$$\text{logit GDP}_t = \zeta + \alpha \text{GDP}_{t-1} + \beta(\text{credit variable})_{t-1} + \varepsilon_t \quad (6)$$

and

$$\text{logit (credit variable)}_t = \theta + \delta(\text{credit variable})_{t-1} + \gamma\ \text{GDP}_{t-1} + \varepsilon_t \quad (7)$$

where GDP and credit variable(s) are the cyclical components (as derived in Section 3.1) respectively of GDP, bank loans, public bonds held by banks and bank claims on the economy.

The pair-wise Granger causality tests are shown in Table 10. Along with the estimated coefficients, when they are significant, in the table we also report the marginal effects, ME, that is the change in probability of expansion when the predictor variable X goes from recession to expansion[52].

The pair-wise Granger causality tests basically provide support to the results reported in Table 9a. In the medium cycles there is no causality in both directions between credit and the business cycle. However, in the short cycles, the probability of upturns in credit is significantly increased by a turning in the business cycle, although the reverse is not true. In particular, causality strongly emerges for total loans and bank claims on the economy, because in these cases the marginal effects are very significant too: when GDP turns from recession to expansion the probability of an expansionary credit phase increases by 26 percentage points as regards the private credit and by 37 percentage points with reference to the total credit to the economy.

[50] Obviously, in the sub-periods, the smaller sample size increases standard errors of estimates and reduce significance of measures.

[51] See, among the few, Haavio (2012).

[52] As it is well-known, in non-linear models the marginal effect of a change in a regressor is not equal to its coefficient. For the logit model, the marginal effect (ME) of a change in a variable is $\Lambda(\beta X)*(1-\Lambda(\beta X))*\beta$ where $\Lambda()$ is the logistic distribution. Yet, for our cyclical (binary) variable derivatives are not appropriate, because the relevant change is when this variable goes from 0 to 1. Then the ME is worked out as a finite-difference calculation: ME=E(y|x,d=1)−E(y|x,d=0); see Long and Freese (2005).

This evidence agrees with the earlier correlation analysis and other studies, according to which, especially in the post-WWII era, GDP leads bank credit (EBF 2011; ECB 2012), at least at the usual business cycle frequencies (our short cycle).

Table 10. Pair-wise causality between credit and business cycle

(estimated coefficients)

Cycle	Bank loans	Public bonds held by banks	Bank claims on the economy
	From credit to GDP (β)		
Medium cycle	0.996	0.092	0.034
Short cycle	0.306	0.095	0.743
	From GDP to credit (γ)		
Medium cycle	-0.868	0.225	0.637
Short cycle	0.829*	0.863*	1.596***
ME	*0.26****	*0.14*	*0.37****

Notes: Logit estimates; robust newey s.e. for autocorrelation of residuals. The marginal effetcs (ME) is the change in probability of expansion when the predictor X goes from recession (X=0) to expansion (X=1).

This result deserves few remarks. First, it is not surprising that causality relationships depend on the definition of cycle and on the frequency of fluctuations. From a purely statistic point of view, as shown by Granger and Lin (1995), intensity of causation changes at different frequencies: medium and short cycles fluctuate at difference frequencies and at differences frequencies the constructed (cyclical) binary variables interact to each other.

Second, the evidence about GDP leading bank credit in short cycles has two consequences. On the one hand, it suggests that during the period examined, episodes of financial distress have not shaped the Italian business cycle. Actually, literature about financial crises emphasize that these latter are preceded by rising credit-to-GDP ratio, and thus it implicitly suggests that credit increases over the cycle anticipating GDP, or as it is said in Jorda et al. (2012) “the prior evolution of credit does shape the business cycle”. On the other, our evidence about synchronization and Granger causality in short cycles is broadly consistent with the financial accelerator .scheme. Actually, in this literature financial frictions amplify and propagate shocks in macroeconomic fundamentals, rather than triggering business cycle movement. In this perspective credit has to be lagging the GDP turning points.

Third, we then put forward an economic rationale underlying the lack of causality between credit and growth in the medium cycles in line with the results about correlation discussed in the previous section. It is likely that medium-credit cycles are more brought about or driven by some structural changes in the banking and financial markets rather than by GDP fluctuations. The main example is the impact of the banking law of 1936, which improved stability of banking system through regulation and better banking supervision by the Bank of Italy, so contributing to stabilize credit cycle.

Finally, it is worth reminding that our result is not at odd with that large empirical and theoretical literature, which has explored the channels through which financial institutions and markets can help increase economic growth rates[53]. Here, we are not calling into question the link between finance and growth. Although our medium cycles may last for some years, they still are the result of a cyclical stationary process, where the underlying trends have been filtered out. As a results, long-term relationships are not tested here.

