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THE ITALIAN FINANCIAL CYCLE: 1861-2011

by Riccardo De Bonis* and Andrea Silvestrini*

Abstract

In this paper we investigate the main features of the Italian financial cycle, extracted by means of a structural trend-cycle decomposition of the credit-to-GDP ratio, using annual observations from 1861 to 2011. In order to draw conclusions based on solid historical data, we provide a thorough reconstruction of the key balance-sheet time series of Italian banks, considering all the main assets and liabilities over the last 150 years. We come to three main conclusions. First, while there was a close correlation between loans and deposits (relative to GDP) until the mid-1970s, over the last 30 years this link has become more tenuous, and the volume of loans has increased in relation to deposits. The banks have covered this "funding gap" mainly by issuing new debt securities. Second, the Italian financial cycle has a much longer duration than traditional business cycles. Third, taking into account the deviation of the credit-to-GDP ratio from its trend, an acceleration of credit preceded a banking crisis in 8 out of the 12 episodes listed by Reinhart and Rogoff (2009). A Logit regression confirms a positive association between the probability of a banking crisis and a previous acceleration of the credit-to-GDP gap. However, there were also periods - such as the early 1970s - in which the growth of the credit-to-GDP ratio was not followed by a banking crisis.

JEL Classification: C22, C82, E32, E44, G01, N10.
Keywords: banking system, credit-to-GDP ratio, financial cycle, unobserved components.

Contents

* Bank of Italy, Economic Research and International Relations.

1 Introduction[1]

The latest crisis has highlighted that financial factors are important drivers of the economy and that financial and business fluctuations are tightly intertwined (see, for instance, Jordà, Schularick and Taylor, 2011b). Banks' extension of credit to the economy plays a key role in the monetary transmission mechanism, through which monetary policy decisions affect economic activity and the price level. In a seminal paper, Bernanke (1983) stressed that monetary forces alone are quantitatively insufficient to explain the Great Depression's depth and persistence, creating the basis for a large literature on the credit channel in the transmission of monetary policy.

Monitoring credit developments is also relevant for the purposes of maintaining financial stability: in the Basel III global regulatory framework, the Basel Committee on Banking Supervision (BCBS, 2010) proposed implementing a countercyclical capital buffer in order to protect the banking system and the economy from periods of excess credit growth or deceleration. It was also suggested that the credit-to-GDP ratio gap constitute an indicator of excessive credit growth.[2] The credit-to-GDP ratio gap is defined as the deviation of bank loans – expressed as a ratio to GDP – from its long-term trend and thus is itself a measure of the financial cycle, and an indicator of financial leverage (Borio, 2012).

Given the relevance of credit fluctuations to policy analysis, several efforts have been made recently to provide an estimate of the financial cycle. Drehmann, Borio and Tsatsaronis (2012) attempt to identify the financial cycle for the US and other selected countries. They suggest measuring the financial cycle by combining credit and property prices. Borio (2012) studies the stylised features of the financial cycle and argues that it has a longer duration and wider amplitude than the traditional business cycle. Furthermore, he believes that the credit gap is highly informative with regard to detecting financial distresses and evaluating the risks of future systemic banking crises: hence, it is important for policy-makers to ensure that the credit gap is properly monitored. A similar view is shared by Schularick and Taylor (2012), who conclude that credit aggregates provide information about the likelihood of future financial crises and that the latter should be viewed as "credit booms gone wrong" (p. 1042). Also Borio (2012)

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[2]For opposite views on the effectiveness of early warning indicators of financial crises see Borio and Drehmann (2009) and Rose and Spiegel (2009).

argues that most banking crises tend to be preceded by rapid credit expansion, occurring close to the peak of the financial cycle.[3]

Yet, to our knowledge, a comprehensive analysis of the empirical features of the financial cycle has not yet been undertaken for Italy. Thus, in this paper, we complement the works by Drehmann, Borio and Tsatsaronis (2012) and investigate the main characteristics and regularities of the Italian financial cycle. Furthermore, we examine whether there is any link between systemic banking crises and long-term credit developments in Italy.

In order to draw conclusions based on consistent historical data, we provide a thorough reconstruction of the key balance sheet time series of Italian banks, on an annual basis, considering all the main assets and liabilities. As a result, our investigation relies on a historical dataset which extends from the unification of Italy in 1861 until the present day. This is crucial since financial cycles are often thought of as being more protracted than business cycles; hence, samples covering long periods of time are needed for accurate econometric estimation.

In the past, several scholars have been involved in collecting data with the aim of reconstructing long-term time series on banking and financial sectors. These efforts started with the 1967 two-volume book by De Mattia, continued with the works by Biscaini and Ciocca (1979), and the 1996 book by Cotula et al.

Despite this, the existing historical time series cover limited periods; this is due to changes in the structure of the financial sector, to breaks in the methodology used over time in response to financial innovation, to changes in the definition of monetary and credit aggregates, and to discontinuities in the statistics. This is clearly a limitation of the extant literature. For instance, De Mattia's data focus on the post-unification period up to 1936. The data reported by Cotula et al. (1996) cover a narrower time span, from 1890 to 1936. More recently, Della Torre et al. (2008) have provided estimates only for the period 1861-1914. According to Della Torre, De Mattia's has underestimated the data for the years around unification, especially because they do not cover the entire population of savings banks. Yet, the new data estimated by Della Torre et al. (2008) refer only to the funding of intermediaries.

Against this background, we combine data from various sources, join often discontinued data series and contribute additional information at the disaggregated level. In doing so, we seek to maintain a constant coverage with regard to instruments, institutional categories, counterpart sectors and compiling methods along all the time span 1861-2011. In our view, this represents an improvement on the existing literature, as we are building and documenting a historical dataset which is methodologically consistent over the last 150 years.

The rest of this paper is organised as follows: Section 2 describes the content of the database, the compiling methodology used and the improvements on the previous literature;

[3] Very recently, Herrera, Ordoñez and Trebesch (2013) show that an increase in the popularity of governments (defined as a "political boom") is a good predictor of financial crises in emerging countries.

Section 3 illustrates the evolution of the data over the last 150 years and presents a discussion of the main features emerging from our new statistics; Section 4 presents the estimation results for a trend-cycle decomposition of the Italian credit-to-GDP ratio; Section 5 examines the relationship between the phases of the financial cycle and the occurrence of banking crises; Section 6 contains the main conclusions and hints at possible paths for further study.

2 A description of the new historical dataset

In this section we provide a description of the new dataset, which is available on the Bank of Italy's website.[4] For additional details, the interested reader may refer to De Bonis et al. (2012).

Table 1 presents our reconstruction of the main items on the assets and liabilities side of the banking sector, from 1861 to 2011: short-term loans (i.e., with a duration of less than 18 months) and long-term loans (i.e., with a duration of more than 18 months), securities other than shares (or debt securities held), shares and other equity, fixed assets, deposits, debt securities issued, and capital and reserves.[5]

As is customary for banking statistics, aggregates are calculated at current prices. The reconstruction of the main aggregates allows for a "balancing" of balance sheets, providing an indicator of the reliability of our estimates. The imbalance between total assets – the sum of loans, debt securities held, shares and other equity, and fixed assets – and liabilities – the sum of deposits, debt securities issued, and capital and reserves – is not too large. It amounts, on average, to about 4 per cent of total assets. The major discrepancies, with values of around 15 per cent, are found during the period spanning World War II, when the quality of the available statistics and details fell dramatically.

In constructing the database, we make use of multiple sources: from 1864 to 1889, De Mattia (1967) is used, with our estimates for the first years after unification. From 1890 to 1936, Cotula et al. (1996) is used, with the exception of some institutional categories of banks, including special credit institutions and *monti di pietà*, taken from De Mattia (1967).[6] Some

[4] At the address: http://www.bancaditalia.it/pubblicazioni/pubsto/quastoeco/quadsto_26 (in Italian).

[5] For the purposes of compiling the series, the following definitions of loans and deposits have been adopted: loans mainly comprise credit granted to households and non-financial corporations; interbank loans are excluded. Loans are estimated net of bad debts because of the difficulties in finding data in the past. As for liabilities, deposits consist mostly of funds collected from households and non-financial corporations, while interbank deposits are excluded.

[6] The expression "special credit institutions" was introduced after the approval of the Banking Law in 1936; before 1936 this category included intermediaries granting credit to the agricultural sector, to the real estate sector, to the industrial sector. They mainly provided long-term credit, issuing bonds and deposits with agreed maturity, without collecting current accounts.

balance sheet items are integrated into our estimates and other sources, particularly for special credit institutions. From 1936 to 1965, data are taken from the historical statistics available on the Bank of Italy's website. Integrations refer to mutual cooperative banks (once rural and artisans' banks) provided by the Italian Federation of Cooperative Credit Banks (Federcasse). From 1966 to 2011, the Bank of Italy' s statistical supervisory reports are used.

Concerning the reporting sector, the banking system covers all the institutional categories of banks resident in Italy and the branches of foreign banks. The time series include both commercial banks that could raise short-term funds (*aziende di credito*) and special credit institutions (*istituti di credito speciale*), the two institutional categories existing until the 1990s. It also includes the mutual banks – formerly the rural and artisans' banks – often excluded from earlier estimations.

It should be noted that in the first years after unification, given the backwardness of the banking system, a significant proportion of total lending to the economy was granted by the banks of issue, whose loans and deposits are reported as a memorandum item in Table 1.[7] Between 1861 and 1936, banks of issue in Italy operated with private entities as well as with other banks. The banks of issue were among the largest Italian intermediaries and, until the 1870s, their loans exceeded those of commercial banks. Subsequently, they ran out of steam, except during World War I, with the public financing of the conflict.

Regarding the counterpart sector, the information relates to residents in Italy, following the methodology normally used for building monetary and credit aggregates. We focus on residents' loans and deposits because those of non-residents remain negligible today. For most of its history, the Italian banking system has had limited links with foreign countries. Only since the 1980s have European directives and the liberalisation of capital movements led to stronger relations with non-residents.

In the next Section, we will comment on the evolution of the main balance sheet items, focusing on loans and deposits.

3 The evolution of loans and deposits over the last 150 years

Italy, a country that arrived later than others at political unification, had a fragmented and underdeveloped banking system in 1861. Barter was common and citizens mainly used coins

[7] In 1861, there were four banks of issue in Italy: Banca Nazionale nel Regno d'Italia, Banca Nazionale Toscana, Banco di Napoli and Banco di Sicilia. In 1864, Banca Toscana di Credito per le Industrie e il Commercio d'Italia was added to the list. Following the annexation of Rome, in 1870, the banks of issue were joined by Banca Romana. During the crisis of 1893, they were reduced to three: Banco di Napoli, Banco di Sicilia and the newly created Bank of Italy. In 1926, the Bank of Italy became the only bank of issue, assuming the characteristics of a modern central bank.

to settle business transactions. The evolution of banks over the subsequent 150 years can be summed up in the "long run-up" (or "catching-up") metaphor (Onado, 2003). As in the case of per capita income, the size and characteristics of the Italian financial system have gradually come closer to those prevailing in major industrial countries.

The new time series reconstructed allow us to discuss the long-run evolution of the Italian banking system since political unification in order to interpret this "run-up".

