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Financial crises, Business cycles, and Bankruptcies in the Very Long Run: France during the 19th Century

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Financial crises, Business cycles, and Bankruptcies in the Very Long Run: France during the 19th Century

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Abstract

This paper studies a century of fluctuations of the bankruptcy rate in France between 1820 and 1913. Focusing on the amplitude of the short-run fluctuations, it is shown that the variations of the bankruptcy rate decreased hugely during the 1870s and continued during the following decades. It is further shown that the very-high variance of the pre-1870 period cannot be explained only by outlier-type of observations and that the pattern of the series of fluctuations differs substantially from the fluctuations of other economic variables such as the GDP, the index of industrial production or wheat price. It appears very unlikely that those results were driven by changes in the demography of firms. Therefore the massive decrease of the variance of the bankruptcy rate is linked to the changes of the policies implemented by the central bank. The review of the massive changes of monetary policies shows that they are coherent with a decreasing variance.

Although our knowledge of the main evolution of the business fluctuations is now fairly well known for the post-1870 period, we still know very little about the earlier period of the 19th century, especially in the case of France.[2] Yet the 19th century was one of the most striving fields of experimentation for various types of economic policies and France may especially be interesting on this dimension as it was characterized by a rather stable legal framework (set up during the first decade of the 19th century) and by a relative political stability. This paper studies the short-term fluctuations of the bankruptcy rate in France for the 1820-1913 period and compares it with the evolution of other indicators of business fluctuations. This complements usefully the national accounts compiled Toutain

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Address for correspondence: Graduate Institute. Département HPI, Voie Creuse. Case postale 136. 1211 Genève 21. Switzerland. E-mail: vincent.bignon@graduateinstitute.ch
[2] Among the major studies of the post 1870 period are A'Hearn and Woitek (2001) and Bordo and Haubrich, (2009). Sarferaz and Uebele (2009) is one exception as they use disaggregated series to extract the common component during the 1820-1913 period in Germany.

(1987) and Levy-Leboyer and Bourghuignon (1985) that are ex-post reconstruction that are not without drawbacks when they are used to gauge business fluctuations.[3] It is shown that the variance of the fluctuations of the bankruptcy rate decreases during the course of the century, a feature that made the evolution of this series unique when compared with the other indicators.

In terms of data, the main contribution of this paper is to compute a yearly bankruptcy rate for the French economy between 1820 and 1913.[4] An entirely new data series, based on contemporary numbers, is compiled for one of the biggest European economies. National bankruptcy figures were published yearly by the French justice ministry and historians gave credit to the statisticians of the ministry for the reliability of their compilation of local numbers.[5] It proved much harder to compile a series of the numbers of independent firms operating in France. This paper makes use of a fiscal source to collect the primary numbers and homogenize them by correcting for the various changes. Combining those series shows that the bankruptcy rate increased from about 0.15% in 1820 to about 0.6% in 1890 and then fluctuated around this level. Because the focus is made on the evolution of the short-term component, various standard filtering methods are used to remove the secular trend and to characterize the short-run pattern of the firms' failure rate. The high variance of the series and the regular occurrence of peaks lead to assess whether the local maxima coincide with the occurrence of f the financial crisis.

Two main results are shown. First, the variance of the short-term component of the bankruptcy rate is declining after 1870. Before the 1860s, any financial turmoil drove the business failures rates to hits. But their impact was much lower after. This finding is coherent with those of Limousin (1900) who found no specific relationship between the bankruptcy rate and the years of financial crises of the 1872-1896 period.[6] Yet when the pre-1870 figures are brought in the picture, the dramatic changes that occurred point either to huge changes of the pattern of firms' demography or suggest that another factor must have played a role. After having ruled the former possibility, it is argued that such an alternative explanation likely relies on the changes of the stance of the monetary policy conducted by the central bank. More precisely it is likely that the central bank learned – in the later part of the century – how to better manage the liquidity needs of the economy during each crisis, so that the variations of the bankruptcy rate smoother than before.

[3] In the case of France, both the national account series of Toutain (1997) and Levy-Leboyer and Bourguignon were criticized (see Asselain, 2006 for an assessment of the qualities of both series).

[4] To my knowledge, Loua (1877) and Limousin (1900) are the first to compute bankrupcty rate. But the scope of their series only spanned during 30 years, between 1844 and 1873 for the former paper and between 1877 and 1896 for the later.

[5] They have already been used in Marco (1985, 1989), Jobert and Chevailler (1986) and Hautcoeur and Levratto (2009).

[6] This finding was supplemented by the fact that no relation can be found for this same period between the loss incurred because of bankruptcies and the crisis' year.

The paper is organized as follows. Section 1 reviews the sources and explains the method used to compute the data series. Section 2 compute the fluctuations of the bankruptcy rate and compared their fluctuations to the evolution of real variables or price series. Section 3 uses a number of indicators to identify financial and monetary crisis. Section 4 reviews some possible explanations. Section 5 concludes.

1. Data and Sources

Computing an annual bankruptcy rate entailed constructing series of both the number of bankruptcy opened each year and the number of firms that may go bankrupt during this year.

1.1. Business failures and bankruptcies

It proved quite easy to learn the number of bankrupted firms each year, thanks to the publication of an annual periodical by the ministry of justice since 1840 onwards. The number for the period between 1820 and 1839 were published in Marco (1985) and Levy-Leboyer and Bourguignon (1985). Few corrections were done to use those data since the definition of the scope of business units that may potentially go bankrupt did not change during the 19th century, nor did the definition of the bankruptcy, i.e. the fact that the manager of this unit is not able to meet its payment obligations. Yet some innovations introduced in the course of the century need to make some assumptions. The most notable change was the 1889 law that introduced a new process through which dispute over the payment of debt could be settled, the *liquidation judiciaire*.[7] This new procedure was said to have been motivated by the intention to lower the failed debtor's shame and social stigma associated with filing for bankruptcy. Therefore a strict reading of the letter of the law would have lead to exclude this procedure from the actual number of bankruptcies. But following the letter of the law would have also created a spurious decrease of the bankruptcy rate, as a huge substitution occurred between the traditional bankruptcy procedures and the new one. Hence, following all previous scholars, the bankruptcy numbers included for the 1889-1913 period both the number of *faillites* and the number of *liquidations judiciaires*.[8]

The bankruptcy numbers were used and commented by most previous scholars in level, without any correction for the potential increases in the number of firms operated. Some compared the evolution of bankruptcies to the evolution of the number of newly incorporated companies (Jobert and Chevaillier, 1986, Marco, 1989). This comparison can however be misleading since legal restriction to incorporations existed before 1867. Moreover, even under the regime of free incorporation, most firms

[7] The main innovation consisted in letting the manager continue to run the business while negotiating with creditors a rescheduling or reimbursement of the debts.

[8] Notably Marco (1985) who argued that the "*Liquidations judiciaires*" mechanism resembles too much a regular bankruptcy to allow scholars to follow blindly the French lawmakers on the tricks they introduced to manipulate the "stigma of failure" associated with the previous bankruptcy procedures.

were still private firms for which no distinction existed between the household's (personal) assets and the firm's assets.

1.2. The stock of operating firms

An additional requirement for the computation of a bankruptcy rate is that the population of firms must included those that may go bankrupt. The legal code and the jurisprudence clearly stated that the bankruptcy procedure may encompassed any type of trader (*commerçant*, i.e. an independent business such as wholesaler, shopkeeper, trader, insurer, banker or manufacturer that regularly earn revenue from the selling of products and/or services) but not firms operated in the agricultural sector or those people earning revenue from the exercise of a *profession libérale* such as physicians, architects, auctioneers, bailiffs, lawyers who sell their qualified white collar services often under the monitoring of some guild known as *ordre* (see Hilaire, 1986, p. 76-77).

I use a fiscal source (the *Patente*) to document the population of firms that may go bankrupt. This measure was favoured by the Ministry of Justice during the 1880s when it compared the evolution of the number of bankruptcies with the stock of firms (in the introduction to the *Compte general de la justice civile et commerciale*).[9] Loua (1877) and Limousin (1900) also used it to proxy for the number of firms when computing bankruptcy rates. Besides those exceptions, no economic historians used it as the benchmark for the population of firms. Indeed, lengthy corrections are needed as a bunch of fiscal reforms altered either its tax base or the population eligible to its payment.[10]

The *Patente* was a tax introduced in 1791 that survived the whole 19th century. It had to be paid by any type of businesses selling goods or services on the market. This included (among others) the shopkeepers but also the wholesalers, the various types of factories, craftsmen, banking and insurance firms. The agricultural sector was granted an exemption from its payment, as were some of the *professions libérales* during part of the 19th century. Three preliminary remarks are in order to use the *patentes* as a measure of independent business units. First, it is important to pick the number of *patentés* (number of people/firms that had to pay the tax) and not the *cote des patentes* (number of units paying the tax). Indeed the tax was paid per building or group of buildings, implying that a firm having branches in various locations had to pay one *patente* per location. Yet to construct the series of the number of firms, only the number of *patentés* must be collected since a bankrupted firm with multiple outlets was counted only once in the bankruptcy statistics. Second the law of the 29 March 1872 changed the unit on which the tax had to be paid by forcing the owner of a firm operating branches to pay one *droit fixe* per branch rather than one *droit fixe* per firm before 1858 and one *droit*

[9] While in some issues of the 1840s, the bankruptcy numbers across the *départements* (counties) are compared with the amount of the Patentes tax collected in those territories.

[10] See e.g. Jobert and Chevailler (1986, p. 235). They however did not work out the issue though they argued that "fiscal 'trail' is from now on perfectly set out" but that such a study presupposes not to fall into a lot of traps and pitfalls". They then listed most of the potential traps. Among them, the only one I do not work with is the retreatment of the firms of mining industry that were not liable to the payment of the patentes. (p. 235-6)

fixe per business and half of a droit fixe for the branch of this business between 1859 and 1872 (Hennebique, 1894, p. 742). Third a distinction is sometimes made between *cote principale* and *cotes secondaires*. Indeed the amount of the *patente* that had to be paid differed across activities and consequently a firm operating various activities had to pay one *patente* for the main activity and other for its auxiliary activities. The number of *cotes secondaires* counted the number of *patentes* paid for those auxiliary activities. When the number of *patentés* was not available for some years, and coherently with the goal of evaluating the number of firms, only the number of *cotes principales* was taken to interpolate the number of independent firms (see appendix for details on sources used).

Numerous adjustments and corrections had to be implemented to get a comparable series of independent businesses operated during each year of the 1820-1913 period. First such needed adjustments resulted from the search by the fiscal administration of a greater convenience in the management of the tax payment. For example the 1844 budget law decided to switch the eligibility date of the tax from the 1st of January to the 31st of December. The tax was then still paid proportionally to the number of months of activity but at the end of the year. This allowed the state to avoid the reimbursement of the overpayment of the tax paid by those taxpayers that had closed their business during the course of a year. This impacted substantially the comparability of the series as 24 months lapsed between the 1st of January 1844 and the 31st of December 1845. To deal with this issue I interpolate linearly between 1843 and 1845 to estimate the 1844 number.

Second the 1841 census entailed a substantial – one time – increase of the *patented* population following a temporary change in the organization of the population census. The finance ministry Humann who organized the 1841 census ruled that governmental tax officers had to act as the main census agents. This constitutes a major change in the organization of both the census and the tax collection scheme. Indeed before and after it the mayors and municipalities decided whether one firm had to pay the *patentes* tax or not and it was the duty of the state tax officers to collect the amount of the tax due. Humann's modification generated important political and social protests.[11] Snyder and Tilly (1972) have shown that they followed from the attempts by tax officers to enter private houses, thus violating the right of every people to prevent the state entering their private properties (Portalis, 1841). The intention, it was argued, was to increase the yield of the tax in a context of fiscal need (Gros, 1841, p. 6; Portalis, 1841, p. 11-15). The governmental tax collectors "discovered" numerous business units that should have paid the *patentes* tax although they did not. Portalis (1841) provided

[11] Some city councils (e.g. Paris or Dijon) petitioned the government to protest against this new organization. The Toulouse prefet (high commissioner of the government in the locality) was dismissed following his protests against the organization of the census. The legality of the design of the census organization followed, according to the vindication of the finance ministry Humann (mentioned in Calmon (1897, p. 210), see Portalis (1841) for a discussion) from the decision of a 1838 provision voted by the Parliament. A lot of petitions and tracts pro and cons the way the census was organized were published in 1841. Exemples are Berriat (1841), Calemard de Lafayette (1841), Gros (1841), Ordinaire (1841), Portalis (1841), Pistoye (1841), Tournadre de Noaillat (1841, p. 47-8).

examples of the people who became thus taxed. He wrote that 20,000 Parisian commissioned workers (*ouvriers en chambre travaillant pour le compte d'autrui*) became taxed, as were some *drudge* workers in Lyons or farmers in the Jura's mountains spending the winter months working in their home as watchmakers, cabinetmakers or fine cabinetmaker (p. 12, 14-5). The examples of professions and activities mentioned by Portalis as having been taxed because of the peculiarities of the census organization correspond to those that became exempted as the result of the 1844 and 1858 reforms. The number of *patentes* (*cotes de patentes*) increased by 5% in 1842 and this generated an artificial decrease of the bankruptcy rate of this year. Therefore a correction is needed. Because the precise dispatch of the newly *patentés* population is unknown for this period, the only possible correction consists in smoothing the increase caused by the zeal of tax officers by redressing the series from its beginning. More precisely I implement the following computations. First I estimate a number for 1842 that do not take into account the tax reassessment by applying to the 1841 number the average growth rate of the 1820-1841 period (1.88%). I then compare for 1842 the observed population with the estimated population and find a 5.4% gap between the two numbers. This growth rate is then use to redress the pre-1842 series for the underestimation resulting from tax avoidance. This is reasonable since we know that neither the tax base nor the tax eligibility to the *patente* was modified between 1817 and 1844. Although this correction is far from perfect, it allows at least to smooth the impact of the 1842 event. The following computation was made to correct for this

$$\text{For any t} < 1842 \qquad y_t^{'} = x_t \left(\frac{x_{1842}}{x_{1841} * \left(1 + \bar{x}_{1820-1841}\right)} \right) \qquad (1)$$

where x_t is the observed series of the number of business units at time t net of the persons exercising a *liberal profession*, $\bar{x}_{1820-1841}$ is the average growth rate of the *patentés* during the 1820-1841 period and $y_t^{'}$ is the estimated "true" series.

Third some adjustments resulted from the changes of the geographic borders such as the annexation of Savoie and the Nice County in 1860 or the loss of the Alsace and part of the Lorraine as a result of the 1870 Franco-Prussian war. They could have impacted the computed variations of the national bankruptcy rate if local rates differed among territorial units, which was likely the case (as noticed in the *Compte Général de la Justice Civile et Commerciale* during the 1880s). Although it would have been correct to adjust the series for the changing size of the territory,[12] it proved impossible to do so as a continuous series of the local (departmental) number of *patentés* is still lacking. However the 1860 event is likely to have had negligible effect as it entailed adding only

[12] By subtracting to the pre-1870 figures the number of *patentés* and bankrupted firms in Alsace-Lorraine and by subtracting the appropriate numbers for the Savoie annexation for the post-1860 period.

18,000 firms (out of 1,364,839 or +1,32%). The 1870 losses reduced the number of firms by 3.46% (49,674 out of 1,435,202).[13]

Finally legal changes occurred because of the *patentes* tax being a disputed issue during the whole 19th century. The main reforms occurred between the 1840s and the 1860s and correcting for them is especially important since they had a sizeable impact on the population of firms and therefore on the estimates of the variation of the bankruptcy rate. Changes were brought either to the tax base or to the population liable to its payment.