6.4. The burden of the credit crunch on the recession.

In the previous sections, we have documented a certain degree of comovement of real and financial variables. However, especially in the medium cycles, their cyclical phases seem only weakly synchronized and they hardly coincide. In this section, we investigate what goes on when the recession phases are synchronized with the loans. As Claessens et al. (2011) and Bordo and Haubrich (2010), we wonder whether coincidence of recessions makes recessions more intense. We first examine how the likelihood of downturn and upturn in business cycles (GDP) change conditional on having a downturn in credit as well and we compare them with the unconditional probability of GDP recession. In Table 11 the unconditional probability is the percentage of years of recession of GDP, while the (conditional) probability is the percentage of years of recession of GDP during the years of expansion / recession of the credit variables considered.

The (unconditional) probability of being in a downturn phase is 16 percent in the medium cycle and 20 per cent in the short cycle[54]. This percentages almost double (31 and 37 per cent respectively) under credit recession and the effect is even stronger when the bank claims on the economy are declining.

Table 11. Probability of recession conditional on financial cycle phase.

State of Financial Cycles	Medium Cycle	Short Cycle
	a) Probability of GDP Recession	
Bank Loans recession	0.31	0.37
Bank Loans expansion	0.11	0.14
Bank claims recession	0.36	0.39
Bank claims expansion	0.12	0.14
Unconditional prob.	0.16	0.20

To appreciate the impact effect of a credit recession on an ongoing real recession, we now move from the analysis of the states of cycle to the growth rates of underlying variables, and measure how much a credit recession affects the deepness of a recession. A simple test consists in estimating the average rate of GDP growth by adding appropriate dummies to control for years of: i) GDP recession; ii) GDP recession and

[53] Many articles have shown how the financial institutions impact on economic growth. See amongst others, Acemoglu and Zilibotti (1997), Bencivenga and Smith (1993), Holmstrom and Tirole (1998); Aghion at al. (2010), King and Levine (1993). Folhin (1999) finds some positive effects of bank assets on Italy GDP growth between 1895 and 1913. For a recent post-WWII analysis see instead Barbiellini Amidei et al. (2012).

[54] As expected, given the presence of a underlying (positive) stochastic trend in the level of variables, the probability of a recession decreases with the duration of the cycle; see footnote 37.

financial contraction. If we denote the yearly GDP rate of growth as g_y, then the estimated equations would read as follows:

$$g_y = \alpha + \beta * D\left(GDP_{recession}\right) \quad (8)$$

$$g_y = \alpha + \beta * D\left(GDP_{recession}\right) + \gamma D * \left(GDP_{recession\ \&\ financial\ recession}\right) \quad (9)$$

where D( ) is an indicator variable, which takes the value 1 under the condition in parentheses (0 otherwise). We repeat the regression both for the short cycle (SC) and medium cycle (MC), and, in regression (9), we control for two different measures of the financial cycle: the loans and the bank claims on the economy. In order to control for autocorrelation of residuals, we provide robust standard errors by using the Newey-West estimator.

In Table 12, the constant coefficient in the regression reported in column (1) and (2) provides us growth rates in expansions (3.5 per cent in the MC and 3.9 in the SC). By adding the estimated coefficient for the dummy (a+b), one works out the average growth rate in recession: -7.4+3.5=-3.9 in MC and -7.8+3.9=-3.9 in SC. To appreciate the effect of financial contractions, we look at columns (3)-(4) and (5)-(6).

Table 12. Impact of financial cycle on GDP growth rate in recession.

Dep. Variable: GDP growth rate	SC (1)	MC (2)	SC (3)	MC (4)	SC (5)	MC (6)
Const (a)	3.9***	3.5***	3.9***	3.5***	3.9***	3.5***
	(0.6)	*(0.5)*	*(0.6)*	*(0.5)*	*(0.6)*	*(0.5)*
GDP recession (b)	-7.8***	-7.4***	-6.2***	-5.2***	-7.0***	-5.9***
	(1.4)	*(1.8)*	*(0.8)*	*(0.9)*	*(1.1)*	*(1.8)*
GDP & Total loans recession (c)			-3.2	-4.7**		
			(1.9)	*(2.3)*		
GDP & Bank claims recession (c)					-1.6	-5.3**
					(1.5)	*(2.3)*
obs.	152	151	152	151	151	150
Average GDP growth in recession (a+b)	-3.9	-3.9				
Average GDP growth in recession and credit expansion (a+b)			-2.3	-1.7	-3.1	-2.4
Average GDP growth in real and financial recession (a+b+c)			-5.5	-6.4	-4.7	-7.7

Note: standard error in parentheses, robust for autocorrelation of residuals (Newey-West correction).