Figure 1 displays bank loans (or credit), bank deposits, and currency in circulation, as a percentage of gross domestic product (GDP) at current prices – based on the new estimate of the Italian GDP series presented by Baffigi (2011).

In 1861, both loans and deposits accounted for negligible percentages of GDP (about 1 per cent). In Italy, the low diffusion of bank deposits led to coins and notes being used to settle exchanges. In addition, as can be seen in the same figure, until 1867 the metallic circulation was larger than that of paper notes. Until the late nineteenth century, their sum – the total currency in circulation – was greater than the stock of bank deposits. The low diffusion of bank deposits and the widespread use of metal currency in Italy until the late nineteenth century, a peculiarity in the international panorama, has been commented on and explained by coeval economists: the size of the agricultural sector in the Italian economy and the subsequent slow industrialization process are the main factors highlighted by Supino (1895) and Fanno (1912) (see Gigliobianco and Giordano, 2010, 2012, for more details).

After 1861, loans and deposits grew at a rapid pace until the late 1880s. The growth of credit was interrupted by the banking crisis in the early 1890s which was resolved with the creation of the Bank of Italy in 1893. Credit growth was revived in the second half of the 1890s and over the subsequent years of economic development, when Giolitti was head of the Italian Government. This acceleration of credit growth is compatible with the ideas of Gerschenkron (1962) on the replacement of the failed French-style banks with German-style universal banks in the 1890s.[8] The latter exported their business model to Italy, mobilised savings and promoted industrial investment, as they did in Germany (De Cecco, 2011); for a sceptical view, see Fohlin (1999).[9]

[8] Also according to Luigi Einaudi and his colleagues at the Turin school of economics, the Italian economy experienced an upward phase in the 1898-1908 "Giolittian growth period", characterised by technological innovations, improvements in productivity, and the formation of German-style "universal banks" (Sella and Marchionatti, 2012).

[9] While universal banking has been often associated by economic historians with sharper growth and higher economic development, other studies has called into question Gerschenkron's hypothesis: recently, Piluso (2010) argues that universal banking is not necessarily related to sustained growth (for instance, the 1950s-1960s "Italian economic miracle" was not dependent on the prevailing banking system at that time). Thus, according to Piluso, banking patterns and credit regulation do not always contribute to the country's macro performance (see also Conti, 2010).

After decreasing during the World War I, the volume of both loans and deposits grew strongly in the 1920s, exceeding 50 per cent of GDP at the outbreak of the Great Depression. The performance of loans and deposits in the 1930s fits in well with the literature on bank failures in Italy during the Great Depression – see for instance Ferri and Garofalo (1994) – who provided evidence of a credit crunch.[10]

With World War II and the associated inflation, loans and deposits decreased gradually to 15 per cent of GDP in the second half of the 1940s, returning to the levels they were at in 1885. On the contrary, from the 1950s to the mid-1970s – the period of the greatest developments in the Italian economy – loans and deposits increased considerably, reaching 75 per cent of GDP.

As of 1974, a decline in the credit-to-GDP ratio can be observed, followed by a slight rise in the second half of the 1980s, which continued until the beginning of the 1990s. The deposits-to-GDP ratio shows a similar, but less marked decrease, always being above the credit-to-GDP level. The gap was closed in 1989. This behaviour can be explained by the introduction of credit ceilings for loans to the private sector: they started in 1973 and were subsequently extended until the second half of the 1980s, after a short interruption between March 1975 and October 1976. Afterwards, with the exception of the recession in 1992-1993, loans increased more than deposits, reaching levels never seen before, as a result of the removal of credit ceilings, increased bank competition, and lower interest rates.

Figure 1 allows us to examine the co-movements of credit-to-GDP and deposits-to-GDP. In fact, visual inspection reveals two distinct phases of the two series: although, in the post-unification period, and for most of the twentieth century, credit-to-GDP and deposits-to-GDP exhibit a close co-movement, this link seems to have been more tenuous since the 1970s. More specifically, using simple correlations we can see that the two series co-move tightly together up until 1973 – end of the Bretton Woods system, characterised by capital controls and tight financial regulation – with a correlation coefficient of 0.98; afterwards, in the 1974-2010 sample period, they follow rather different paths and, as a result, the correlation is almost null. Nowadays, bank loans are more than 100 per cent of GDP, while deposits are around 70 per cent; the latter having almost returned to the levels reached in the 1970s. The Italian banking system funded the gap between loans and deposits mainly by issuing new bonds.

As shown in Figure 2, the ratio of loans to deposits oscillates around 1 up until the mid-1990s, and suddenly increases to 1.4 in 2000. Conversely, the ratio of loans to the sum of deposits and debt securities issued by banks is somewhat stable from 1861 to 2011.

Focusing on the loans-to-deposits ratio, Figure 2 shows that this indicator increased notably

[10]The credit crunch was a part of tighter monetary policies, which in Italy date back to the 1926 “quota 90” by Mussolini. On this Italy was not unique, of course. There is now new evidence stressing the role played by tighter financial and monetary policy for the onset and development of the 1929 crisis. For the US, see for example Greasley and Madsen (2013).

during the real estate boom of the 1880s, rising to 1.2 in 1890, the highest value in the nineteenth century. After declining up until the outbreak of World War I, the ratio rose again in the 1920s and 1930s, before the explosion of the banking crises and the start of World War II. Growth in the loans-to-deposits ratio occurred during the economic boom of 1958-1963, when it rose above 1 (in 1944, it was equal to 0.6). In the 1980s and the 1990s, it was then affected by the slowdown in deposits, owing to households switching to other uses of savings, such as government bonds and mutual funds. The ratio reached its historical peak of 1.65 in 2007, and then fell as a result of the 2008-2009 recession. The increasing gap between loans and deposits – the "funding gap" – is in fact a trend common to other banking systems and is considered one of the causes of the financial crisis in some countries (see Barwell and Burrows, 2011, on the UK case).

Over the last 150 years, the loans-to-deposits ratio has been influenced by the degree of international openness of the banking system and the consequent reliance on foreign capital markets. In the nineteenth and early twentieth centuries, the internationalisation of Italian banks was limited. After World War II, internationalisation increased, and accelerated with the entry into force of the European exchange rate arrangements, especially with the liberalisation of capital movements in 1990 and the creation of the euro area in 1999. The use of interbank foreign funding – in recent years banks have been net foreign debtors – together with the increased availability of equity and bond funding, explains why the loans-to-deposits ratio after the EMU onset has reached levels far above one. Our conclusion is consistent with the results presented by Schularick and Taylor (2012): looking at industrial countries, they claim that, while in the past credit was closely tied to money, financial innovation and regulation have, later on, broken this link.

4 Trend-cycle extraction from the credit-to-GDP ratio

In this section, we focus on the credit-to-GDP ratio in order to examine the main stylised features of the Italian financial cycle. This variable, which has often been proposed in the empirical macro literature (Borio, 2012), has a number of interesting properties: being expressed as a ratio to GDP, it is normalised by the size of the economy and facilitates international comparison. Being a ratio of levels, it is generally smoother than a variable calculated as differences in log-levels, such as credit growth (BCBS, 2010).

A structural decomposition of this indicator is performed in order to obtain an estimate of the credit-to-GDP ratio gap, which is defined as the deviation of credit-to-GDP from its long-run trend. In general, a number of econometric approaches are available to identify cyclical fluctuations and to obtain a dating for the cycle. To this end, non-parametric and parametric

methods can be employed (see Mills, 2009, for a retrospective on the modelling of trends and cycles in economic time series).

For instance, in classical business cycle analysis, a fully non-parametric procedure was proposed in the 1970s by Bry and Boschan (1971) in order to identify turning points. This method essentially allows the expansions and recessions in economic activity identified by peaks and troughs in the cycle to be dated. Another non-parametric method is provided by the Baxter and King (1999) filter, which is a band-pass filter, meaning a filter built to eliminate fluctuations outside a predetermined frequency band.

Regarding parametric procedures, several approaches allow trend-cycle decompositions – designed to separate the trend from its cyclical deviations – to be performed. The most popular trend-cycle decomposition is probably that suggested by Beveridge and Nelson (1981), which defines the trend as the limiting forecast of the time series – adjusted for its mean rate of change – and the cycle in a residual manner. Other model-based decompositions can be performed using unobserved components models. Representations of unobserved components allow the observed time series to be decomposed into frequency components, i.e., a permanent trend, and into other residual stationary components such as cycles and seasonals. Each of these components characterises a different fluctuation pattern in the data: for instance, the trend component represents the evolution of the series in the long-run. The cyclical component is instead linked to the recurrence and alternation of phases, such as business activity, while the seasonal component captures systematic and repetitive fluctuations.

In order to extract a measure of the Italian financial cycle over the past 150 years, we apply a fully parametric procedure. In particular, we fit the stochastic trend plus cycle structural time series model proposed by Harvey (1989) to the Italian credit-to-GDP ratio series:

$$y_t = \tau_t + \psi_t + \epsilon_t \qquad \epsilon_t \sim NID(0, \sigma_\epsilon^2) \tag{1}$$

in which the time series y_t ($t = 1, \ldots, T$) is thought of as being composed by a stochastic trend component τ_t, a cyclical component ψ_t and a transitory disturbance term ϵ_t which captures the more erratic fluctuations of the data. Intervention variables such as outliers and structural breaks may be added to (1).

In the context of unobserved components models, trends and cycles are latent variables that have to be represented parametrically. The stochastic trend τ_t is assumed to follow a local linear trend model, such as:

$$\begin{aligned} \tau_t &= \tau_{t-1} + \beta_{t-1} + \eta_t & \eta_t &\sim NID(0, \sigma_\eta^2) \\ \beta_t &= \beta_{t-1} + \xi_t & \xi_t &\sim NID(0, \sigma_\xi^2) \end{aligned} \tag{2}$$

where β_t is a stochastic slope which moves up or down because of the disturbance term ξ_t. The trend, the slope and the irregular disturbances are mutually independent. In particular,

they are normal and independently distributed (NID) with mean zero and variances σ_η^2, σ_ξ^2, σ_ϵ^2, respectively.

The local linear trend is a very flexible parameterisation since it encompasses several alternative specifications widely employed in empirical applications. For instance, when $\sigma_\xi^2 = 0$ and $\sigma_\eta^2 > 0$, the slope is fixed and the trend is a random walk with constant drift. In contrast, when $\sigma_\eta^2 = 0$ and $\sigma_\xi^2 > 0$, the trend is an integrated random walk and the resulting specification is often referred to as "smooth trend". Interestingly, the popular Hodrick and Prescott (1997) filter (HP filter) proves to be a smooth trend model ($\sigma_\eta^2 = 0$) in which the smoothness parameter is chosen according to the observation frequency (Harvey and Jaeger, 1993); for instance, it is restricted to be equal to 1600 when working with quarterly data. It can be shown (Harvey, 1989) that the reduced form of a local linear trend model is an ARIMA(0,2,2), i.e. $(1-L)^2 y_t = (1 + \theta_1 L + \theta_2 L^2)\zeta_t$, whose parameters are functions of the original structural parameters, i.e. σ_η^2, σ_ξ^2, σ_ϵ^2.[11] In implementing the HP filter, when the restriction $\frac{\sigma_\epsilon^2}{\sigma_\xi^2} = 1600$ is imposed, the two implied ARIMA(0,2,2) moving average parameters can be promptly calculated: $\theta_1 = -1.777$; $\theta_2 = 0.799$.[12] The calibration of the smoothness parameter in the HP filter for different time frequencies is extensively discussed by Ravn and Uhlig (2002) and Maravall and del Rio (2007).