A number of alterations of the tax base were voted by the parliament to decrease the amount to be paid by certain professions (as in 1844 when it was decided to divide by two the tax rate on the *droit proportionnel* (from one tenth to one twentieth of the rent value of the working place) or in 1850 when the parliament voted a cut by half of the tax on independent blue collar workers (*ouvriers travaillant pour leur compte)* provided that they worked without wagers. Sometimes however, the tax rate was increased such as the one paid by department stores in 1880. Some temporary increases were also voted to balance the state budget in times of necessity (such as in the years that followed the 1870 war). In my estimate, I disregard the impact of the changes of the tax base on the population of firms. This amounts to assume that they did not significantly impact the size of the population of firms, albeit through the incentives to settle or close a business. The main difficulty with estimating them is the huge difficulty in finding the rough numbers of business units by occupations[14] and level of revenue (i.e. the *patente* differed according to the rent paid for the building in which the production was made).

The legal changes also modified the professions or activities liable to the payment of the tax. Changes to the taxable population were brought in by the lawmakers in 1844, 1850, 1853, 1858, 1862 (Faure, 1983, p. 203-205). The 1844 reform[15] must have induced the stricking off from the taxable population of 131,856 people (of which 108,000 independent workers, notably commissioned workers[16] and 7,000 physicians) but in the end 40,000 were not excluded and the review of the taxable did entailed the inclusion of 30,000 persons or firms that previously managed to escape its payment despite their eligibility. The 1850 reform made eligible to the payment of part of the tax (*droit proportionnel*) some of the *professions libérales* that were previously exempted. These included the "notaries, lawyers, attorneys-at-law (*avoués*), court clerks, auctioneers, bailiffs, architects, physicians, surgeons, veterinarians, architects, health officers, masters and heads of boarding school"

[13] In 1829, the Moselle and the two departments that composed Alsace hosted 5.18% of the *patentés*.
[14] Those are available only for 1885 and 1897.
[15] In Koepke, 1980, The Loi des patentes of 1844, p. 399: "Adeline Daumard, in her recent work on the Paris bourgeoisie, is less certain than Kent about the intent of the revised patente. While she agrees that the major impact of the bill was to erase many small retail merchants and artisans from the electoral rolls, she also recognizes that the "principal object" of the revision was to up-date the law."
[16] Commissioned workers (*ouvriers à façon*) were, according to the usual definition, independent workers that used the inputs given by the sponsor, prime manufacturer of the work. They therefore did not have to pay their inputs before the end of the production.

(Hennebique, 1894, p. 742). The law of the 4 June 1858 exonerated the independent blue collar workers (*ouvriers travaillant pour leur compte*), a population of 120,000 people according to Faure (1983, p. 205). The law of the 2 July 1862 enacted a further enlargement of the exoneration to independent workers working in a shop exhibiting an emblem. This reduced the population of *patentés* by 100,000 people (Faure, 1983, p. 205).[17]

Therefore the computation of an estimate of the population of firms that may go bankrupt implied adjusting the series of business units for two main changes.

First most of the people exercising as *profession libérales* did not belong to the population eligible to the bankruptcy procedure although they were sometimes taxed. The 1844 law entailed the tax exemption of 21,998 people exercising a *profession libérale*. This number is subtracted from the *patentés* series between 1820 and 1844. The people of this category are not included in the published statistics up to 1850. The 1850 reform reintroduced some of the liberal professions exempted in 1844 but as the 1844 law created a separate heading to count them, the *tableau D*, they are not included in the series of firms I have constructed.

Second the changes in the number of independent workers (*ouvriers à façon*) need to be smoothed since it proved impossible to subtract them from the series of the pre-exemption years. Smoothing them is especially important as those exemptions entailed sizeable drops of the population of business units (more than 100,000 in a couple of cases) that could lead to spurious computation of the variation of the bankruptcy rate. The tax reform of 1844, 1858 and 1862 altered the size of the population by exempting some from the payment of the tax.

The tax reforms then progressively exempted the commissioned or *drudge* workers from the tax payment. To avoid a jump in the bankruptcy rates, I corrected the number of the pre-reforms years by subtracting from the taxed population the people that became exempted. Although reducing the number of firms, this was likely to not bias the computation of the bankruptcy rate. Indeed although *drudge* workers were legally running a business and could have filed for bankruptcy, this was highly unlikely. The exempted worked with inputs given (and paid) by the persons who commissioned the work. Most of the time, they had only one ordering party that supply both the inputs and the primary materials needed to transforms those inputs (see Woronoff, 1994). In this context, not only were the commissioned workers very unlikely to be indebted in money (and then to being in the position to file for bankruptcy) but if they have only one ordering parties (often a merchant of the neighborhood), a default on this debt would have qualified them not for the bankruptcy procedure (that is by definition a collective procedure suitable for multi-creditors cases) but to another specific procedure that has to be used for debt dispute with only one debtor.

[17] A. Faure p. 205: « La boucle était bouclée : au regard de la loi, rien ne distinguait plus les façonniers des artisans et c'était désormais l'exercice du travail en famille qui traçait une frontière entre patentables et non patentables, entre les vrais et faux entrepreneurs qu'étaient, aux termes de la loi, ces ouvriers. »

To correct the observed series of the above-mentioned defect and construct a coherent estimate of the number of independent business units, the following computation were made (where y'_t is the series of the number of business units at time t computed with equation (1) – net of the numbers for people the *professions libérales*)

$$\text{For any } t \leq 1844 \begin{cases} y''_t = y'_t\left(1-\dfrac{68{,}000}{x_{1844}}\right) & \text{if } t \leq 1842 \\ y''_t = x_t\left(1-\dfrac{68{,}000}{x_{1844}}\right) & \text{if } 1842 < t \leq 1844 \end{cases}$$

$$\text{For any } t \leq 1858 \begin{cases} y'''_t = y''_t\left(1-\dfrac{120{,}000}{x_{1858}}\right) & \text{if } t \leq 1844 \\ y'''_t = x_t\left(1-\dfrac{120{,}000}{x_{1858}}\right) & \text{if } 1844 < t \leq 1858 \end{cases}$$

$$\text{For any } t \leq 1862 \begin{cases} y''''_t = y'''_t\left(1-\dfrac{100{,}000}{x_{1862}}\right) & \text{if } t \leq 1858 \\ y''''_t = x_t\left(1-\dfrac{100{,}000}{x_{1862}}\right) & \text{if } 1858 < t \leq 1862 \end{cases}$$

The series is then re-assemble by taking the y''''_t value for any of the years prior to 1862 (included) and the observed value x_t for the year after 1862.

2. The vanishing fluctuations of the bankruptcy rate (1820 – 1913)

As shown on figure I the bankruptcy rate exhibits a clear upward trend during most of the 19th century, increasing from about 0.15% to 0.6%. It also fluctuates a lot in the short run with periodical (and large) ups and downs, especially the substantial drops experienced in the beginning of the 1830s, or those after the peaks in 1839, 1862, 1869, 1886, 1889, 1906, 1912 Using this rate as a measure of business fluctuations therefore call for the use of some method to separate the long-run from the short-term components. The use of some de-trending method amounted to assume that the long run determinants can be assumed to be independent from its short-run determinants. The recent literature on the determinants of the consumer bankruptcy rate in the U.S. that had been labelled the "bankruptcy puzzle" (Buckley and Brinig, 1998), listed some of the causes of an increased bankruptcy rate. Some argued that this can be explained by a decrease in the cost of filing for bankruptcy such as decrease of judicial cost or of the stigma associated with it (Gross and Souleles, 2002; Fay, Hurst and White, 2002), by changes in the environment of the credit sector (Dick and Lehnert, 2007) such as credit market innovation (Barron and Staten, 2003) or the removal of interest rate ceilings (Ellis, 1998). Barron, Elliehausen and Staten (2000) and Warren and Warren Tyagi (2003) argued that increased uncertainty of the earnings and expenses of households also played a role. The paper by

Sullivan, Warren and Westbrook (2000) highlighted the role of demographic changes. Livshits et al. (2007) suggested that changes in the credit market environment, through a decrease in the transactions costs of lending and a decline in the cost of bankruptcy explained the recent US evolution.

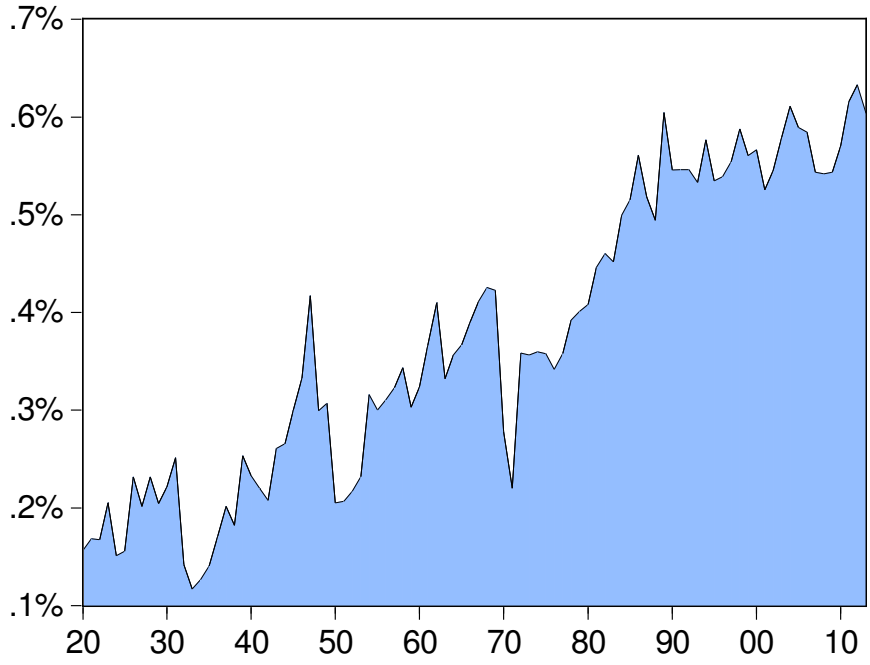

Figure I: Bankruptcy rate in France (1820-1913)

Those elements may also have been at play in 19th century France. They may e.g. have played a pivotal role by allowing an increased in moral hazard and then the secular increase of the bankruptcy rate. Yet it seems very unlikely that they could have generated the short-run fluctuations exhibited on figure I. Those variations may likely have been driven by other factors that the ones listed above. One may think that short-term determinants of the decision to file for bankruptcy played a role. The very definition of bankruptcy in the French 19th century context, i.e. that a firm is bankrupted when it was unable to pay its debt to one of its various creditors (according to the 1807 code either because it decided to file for bankruptcy or because one creditor asked the tribunal to open such a procedure), implies that filing for bankruptcy does not necessarily means that the firm is insolvent (i.e. that the value of its assets is lower than the value of its debts). This event may rather derives from the fact that it cannot temporarily pay – at least – one of its debtors. This can happen because of firms' greater financial discomfort stemming from a liquidity or solvency shock which translated into greater difficulty for firms to repay their debt. Those shocks may be linked to the firm's manager bad decisions but they may also partly originate in clients' firms or in financial intermediaries. Typically those types of bankruptcies would take place in a chain of defaults. Those chains are however likely to

occur (and have an impact) only in the short-run and only in special conditions. To study the importance of those events, I therefore de-trend the series of the bankruptcy rate.

Following Canova's argument (1998, 1999), using different methods to gauge the nature of business fluctuations is especially interesting since it provides various types of information. In this paper, I use two de-trending methods to extract the fluctuations part of the bankruptcy rate: the first difference of the series and the Hodrick-Prescott filtering method (HP filter). The HP filter consists in removing a smooth trend τ_t from some given data y_t by solving

$$Min_{\tau_t} \sum_{t=1}^{T} ((y_t - \tau_t)^2 + \lambda((\tau_{t+1} - \tau_t) - (\tau_t - \tau_{t-1}))^2).$$

in which the $(y_t - \tau_t)$ term (the deviation to the trend) is commonly referred to as the *business cycle component*. The smoothing parameter λ is the key variable as an increase in λ will increase the variability of the trend component (and conversely). With annual data, Hodrick and Prescott proposed to set λ to 100. Some papers discussed the impact of this choice on the quality of the filtered result. This is quite important given that one may not want to capture, in the cyclical component, elements linked to longer term trends. In 2002, Ravn and Uhlig discussed this issue and proposed for annual data to set λ=6.5, a level close to the one proposed by Baxter and King (1999) who proposed 10. As noticed by Davis, Hanes and Rhode (2009) such a level for annual data is more consistent with the value of 1,600 conventionally applied for quarterly data. However this value creates trends that are more sensitive to short-term fluctuations. In this paper, I use the values recommend by both Hodrick and Prescott and Ravn and Uhlig (2002). As will be shown the main result is unaffected.

Using those filtering methods, I computed the fluctuations of the bankruptcy rate as follows:

$$\Delta BR^{FD} = \left(\frac{BR_t - BR_{t-1}}{BR_{t-1}} \right) * 100$$

$$\Delta BR^{HP} = \left(\frac{y_t - \tau_t}{\tau_t} \right) * 100$$

where BR is the bankruptcy rate compute as the ratio of the number of bankruptcy to the number of firms; FD referred to the series in First Difference and HP to the series computed using the HP filter (with HP 100 used to indicate that λ was set to 100 and HP 6.5 when λ was set to 6.5); t is a time indicator that go from 1820 to 1913.

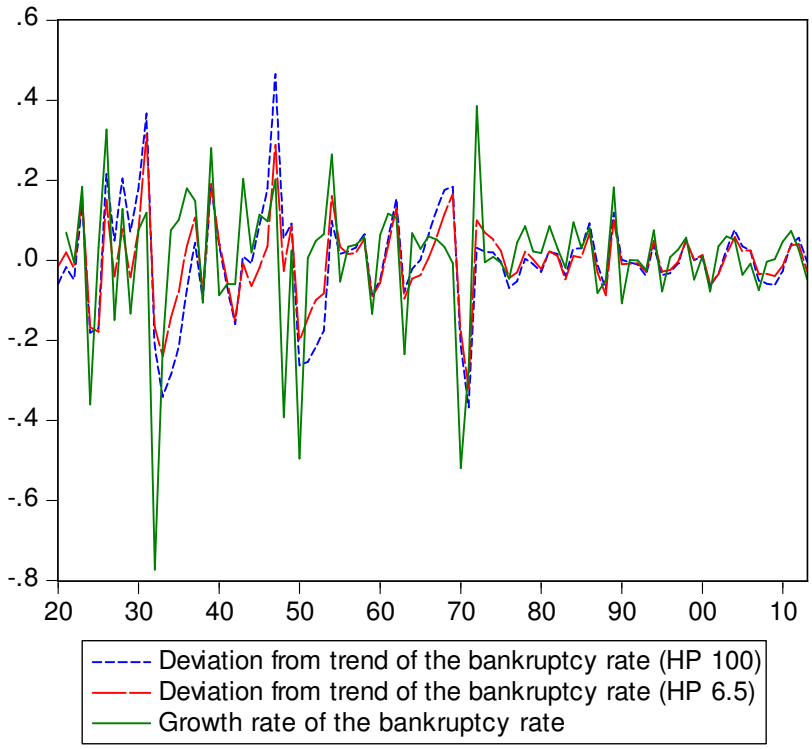

Figure II: Fluctuations of the bankruptcy rate in France using various filters (1820-1913)

Figure II plots the three series. They exhibit huge fluctuations of the bankruptcy rate during the first part of the period. Both seem also characterized by a decreasing variance that becomes very low beginning in the 1870s. Coherently the distribution of both series is not normal during the 1820 – 1913 period. The skewness of the distribution (1820-1913) computed with the HP 6.5 series is close to zero but the Kurtosis is close to 5, which indicate a sharper peak and longer, fatter tails than the normal distribution (see figure III in appendix). Interestingly, dividing the sample into two sub-samples (1820-1869 and 1872-1913) lower the Kurtosis to a level equal to 3 and the Normality test do not reject that the distribution of each subsample is normally distributed (see figure III and IV in appendix). 1870 and 1871 are excluded of those computations since a standstill was declared on debts' payment, which likely drove the massive drop of the fluctuations of the bankruptcy rate during those two years. This standstill allows the debtors that could not meet his payment obligation not to file for bankruptcy if he was able to reach an agreement (*concordat*) on the rescheduling of his debt.