Now, the constant term still represents the growth rate in expansion, while the coefficient associated with "GDP recession" is the drop of the GDP growth rate in recession, conditional on credit variable being in expansion (that is, the second dummy=0 in equation (9)). As expected, the estimated coefficient of the GDP recession lowers compared to regression (1)-(2): if credit (private or total) is not declining during a business cycle downturn, recession is less intense. For instance, in medium cycles (4) and (6), the contraction is now respectively (a+b) 1.7% and 2.4%. Vice versa and more importantly, when credit and real downturns coincide, GDP recessions are more severe. Let's take column (4), when the effect of bank loans decrease is

significant: GDP then drops by (a+b+c) 3.5-5.2-4.7=-6.4 per cent and the impact is even stronger when bank claims on the economy drops (-7.7 per cent); a negative change much higher than the unconditional growth rate in recession. Although still negative, the impact of financial turmoil is not significant during short cycle recessions.

The estimates in Table 12 suggest two conclusions. Firstly, financial cycle can worsen the business cycle in downturns, but only when we look at medium term fluctuations, when downturns are associated with more severe credit crunches and financial disruption (Aikman et al 2014; Jorda et al. 2012) Secondly, the broader the financial aggregate, the larger the effect on business cycle. This suggests that when banks restrict credit provision also to the public sector, the effect of a credit crunch is more intense for the real economy.

7. Concluding remarks

The idea that financial and business fluctuations were closely interlinked has a long history, but for a long time scholars have only looked at interest rates or monetary aggregates. The recent financial crisis has shown an increasing role for asset prices' booms and busts, which turn to be related to cycles of financial variables. These fluctuations are typically longer than usual business cycles and, in addition, when downturns in financial cycles coincide with a drop in economic activity, recessions are particularly severe and long-lasting.

In this backdrop, we investigated the link between business and credit cycles on a long historical period in Italy. We looked both at the usual business cycle frequencies and at longer fluctuations, where turning points are less frequent just as the most relevant events of financial turmoil and macroeconomic disruption.

We used a definition of cycle based on turning points in the level of variables similar to the classical approach to business cycle analysis. We defined short and medium cycles for GDP (our reference cycle) and some credit aggregates (total bank loans and bank claims on the economy, which includes bank holdings of public bonds) and we present the main characteristics of cycles in terms of duration, amplitude and intensity of recoveries and recessions. Along with a detailed historical analysis of main events behind credit and real economy fluctuations, we formally examined the extent of synchronization across cycles using different indexes.

In the medium term, cycles in bank loans appears to be weakly associated with business cycles. However, comovement increases and measures becomes significant, when the broader aggregate of bank claims on the economy (including public bonds held by banks) are taken into account. On the contrary, at the usual business cycle frequencies, all measures of comovement turn significant for all credit aggregates.

The fact that credit and business cycles are weakly synchronized is only an apparent contradiction. In fact, two cycles may be little synchronized and still influence each other: when their negative phases overlap, as in the recent crisis and in other few cases in the past, recession turns to be deeper. However, if these events are relatively few, as in our historical evidence, the correlation between cycles remain low on average.

When we try to answer the question about what leads the cycle, we do not find evidence that credit leads the business cycle, both in the medium and in the short fluctuations. On the contrary, in the short cycle, we find some evidence that business cycle leads the credit one. A causality analysis, performed using logit regressions, confirms that GDP Granger-causes credit in short cycles and that, when causality is significant,

the impact in term of probability is large: in an expansionary phase, the probability of upturn in credit increases by about 25-37% , depending on the credit aggregate considered.

Finally, public bonds held by banks are a relevant component of the cyclical behavior of credit aggregates with respect to the business cycles. As said, when the bank financing to the economy includes public bonds held by banks along with loans, this broad aggregate is significantly correlated with economic activity fluctuations also in the medium term. However, although the increase in public bonds help stabilize the total credit to the economy during downturns in the bank loans, a strong negative correlation emerges in the post-war era starting from 1970's, when during credit contractions in the medium cycles, we witness a strong increase of government securities in banks' balance sheets. On the contrary, before the WWII, during credit contractions, banks would also reduce public bonds held in their portfolios.