In equation (1), the stochastic cycle ψ_t is stationary and evolves according to the following bivariate AR(1)

$$\begin{bmatrix} \psi_t \\ \psi_t^* \end{bmatrix} = \begin{bmatrix} 1 - \rho\cos\lambda_c L & -\rho\sin\lambda_c L \\ \rho\sin\lambda_c L & 1 - \rho\cos\lambda_c L \end{bmatrix}^{-1} \begin{bmatrix} \kappa_{1t} \\ \kappa_{2t} \end{bmatrix} \tag{3}$$

where κ_{1t} and κ_{2t} are mutually independent white noise disturbances with the same variance σ^2, while $0 < \rho < 1$ is the damping factor and $0 < \lambda_c < \pi$ is the frequency of the cycle, measured in radians. The cycle periodicity is $\frac{2\pi}{\lambda_c}$. The variable ψ_t^* only appears by construction.

The cycle in (3) can be further expressed as:

$$(1 - 2\rho\cos\lambda_c L + \rho^2 L^2)\psi_t = (1 - \rho\cos\lambda_c L)\kappa_{1t} + (\rho\sin\lambda_c L)\kappa_{2t} \tag{4}$$

The right-hand side of (4) is equivalent to a moving average of order one.[13] As a consequence, the cycle can be reparameterised in the ARMA(2,1) form with complex roots

$$(1 - 2\rho\cos\lambda_c L + \rho^2 L^2)\psi_t = (1 + \theta L)\kappa_t$$

[11] Sbrana (2011) derives the analytical relationships between structural and reduced form parameters of the local linear trend model with correlated shocks.

[12] Sbrana (2013) provides the implied values of θ_1 and θ_2 when $\lambda = 100$ (annual data: $\theta_1 = -1.558$; $\theta_2 = 0.638$) and $\lambda = 14400$ (monthly data $\theta_1 = -1.871$; $\theta_2 = 0.879$).

[13] See, among others, Sbrana and Silvestrini (2012), who study the consequences of temporal aggregation on the cyclical component model as in (3).

where κ_t is a white noise disturbance with variance σ^2_κ. When $\theta = 0$, the ARMA(2,1) representation reduces to an AR(2) cycle, as in Clark (1987).

Estimation of the trend plus cycle model in (1), (2) and (3) is conducted using STAMP 8.2 (Koopman, Harvey, Doornik and Shephard, 2007). Several different specifications for the cyclical component are evaluated with STAMP: "LLT" is the local linear trend model as in Harvey (1989); "LLT(S)" is the "smooth trend" model in which $\sigma^2_\eta = 0$ and $\sigma^2_\xi > 0$. "LLT+Stoch. Cycle" is the local linear trend model with stochastic cycle as in (3) and (4); "LLT+AR(2)" is the local linear trend model with a stationary AR(2) component. Similarly for the "smooth trend" specifications (i.e., "LLT(S)+Stoch. Cycle" and "LLT(S)+AR(2)").

We refer to Table 2 for a diagnostic check of the residuals of the fitted models. Table 2 presents standard descriptive statistics such as the serial correlation test, the normality test and the log-likelihood. The normality test statistic is the Bowman-Shenton statistic with Doornik and Hansen's (1994) correction, distributed under the null hypothesis as $\chi^2_{(2)}$. The Q test statistic of residual autocorrelation is the Box-Ljung statistic for residual serial correlation, based on the first 12 residual autocorrelations.

Overall, all the diagnostics appear satisfactory. Based on the goodness-of-fit statistics reported in Table 2, the "LLT+AR(2)" seems to provide the most appropriate description of the long-run and cyclical properties of the credit-to-GDP ratio series, and is preferred to its "smooth trend" version ("LLT+AR(2)"). "LLT(S)+Stoch. Cycle" is also an appropriate model, but it presents a slightly worse fitting. The "LLT+Stoch. Cycle" model features a very similar fit with respect to the "LLT(S)+Stoch. Cycle", and hence its diagnostics are not shown in Table 2. "LLT" and "LLT(S)" are more restrictive models which seem to fit the data less adequately.

Maximum likelihood estimation results for the "LLT+AR(2)" are presented in Table 3, while for model "LLT(S)+Stoch. Cycle" estimates are provided in Table 4.

For "LLT+AR(2)", $\sigma^2_\eta = 0.72405$ and $\sigma^2_\xi = 0.20370$, while $\sigma^2_\epsilon = 0.05169$. First-order and second-order autoregressive cyclical components are equal to 1.54647 and -0.59635, respectively. The estimated cyclical representation is stationary.

For "LLT(S)+Stoch. Cycle", the irregular variance has been estimated to be zero. The damping factor is 0.94296 and therefore the cyclical component is stationary. The period of the stochastic cycle is roughly 23 years: thus, in Italy, the credit-to-GDP gap has a much longer duration than traditional business cycles. In fact, based on the sample 1861-2010, Baffigi et al. (2013) identify 26 complete business cycles with an average duration of 5 years and 6 months (Table 4, p. 52). Similar estimates are provided by Bergman, Bordo and Jonung (1998) for 13 advanced countries[14] over the time span 1873-1995 (please refer to Table 1, p. 74, in their

[14]The countries considered in the sample are the United States, the United Kingdom, Germany, France, Japan, Italy, Canada, Belgium, the Netherlands, Denmark, Finland, Norway, and Sweden.

paper) and by A'Hearn and Woitek (2001).[15]

Our evidence for Italy corresponds to the average duration of the financial and business cycles in the United States and in other advanced countries. Indeed, according to the National Bureau of Economic Research (NBER), business cycles have an average periodicity between two and eight years. In contrast, Drehmann, Borio and Tsatsaronis (2012) find that for the US and other selected countries[16] the financial cycle lasts between 10 and 20 years, depending on whether the economy was liberalised or not.

A tentative interpretation of our findings is that changes in the banking regulatory framework are a major factor that affect the financial cycle. As regulatory measures may last for decades – one may refer to the Italian Banking Act that was in effect from 1936 to 1993 – the financial cycle has a greater duration than the business cycle. This claim implicitly suggests that those factors driving the business cycle – labour, capital and technological progress – are subject to faster changes than regulatory measures. This is in our view a reasonable hypothesis.

A similar message appears when fitting a "LLT" in order to extract the trend component from credit-to-GDP and considering the resulting (standardised) residuals, which somehow constitute an estimate of the cyclical component. The top panel of Figure 3 displays a graph of these residuals. The bottom panel of Figure 3 shows a plot of their estimated power spectrum. The power spectrum – or spectral density – is an alternative representation of the sample autocovariance function, in terms of frequencies rather than time. The area under the spectrum for a given frequency band can be interpreted as the contribution to the variance of the time series that should be assigned to the frequencies covered in the considered range. In Figure 3, the spectrum has its global maximum at 0.27, corresponding to a cycle of around 23 years, which explains the largest part of the variance of the series. A second cycle of around 9 years seems also be present (corresponding to a local maximum at 0.68 on the horizontal axis).

Some outliers and level breaks are automatically estimated by STAMP, allowing to take account of data irregularities (for example, World War I, World War II, the oil shock in 1973-1974). Estimates of the intervention variables are presented in Table 5 for "LLT+AR(2)" and in Table 6 for "LLT(S)+Stoch. Cycle".[17] Three outliers (1924, 1942, 1974) and four level breaks (1919, 1935, 1937, 1944) are detected. They are all statistically significant at the 1% level.

Figure 4 shows the original credit-to-GDP series, the estimated smoothed level (with in-

[15]Working with industrial production data over the 1866-1913 period, these authors identify for 13 advanced North Atlantic economies (Australia, Austria, Canada, France, Germany, Hungary, the Netherlands, Italy, Russia, Spain, Sweden, UK, USA) a fairly regular cycle with a periodicity of 7-10 years.

[16]The seven countries studied over the period 1960-2011 by Drehmann, Borio and Tsatsaronis (2012) are: Australia, Germany, Japan, Norway, Sweden, the United States and the United Kingdom.

[17]STAMP estimates interventions variables, i.e. dummy variables defined to take the value zero up to the point in time in which an exogenous event occurs, and the value one thereafter. They are often associated with episodes such as changes in the government policy, external shocks, or wars.

terventions), the AR(2) cycle and the irregular component for the "LLT+AR(2)", which is our preferred model specification. A clear cyclical pattern is evident, somewhat irregular in amplitude. A similar graph for the "LLT(S)+Stoch. Cycle" model, not shown for space limitations, is available from the authors upon request.

Further diagnostic checking for the "LLT+AR(2)" preferred model is provided in Figure 5, which displays some residuals graphics:[18] from left to right and top to down, the residuals plot with error bands; their autocorrelation function; their estimated spectral density; a graph (histogram) of the residuals' empirical distribution (for illustrative purposes, a Normal probability density function and a kernel density estimate are also displayed).

Except in a very few cases, the standardised residuals lie within the confidence bands. The sample autocorrelation function (ACF), with a maximum time lag equal to 20, is similar to that of a white noise, being always within the two standard error limits. The estimated power spectrum is flat and also similar to that of a white noise. Overall, this further diagnostic checking confirms that the "LLT+AR(2)" model seems to be legitimate for the trend-cycle extraction.

Based on the previous estimates, Figure 6 shows the estimated smoothed financial cyclical component employing the "LLT+AR(2)" model and the "LLT(S)+Stoch. Cycle" model. These estimates of the financial cycle are compared to the cycle resulting from the Baxter and King (1999, BK henceforth) filter – implemented with the optimal finite-sample approximation as in Christiano and Fitzgerald (2003) – and to the standard HP cycle.[19] The BK cycle is estimated selecting all the fluctuations in a range of periodicities comprised between 5 and 20 years.

Overall, these alternative model specifications provide a rather consistent picture. In particular, prior to World War II, all the filtered cycles peaked at the end of the 1880s, in 1913, and somewhere in between 1930 and 1935. In the postwar, after a period of stability, three peaks were clearly visible in the first half of the 1970s, between 1990 and 1995, and in 2008-2010. In terms of the economic interpretation of our estimates, the peak in the early 1930s and the drastic decline that followed was related to the stock market crash of 1929 and to the Great Depression. The expansion/contraction phase in the first half of the 1970s seemed to be linked to the end of the Bretton Woods system and to the 1974-1975 global recession (that followed the 1973 first oil shock). The 2008 peak referred to the credit expansion phase which lasted until the eve of the global financial crisis. However, even if credit growth was sustained until 2008, it should be stressed that no major bank failures occurred in Italy after that crisis (nor

[18] A similar graph with further diagnostic checking for the "LLT(S)+Stoch. Cycle" model is available from the authors upon request.

[19] Please note that also Ciccarelli and Fenoaltea (2007) propose both the Baxter and King (1999) filter and structural time series models to identify the Italian business cycle over the period 1861-1913. They apply these two techniques to the new estimates of Italy's GDP presented by Fenoaltea (2005).

after the explosion of the sovereign debt crisis in 2011).