To check the robustness of the decreasing variance of the fluctuations of the bankruptcy rate, I test the significance of the differences in variance across sub-periods of the HP filtered series. The numbers reported in table 1 are those computed with a value of λ set to 6.5. They are grossly unaffected by a change in either the value of λ or by the use of the FD filter. Interestingly, the standard deviation of the fluctuation decreased smoothly over time, from a level of 13 during the [1820,1851] period to 8.67 during the 1852-1869 period and 4.19 in the 1872-1913 period. The tests

do not reject the hypothesis that the distribution of any sample is normal. The differences between the variances of the first two sub-periods are not significant according to each criterion while they are when they are compared with the 1872-1913 period (see table 3). This finding is robust to change of the time boundaries of the first and second sub-periods (i.e. when the tests are computed using 1848, 1849 or 1850).

	1820-1913	1820-1869	1820-1851	1852-1869	1872-1913
St. Dev.	9,86	12,79	13,57	8,67	4,19

Table 1: St. Dev. Of the deviation of the BR to its trend (estimated using HP filter with λ=6.5)

Finally computing moving variance of the deviation of the BR from its trend with a moving window of width of 10 years confirms this impression of a century-long decreasing variance (see figure V). The curve exhibits three peaks. The first is centered around 1830, the second around 1848 and the third occurred at the end of the 1860s. The first two peaks drove the variance to hit 0.06 while the variance of the last peak reaches only half of that value. The rest of the century shows, consistently with figure I and II a very flat variance of the BR. One may wonder whether this pattern is explained by a few outliers or not. Indeed the 1830 and the 1848 crisis are well known episodes that yields two revolutions. To deal with this issue, I compute the same moving variance – using the same time window – but I remove any observation with a value above or below two standard deviations of the average variance. The dashed line on figure V represents the evolution of this curve. It shows exactly the same pattern as the curve with outliers except that the peaks now rise to only half of their previous level.

One conclusion then appeared clearly. Business failures, as measured by the deviation of the bankruptcy rate to its trend, were much smoother in the later part of the century than in the beginning. This change may come partly from the disappearance of important financial and political crises such as 1830 and 1848 that impacted the bankruptcy rate so much that they may appear as outliers when compared with the rest of the series. Yet if those events are not taken into account, the variance of the bankruptcy rate is still far higher during the first half of the [1820, 1913] period and it gradually declined. To study whether the behaviour of the bankruptcy rate was shared by other macro-economic indicators, the next subsection compared it with real and price variables.

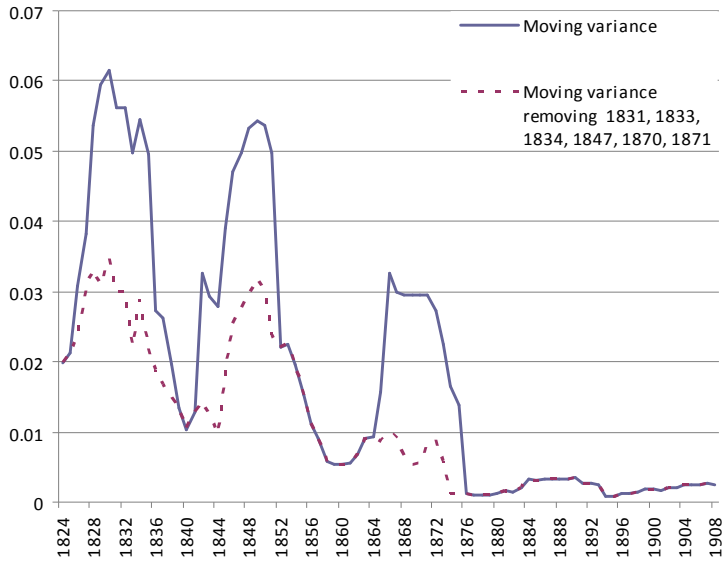

Figure V : Variance of the deviation of the bankruptcy rate from its log trend – i.e. log (BR+1) – using a moving window of width 10 years. [18]
Source: Author's computations.

2.2. The peculiarity of the bankruptcy rate series: Comparing its fluctuations with other indicators

There are obviously a number of other indicators to measure business fluctuations than the bankruptcy rate. Since the advent of national accounting in the 20th century, they are traditionally measured using the real GDP. During the 19th century it was common to measure business fluctuations using the index of industrial prices or commodity prices such as wheat to gauge them (Juglar, 1883; Jevons, 1878). In this section we study the fluctuations of those series and compare them with the pattern of the fluctuations of the bankruptcy rate. Four other series are studied. First the real GDP and the index of industrial production are taken in Toutain (1987, V45 p. 158-163 and V14 p. 111-121 resp.). Wheat prices are taken in Dreyfus, Labrousse and Romano (1971) and the index of industrial prices is from Levy Leboyer and Bourguignon (p. 1985, 333-7). The real GDP is in thousands of francs. The index of industrial production is computed with the basis years equal to 100 in 1905-1913. The reference years for the index of industrial prices are 1908-1912. Other series such as the wholesale prices were also tried.

For each series except the bankruptcy rate, I have computed their deviation from their log trend estimated using the HP filter with λ set at 100 or 6.5. For the bankruptcy rate I compute the deviation to the log trend plus one (the log of the HP filtered bankruptcy rate +1). Table 3 reports the cross-correlations of all those variables. The correlation of those deviations is very low except between the industrial production index and the Index of industrial prices (0.41) and the one between the bankruptcy rate and the wheat prices (0.46). Table 4 presents the main descriptive statistics of those

[18] The computation of the variance is centred so that for example the 1824 value is computed using the values of the deviation of the BR to its trend of the [1820, 1829] period.

series. Except for real GDP the autocorrelation of each series (1 lag) amounted to about 0.4 when λ is set at 100 and close to zero when λ is set at 6.5.

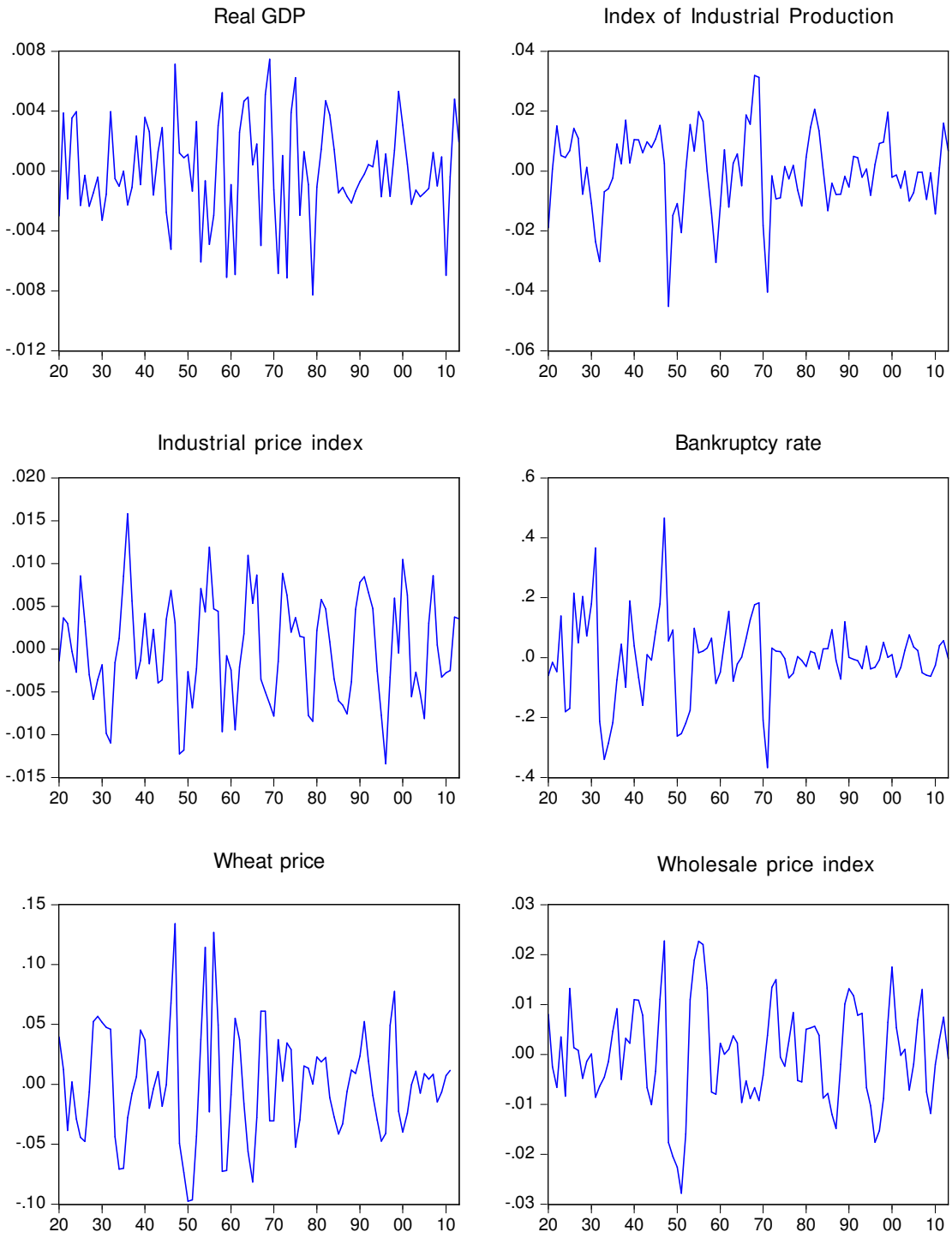

Figure VI: The deviation of various statistical series from their log trend in France (1820-1913)
Sources: Author's computations using the sources detailed in the text.

To check whether those series exhibited the same pattern of high variance before the 1870s and of a smoothed evolution starting from this decade, figure VI plots the evolution of each series. None shows the same pattern. To confirm this visual impression, figure VII plots their moving variance with a window of width 10 years. The variance of the industrial production index, of the real GDP and of wheat prices exhibited the same declining evolution. The shape of the moving variance of the real GDP differed however hugely from the one of the bankruptcy rate as it is single peaked with a maximum at the beginning of the 1870s after a long increase since the beginning of the 1840s. Hence it does not exhibit any peak in the 1830s. Moreover the variance started again to increase after the end of the depression of the beginning of the 1890s. The variance of the deviations of the wheat prices series to its trend on the contrary has a small peak in the 1830s and in the middle of the 1890s. The evolution for the index of industrial production is the one that looks much closer to the evolution of the series of the bankruptcy rate with some variance up to the 1870s and a smoothed evolution thereafter.

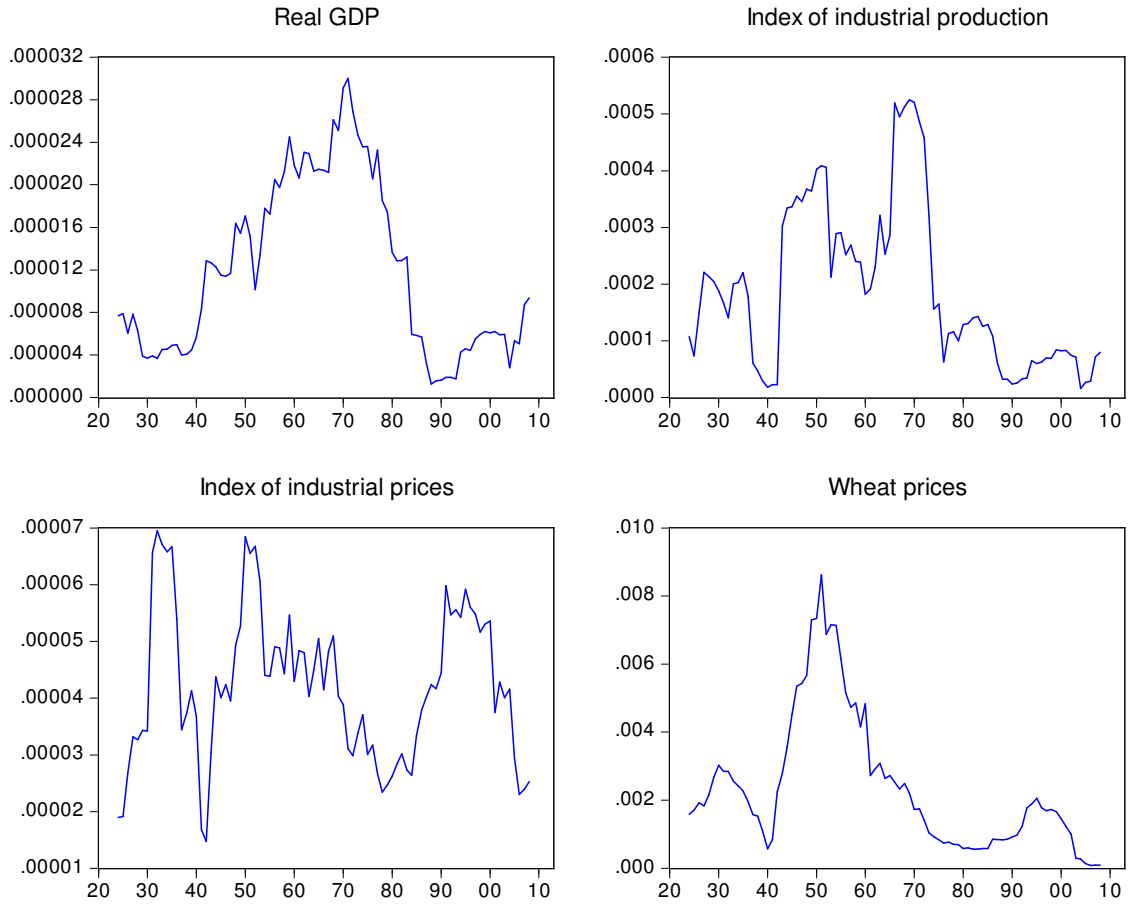

Figure VII: Moving variance with a window of width 10 years of various economic series, France (1820-1913)
Source: Author's computations.

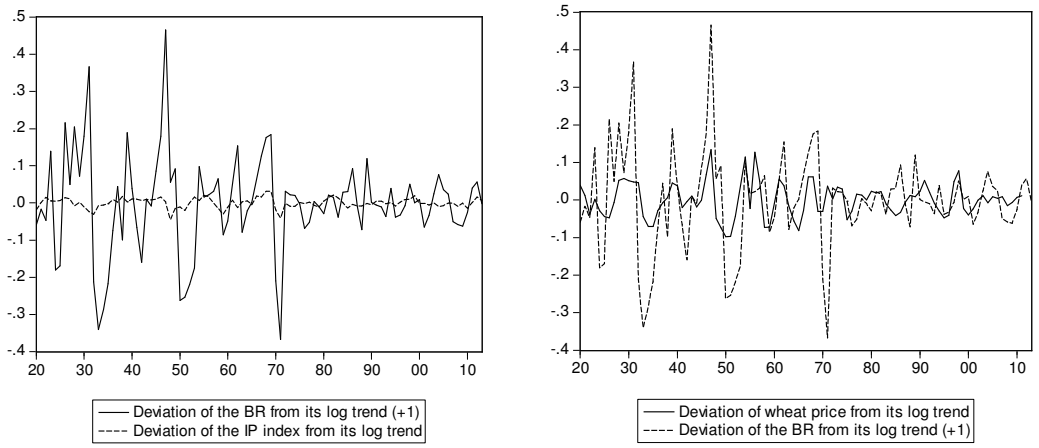

Figure VIII: Comparison of the evolution of the deviation of various series from their trend with the evolution of the bankruptcy rate.