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APPENDIX

A.1 The Italian Business Cycle: A Comparison

In this work, we take real GDP as the representative variable for business cycle as it is common practice in the empirical literature and in other papers on Italian business cycle (Gallegati e Stanca,1998; Delli Gatti et al 2005, Baffigi et al. (2013). Although there is not an official dating to look at, as our dating procedure is new as well as the amplitude of the time period taken into account, we compare our turning points to some of those find out in the literature. Baffigi (2013) recently estimated peaks in Italian GDP over the last 150, by using the methodology introduced by Bai e Perron (1998, 2003). As a benchmark, he also drew up a list of business cycle peaks, by combining the results of some previous works. Jorda et al. (2012) provide a dating of the Italian business cycle for the recent 140 years, by using the Bry and Boschan (1971) algorithm, collecting data on GDP from different sources. Differently from our dating, they use real GDP per capita to determine turning points in the economic activity. We contrast these dating to our short-term business cycle in Table A.1.

Looking at the fourth column, our dating based on Harding and Pagan algorithm mimics most of the peaks found in literature (column 1 and 3). With regard to the Jorda et al. (2012) dating, we find the same cyclical phases, 17, although in few cases (3 out of 17) the cycles obtained with one procedure are not identified as autonomous cycles in the other. However, the distance (in years) among the commonly identified peaks is often equal to zero (column 6). Moreover, we do not anticipate or postpone the turning point systematically.[55]

[55] As to the sources of data, Jorda et al. (2012) refer to Schularick and Taylor (2012), who generically cite official statistical publications and the work of individual economic historians.

Table A.1. Business Cycle Dating: A comparison

Short cycles (this work)	Baffigi et al. (2013) (1)	Baffigi et al. (2013) (2)	Jorda et al. (2012) (3)	BCMP (this work) (4)	Difference in years (4)-(3)
	1862				
	1866	1867		1866	
1	1870		1870	1870	0
2	1874		1874	1875	1
	1878	1879			
3	1883		1883	1883	0
4	1887		1887	1888	1
5	1891		1891		
6	1896	1897	1897		
	1900				
	1907				
	1914	1913		1913	
7	1918		1918	1917	-1
8			1923	1920	-3
9	1925	1922	1925	1926	1
10	1929	1930	1929	1929	0
11			1932	1932	0
				1935	
12			1939	1939	0
	1943	1941			
	1947	1948			
	1951				
	1957				
	1963				
	1970	1969			
13	1974		1974	1974	0
	1980	1981			
14	1990	1991	1992	1992	0
	1995				
15	2000	2002	2002	2002	0
16	2007		2004		
17			2007	2007	0

(1) Year of peak worked out as the union of different sources: Ciccarelli e Fenoaltea (2007), Delli Gatti, Gallegati e Gallegati (2005), ISTAT (2001) and Istat 2011.
(2) Year of peak based on Bai and Perron (1998,2003)
(3) Year of peak based on per capita GDP (real)
(4) Year of peak from our dating. We wittingly excluded 2011 peak, because Baffigi's data end in 2010.

A.2 The Concordance Asymmetry Index

Harding and Pagan concordance index for two series *y* and *x* is

$$I = \frac{1}{n}\sum_{n} S_y S_x + (1-S_y)(1-S_x) \tag{1}$$

where $S = 1$ if the variable is in the expansionary phase, $S = 0$ otherwise. Let n_1 the number of periods for y to be in expansion. Then, $(n - n_1)$ are the periods in recession. When y is in expansion, the concordance index (1) becomes

$$I_{exp} = \frac{1}{n_1}\sum_{n1} S_y S_x \tag{2}$$

When y is in recession, index is instead

$$I_{rec} = \frac{1}{n-n1}\sum_{n-n1} (1-S_y)(1-S_x) \tag{3}$$

Our asymmetry index is based on the difference between (2) and (3):

$$CI_{asym} = I_{exp} \_ I_{rec} \tag{4}$$

When (2)=(3) concordance in recession and expansion is the same. Firstly, we check if this difference is an index, that is it varies within fixed limits. Equality between (2) and (3) amounts to the condition

$$\sum_{n1} S_y S_x - \frac{n1}{n-n1}\sum_{n-n1} (1-S_y)(1-S_x) = 0 \tag{5}$$

(5) has a maximum equals to n_1, while the second term is minimun in 0. The normalized index (0,1) is then

$$\frac{1}{n1}\left(\sum_{n1} S_y S_x - \frac{n1}{n-n1}\sum_{n-n1} (1-S_y)(1-S_x)\right) \tag{6}$$

which is just I_{exp} - I_{rec}. Being a difference of frequencies, our test is based on the binomial distribution, which for large samples has mean 0 and variance $V_I = I(1-I)n/(n1(n-n1))$.