5 The credit-to-GDP ratio gap and the occurrence of banking crises

As claimed by Drehmann, Borio and Tsatsaronis (2012), a crucial issue for financial stability is the relationship between the phases of the financial cycle - i.e., credit expansion - and the occurrence of banking crises. In the same spirit, Jordà, Schularick and Taylor (2011a) argue that credit growth generates the best predictive signals of financial instability. If such a relationship does exist, then the statistical features of the financial cycle should be carefully monitored in order to prevent vulnerabilities and to identify potential risks for the financial system as a whole.[20]

In what follows, focusing on our estimates of the Italian financial cycle, we examine whether there is any systematic evidence of a relationship between credit expansion and banking crises over the last 150 years. For a historical dating of the most important Italian banking crises in Italy we rely on Reinhart and Rogoff (2009). These authors list twelve episodes of banking crises which have occurred in Italy since 1800: 1866, 1868, 1887, 1891, 1893, 1907, 1914, 1921-1922, 1930-1931, 1935, 1990-1995 and 2008. These episodes are indicated by grey shaded areas in Figure 6.

Other banking crisis databases are available in the literature. Notably, Laeven and Valencia (2008) propose a dataset which describes 42 systemic banking crises from 37 countries and also includes detailed information about the type of policy responses employed by governments to resolve them. Yet, the Laeven and Valencia dataset covers only the period 1970-2007, and hence does not fully fit to our purposes. Therefore, we accept the chronology of Reinhart and Rogoff even if we are aware of the fact that some crises - as we will see - are closely linked. This is the case of the 1866-1868, 1887-1893, and 1930-1935 episodes.[21]

In the sequel we will summarise the main elements of the banking crises in Italy. We do not aim at providing a full account of the crises: in fact, our goal is mainly to examine the link

[20] In this article the emphasis is on the credit-to-GDP ratio, but we acknowledge that other variables have been suggested as early warning indicators of future financial instability. Notable examples include total bank assets and measures of real estate and equity price appreciation, such as the percentage change in real estate prices and the stock market growth. For an analysis on the effectiveness of macroprudential instruments and on their implementation useful references are Borio and Drehmann (2009), Rose and Spiegel (2009), Lim et al. (2011) and Panetta (2013).

[21] Toniolo (1995), Carriero, Ciocca and Marcucci (2003), De Bonis (2008) and Gigliobianco and Giordano (2012) provide contributions on the most important crises that the Italian banking system has witnessed since 1861 and on connected regulatory changes.

between the occurrence of banking failures and deviation of credit-to-GDP from trend.

After Italy reached political unification, the first crisis episode was in 1866-1868. The economic situation became difficult and prices declined on a global scale. Many banks failed in Western countries and the Italian banking system was also hit, with a suspension of convertibility declared by law in 1866 to avoid a wider collapse (Luzzatto, 1968). It appears that credit growth was not strong around those years.

Afterwards the Italian economy registered an expansionary phase, characterised by a house bubble and rapid credit growth. Convertibility was reintroduced in 1883. Another period of banking instability started in 1887, when the economy faced a serious recession. A massive outflow of capitals led to the weakening of the Italian lira and caused financial distress. Suspension of convertibility was again declared.

The peak of the financial cycle in 1887 is clearly visible in Figure 6. This peak occurred slightly prior to the severe banking crisis that, in the early 1890s, hit Italy when prices in the real estate market fell, causing a deterioration of banks' balance sheets. This helps the interpretation of the 1891 and 1893 crises. In 1893, the Banca Romana corruption scandal led to the liquidation of this bank of issue and to the fall of Giolitti's government. The crisis was resolved in 1893 with the creation of the Bank of Italy, that became the leading bank of issue. Soon after, the Società generale di credito mobiliare italiano – an important intermediary which was very active in placing public debt securities and in long-term financing – accumulated large amounts of bad loans and went out of business (as underlined by Gigliobianco and Giordano, 2012, one may refer to a single banking crisis over the period 1887-1893).

In 1907, the Società bancaria italiana – the third largest Italian bank at that time – was hit by the harsh international financial crisis that struck the United States and then spread to European countries. The company was bailed out by a banking consortium led by the Bank of Italy and other banks. After a few years, the Società bancaria italiana was absorbed by the Banca italiana di sconto. It should be noticed that Figure 6 shows that the 1907 crisis was preceded by a phase of credit expansion from 1900 to 1905.

The 1907 crisis was followed by the outbreak of World War I and the worsening of the international political situation. Even though Italy did not immediately enter into the conflict, its economic consequences were severe. The banking system was also involved. In order to avoid a bank run, a moratorium on bank deposits was in force from 1914 until 1915. In 1914 both deposits and loans declined, after twenty years of continuous growth (see Table 1). Furthermore, the Bank of Italy suspended the gold convertibility of the lira (Toniolo, 2003). Notably, the Banco di Roma suffered considerable losses in 1914 and "was compelled to devalue the share capital" (Pohl and Freitag, 1994, p. 631). Figure 6 aptly reflect these events, showing a cycle peak in 1910.

In 1921, one of the largest Italian banks at that time – Banca italiana di sconto – collapsed

owing to its exposure to the company Ansaldo, which controlled its property.[22] The failure of the Banca italiana di sconto was followed, in 1922, by the new Banco di Roma crisis, which was resolved by government intervention.

Like most industrial countries, Italy was hit by the Great Depression in 1929 and underwent a period of severe and prolonged decline in income. GDP turned down severely, as did industry,[23] firm's profits declined and bad loans increased rapidly. There were repeated bank failures from the end of the 1920s.[24] A peak in the cycle is clearly visible between 1932 and 1935, depending on the chosen structural decomposition (see Figure 6). It should be noticed that the persistent deflation in the 1930s contributed to the steady increase in the credit-to-GDP ratio.

In 1936 a comprehensive Banking Act was enacted, aiming to enlarge the supervisory powers of the Bank of Italy and to ensure banking stability also through limits to competition (see Toniolo, 1995). The law featured severe regulation of entry, limitations in the geographical span of bank lending and separation of short from long-term lending.

From 1936 to the 1980s banking regulation remained almost unchanged, and mostly succeeded in supporting economic development through an efficient sectoral credit allocation.[25] A lending boom was clearly visible in the early 1970s; as anticipated in Section 3, in 1973 credit ceilings were introduced to steer monetary policy and as a result a phase of credit contraction began. Remarkably, as can be seen in Figure 6, no major crisis episodes occurred until the end of the 1980s.[26]

Between the end of the 1980s and the first 1990s credit strongly accelerated. Notably, and according to our estimates, a cycle peak occurred between 1992 and 1993. The main South-

[22] Sraffa (1922) wrote that the failure of the Banca italiana di sconto was the result of the close relationship between mixed banks and firms; firms became increasingly dependent on banks, by taking control of them in order to secure funding. This led to the formation of large groups of industrial companies dependent on one or a few banks, mutual exchanges of common shares and the appointment of directors (the so called "interlocking directorate").

[23] For up-to-date comparisons with the other main European countries, see Felice and Carreras (2012), pp. 448–449.

[24] The three largest private banks – Banca Commerciale Italiana (COMIT), Credito Italiano (CREDIT) and Banco di Roma – experienced a deep crisis and the state intervened by establishing, in 1933, the "Istituto per la Ricostruzione Industriale" (IRI), a public holding company which aimed to provide a stimulus to the economy and to take control of the troubled banks. Consequently, COMIT, CREDIT and Banco di Roma were nationalised and became the largest state-owned banks.

[25] Battilossi, Gigliobianco and Marinelli (2013) provide evidence of allocative efficiency only up to the early Seventies, and later on, in the Nineties, when financial liberalisation is thought of as having promoted once again the efficiency of the banking system.

[26] A notable exception is the "Banco Ambrosiano scandal", erupted in 1982, which was essentially a fraudulent-bankruptcy case. Also some special credit institutions were affected by capital adequacy and profitability problems that led to state recapitalisations, without resulting in major crises.

ern banks – all owned by the general government and already affected by allocative and cost inefficiencies – were hit by the 1992 crisis when Italy was forced to leave the European Monetary System. The consequences were very severe, especially because of the strong recession of 1992-1993. The crisis of the Southern banks was solved by favouring mergers, acquisitions and privatisations.

In Italy the second half of the 1990s and the first years of the new Millennium did not register major banking crises. In contrast the situation changed drastically since 2007, when most of the OECD countries were hit by the global economic and financial crisis that erupted in 2008 with the failure of Lehman Brothers. Figure 6 shows that the 2007-2008 crisis was clearly preceded by a credit expansion. Yet, in Italy the global financial instability did not have disruptive consequences on the banking system. Also after the outbreak of the sovereign debt crisis in 2011 the government support to troubled banks was very limited.

In a nutshell, figure 6 shows that in 8 out of the 12 crises episodes selected by Reinhart and Rogoff there was indeed a preceding and/or a contemporaneous acceleration in the credit-to-GDP gap. This is the case of the crises of 1887, 1891, 1893, 1907, 1914, 1930-1931, 1935, and 1990-1995. However, we must underline that in some cases – for instance in 1866, 1868 and 1921-1922 – banking crises took place without being preceded by an acceleration of credit. Most importantly, the strong growth of loans in the first 1970s was not followed by banking instability. On the other hand, the 2008 episode – selected by Reinhart and Rogoff for most Western countries after the failure of Lehman Brothers – was preceded by an acceleration of credit, even if in Italy liquidity and funding problems were the main explanation for bank troubles.

In order to further examine the link between financial cycle and banking crises, we complement the previous historical *excursus* with some econometric modelling: in particular, we estimate a binary choice model in which the dependent variable "crisis" is regressed on a constant and on contemporaneous and lagged values of the cyclical component extracted by fitting the "LLT+AR(2)" model. As already anticipated the extracted cyclical component provides us with an estimate of the credit-to-GDP gap. The binary dependent variable is equivalent to 1 in the event of crisis and 0 otherwise.

The Logit and Probit models are estimated in Eviews by maximum likelihood (by using the quadratic hill-climbing algorithm). The signs of the coefficients are identical across the two different specifications. Moreover, unsurprisingly, the estimate of the marginal effect obtained from the Logit model is roughly $\pi/\sqrt{3}$ larger than that obtained from the Probit model (see, for instance, Verbeek, 2008). Thus, only the Logit estimation output is presented in Table 7 (results based on the Probit specification are available from the authors upon request).

The intercept and the explanatory variable are highly significant. The credit-to-GDP gap has a positive effect on the probability of banking crisis. Several estimations have been con-

ducted by considering contemporaneous values of the credit-to-GDP gap and up to two lags of the same variable. The highest log likelihood and pseudo R-squared values are obtained with a specification which includes the intercept and the credit-to-GDP gap lagged once. The estimate of the financial cycle coefficient is positive and equal to 0.5; straightforward calculations show that an estimate of the corresponding marginal effect, evaluated at the sample mean of the explanatory variable, is roughly equal to 0.05: thus, over the time span 1861-2011, when the credit-to-GDP gap increases by one unit at time t-1, the probability of a banking crisis at time t increases of around 5 per cent. Therefore, as argued by Borio (2012) studying a set of advanced economies, the credit-to-GDP might be used as an indicator of incumbent crises also for Italy, in conjunction with a broader range of macroeconomic and financial variables.