To allow a comparison of the magnitude of the deviations, figure VIII plots on the left the evolution of the deviation of the wheat price and on the right of the index of industrial production against the evolution of the deviation of the bankruptcy rate. The evolution of the wheat price appears parallel to the BR during the last 40 years but the variations during the first 50 years are far smoother. This is not something that can be said of the comparison with the index of industrial production. These elements confirm the impression that the evolution of the deviation of the BR seems unique. The next section spells out a number of potential explanations for the smoother evolution of the fluctuations of the bankruptcy rate.

3. Financial and monetary crises of the 19th century in France.

3.1 Criteria that allow assessing the existence of a financial crisis

In 1820 the French economy was mainly agricultural and had not yet experienced its industrial revolution. Economic development is said to have begun during the 1830s, which also saw a broadening of its financial market. Yet although the first booms and busts occurred as early as the 1820s and 1830s as documented by Gilles (1964), few securities were traded during the first part of the century except the Banque de France's stock, and stocks of railways and canals companies. However no stock index was compiled for the whole 19th century before Arbulu (2006). His stock index exhibits a clear upward trend during the whole period. Figure IX (left panel) plots the fluctuations of the stock index after having removed its trend (filtered using HP with λ set at 6.5). The evolution shows a clear changeover between booms and busts starting with the 1840s. This pattern is especially prevalent between 1840 and 1860 and after the 1880s. To allow a more precise comparison across time of the stock market index drops, the right panel of figure IX normalizes those variations by

computing their deviations from the trend. This shows that starting with the 1860s (with the exception of the 1882 crash), the variance of the fluctuations of the stock index decreased smoothly, especially after the 1870s. Besides the 1882 crash, none of the financial turmoil is larger than the bands defined by the one standard deviation around the mean. The pattern of deviations of the stock index to its trend resembles then to the pattern of the deviations of the bankruptcy rate. During the last three decades financial turmoil impacted much less the stock index than they did during the previous decades.

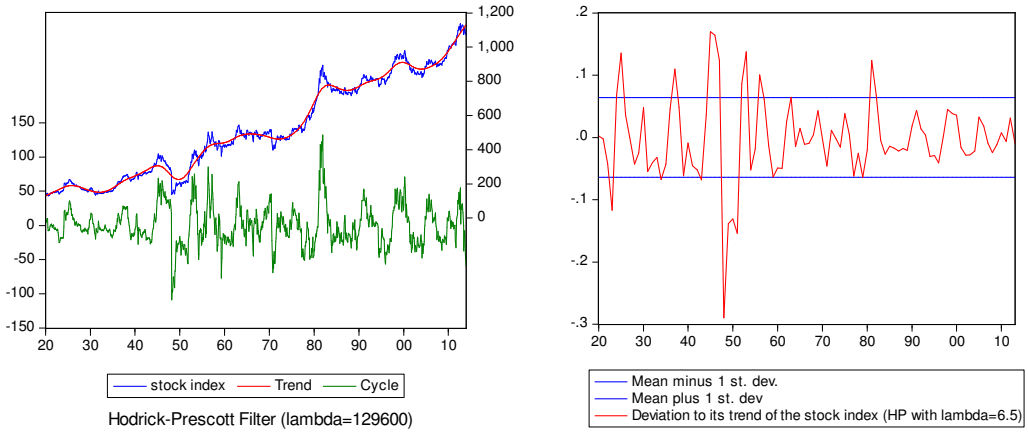

Figure IX: (a) left panel: Stock index, its trend and the variations of the cyclical component of the Paris stock index and (b) right panel: Deviations to its trend of the Paris stock index.
Source: Arbulu (2006)

Because such aggregate information was not available and in his attempt to measure business cycles, Juglar (1862, 1889) searched in the balance sheets of the central banks the indication of the occurrence of commercial crisis in France, England and the US. As noticed by Niehans (1992) and Besomi (2009), Juglar's perspective is mainly a-theoretical. But having compiled a database of the various items of central banks' balance sheets, he used them to uncover the fluctuations of the business and commercial activity. Juglar (1862, 1889) argued that a crisis can be foreseen in the evolution of the total value of circulating banknotes and of the central bank's discount relative to its metallic holdings. Juglar further argued that those measures fit well with the occurrence of financial crisis when they are determined by the following qualitative definition: a crisis is a period of one or two weeks of panics on the financial market. He however noticed that a crisis always occurred after a period of a thriving economy and is always followed by a liquidation period, i.e. a period of decreasing prices (1889, p. 16-7). He moreover suggested that early-warning signals of crisis can be found in the data and indeed was praised to have forecasted six months in advance – and announced in a published article – the 1857 crisis (Niehans, 1992, p. 548).

Juglar's key intuition lies in the following mechanisms that impacted the position of the central bank before the crisis burst. First distressed financial and commercial agents (those that have long –

speculative – position) asked the central bank for a refinancing of their business through the discount facilities. In the same time, some others asked for the reimbursement of their banknotes in metal (a 'flight to quality' type of mechanism). These later actions reduced the metallic holdings of the central banks and then weakened its ability to rediscount distressed agents. A crisis then occurred when the central banks took actions to offset those opposed tendencies that threatened the liquidity position of the bank. Before and during the crisis of 1847-48, those actions consisted in suspending or reducing the discount facilities (quantitative rationing) while in the 1850s-1860s, the central bank begun to follow (invent) the classical doctrine of the lender of last resort.[19] It then rediscounted at will distressed agents provided that they paid a higher interest rate and proposed good collaterals. One of the fortunate consequences of an increase of the discount rate was to curb the outflow of reserve from the safes of the bank, which counterbalanced the flight-to-quality mechanism.

I use the same data as Juglar to construct two ratios of the liquidity position of the Banque de France. The first is the ratio of the value of discounted bills at the central bank to the metallic holdings and the second is the ratio of the value of banknotes to the bank's metallic holdings. The former measures the size of the intervention of the bank on the financial markets while the later is a measure of the bank's liquidity constraint created by its participation to the gold and silver standard. Figure X and XI draw the evolutions of each ratio. They both share the same evolution of a decreasing variance around a stable mean during the last 30 years of the period. As for the first 60 years (1820-1880), differences appeared clearly. First the banknote to reserves ratio is characterized by a decreasing trend that started in the 1840s and reached its lowest level in 1873 at 30%. The value of banknote in terms of gold and silver holdings returned to 80% during this decade and fluctuates around this value during the rest of the period. Second the ratio of discounted bills to metallic reserves. The evolution of the ratio of the volume re-discounted to the metallic holdings is displayed together with the crisis year identified by the Juglar's criterion. It shows that the ratio peaked during each crisis of the pre 1870s period, eventually at a very high level (as in 1857 and 1854). Although a crisis year is also associated with a local maximum after 1872, the increase is always much lower than before. It is even lower than the increases experienced during the 1820s and 1830s.

[19] Bagehot, 1873.

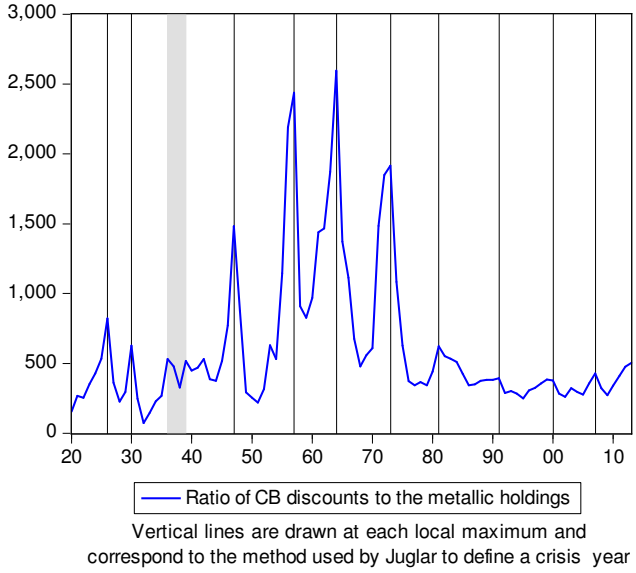

Figure X. Ratio of the refinancing activity of the Banque de France to its metallic holdings

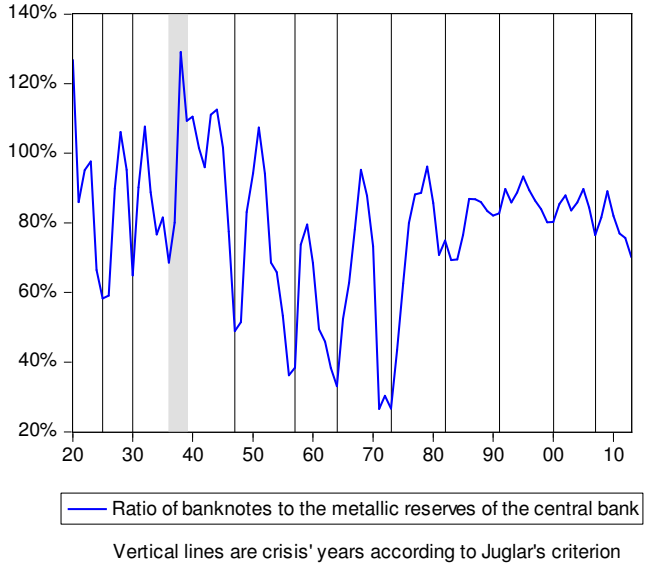

Figure XI. The liquidity ratio of the French central bank
Source: Author's computation using INSEE 1946 statistical yearbook p. 143*-144*

The two measures of central bank intervention (the liquidity ratio and the re-financing ratio of figures X and XI) suggest that a regime change occurred in the 1870s in terms of the central bank's management of the financial crises with a much lower variance of both ratios. This contrasts with their behavior during the first 50 years, during which the central bank experienced a drop of its liquidity constraints during each crisis (as measured by the banknotes to reserves ratio).

To better check the occurrence of financial crises, I also studied the evolution of the short-term interest rate. It is indeed very likely that an increase in financial distress or fragility translated into

higher market rate for bills of exchanges. The English periodical 'The Economist' published the figure on the Paris market from 1863 onwards. There is however no series of money market rate for the Paris for the first part of the century. To remedy this difficulty, I extend to the pre-1843 period the series computed by Bignon, Flandreau and Ugolini (2011) who measures the variations of the money market interest rate for the 1844-1913 period using the prices in British Pounds of spot (3-days sight) and forward (3 months) bills of exchange on Paris in London. The data were taken in *The Course of Exchanges*. There are two components in those prices, an exchange rate component and an interest rate component. Assuming that exchange rate expectations are constant (see Flandreau et al. 2009 for a detailed exposition of the method), the ratio of the spot over the forward prices gives an estimate of the short-term (implicit) interest rate on the Parisian money market. Figure VII shows the evolution of this implicit rate.

To gauge the quality of the estimated interest rate, I compare this series with the money market rate in Paris published by The Economist. The correlation between the two series is fairly large (about 70%), and the peaks corresponds in both cases. There is however a systematic deviation of the level of the shadow rate which may points to an overestimation compared to market rate in Paris published by the Economist. Because I am interested in identifying the peaks of the series before 1870, this (potential) overestimation must however not impacted the moment at which the rate peakedThe left panel of figure XII plots the evolution of this shadow rate on a monthly basis. The right panel used annual value of this interest rate (compiled by taking the monthly maximum value) and compared the peaks of this series with the crisis' years as indicated by Juglar's criterion. It shows that all crises found using Juglar's criterion is also a crisis according to the money-market rate.

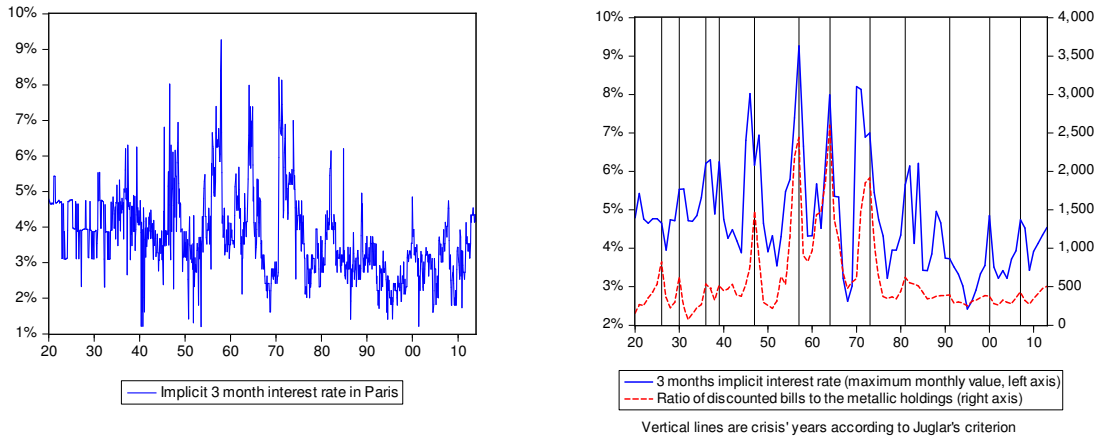

Figure XII: (a) left panel: Monthly observation of the implicit interest rate 3 months; (b) right panel: The implicit 3 month market rate in Paris (annualized by taking the maximum value of each year), the refinancing ratio of the central bank, 1820-1913

The evolution of the money-market rate is far from flat during the last four decades (see figure XII). However, as shown by figure XIII (in appendix), those peaks were much lower than they were

during the 1840-1873 period. Indeed none of the post-1873 observations fell outside the one standard deviation band (centered on the mean). To get a more precise assessment of the tensions on the money market, it can be interesting to use the weekly market interest rate published by the English newspaper *The Economist* that we know measured the market rate in Paris. Since the central bank followed a policy of non-rationing during this period, the market rate is bound to be either lower or equal to the central bank rate. One can interpret the equality between those two rates as a period of high demand for money (alternatively for the high powered money is one interpreted bills as part of broad money aggregate). The number of weeks during which this equality holds between 1870 and 1913 is plotted on figure XIV (in appendix). It shows that when measured by the numbers of weeks the money market rate hit the central bank's interest rate, financial tensions popped up regularly during this period. Indeed only 8 years did not exhibited any week with a market rate equal to the bank rate (out of 44 years). The sample average is 5.73 weeks. If one subtracts one standard deviation (6.14 weeks) to each year's number, there is still 14 years which featured tensions on the money market. Those years are quite evenly sparse during the period with peaks in 1870, 1873, 1881, 1897-1900, 1906-07 and 1911. Interestingly, those years are also the crisis years according to the criteria used by Juglar and Siegfried.

Table V summarizes those pieces of information. Columns (1) and (2) give two different metrics of the crisis years defined as a fluctuation of the bankruptcy rate greater than one standard deviation. According to those measures the crisis years spanned mostly during the 1820-1872 period with the notable exception of 1882. Crisis occurred according to the HP metric (first column) in 1823, 1826, 1831, 1837, 1839, 1847, 1854, 1862, 1868, 1869, 1872 and 1882.[20] Juglar's dates of financial and monetary crises are given in column 3 and 4. Column 3 presents the date presented in the first edition of Juglar's book while column 4 presents those of the 1889 edition. As can be seen, the precise years of crisis fluctuated as the 1826 crisis of the 1863 edition is said to have occurred in 1825 according to the 1889 version. There is a broad correspondence between Juglar dating of financial crisis and the dating obtained using the fluctuations of the bankruptcy rate (BR). Indeed except in 1823, any significant variation of the BR is also a crisis according to Juglar's criterion. This does not hold anymore starting with the 1850s as the BR peaks in 1854, 1862 and 1868-9 while Juglar's criterion points to crisis occurring in 1857 and 1864. Siegfried (1899) used Juglar's criteria to extend this dating to the 1890s period (column 5). I use the same data to further extend the dating to the last decade (column 6). I found that except for the 1825-6 crisis and for the 1881-2 crisis, my own dating lead to the same dates as Juglar and Siegfried (column 6).[21] Moreover 1907 and 1911 must be added although the decreases that occurred during those two years so small that they are likely not significant.