Figure 7 shows the actual and fitted values of the dependent variable from the estimated Logit specification.

Also visual inspection of Figure 7 confirms that an acceleration of credit preceded a banking crisis in 8 out of the 12 episodes listed by Reinhart and Rogoff (2009). However, as already discussed, there were also a few cases – notably in the 1970s – in which the growth of the credit-to-GDP ratio was not followed by a banking crisis.

In summary, our key finding is that the Italian financial cycle has a lower frequency than traditional business cycles. Over the last 150 years, most episodes of banking crises seem to have been associated with (or preceded by) rapid credit expansion.

6 Conclusions

In this paper we have investigated the main stylised features of the Italian financial cycle. We have presented and analysed a new historical dataset which gathers the main items of banks' balance sheets since the unification of Italy in 1861. It is probably true that Italy is paid scant attention in the international quantitative literature (see Fratianni, Muscatelli, Spinelli and Trecroci, 2012); we hope that our new statistics will be of use in studying long-term trends in the Italian financial system. We reached three key findings.

1. While until the mid-1970s there was a close correlation between loans and deposits (both expressed as a ratio to GDP), over the last 20 years loans have increased in relation to deposits. Since the 1990s, banks have covered this "funding gap" mainly by issuing new debt securities.

2. The Italian financial cycle – extracted by means of a structural trend-cycle decomposition of the credit-to-GDP ratio – has a much longer duration than traditional business cycles. Italy shares this feature with the US and other European countries.

3. Episodes of financial distress mainly reflect previous long-term credit developments. In fact, an acceleration of credit preceded a banking crisis in 8 out of the 12 episodes listed by Reinhart and Rogoff (2009). Consistently, a simple Logit regression shows a positive association between the probability of a banking crisis and a previous acceleration of the credit-to-GDP gap. Thus, we argue that the credit-to-GDP gap may help in evaluating the likelihood of future financial crises. However, there were also periods – such as the early 1970s – in which the growth of the credit-to-GDP ratio was not followed by a banking crisis. Moreover, some crises cannot be attributed to an extraordinary preceding increase in loans.

It is worth noting that in this paper we have identified the financial cycle by focusing only on the credit-to-GDP ratio. A desirable extension of this work would be examining a broader range of variables: for instance, residential property prices, equity prices, or macro-financial indicators such as the loan-to-value ratio. Yet, given our interest on long-term cycles, some care should be taken because some of these time series might be too short (due to data availability constraints) to permit meaningful trend-cycle extraction.

The time series presented here lay the foundation for further steps in many other directions. It will be interesting to study the degree of stability of the relationship between deposits and loans and the long-term relationship between money, credit and GDP. Another important policy issue which deserves to be investigated is the link between house price bubbles and banking crises. All this is to be explored in future research.

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Table 1: Banks' balance sheet: main assets and liabilities 1861-2011

YEARS	ASSETS						LIABILITIES			*Memorandum item: from banks of issue balance sheet 1861-1936*	
	Total Credit	Loans		Securities other than shares	Shares and other equity	Fixed assets	Deposits	Debt securities issued	Capital and reserves		
		of which: short-term	of which: long-term							Loans	Deposits
1861	79	55	24	5	8	2	67	3	14	*91*	*24*
1862	90	60	30	8	10	2	77	5	17	*127*	*36*
1863	100	68	32	10	13	2	90	6	19	*103*	*39*
1864	116	69	47	13	16	3	108	8	23	*135*	*38*
1865	132	77	54	17	18	3	124	10	27	*152*	*51*
1866	148	92	55	23	23	3	142	10	30	*295*	*71*
1867	169	113	55	28	31	4	165	12	35	*364*	*37*
1868	184	130	55	36	36	4	191	14	41	*404*	*31*
1869	200	145	55	41	44	4	217	15	46	*423*	*45*
1870	228	159	70	30	52	5	250	20	54	*550*	*121*
1871	295	216	79	39	73	5	319	29	70	*633*	*104*
1872	459	365	95	62	121	7	440	53	99	*746*	*109*
1873	444	330	114	79	135	8	405	65	94	*790*	*100*
1874	472	344	128	73	120	10	438	74	102	*350*	*107*
1875	509	372	138	86	119	12	494	81	115	*378*	*116*
1876	521	368	153	91	130	14	518	89	121	*396*	*136*
1877	602	410	192	104	111	16	583	94	136	*420*	*150*
1878	618	413	205	123	113	18	614	106	144	*441*	*165*
1879	669	444	225	121	116	19	651	124	155	*468*	*153*
1880	684	439	245	149	121	21	681	137	164	*402*	*178*
1881	735	462	273	159	133	23	721	160	176	*487*	*317*
1882	782	485	296	190	127	26	739	183	184	*373*	*175*
1883	823	525	298	210	133	28	816	187	200	*315*	*136*
1884	884	554	330	256	136	31	889	211	220	*347*	*136*
1885	996	610	386	258	154	35	974	230	241	*480*	*179*
1886	1,208	761	447	295	162	38	1,124	251	275	*534*	*200*
1887	1,300	766	533	297	195	42	1,167	297	293	*612*	*248*
1888	1,360	756	604	310	200	46	1,192	347	308	*629*	*261*
1889	1,430	759	671	352	175	51	1,190	406	319	*684*	*305*
1890	1,390	667	723	351	150	57	1,151	413	356	*681*	*333*
1891	1,262	552	709	422	121	63	1,071	443	373	*708*	*356*
1892	1,276	577	699	466	103	64	1,121	436	361	*684*	*348*
1893	1,214	525	689	492	83	62	1,129	426	320	*729*	*324*
1894	1,168	488	680	506	51	61	1,104	415	325	*653*	*307*
1895	1,188	516	672	539	46	60	1,164	405	307	*679*	*331*
1896	1,196	547	649	574	44	60	1,163	374	312	*631*	*308*
1897	1,192	553	639	583	41	57	1,201	365	303	*572*	*304*
1898	1,176	555	621	629	37	55	1,256	362	313	*579*	*313*
1899	1,235	636	598	671	45	41	1,371	362	380	*526*	*196*
1900	1,283	695	588	669	45	39	1,408	353	398	*525*	*213*
1901	1,371	777	594	678	47	40	1,491	348	416	*501*	*226*
1902	1,432	834	598	692	49	40	1,541	343	427	*468*	*219*
1903	1,572	974	598	709	47	41	1,688	335	446	*438*	*267*
1904	1,702	1,096	606	741	56	41	1,831	330	468	*430*	*274*
1905	1,924	1,298	626	816	66	44	2,030	324	559	*490*	*320*
1906	2,119	1,464	656	799	100	44	2,180	321	601	*493*	*305*
1907	2,192	1,517	676	803	114	46	2,305	324	613	*572*	*308*
1908	2,420	1,699	721	833	126	52	2,546	336	647	*479*	*179*
1909	2,670	1,884	786	862	128	54	2,794	347	663	*529*	*201*
1910	2,919	2,069	850	881	136	60	2,956	362	701	*616*	*235*

(continued)

Note: end-of-period stocks in thousands of euros; from 1974 onwards end-of-period stocks in millions of euros.

Table 1: Banks' balance sheet: main assets and liabilities 1861-2011 (continued)

YEARS	ASSETS						LIABILITIES			*Memorandum item: from banks of issue balance sheet 1861-1936*	
	Total Credit	Loans		Securities other than shares	Shares and other equity	Fixed assets	Deposits	Debt securities issued	Capital and reserves		
		of which: short-term	of which: long-term							Loans	Deposits
1911	3,156	2,248	908	910	165	63	3,240	384	747	*684*	*222*
1912	3,330	2,355	975	914	169	67	3,349	400	788	*659*	*221*
1913	3,492	2,479	1,013	932	149	73	3,507	418	799	*633*	*254*
1914	3,205	2,174	1,031	985	132	88	3,326	424	833	*1,166*	*407*
1915	3,228	2,171	1,056	1,108	130	88	3,591	429	805	*1,850*	*577*
1916	3,830	2,766	1,064	1,778	126	90	4,731	436	793	*2,142*	*460*
1917	4,734	3,663	1,071	2,517	129	89	6,288	431	843	*4,128*	*682*
1918	6,269	5,180	1,089	3,577	212	96	8,851	438	1,053	*5,536*	*979*
1919	9,782	8,563	1,219	4,872	322	110	12,986	463	1,423	*8,759*	*1,601*
1920	14,253	12,675	1,578	4,258	594	142	16,645	502	1,755	*10,933*	*1,671*
1921	15,392	13,498	1,894	5,776	712	194	19,292	621	2,202	*11,526*	*2,053*
1922	15,997	13,746	2,251	6,278	642	254	19,908	744	2,568	*10,284*	*1,521*
1923	16,702	14,129	2,573	6,426	804	228	21,251	895	2,608	*10,892*	*2,171*
1924	20,649	17,399	3,250	6,920	876	247	24,812	1,260	3,084	*10,972*	*1,522*
1925	23,130	19,182	3,948	6,461	1,085	303	26,136	1,528	3,869	*11,748*	*1,998*
1926	26,461	21,791	4,670	6,169	1,152	381	29,009	1,611	4,991	*8,270*	*1,365*
1927	28,113	22,725	5,388	6,161	1,248	449	31,025	1,989	5,186	*6,801*	*2,203*
1928	30,763	24,618	6,145	6,078	1,415	507	32,829	2,527	5,261	*4,264*	*1,804*
1929	31,057	23,818	7,239	6,057	1,414	564	32,673	2,835	5,436	*4,447*	*1,847*
1930	30,811	22,874	7,937	6,662	1,301	574	32,676	3,397	5,316	*4,503*	*2,123*
1931	28,748	19,969	8,779	7,268	1,131	595	30,874	3,824	5,254	*4,911*	*2,201*
1932	28,677	18,618	10,059	8,479	1,132	641	30,472	4,384	5,258	*5,064*	*2,566*
1933	29,885	18,130	11,754	11,507	1,131	634	30,387	6,653	5,328	*3,436*	*1,775*
1934	29,172	17,110	12,062	11,204	905	655	29,266	6,391	4,868	*4,278*	*1,929*
1935	27,871	16,092	11,779	10,901	735	723	27,399	6,282	4,697	*6,566*	*581*
1936	29,814	17,587	12,227	11,253	848	786	31,274	6,189	4,973	*7,369*	*1,472*
1937	31,572	18,250	13,322	10,359	656	795	28,405	6,714	5,559		
1938	32,540	20,952	11,588	10,671	805	808	29,955	7,432	5,390		
1939	36,084	23,469	12,615	11,308	745	779	31,675	7,757	5,500		
1940	40,674	27,666	13,008	13,838	758	795	37,676	7,762	5,830		
1941	50,831	37,562	13,268	20,461	1,208	773	48,613	8,121	6,213		
1942	64,847	50,991	13,857	28,415	1,209	620	61,346	9,209	6,642		
1943	69,489	56,041	13,448	35,750	1,388	797	74,496	9,416	6,923		
1944	73,840	60,959	12,880	49,208	1,239	791	128,718	9,444	7,260		
1945	124,168	108,459	15,709	75,001	1,241	859	213,157	11,468	7,945		
1946	264,509	238,048	26,461	117,324	2,068	1,244	366,031	18,565	10,534		
1947	509,008	454,187	54,821	144,071	2,904	2,047	531,797	25,857	13,495		
1948	652,945	522,602	130,343	238,238	4,464	3,077	854,682	61,066	20,653		
1949	866,177	676,144	190,033	254,363	7,697	4,583	1,069,876	86,486	29,058		
1950	1,107,342	796,584	310,759	324,931	10,474	6,063	1,224,020	129,113	39,724		
1951	1,336,029	946,193	389,836	380,253	11,603	6,860	1,461,514	155,624	48,185		
1952	1,646,874	1,149,434	497,439	454,152	15,299	8,108	1,798,578	228,115	58,089		
1953	1,990,736	1,381,970	608,766	533,834	19,699	15,737	2,102,009	307,277	76,092		
1954	2,284,359	1,570,510	713,848	585,122	27,029	19,600	2,393,446	377,858	95,641		
1955	2,708,774	1,815,546	893,228	658,731	27,454	21,509	2,749,338	501,660	114,281		
1956	3,119,363	2,088,295	1,031,068	745,965	27,752	22,807	3,101,714	577,394	134,311		
1957	3,440,994	2,261,117	1,179,877	814,370	33,394	28,026	3,465,427	655,973	165,527		
1958	3,707,640	2,345,789	1,361,851	1,050,478	45,362	32,090	4,012,390	775,895	197,076		
1959	4,300,694	2,684,280	1,616,414	1,314,441	72,371	35,985	4,678,759	946,951	255,126		
1960	5,248,796	3,309,779	1,939,017	1,542,560	87,728	43,401	5,386,103	1,189,980	313,868		

(continued)

Note: end-of-period stocks in thousands of euros; from 1974 onwards end-of-period stocks in millions of euros.

Table 1: Banks' balance sheet: main assets and liabilities 1861-2011 (continued)

YEARS	ASSETS						LIABILITIES		
	Total Credit	Loans		Securities other than shares	Shares and other equity	Fixed assets	Deposits	Debt securities issued	Capital and reserves
		of which: short-term	of which: long-term						
1961	6,271,986	3,870,086	2,401,901	1,735,649	109,834	49,964	6,321,586	1,543,703	359,151
1962	7,853,232	4,829,506	3,023,726	1,984,203	130,925	58,004	7,504,429	2,029,686	428,945
1963	9,399,518	5,768,046	3,631,472	2,154,972	117,535	68,798	8,467,953	2,543,839	479,530
1964	10,109,190	5,851,263	4,257,927	2,366,249	113,051	78,068	9,196,598	3,043,040	536,410
1965	11,147,526	6,060,079	5,087,448	2,909,925	136,061	89,851	10,822,099	3,678,213	581,595
1966	13,152,718	8,395,530	4,757,188	3,735,743	176,654	111,612	12,464,274	3,426,692	724,129
1967	15,305,346	9,719,554	5,585,791	4,270,676	189,720	132,356	14,285,043	3,948,520	839,425
1968	17,199,978	10,777,992	6,421,987	5,161,319	190,392	166,101	16,158,129	4,605,814	1,021,708
1969	19,389,465	12,400,564	6,988,901	6,229,624	225,717	173,716	18,092,466	5,282,424	1,124,891
1970	22,456,760	14,149,706	8,307,054	7,516,015	246,892	179,734	20,986,588	6,126,677	1,297,814
1971	26,022,822	15,992,041	10,030,781	8,980,594	211,825	192,981	24,733,173	7,428,148	1,394,092
1972	30,671,037	19,012,074	11,658,963	11,800,839	216,679	253,572	30,378,408	8,860,593	1,585,255
1973	37,292,924	22,698,162	14,594,762	14,535,639	235,375	309,688	36,492,690	12,318,272	1,881,799
1974	43,462	24,640	18,822	17,582	411	514	43,574	13,613	2,737
1975	50,411	28,019	22,392	23,571	532	777	54,584	16,927	3,966
1976	60,140	34,508	25,632	26,194	683	1,145	66,092	19,713	4,902
1977	66,849	37,593	29,256	40,027	824	1,357	80,714	22,584	6,051
1978	75,502	41,711	33,791	51,461	1,014	1,568	100,068	25,532	7,255
1979	89,277	50,737	38,540	59,082	1,190	1,773	119,934	28,247	9,445
1980	105,635	61,004	44,631	65,468	1,584	2,098	136,264	31,492	12,134
1981	121,596	69,970	51,626	71,635	1,828	2,419	149,935	35,565	15,955
1982	136,168	76,837	59,331	93,862	2,734	2,877	182,285	39,856	19,774
1983	156,857	89,296	67,561	110,108	4,354	6,107	203,532	43,968	26,789
1984	185,521	109,084	76,437	119,179	5,551	7,131	228,950	46,251	32,330
1985	206,823	124,788	82,035	132,091	6,143	7,642	252,178	49,075	38,088
1986	227,779	139,134	88,645	139,288	7,670	8,165	275,144	52,778	45,023
1987	251,229	151,035	100,194	141,042	8,496	8,745	295,568	58,711	52,082
1988	294,801	179,374	115,427	134,905	9,613	9,223	324,905	62,615	56,233
1989	353,738	212,740	140,998	129,078	12,425	9,735	361,329	66,954	62,814
1990	412,059	243,424	168,635	127,276	13,625	10,322	401,122	70,172	70,534
1991	471,908	274,738	197,170	157,584	19,418	16,334	458,991	79,108	87,290
1992	527,225	305,722	221,503	188,199	21,596	24,588	500,618	85,942	104,735
1993	550,362	301,215	249,147	200,989	22,456	25,093	532,224	100,251	113,287
1994	559,184	289,767	269,417	221,790	25,890	25,686	532,098	111,387	121,507
1995	580,107	302,194	277,913	202,419	26,479	27,734	608,445	111,186	129,537
1996	591,905	302,511	289,394	221,872	29,653	27,938	622,428	144,718	139,053
1997	634,836	322,610	312,226	206,231	31,386	27,863	589,793	204,728	145,266
1998	678,030	341,918	336,112	219,186	45,699	27,243	577,615	251,032	160,260
1999	751,391	367,387	384,004	206,984	60,563	26,345	583,441	271,553	178,489
2000	858,951	435,839	423,112	187,346	67,439	25,802	605,134	302,481	198,849
2001	925,765	464,196	461,569	178,981	73,469	26,360	643,870	334,672	208,349
2002	980,253	465,483	514,770	164,295	80,284	23,960	696,177	367,969	223,965
2003	1,038,714	460,122	578,592	170,448	94,423	18,092	699,690	399,958	240,875
2004	1,096,213	433,968	662,245	177,068	98,517	18,841	732,066	442,994	249,691
2005	1,192,664	443,493	749,171	207,060	109,107	19,357	784,199	484,416	278,121
2006	1,322,196	484,935	837,261	219,013	125,444	22,146	846,131	544,744	299,123
2007	1,453,310	516,963	936,347	236,076	138,977	20,902	879,256	608,700	359,677
2008	1,523,276	610,639	912,637	335,697	135,184	17,500	944,933	730,576	338,278
2009	1,500,680	613,981	886,699	437,166	136,582	16,829	1,003,654	811,349	363,621
2010	1,610,583	645,745	964,838	434,753	127,072	16,577	1,095,264	800,332	367,276
2011	1,620,526	649,889	970,637	530,245	115,624	16,175	1,026,202	906,043	408,309

Note: end-of-period stocks in thousands of euros; from 1974 onwards end-of-period stocks in millions of euros.

Table 2: Diagnostic checking for alternative model specifications

Summary statistics	LLT	LLT(S)	LLT(S)+Stoch. Cycle	LLT+AR(2)	LLT(S)+AR(2)
Standard Error	1.9281	1.9675	1.8998	1.8642	1.9024
Normality	4.4530	4.1207	4.4049	5.0558	5.5593
Box-Ljung	9.9465	12.4430	14.1310	11.1070	11.1040
Log-likelihood	-100.1880	-103.3480	-98.0553	-95.6381	-98.4156
R_D^2	0.5691	0.5513	0.5817	0.5972	0.5805

Notes: R_D^2 is the coefficient of determination. The symbol (*) denotes rejection of the null hypothesis at the 5% significance level.

Table 3: Parameter estimates: "LLT+AR(2)"

Parameter	Estimate
Variances of disturbances:	
Level	0.72405
Slope	0.20370
AR(2)	47.6828
Irregular	0.05169
AR(2) cycle other parameters:	
AR(1) coefficient	1.54647
AR(2) coefficient	-0.59635

The estimated model is the local linear trend in (2) with stationary AR(2) cycle as in Clark (1987).

Table 4: Parameter estimates: "LLT(S)+Stoch. Cycle"

Parameter	Estimate
Variances of disturbances:	
Level	0.00000
Slope	0.34766
Cycle	2.03507
Irregular	0.00000
Cycle other parameters:	
Variance (σ_κ^2)	18.36278
Period ($2\pi/\lambda_c$)	23.56051
Frequency (λ_c)	0.26668
Damping factor (ρ)	0.94296

The estimated model is the local linear trend in (2) with $\sigma_\eta^2 = 0$ ("smooth trend") and stationary stochastic cycle as in (3) and (4).

Table 5: Estimates of intervention variables: “LLT+AR(2)”

	Coefficient	st. error	t-ratio
Outlier 1924	4.64496	1.00926	4.60236 (***)
Outlier 1942	4.20151	1.02445	4.10123 (***)
Outlier 1974	-4.10345	1.00926	-4.06582 (***)
Level break 1919	7.39076	1.66415	4.44115 (***)
Level break 1935	-7.96768	1.66905	-4.77379 (***)
Level break 1937	-7.42860	1.66904	-4.45081 (***)
Level break 1944	-11.74835	1.68921	-6.95493 (***)

The symbol (***) means statistically significant at the 1 % level.

Table 6: Estimates of intervention variables: “LLT(S)+Stoch. Cycle”

	Coefficient	st. error	t-ratio
Outlier 1924	4.52965	1.09885	4.12216 (***)
Outlier 1942	4.48387	1.10173	4.06986 (***)
Outlier 1974	-4.01196	1.09883	-3.65112 (***)
Level break 1919	7.98735	1.73377	4.60693 (***)
Level break 1935	-8.39419	1.74878	-4.80004 (***)
Level break 1937	-7.54337	1.74881	-4.31342 (***)
Level break 1944	-12.33350	1.73825	-7.09534 (***)

The symbol (***) means statistically significant at the 1 % level.