[20] The λ was set to 6.5 for those computations.

[21] The discordance between 1881 and 1882 can easily be explained by the fact that the financial crash occurred in January 1882.

Columns 7 and 8 give the local maximum of the interest rate series. Column 9 gives the variations of the stock index that appeared to have been larger than one standard deviation. Except few lags, the years of tensions on the Parisian money market or stock market are also crisis years according to Juglar criterion. Some years must however be added as years of crisis, such as 1821, 1842 and 1861. The use of those two indicators are however especially interesting. They indeed show that both the financial crises and the tensions on the money market did not disappear during the last four decades of the century. What happened is coherent with a decoupling between the monetary variables and the BR on one hand and the evolution of the other financial variables on the other hand. Interestingly enough, the last four decades are also widely recognized as the period of the greatest financial development in France. Yet both the money market rate and the stock prices index pointed to a decreasing variance of the severity of those financial events. Combined with the lower variance of the ratios of central bank's activity, they suggest that the central bank was able to avoid the consequences of financial crises in its balance-sheet. The next sub-section uses the indicators of crisis' years to study how bankruptcy rates fluctuated during and before those crises.

3.2. Financial crises and the fluctuations of the bankruptcy rate

The usual intuition is that bankruptcy rate peaks during crisis as the result of the tightening of the refinancing of the existing firms. To see whether this holds for the French series, figures XV and XVI plots the evolution of the fluctuations of the bankruptcy rate together with the years of crisis. I find it useful to discuss the two measures of the fluctuations of the bankruptcy rate as they may yield different conclusions. Although the HP filter is considered as better suited for the comparison of the business fluctuations because it removed the long-term component from the observed series, the first-difference filter also contained interesting information. In the case of the bankruptcy rate, this later filter is the one that was easily observable by the contemporary observers (and especially the central bank) and that could have been of use if they experienced some difficulties to separate the trend from the cyclical component of the bankruptcy rate. I therefore discussed the results given by both filters.

- HP filtered series: When the variations of the bankruptcy rate (the cyclical component) are measured with the Hodrick and Prescott filter, two types of situations are worth to be distinguished. First during the 1820s, the crisis years when measured with Juglar's criterion are not associated with an increase of the bankruptcy rate. This is also the case at the end of the century with the crisis of 1864, 1891 and 1907. Starting with the 1830 crisis, some financial crises came to be associated with an increase of the (cyclical component of the) bankruptcy rate. This pattern repeated itself during the crises of 1836-39, 1847, 1857, 1873, 1882 and 1911.
- First difference series: When the variations of the bankruptcy rate (the cyclical component) are measured using the first difference filter, the pattern isolated using the HP filter

changed. Up to the 1870s, the crisis' years are then always associated with an increase of the bankruptcy rate, that even reached a local maximum during the crisis year in 1847, 1857 and 1864. Moreover, starting with the 1836 crisis (up to 1870), the bankruptcy rate increased for several years when the crisis burst. There is a continuous increase of the bankruptcy rate two years before the 1836 crisis burst, 4 years before the 1847 crisis burst; 3 years before the 1857 crisis. This is also the case for the 1882 crisis, although the deviation of the first difference component to its initial level is much lower than in the 1840s or 1850s. As for the 1891, 1900 and 1907 crisis are concerned, no increase of the bankruptcy rate is associated with the occurrence of a crisis.

A difference then appears between the two series. The local peaks of the HP filtered series much often corresponds to the crisis years and they correspond to a change of the sign of the variation of bankruptcy rate (that turn from negative to positive). On the contrary, the peaks of the First-difference filtered series begun to increase before the crisis burst. This is coherent with an interpretation in which the central bank did not intervene when the bankruptcy rate begun to increase. Partly this can be explained by the fact that the first difference series included long-term component linked to the upward trend of the original series. This seems to suggest that everything happened as if the central bank interpreted the pre-crisis' increases of the bankruptcy rate as part of the long-term trend, and therefore discounted them in the conduct of its monetary policy.[22] As documented in the next section, the central bank did not indeed try to manage the pre-crisis year. Contemporary observers indeed noticed that the central banks accommodated the re-discount up to the point at which it became interested in managing its liquidity ratio (i.e. avoiding increasing the circulation of banknotes at the expense of decreasing its reserve to banknote ratio).

4. Hypotheses that may explained the changing pattern of the fluctuations of the bankruptcy rate

In this section, I review some elements that may explain the smoother fluctuations of the bankruptcy rate during the post 1870 period. I first start by analyzing the demographic factors and then turn to the changes that occurred in the conduct of monetary policy.

4.1. Demographic factors: Limited liability companies, moral hazard and the bankruptcy rate

The evolution of bankruptcies could have been determined mostly by changes in firms' demography. If the younger firms faced a higher probability to file for bankruptcy than older firms, it may be that the variations of the bankruptcy rate derived from a decreasing number of firms' creation

[22] This is coherent with the fact that very few economic commentaries of this time used the bankruptcy rate to gauge the evolution of the short-term variation of the economy.

during the course of the century. In that view the lower amplitude of the fluctuations of the bankruptcy rate shall then have been preceded by a lower amplitude of the fluctuations of the firms' creation. To test for this possibility, I use a 'difference in difference' approach and regress the variation between year t and t–1 of the number of bankruptcies on the variation of firms between years t – 1 and t – 2. If the change in the firms' demography is an important driver of the future variations of the bankruptcy rate, a positive and significant relationship must exist between the variation of the bankruptcy rate and the past changes in firms' creation. One obvious question is the number of lags. I also make various robustness check by adding supplementary lags to the computation. Letting Delta B (T) the number of bankruptcies between year T and T – 1 and Delta F the number of firms created in year T-1, the regression amounts to compute

$$\Delta B_t = a + b \Delta F_{t-1}$$

Since the patents statistics was compiled at the beginning of each year, the computation of the number of new firms, I subtract the number of firms that paid the patents during year t and t – 1 and added the number of firms that went bankrupted during year t - 1. The results, that are not reported here, show no association between the increase of the number of *patentés* and the variations of the bankruptcy rate.

Another possible explanation of the evolution of bankruptcy lies in a change of the number of corporations or companies as compared to individual private firm. The intuition will run like this. During the course of the century more and more corporations were created. Because they were characterized by some form of limited responsibility, this growth of corporations could have been an important driver of the bankruptcy rate. To check whether this may have been at stake, I study the evolution of the legal status of the companies during this period.

Three types of legal statutes existed for 19th century firm. The overwhelming majority was constituted of businesses that did not have any legal recognition and therefore existence. Those businesses were owned and managed by a single individual. Moreover the patrimony of the individual running the firm was not distinguished from the capital of the firm.It was however also possible to organize a business using partnership. The *1807 code de Commerce* provided the juridical framework of 19th century business organization. Among the various partnership forms that existed, ordinary partnership (*société en nom collectif*) were the most common form during the whole century (Lamoreaux and Rosenthal, 2005). It involves at least two individuals whose relationships were governed by a company contract (*contrat de société*). Yet each partner was also liable on their personal wealth for the partnership's debts. Another form of business organization was the limited partnership (*société en commandite simple*) whose contract bind general partner(s) – who manage the company and have unlimited liability – and special partner(s) who enjoyed limited liability but cannot take management decision. Partners could also organize their business using joint-stock companies,

i.e. limited partnership with shares. The liability of the various partners was similar to the regular limited partnership except that the capital was divided into shares that could have been bought and sold. Finally public company (*société anonyme*) was also an option. The shareholders have liability towards the company's debt limited to their capital contribution. Before 1867 their creation required the prior agreement of the government through one of its legal office – the *Conseil d'Etat*. Incorporation was free after this date.[23]

Figure XVII plots the evolution of the stock of partnerships and limited liability companies in percentage of the total number of firms (the *patentes* series).[24] The appendix details how the various stocks of partnerships and corporations were derived. In 1867 only 616 corporations had been chartered. This represents 0.045% of the firms in business this year. By 1913 the proportion had jumped to 1.2%. The stock of partnerships (ordinary or any type of limited) represented about 3% of the operating firms in 1840 and increased at a constant rate before the 1900s to about 10% in 1900. In 1913 they accounted for 11.7% of the stock of firms.

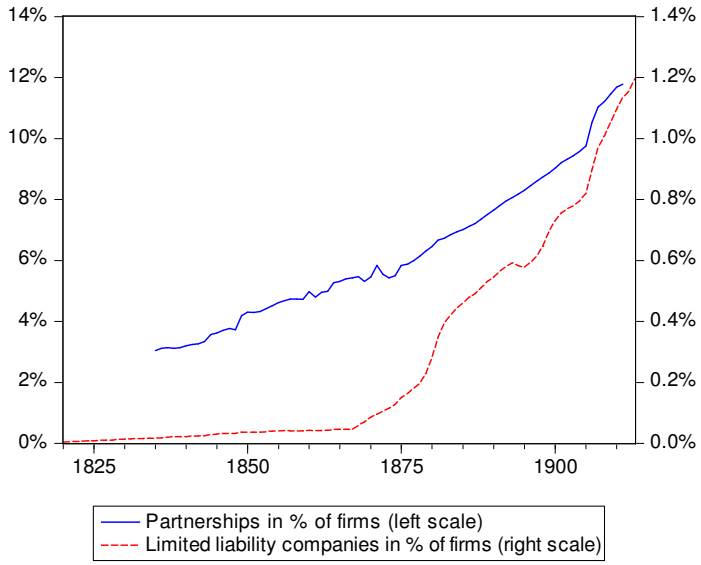

Figure XVII: The evolution of the proportion of partnerships in the total number of firms in France 1820-1913
Source: Author's computation, see appendix for details on sources.

As regards to the impact of the various types of business organization on the decision to file for bankruptcy and because of moral hazard problems, limited liability is often cited as one factor that may increase the bankruptcy rate. We have however seen that partnerships always involved the unlimited liability of at least some of the shareholders. Owners of regular partnerships have full

[23] Limited liability company (*Société à responsabilité limitée*) were made legal in 1925 only (Lamoreaux and Rosenthal, 2005).
[24] Before 1925 only incorporated companies (*sociétés anonymes*) guaranteed limited liability to the shareholders.

liability and therefore it is unlikely that they could have had an interest in playing moral hazard with the debtors since during a bankruptcy they would have had to repay the debt using their personal wealth. The managers (the *commanditaire*) of the limited partnership – who must also have been shareholders – were in a similar situation towards the other shareholders. They therefore would have had – on average – very little interest in managing the firms up to the point at which it had to go bankrupt. Therefore it seems unlikely that the observed growth in bankruptcies could have been explained by the rise of limited liabilities firms.

As for corporations, they could have been subject to moral hazard problem by the managers. But it must be noted that the decrease of the variance of the bankruptcy rate goes exactly in the inverse direction to the prediction given by the moral hazard problem applied to bankruptcy decision. The variance goes down in the 1870s exactly when the number of corporations skyrocketed. Moreover the stabilization of the bankruptcy rate around 0.6% in the 1890s occurred exactly when the increase of the proportion of corporations in the total of firms accelerated, as can be noted on figure XX. Finally when the number of bankruptcies is compared with the stock of corporations registered, the number of bankruptcies amounted to 50% of the registered corporations in 1913 (figure XVIII). Again, although the moral hazard associated with the rise of the limited liability corporations could have played a role in firms' bankruptcy decision, the impact was likely to have been of second order. The puzzle remained that the observed stabilization of the variance of the bankruptcy rate stabilized when the modern forms of organizing businesses spread widely.

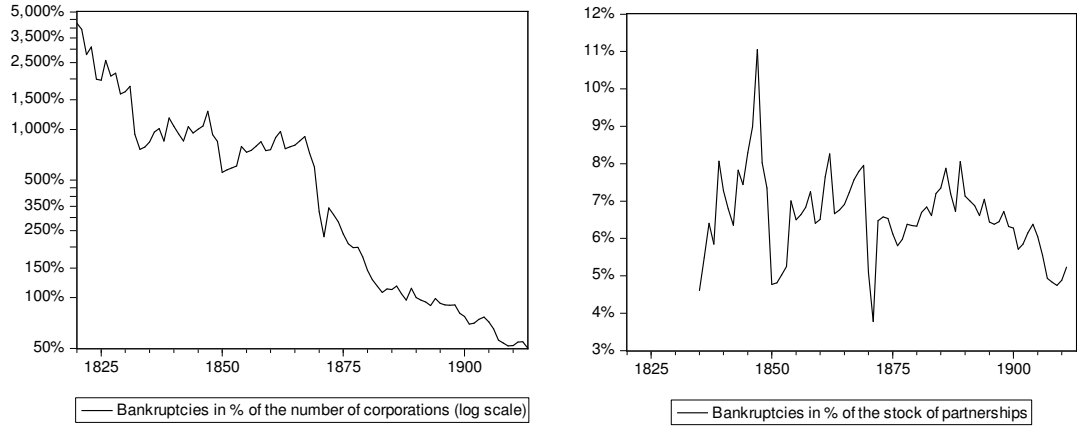

Figure XVIII: Proportion of annual bankruptcies in the stock of corporations (left) and partnerships (right) in operation during that year (France, 1820-1913)

Source: Author's computation using bankruptcy numbers and sources detailed in appendix

4.2. Monetary policy and the smoother evolution of the bankruptcy rate fluctuations

It is common to link the bankruptcies with financial turmoil, i.e. that firms' distress grew as financial conditions become more severe. One important factor of firms' greater discomfort during crisis comes from liquidity or solvency shocks, which partly originated in clients firms or in financial intermediaries. Those shocks translated in greater difficulty for firms to repay their debt and may lead to bankruptcy. It is impossible ex-post to distinguish between firms that went bankrupted because of liquidity or solvency problems. Then, rather than trying to disentangle those two dimensions, I look at the changes in the monetary policy of the central bank during the 19th century and articulate a number of arguments that are consistent with the view that the management of the crises by the Banque de France is likely to lower the variability of the bankruptcy rate.[25]

An important element that could have impacted the bankruptcy rate of firms and financial intermediaries is the refinancing policy of the central bank (notice that non-financial companies were also eligible to central bank refinancing).[26] During the whole period, the Banque de France is a public company whose capital is owned by its private shareholders. The government has granted it the privilege of issuing banknotes and required it to maintain the convertibility of those notes into gold and/or silver (France is on a bimetallic standard up to 1873 and then on the gold standard). The bank also performed (more) traditional banking function such as the financing of the private sector through either advances against securities or discount of bills of exchange.

The Banque de France then could have granted credit, using as collateral an asset that was not likely to default. The main instrument used by the Banque de France to refinance agents (financial or commercial) was the rediscounting bills of exchanges. Figure XIX plots the proportion of the discount facility to the advances made by the central bank against T-bills or other eligible securities. The Banque de France usually accepted as collateral bills for which the end-date was less than 90 days and it was said that most of the bills lasted between 90 and 180 days (Roulleau, 1913). The bank could however change the eligibility of the various maturities.