Table 7: Probability of banking crises in Italy (1861-2011): Logit model

Estimation method: ML - Binary Logit (Quadratic hill climbing)
QML (Huber/White) standard errors and covariance

	Coefficient	st. error	t-ratio
Const	-2.15402	0.273603	-7.872786 (***)
AR(2) cycle (1 lag)	0.503494	0.142362	3.536708 (***)

McFadden R-squared	0.09191	Mean dependent var.	0.126667
S.D. dependent var.	0.333713	S.E. of regression	0.323771
Akaike info criterion	0.716816	Sum squared residuals	15.51453
Schwarz criterion	0.756958	Log likelihood	-51.76122
Hannan-Quinn criterion	0.733125	Deviance	103.5224
Restr. deviance	114.0002	Restr. log likelihood	-57.0001
LR statistic	10.47776	Avg. log likelihood	-0.345075
Prob(LR statistic)	0.001208	Total obs.	150

The dependent variable is the binary dependent variable "Crisis" which takes value 1 in the event of crisis and 0 elsewhere. The banking crises dates are those reported by Reinhart and Rogoff (2009). The explanatory variable is the cyclical component extracted by fitting the "LLT+AR(2)" model (lagged once). A constant is included. The top part of the table displays the coefficient estimates, the asymptotic standard errors, the z-statistics and corresponding p-values. The symbol (***) means statistically significant at the 1 % level. The bottom part of the table provides some descriptive statistics such as the mean and standard deviation of the dependent variable, the standard error of the regression, and the sum of the squared residuals. In addition, several likelihood based statistics are presented, such as: the Akaike, Schwarz and Hannan-Quinn information criteria, the maximized value of the log likelihood function (Log likelihood), the LR statistic (which tests the joint null hypothesis that all slope coefficients except the constant are zero), the p-value of the LR test statistic (asymptotically distributed as a chi-squared variable, with degrees of freedom equal to the number of restrictions under test). The number of observations is also reported.

Figure 1: Bank loans and deposits: 1861-2011 (as a ratio to GDP)

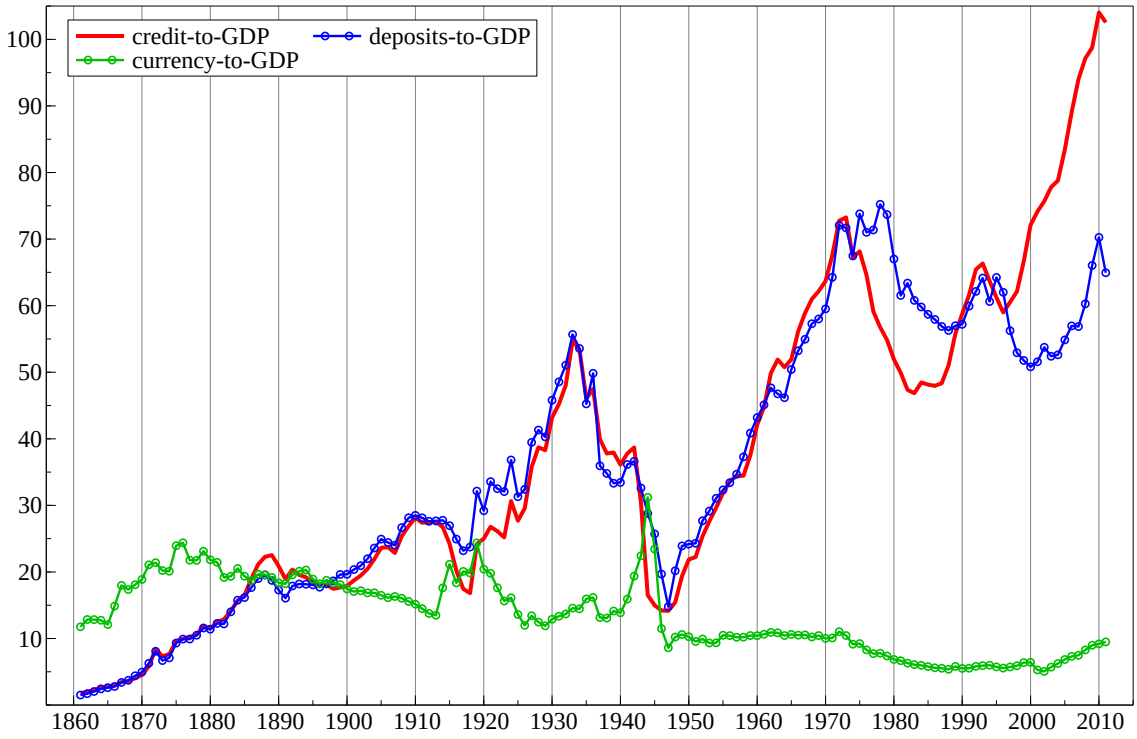


Figure 2: Loans-to-deposits ratio: 1861-2011

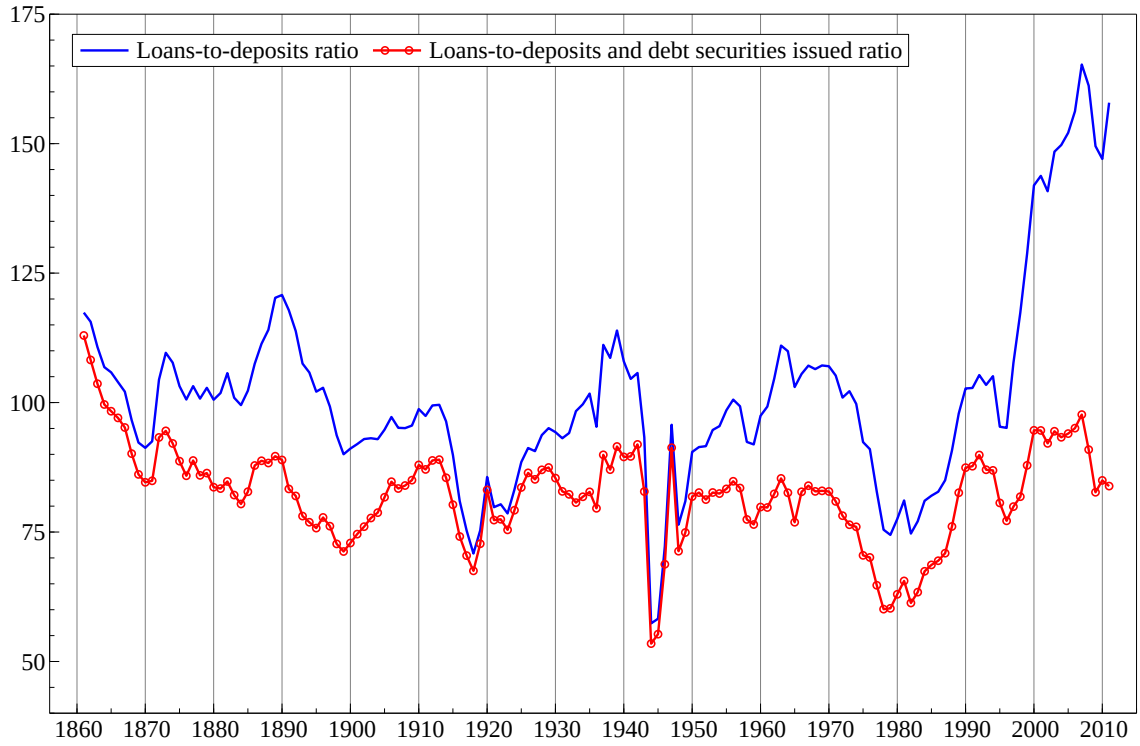
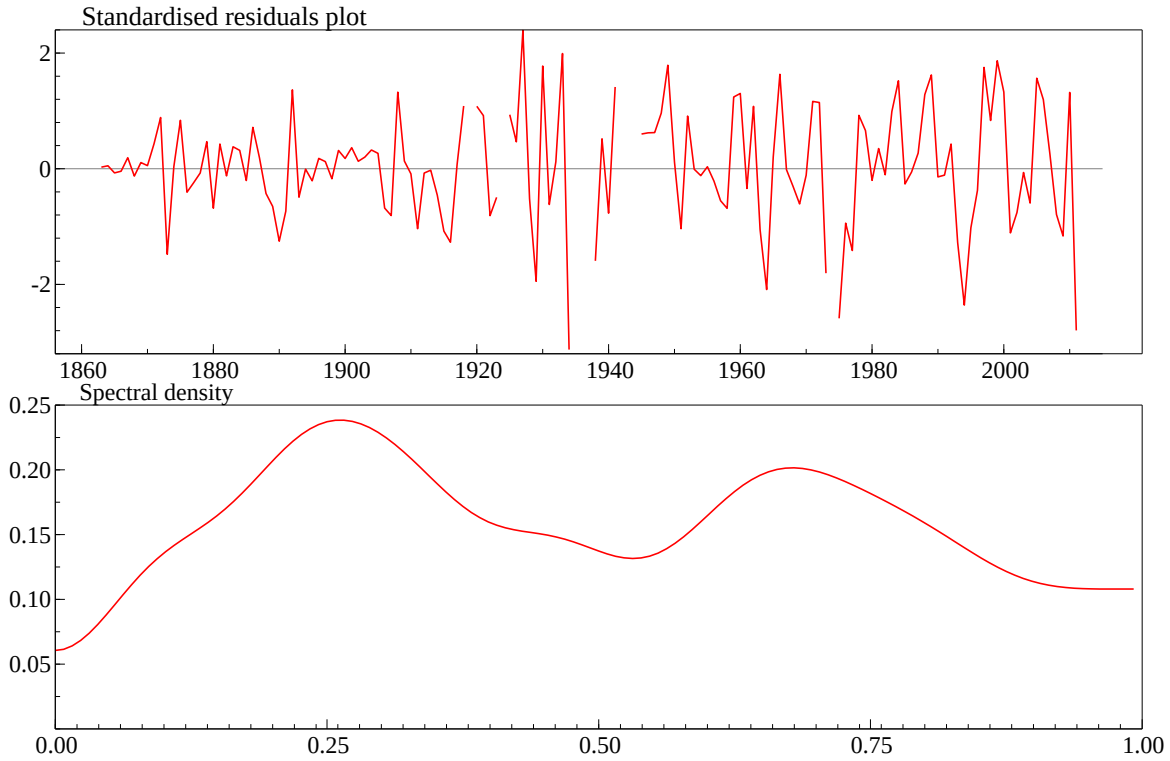
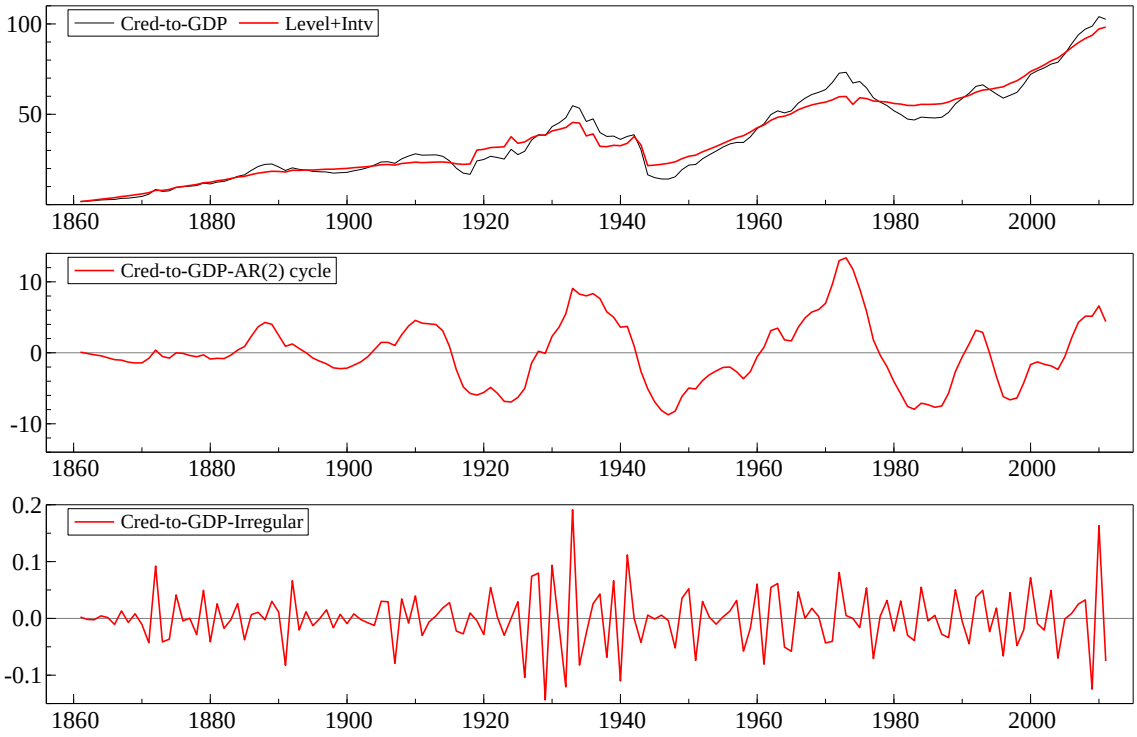


Figure 3: Standardised residuals of the “LLT” model



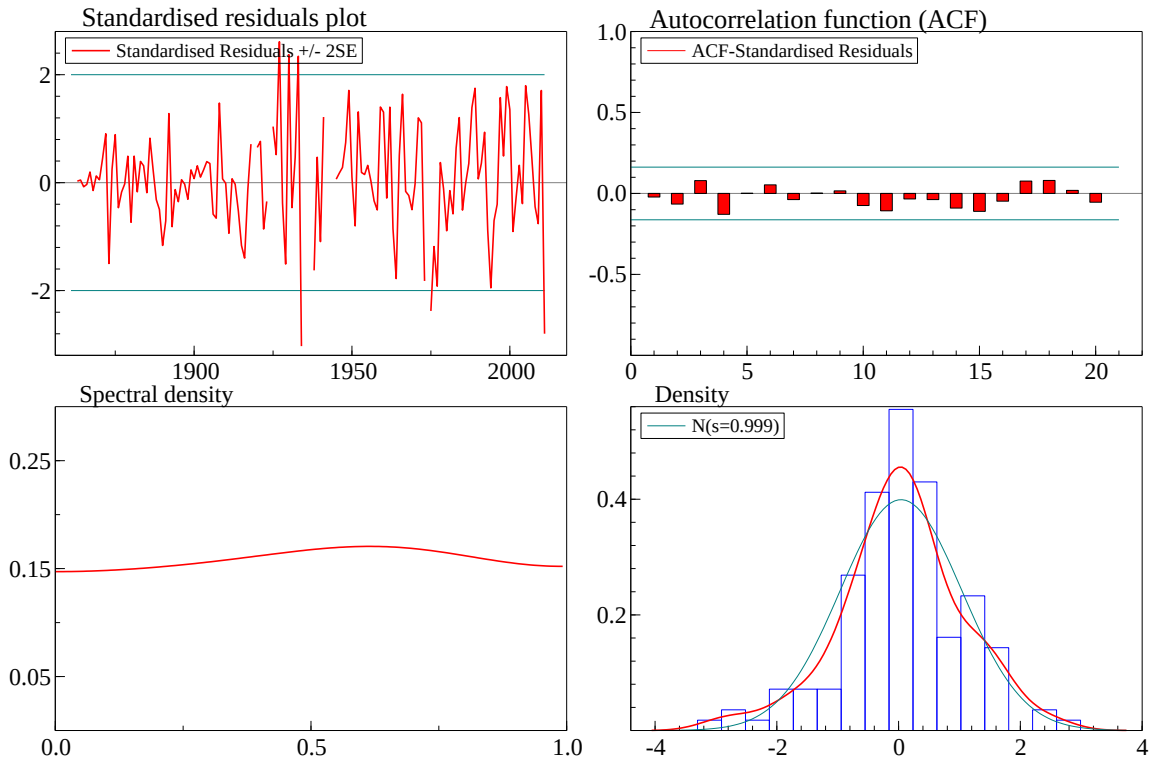
The estimated model is a “LLT” (with interventions) fitted to “credit-to-GDP”, which is defined as credit expressed as a ratio to GDP. From top to down: time series plot of standardised residuals; their spectral density.

Figure 4: Estimated smoothed level (with interventions), AR(2) cycle and irregular components for the "LLT+AR(2)" model



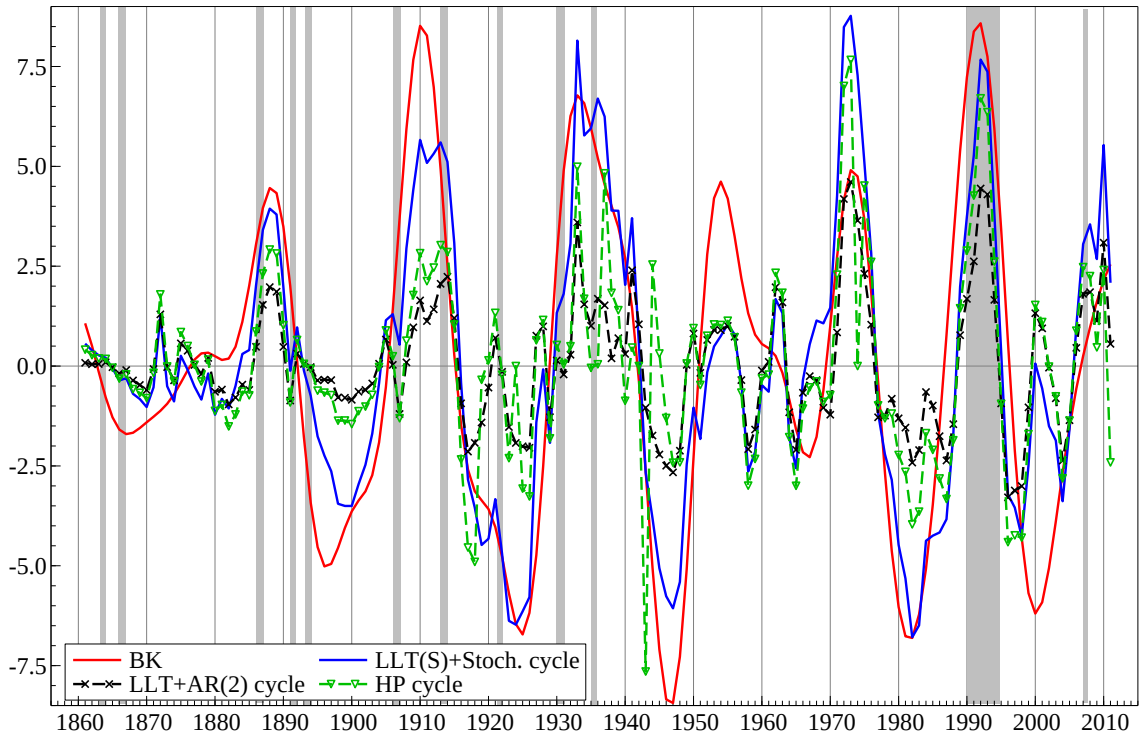
The estimated model is a "LLT+AR(2)" (with interventions) fitted to "credit-to-GDP", which is defined as credit expressed as a ratio to GDP.

Figure 5: Standardised residuals of the “LLT+AR(2)” model: diagnostic plots



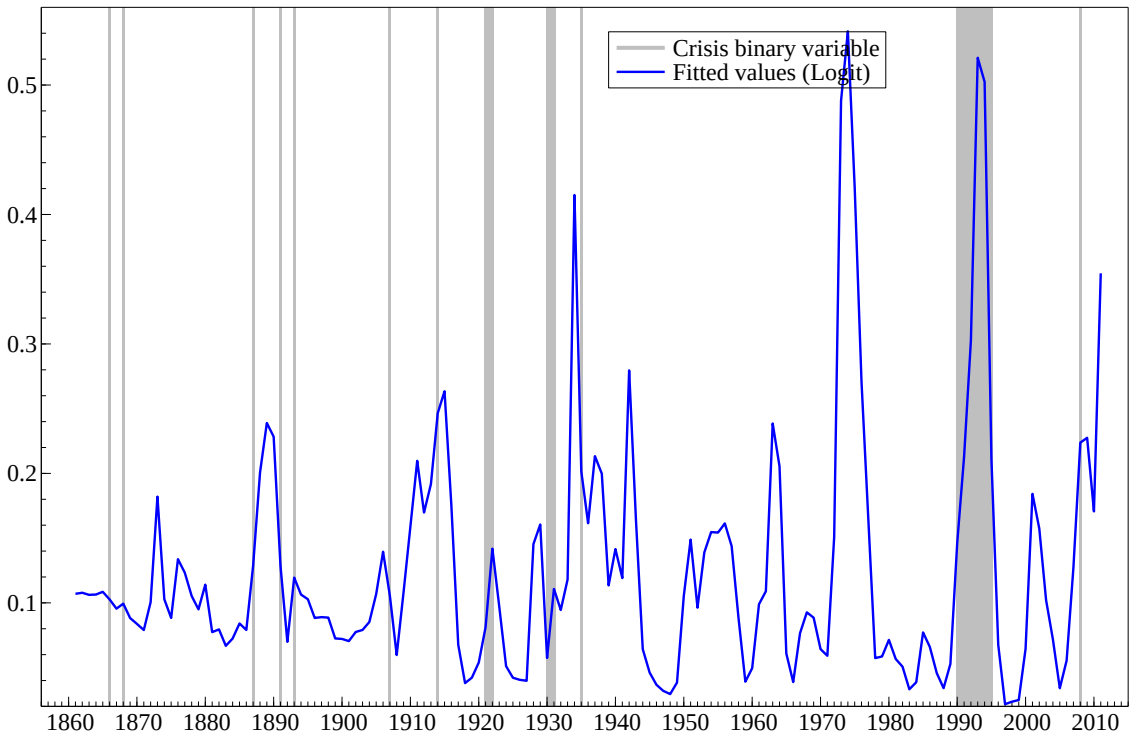
The estimated model is “LLT+AR(2)” (with interventions) fitted to “credit-to-GDP”, which is defined as credit expressed as a ratio to GDP. From left to right and top to down: time series plot with error bands; autocorrelation function; spectral density; histogram with kernel density estimate and normal density function.

Figure 6: Estimates of the financial cycle in Italy



Credit-to-GDP gap (percentage points). Grey shaded areas indicate banking crises dates as reported by Reinhart and Rogoff (2009). Sample: 1861-2011. Source: Authors' estimates.

Figure 7: Binary choice (Logit) model: actual vs fitted values



"Crisis" is a binary dependent variable which takes value 1 in the event of crisis and 0 elsewhere. The banking crises dates are those reported by Reinhart and Rogoff (2009). The fitted values are those of the Logit model.

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