The endorsing parties of a bill of exchanges were the main collateral used by the central bank to grant credit to the other agents. Indeed solidarity among the endorsing parties must have ensured that in case of one defaulting, the others had to show up and paid in place of the defaulter. This type of collateral was then said to be quite safe. It was even safer than one could imagine since the central

[25] Another possibility is that the banking sector consolidated and became much safer during the course of the century; say because banks had a higher capital ratio or because their probability to go bankrupt decreased. Though I shall present some data on bankrupted financial intermediaries over the course of the century, the lack of data – even the number of banks is lacking – prevents the exploration in details of this possibility. Moreover, it is important to note that the specific role of the financial sector may prove especially difficult to disentangle from the policy of the private central bank.

[26] White have shown that the crisis of 1881 was especially mitigated by the behaviour of the central bank.

bank conducted a periodic assessment of the credit worthiness of its borrowers. Given that the main instrument through which the central bank provided liquidity did not change during the course of the century, the potential for a role of monetary policy in explaining the smoother evolution of the bankruptcy rate fluctuations may lie in a change of the type of policy implemented by the bank.

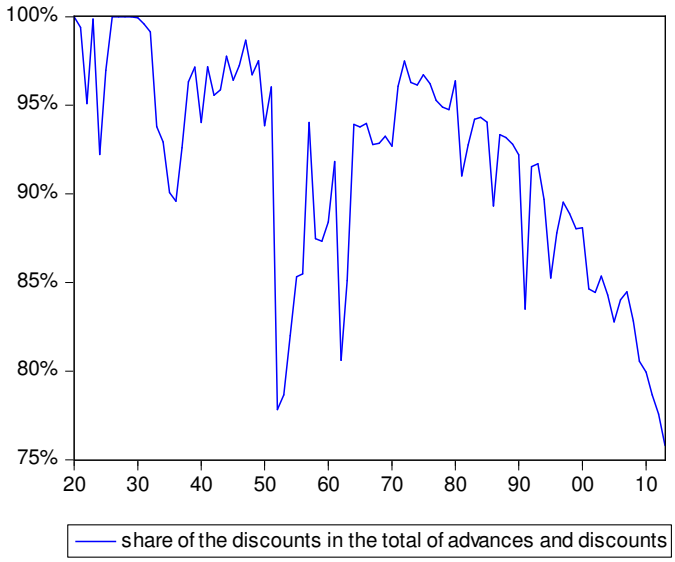

Figure XIX: Evolution of the share of the amount of the discounts in the total of advances and discounts provided by the Banque de France (1820-1913)
Source: Annuaire statistique de l'INSEE, partie rétrospective, 1946, p. 143-4

Section 2 had shown that the impact of each crisis on the variations of the bankruptcy rate is declining over the course of the 19th century. Before the 1860s, any financial turmoil drove the business failures rates to hits, while their impact was much softer after the 1870s. This result is coherent with the finding of Limousin (1900) that no relation existed between the bankruptcy rate and the years of crisis isolated by Siegfried (1899) during the 1872-1896 period.[27] As Siegfried isolated the crisis years with Juglar's criterion, this finding can be related to two different explanations. On one hand, either the central bank became able to better manage liquidity provision during crisis (which may explain why the evolution of Juglar's criterion appeared increasingly uninformative). This implies that the bank was able to isolate the impact of financial tensions on the real economy by changing the implemented policies. On the other hand, a regime change could have occurred in the 1870s (a period that corresponds to the Classical gold standard era) because either the bank experienced a relaxation of the convertibility constraint or because the structure of the discounting policies was deeply altered. This section documented the changes of policies that the central bank pursued during crisis.

4.2.1. The pre-1870 period.

[27] This finding was supplemented by the fact that no relation can be found for this same period between the loss incurred because of bankruptcies and the crisis' years.

The 1820-1850 period is depicted by contemporary as a period during which the central bank was constrained during crises by it's metallic reserves. Many blamed its timidity. Delamathe (1848) for example wrote that "La Banque de France, qui comme on sait, n'est pas prêteuse" (which may be translated as "The Banque de France, as anybody knows, does not lend") and added that it discounted very reluctantly bills, searching details to find a motive to reject the bill(s). During each crisis, the Banque de France believed that increasing too much the total of bills discounted may endangered the convertibility of the banknote. Ramon (1929) in his account of the 1847-8 crisis pointed that the (relatively) low rate of the bank during the crisis inevitably had attracted a lot of distressed sellers up to the point at which the central bank had judged that the metallic reserve was not sufficient to maintain the 'confidence' in the circulation of its banknotes. The bank then began to ration the quantity discounted by, for example, lowering the number of days of the eligible bills of exchange.[28] This chain of events transformed the commercial and financial crisis into a monetary crisis and explained why Juglar was able to trace commercial crisis into the central bank's balance sheet.[29]

During the worst crises of this period (1830 and 1847), the timidity of the Banque de France led the public authority to create or encourage the creation of new financial institutions to refinance the economy. Various "discount houses" (*Comptoirs d'escompte*) were founded in 1830 in the main cities to discount the bills that the central bank did not want to discount.[30] Other argued that the best solution to cope with crisis consists in increasing the capital of the Banque de France, arguing that the reason why the bank had to resume its refinancing operations was linked to it becoming short of collateral to pledge the bills whose value was uncertain. Other argued in favor of the resumption of the 1807 usury law to allow the bank to increase its interest rate and then to keep its metallic reserve. A.B. (1857) discussed and refuted this last proposal on the ground that this would have increased the benefit of the central bank but also make more costly for lenders to discount their bills (p. 16-7). After having opposed some arguments to the proposal of an increase of the bank's capital, A.B. argued that the real causes of financial crisis are grounded in the malfunctioning and inappropriate organization of the credit system. He then blamed that the bank had to repay its banknotes on demand and proposed to introduce some frictions in this ability by allowing the reimbursement of banknotes only at pre-specified and periodic dates.

The figures X and XI (the liquidity and refinancing ratio) suggest however that the central bank's policy changed during the 1850s and 1860s when the central bank started to increase its interest rate to cope with financial difficulties. Indeed the ratio of the total value of discounted bills to the

[28] See Juglar (1862 and 1889) for a description of the reaction of the central bank during each of those crises.
[29] Commercial crisis is often referred to at that time as the difficulty in financing trade using bills of exchanges. See Juglar (1862, 1889) for a detailed exposition.
[30] See Delamathe (1848). The foundation of the Comptoir National d'Escompte in 1848 is said to have been inspired by the role assigned to the various Comptoirs d'escompte during the 1830 crisis.

central bank metallic holding increased several times during the crisis year of 1847, 1857 and 1864. Conversely the banknotes-to-reserves ratio hit the lowest floor of the series, with a value of circulating banknotes to the metallic reserves amounting to about 35 to 40% of the metallic holdings of the bank. This occurred in a period of varying interest rates of the central bank. Figure XX plots the value of central bank refinancing (discounts and advances on securities). The panel on the left shows the evolution of the deviation of the cyclical component to the trend. The trend and cyclical component of central bank's refinancing is on the right panel.[31] Graph XX shows that although the absolute value of central banks refinancing was flat before the 1850s, their relative value compared to the trend is much larger during the crisis of 1830 and the subsequent crisis. This suggests that problem could not have been a matter of intention but rather of means, as pointed by Ramon (1929).

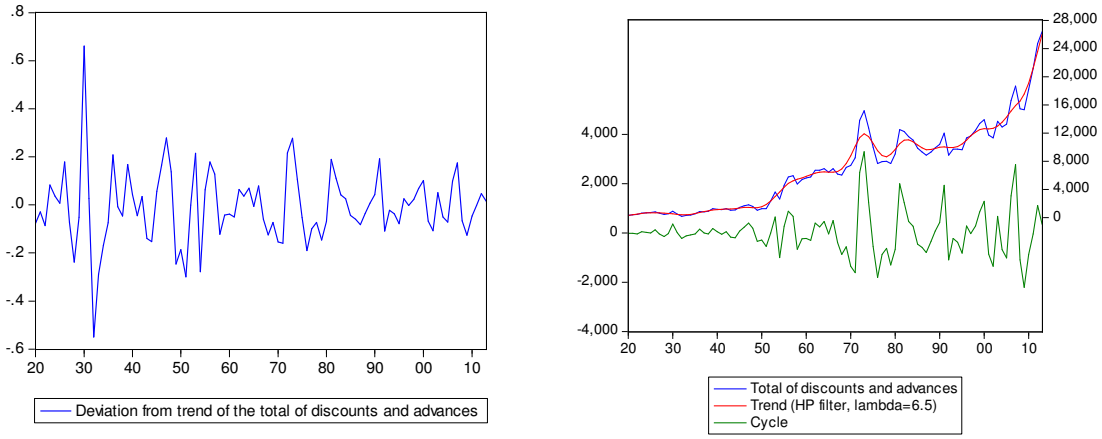

Figure XX: (a) Deviation from trend of discounted bills and advances on securities at the Banque de France (left) and (b) trend and cycle of CB discounts and advances (right)
Sources: INSEE statistical yearbook, 1946, retrospective part (p. 143*-144*)

With the removal of the usury law at the beginning of the Second Empire in 1850, the Banque de France began to use its interest rate as a tool to cope with financial and monetary crisis. Martin (2009) following one interpretation of Bagehot (1873) argued that the increase of the interest rate was intended to manage the metallic reserves of the central bank. In this reasoning, an increase of the interest rate discourages outflows of gold and silver from the safes of the central bank. Bignon, Flandreau and Ugolini (2011) however argued that those increases may also be interpreted as a tax on commercial banks' excessive timidity to lend to other banks on the money market because the commercial or private banks had to pay the discount rate to deposit at the central bank. Any increase in the central bank rate therefore raises the opportunity cost of not lending to the other players of the interbank markets. That way, the money market could have been be reactivated much more quickly. Figure VIII shows that during this period the peaks of the series lasted only one year, suggesting that the periods of high interest rate on the money market were used as a short-term tool and not

[31] The trend component is measured using the Hodrick and Prescott filter with Lambda set at 6.5.

permanently. Interestingly enough, during this policy of high interest rate, the variance of the bankruptcy rate decreased during the 1851-1869 period compared with the previous period (1820-1850), though the difference is not significant (see table 1).

4.2.2. Post 1870 changes.

Section 3.1 had documented that financial crisis did not disappeared during the last 40 years of the period. But the joint evolution of the ratios of central bank activities and of other crisis' indicators are coherent with an interpretation stating that the central bank was able to accommodate a higher level of re-financing of the economy during the latter part of the period. The rest of this section studies the possible explanations for this co-movement. Were they due to a much more aggressive central bank's rediscounting policy or to the loosening of the liquidity constraint created by the commitment to the gold – silver standard?

To check whether central banks accommodated more refinancing of the economy during the last decades of the century, it is interesting to look again at graph XX and to compare the pre-1870 figures of the total value of bills discounted by the central bank with those of the post-1870 period. The right-hand side graph shows an increased volatility of the total discounted or advanced, which tends to indicate that the intervention of the central bank during crisis increased substantially. However, when those interventions are measured as the deviation to the trend component, this seemingly higher variability of the central bank's refinancing disappears. Hence, although the absolute numbers became larger during the course of the century, their relative size did not vary much.

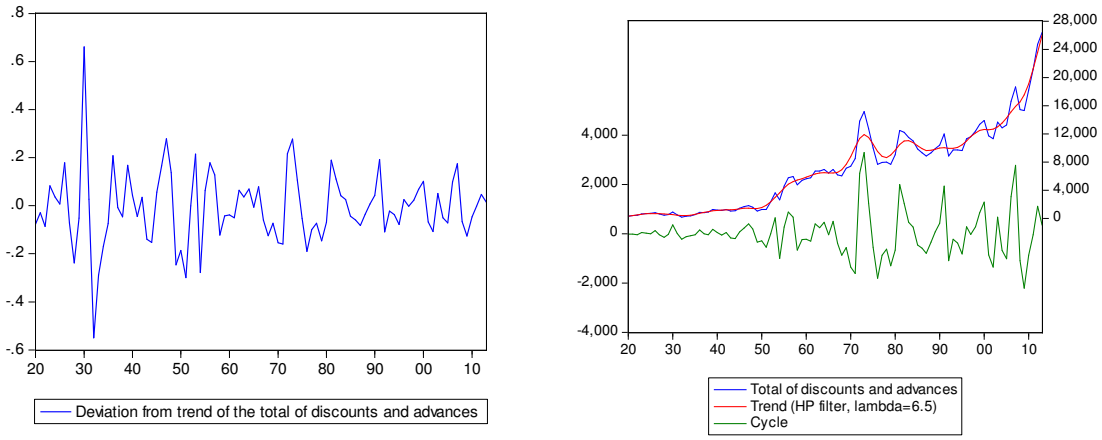

Figure XX: (a) Deviation from trend of discounted bills and advances on securities at the Banque de France (left) and (b) trend and cycle of CB discounts and advances (right)
Sources: INSEE statistical yearbook, 1946, retrospective part (p. 143*-144*)

Part of the explanation came partly from the fact that, during the 1860s, the central bank begun to accumulate huge reserves. Their total value, plotted on figure XXI, increased from few hundreds to

4,000 millions on the eve of World War I. This shall have made the central bank less sensitive to the fear of not being able to guarantee the metallic convertibility of its banknotes. This also explains the relative stability of the ratio of banknotes to metallic holdings documented by figure XI (the liquidity ratio of the French central bank). This tends to indicate that the central bank became able, after 1870, to secure an increase of the total value of discounted bills while managing to prevent a decrease of the gold and silver holding. The increase of the metallic reserve allowed the central bank to manage an increasing leverage of refinancing during bad times without impacting the free convertibility of the banknotes in gold. In the same time, as described by Contamin and Denise (1999) and Contamin (2003), the Banque de France used various – non conventional – tools to discourage the outflows of metallic reserves during bad times, such as reimbursing the banknotes in silver rather than in gold (the country was then formally on gold only). But the other part of the explanation must also lied in an increased ability of the central bank to better manage the refinancing of distressed agents while limiting its exposure to risky assets. I consider both issues in turn.

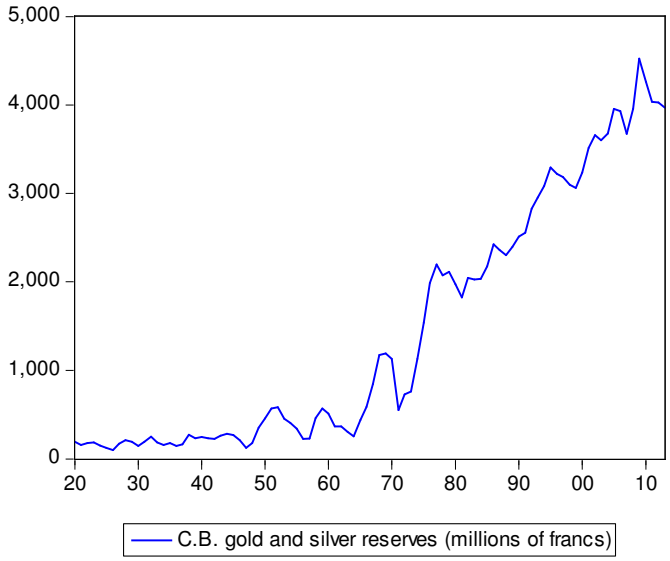

Table XXI: The metallic reserves in the safes of the Banque de France
Source: INSEE, Annuaire statistique de la France 1946, partie retrospective (p. 143-4)

4.2.3. The Banque de France was not a bad bank

The main instrument for refinancing the economy was then the discounting of the bills of exchanges. Historians insisted that the policy of the bank was especially conservative since it discount only bills endorsed by at least 3 persons (Lescure, 2003). The endorsing parties of a bill of exchanges were then jointly liable for the repayment of the debt. Though, the central bank could have chosen to act as a bad bank by selecting the bills of insolvent firms, and withdrawing those bad (risky) bills from circulation. To check whether the smoother variations of the bankruptcy rate were accompanied by a

relaxation of the quality standard of the central bank, I study the quality of the bills discounted by the central bank.

The quality of the bills can be judged by looking at those that became protested. Protested bills were those that appeared unpaid at the due – pre-specified – date. And the act of protesting a bill was a legal action that allows the debtors to turn to other endorsers for the payment of the unpaid bills. As the protested bills potentially created a loss for the central bank, it kept track of them in a specific account. This account allows both to track the evolution of the status of those bills but also to determine the provisions accounted by the bank when it set up its profits and losses statement at the end of each year. The losses associated with those bills were only potential, possible and because of the joint liability of the endorsing parties, they became effective only when all the endorsing party ended up defaulting. The numerator of the bad bank ratio is then estimated using the numbers – published each year in the report to the bank's shareholders – written in the account "*Nouveaux effets protestés durant l'année*" (newly protested bills during the year). The denominator was taken in the INSEE Statistical Yearbook of 1946.

To check whether the bank act as a *bad bank*, the ratio of the value of protested bills to the total amount of bills of exchanges discounted by the central bank is computed. This ratio is then compared to the same ratio but computed using numbers at the economy-wide level. The latter includes any bills issued between 1842 and 1912. The estimation of the value of circulating bills was computed by Roulleau (1913), who used a fiscal source, the stamp duties, to infer the true numbers of both the value of issued bills and protested bills. If the former is higher than the latter, this will tend to indicate that the central bank used its refinancing facilities to help in priority the most distressed (and riskiest agents. On the contrary, if the CB ratio is much lower, this will undoubtedly indicated that the smaller fluctuations of the bankruptcy rate must not be attributed to a relaxation of the standard of the rediscounting facilities.

Figure XXII plots the two ratios. It shows that the central banks did accept very few bills that ended up as being protested and that it was able to better discriminate between borrowers than the private agents. Indeed the level of the central bank ratio is much lower than the other with an average of 0.18% during the 1826-1900 period (2.19% at the level of the economy). The central bank did not provision for protested bills during 40 of the 95 years of the time period. During 22 years, the provision amounted to less than 0.1% of the value of the bills discounted. At the economy-wide level, the percentage of protested bills decreased sharply after the 1870s, from 3.79% in 1842 and 2.78% in 1874 to 0.78% in 1912.

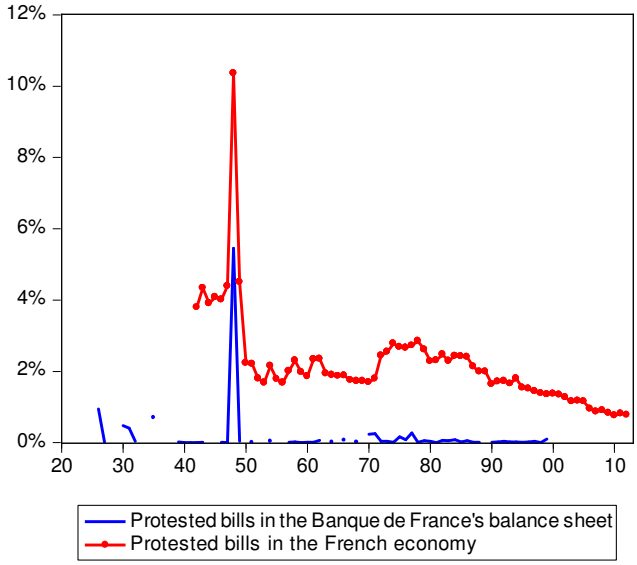

Figure XXII: Amounts of protested (unpaid) bills held by the central bank or circulating in the economy in % of their respective total amount.
Source: annual reports of the Banque de France, 1820-1913 (protested bills held by the Banque de France), 1946 INSEE statistical yearbook (bills discounted by the central bank), and Roulleau (1913, protested bills and total bills at the economy-wide level).

Illiquidity or insolvency of financial intermediaries may prove especially important to translate the financial tensions to the non-financial firms. Their failures may indeed modify the price or availability of the financial contracts or even make other firms forced to file for bankruptcy because part of their cash were deposited in the vaults of bankrupted intermediary. To this end figure XXIII plotted the number of banks, brokers and speculators filing for bankruptcy during each year of the 1820-1849 and 1875-1913 periods together with the stocks of banks branches operated during some sampled years.[32] The graph shows that although the number of banks branches increased, the absolute number of bankruptcies of financial intermediaries decreased during the 1875-1913 period compared to the 1840.

The increased safety-ness of the bills of exchanges as a mean of payment and the decrease of financial intermediaries' bankruptcies did not mean that the economy became safer in terms of business failures. The evolution of the bankruptcy rate (figure I) shows a century long increase up to the 1890s. Therefore the vanishing impact of the bankruptcy rate is consistent with the view that the economy was much more dynamic, riskier but also that liquidity management during crisis was able to smooth the various shocks that hit the economy.

[32] The number bankrupted financial intermediaries were taken in the Compte General de la Justice Civile et Commerciale for the later part of the period and in the archives, file F 20 720 – 1/2. The stock of banks was estimated by Hoffman, Rosenthal and Postel Vinay (2007) using the volumes of the yellow pages. Indeed during the whole period, entry in the banking sector did not require a registration to any public authority.

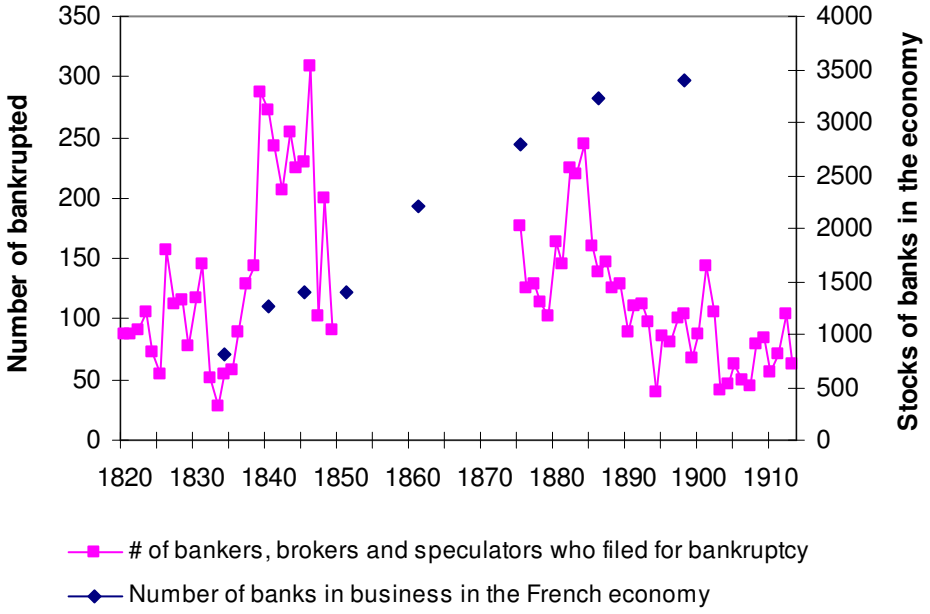

Figure XXIII: Bankruptcies of financial intermediaries and bank branches (selected dates)
Source: Archives Nationales, Annuaire de la justice civile et commerciale and Hoffman et al. (2007)

4.2.4. Changes in the management of the central bank rediscounting facilities.

An important change of the French central bank intervention was the development of a network of bank branches throughout the territory. The development of this network was the local arm through which the central banks increased the refinancing of the French trade during the 19th century (Jobst, 2007). This is likely to have impacted the evolution of the fluctuations of the bankruptcy ratio since it is computed at the national level for the whole century. Indeed one expect that, provided the refinancing of the central bank impacted negatively the likelihood of bankruptcy, that a cheaper and easier access to central bank refinancing must have lowered the number of firms that went bankrupt because of liquidity shortages. The development of the bank's branch network should have reduced the transaction costs associated with the liquidity provision to private agents as well as the availability of this cash during financial distress event. In a country in which numerous local banks were the main financial intermediaries that financed the local economic activity (as shown by the recent historiography, see Lescure and Plessis, 1999), the development of the central banks' network must have had the impact of easing the refinancing of the local banks, even in times of crisis.

To conclude a last mechanism is worth mentioning. Besides the massive accumulation of the metallic reserves, the use of non-conventional tools of to limit the reimbursement of banknotes during periods of financial stress and the expansion of the bank branches, it is also possible that the relatively weaker volatility of financial events was not explained by the policies of the Banque de France but rather by those of the Bank of England. Indeed, Flandreau and Galice (2005) had shown that during the 1900s, Paribas was able to manage a refinancing of their portfolio directly at the Bank of England.

Provided this can be generalized to other French banks, and given that in the 1900s the Banque de France helped the Bank of England to cope with financial and monetary difficulties, those facts could well explained why the management of the crises by the European central banks did not worsened the situation through the implementation of inappropriate policies. This may well explained the decreasing variance of the fluctuations of the bankruptcy rate during the 19th century. But this also implies that something has to be said about crisis' management by the central banks during the early period.

5. Conclusion.

In this paper, I documented the fluctuations of the bankruptcy rate in France between 1820 and 1913. It was shown that the variance decreased massively during the course of the century. This finding seems to be a feature unique to the bankruptcy rate and it suggested that a regime change occurred after 1870. It was also shown that the short-term components of the bankruptcy rate peaked during most of the crisis prior to the 1880s but that posterior crises did not exhibited such a feature. This is in line with Limousin (1900) who concluded that no relationship exists during the last three decades of the century. Those changes were linked to the changing pattern of the monetary policy implemented by the central bank during the century. Indeed one of the important change that occurred as far as financial (commercial as contemporary observers qualified those events) crisis were concerned was the breakdown of the link, existing up to the 1850s, between financial crisis and monetary crisis. After 1850s, a commercial crisis does no longer endanger the bank's existence. Future research will be devoted to better track the link between the bankruptcy rate and the real indicators. It will also search for measures of the deep changes that the financial sectors experienced during this century.

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Appendix: data sources

The population of firms

The number of *patentés* of the years 1822 and 1829 were taken in Block (1867, p. 489) and in Rapport au Roi sur l'administration des finances (1830, p. 25).[33] Those of the years 1821 and 1826 were taken in Block (1860, p. 124). The 1830 figure is published by Rubichon (1837, p. 140). The number of patentés (professions liberals excluded) in 1845; 1852; 1859; 1861; 1863; 1869; 1871; 1873; 1880; 1890 were taken in Hennebique (1894, p. 758). The figures (without *professions liberales*) for the remaining years in the time span between 1860 and 1905 are detailed in the *Résumé rétrospectif de la France* published in the 1905 statistical yearbook of the *Statistique Générale de la France*. Numbers for the years 1906-1910 are taken in Jobert (1991, p. 37). The numbers of *patentés* are also available for 1844 and 1845 in Guillaumin (1846, p. 341) and in 1844-1874 in Loua (1877, p. 283). The number of *patentés* in 1820 and 1823-1825 is interpolated linearly using the total amount paid of the *patentes* tax of the years 1817-1828 as published in Audiffret (1854, p. 324).

As the numbers of *patentés* for the years 1850, 1851 and 1853-1858 does not provide a breakdown by types of activity (i.e. trade, banking, financial intermediaries and industry), a correction is needed to adjust for the number of physicians, surgeons, veterinarians, bailiffs, auctioneers and architects. As there are very few variations in the numbers of professions liberals during those years (the numbers ranges between 51,700 and 52,000), the number of *patentés* is computed for those years by subtracting the average of the minimum and maximum numbers.

For the remaining years that ranged between 1827 and 1843, I was not able to find a source with the number of persons liable to the payment of the patentes tax. The number of *cotes des patentes* was however published in the *Compte général de l'administration des finances* (1838, p, 50-1) and in the *Résumé rétrospectif* (1905, p. 128). I therefore use this series to interpolate the missing years by using the number of cotes as the percentage of evolution between years. This amounts to suppose that the number of activities (professions) that a person exercised was constant during the period (which means that there were very limited change in the diversification of shopkeepers or manufacturers). When both numbers are available, the number of cotes exceeded the numbers of patentés by 3 to 5 %.

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[33] The number for 1829 is the same as the one published by Vignes (1862, p. 444)

Sources for the data on partnerships and corporations

Sociétés anonymes (SA). 1820-1867: Freedeman (1965, table 1 page 200). 1867-1879: *Compte Général de la Justice Civile et Commerciale*. 1880-1913: 'retrospective' part of the 1946 INSEE statistical yearbook (p. 79). When available (after 1890) statistics on the dissolution of SA is used to more accurately measure the stock of SA.

Partnerships. For any other society than the SA, those numbers were taken after 1840 in the yearly *Compte Général de la Justice Civile et Commerciale*. The number of partnership dissolution was published in the same source but only after 1859. There is no information on the stocks of companies in France before 1840 but a number quoted in Freedeman (1965, p. 202) citing a parliamentary report by M. Legentil. This mention pointed to the registration of 1106 *commandites par actions* at the Paris commercial court during the 1826-1837 period.

The estimation of the stock of partnership needs to made assumptions on (a) the number of dissolution in the pre-1859 period and on (b) the stock of companies before 1840. Assumption (a) aimed at correcting for the fact that a change in the characteristics of the company's contract (such as a change of the general partner in a limited partnership) implied that the company had to be re-created and then dissolved. Given that the average ratio of dissolved companies to newly registered companies is about 51.45% between 1859 and 1913, this correction will impacted hugely the estimate of the stock. The following assumptions had been made:

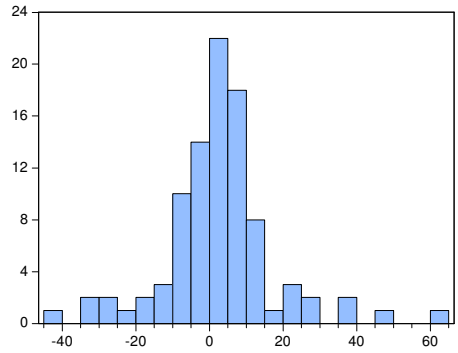
- The number of dissolution of partnerships during each year prior to 1859 is estimated using the average ratio of created to dissolved companies using the years 1859-1880 as the benchmark (56.55%).
- Second I use Freedeman mention of the number of limited partnership with share (1106) registered in the Paris court to extrapolate the number of companies registered in France between 1826 and 1837. divide the number of newly registered *commandites par actions* companies in Paris in 1826-1837 by an estimate measuring the proportion of this type of companies in the total number of firms registered in France. The estimation is done using the number published in the yearly *Compte de la Justice Civile et Commerciale* for 1840-1843 and 1845-1846. It shows that the Parisian *commandites par actions* represented 3.56% of the companies registered in France during those years. This yields an estimate of 31,000 companies registered in France between 1826 and 1837.

I additionally make the two following extreme assumptions: (1) I do not correct here for the number of dissolution during this period, (2) I assume that the stock of partnership in 1825 is zero.[34] Those two assumptions are motivated by the following notes. First I do not know the dynamics of companies creation during this period and Freedeman (1965, p. 202) mentioned a boom in the 1830's. Second, my estimate is not unreasonable compared to the figures of the 1840s. My estimate gives about 2500 registration of companies per year in France between 1826 and 1837, a number that is in line with the figures of the 1840s (average of 2,300 per year). A dissolution rate of about 56% during this period would have produced about 16,000 dissolutions, leaving a stock of about 15,000 companies. Given that the registration of new companies in the 1840s averaged at about 1,000 per year, this is equivalent to assume a stock of 3,000 in 1825, a figure that is not so different from the assumption of a negligible stock. More importantly it is important to remember that any important change in the statute required another registration of the companies (as this allows publicizing the partnership's contract).

[34] This is obviously a strong assumption since the statute of unlimited liabilities partnership was allowed well before 1825. Yet I was not able to find any estimates for the previous period. I will be grateful to any scholar ready to share his knowledge on the stock of partnership in France before the 1830.

Tables and figures.

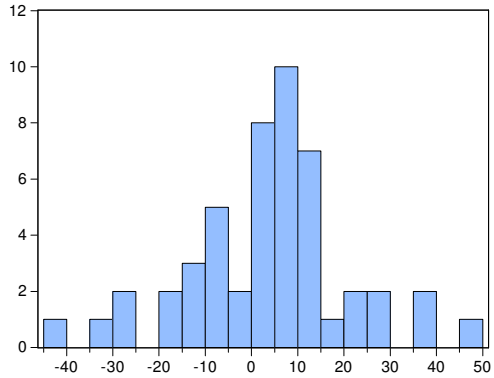
(a)



Series: Deviation of the bankruptcy rate to its initial level (first difference)
Sample 1820 1913
Observations 93

Mean	2.622700
Median	2.822941
Maximum	62.72155
Minimum	-43.63371
Std. Dev.	15.40667
Skewness	0.474059
Kurtosis	6.305044
Jarque-Bera	45.81119
Probability	0.000000

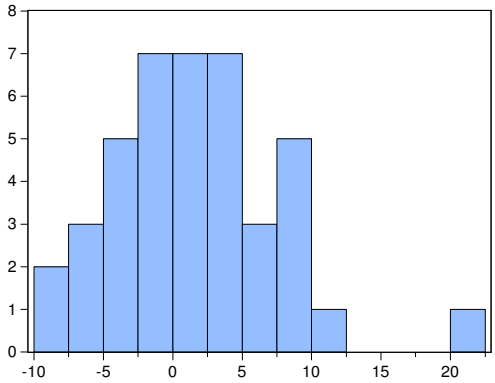
(b)



Series: Deviation of the bankruptcy rate to its initial level (first difference)
Sample 1820 1869
Observations 49

Mean	3.597334
Median	5.052314
Maximum	48.68756
Minimum	-43.63371
Std. Dev.	17.49628
Skewness	-0.158076
Kurtosis	3.853317
Jarque-Bera	1.690707
Probability	0.429405

(c)

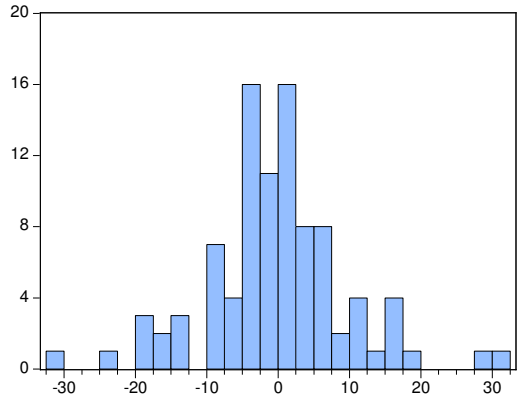


Series: Deviation of the bankruptcy rate to its initial level (first difference)
Sample 1873 1913
Observations 41

Mean	1.460548
Median	0.865026
Maximum	22.29434
Minimum	-9.726569
Std. Dev.	6.177141
Skewness	0.749052
Kurtosis	4.509260
Jarque-Bera	7.725389
Probability	0.021011

Figure III: Descriptive statistics on the distribution of the first difference series (deviation in % of the 1st difference to the level of the bankruptcy rate)
Panel (a): 1820-1913. Panel (b): 1820-1869. Panel (c) : 1872-1913

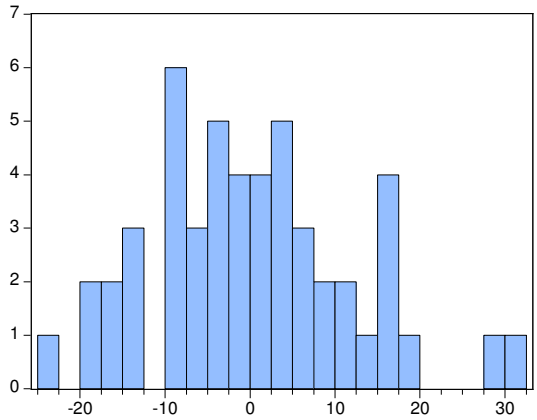
(a)



Series: Deviation of the cyclical component of the bankruptcy rate to its trend (HP=6.5)
Sample 1820 1913
Observations 94

Mean	-0.284186
Median	-0.487946
Maximum	31.45478
Minimum	-31.88304
Std. Dev.	9.894626
Skewness	0.074619
Kurtosis	4.764863
Jarque-Bera	12.28664
Probability	0.002148

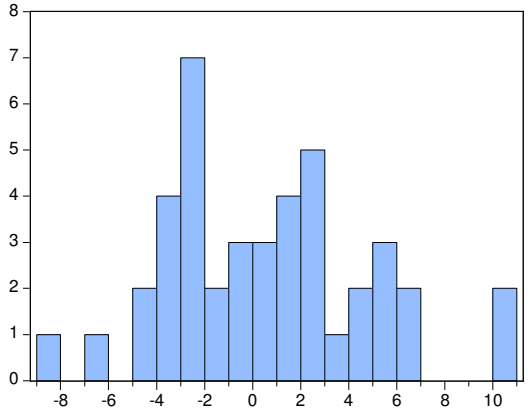
(b)



Series: Deviation of the cyclical component of the bankruptcy rate to its trend (HP=6.5)
Sample 1820 1869
Observations 50

Mean	0.075962
Median	-1.076237
Maximum	31.45478
Minimum	-23.73940
Std. Dev.	11.99742
Skewness	0.396392
Kurtosis	3.034752
Jarque-Bera	1.311906
Probability	0.518947

(c)



Series: Deviation of the cyclical component of the bankrupcty rate to its trend (HP=6.5)
Sample 1872 1913
Observations 42

Mean	0.454301
Median	0.219942
Maximum	10.13641
Minimum	-8.716380
Std. Dev.	4.192238
Skewness	0.364503
Kurtosis	2.829933
Jarque-Bera	0.980652
Probability	0.612427

Figure IV: Descriptive statistics on the distribution of the first difference series (deviation of the HP filtered cyclical component to the trend of the bankruptcy rate)
Panel (a): 1820-1913. Panel (b): 1820-1869. Panel (c) : 1872-1913

	1820-1869 vs. 1872-1913	1820-1869 vs. 1872-1913	1820-1869 vs. 1872-1913	1820-1851 vs. 1852-1869	1820-1851 vs. 1852-1869	1820-1851 vs. 1852-1869
Method	df	Value	Probability	df	Value	Probability
F-test	(41, 51)	9.308151	0.0000	(17, 31)	2.447576	0.0296
Siegel-Tukey		4.764569	0.0000		0.980248	0.3270
Bartlett	1	44.32172	0.0000	1	3.844429	0.0499
Levene	(1, 92)	26.74118	0.0000	(1, 48)	2.763318	0.1030
Brown-Forsythe	(1, 92)	26.13014	0.0000	(1, 48)	2.470029	0.1226

Table 2: Results of the tests of equality of variance for the various subsamples.
Sources: Author's computations.

HP with λ set to 100	Real GDP	IP	Indust. prices	BR	WP
Real GDP	1	0.271510	0.024127	0.149697	-0.116355
IP	0.271510	1	0.412154	0.247539	0.208124
Indust. prices	0.024127	0.412154	1	-0.052450	0.099126
BR	0.149697	0.247539	-0.052450	1	0.458123
WP	-0.116355	0.208124	0.099126	0.458123	1

HP with λ set to 6.5	Real GDP	IP	Indust. prices	BR	WP
Real GDP	1	0.267308	-0.008537	0.184072	-0.049113
IP	0.267308	1	0.359579	0.295012	0.217351
Indust. prices	-0.008537	0.359579	1	0.029788	0.091429
BR	0.184072	0.295012	0.029788	1	0.383689
WP	-0.049113	0.217351	0.091429	0.383689	1

Table 3: Cross correlations of the deviations from HP trends (λ set to 100 or 6.5) of the bankruptcy rate (BR), real GDP, index of industrial production (IP), index of industrial prices (Indust. prices) and wheat prices (WP).
Source: Author's computations using the references indicated in the text.

	BR	BR	Real GDP	Real GDP	IP	IP	Indust. Prices	Indust. Prices	Wheat price	Wheat price
	HP λ=6.5	HP λ=100	HP λ=6.5	HP λ=100	HP λ=6.5	HP λ=100	HP λ=6.5	HP λ=100	HP λ=6.5	HP λ=100
Max	0.315	0.465	0.006	0.007	0.024	0.031	0.0103	0.015	0.120	0.134
Min	-0.319	-0367	-0.007	-0.008	-0.033	-0.045	-0.009	-0.013	-0.075	-0.097
St. Dev.	0.099	0.131	0.002	0.0033	0.009	0.013 4	0.004	0.006	0.035	0.045
Auto correlation (1 lag)	0.063	0.363	-0.211	0.002	0.04	0.451	0.204	0.48	0.19	0.4
Auto correlation (2 lags)	-0.218	-0.023	-0.207	-0.13	-0.32	0.071	-0.237	0.001	-0.344	-0.14
Skewness	0.071	0.073	-0.243	1.092	-0.855	-0.584	0.039	0.023	0.583	0.372
Kurtosis	4.765	4.961	3.144	10.998	5.531	4.295	2.43	2.454	3.842	3.362

Table 4: Descriptive statistics: Deviations of the Bankruptcy rate (BR), Real GDP and Index of industrial production (IP) from trends with λ set to 100.
Source: Author's computations using the references indicated in the text.

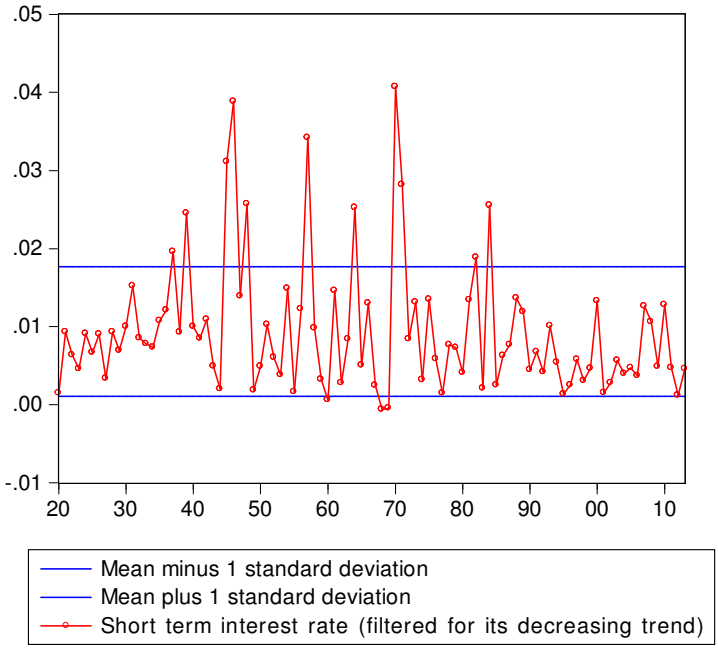


Table XIII: Annualized short-term interest rate (filtered for its decreasing trend with the HP filter)

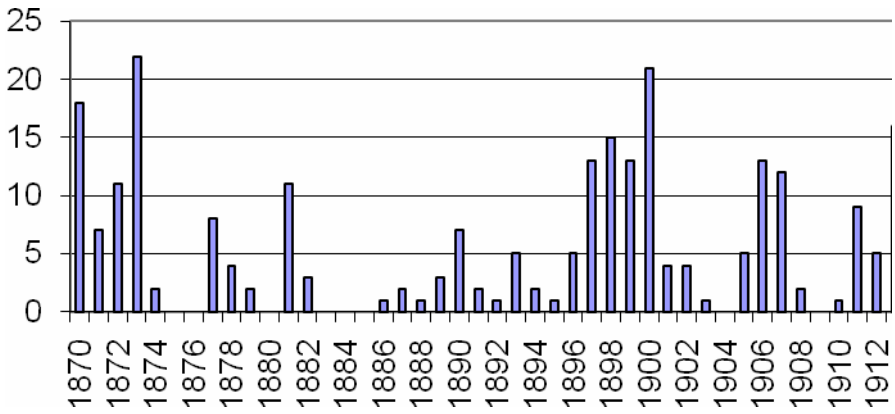


Figure XIV : Numbers of weeks with a nil interest rate differential between the Bank's and the money market's rate (1870-1913, Mean = 5.73; St. Dev. = 6.14)

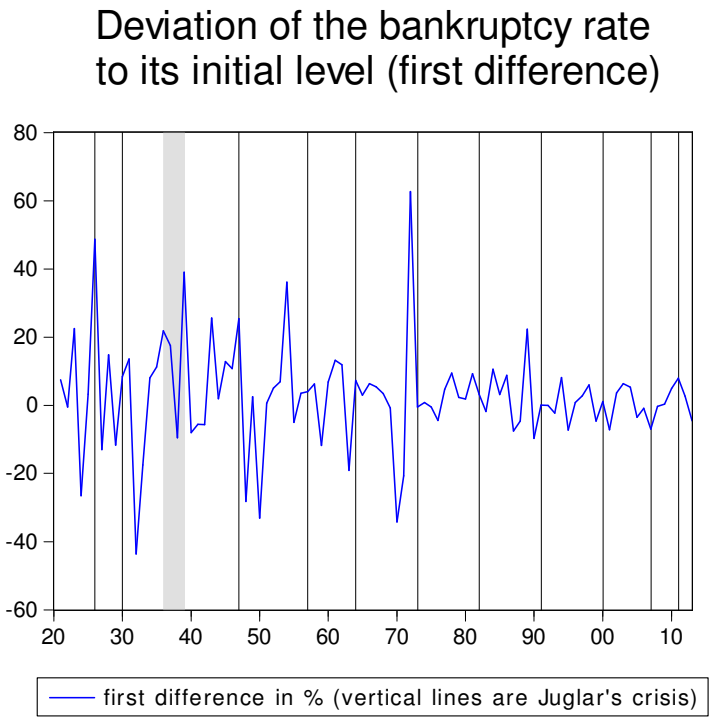
Source: The Economist

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Deviations of the BR to its trend, greater than one st. dev. (**HP filter**)	Growth rate of the BR to its trend, greater than one st. dev. (**FD filter**)	Central bank ratio Juglar, 1862 edition	Central bank ratio Juglar, 1889 edition	Central bank ratio Siegfried (1899)	Central bank ratios Bignon using Juglar's criteria	Short term Implicit Interest Rate Local Max	Short term Implicit Interest Rate, greater than one st. dev.	Negative variations of the stock index, greater than one st. dev.
Crises' years	Crises' years	Crises' years	Crises' years	Crises' years	Crises' years	Crises' years	Crises' years	Crises' years
						1821		1821-23
1823	1823					1824		
1826	1826	1826	1825		1826			1827-29
1831		1830	1830		1830	1831		1831-35
1837	1836	1836	1836-39		1836	1836	1837	
1839	1839	1839			1839	1839	1839	1839-43
	1843					1842	1845-46	
1847	1847	1847	1847	1847	1847	1848	1848	1848-51
1854	1854					1854	1854	1854-55
		1857	1857	1857	1857	1857	1857	1858-59
1862						1861	1864	
			1864	1864	1864	1864		1864
1868								1866-67
1869						1871	1870-71	1870-71
1872	1872			1873	1873	1873		1873-74
								1877-80
1882			1882	1882	1881	1882		1883-89
	1889			1891	1891	1888-1891		
								1894-96
				1900	1900	1900		1901-04
						1903		
					1907	1907		1907-09
					1911	1913		1911, 1913

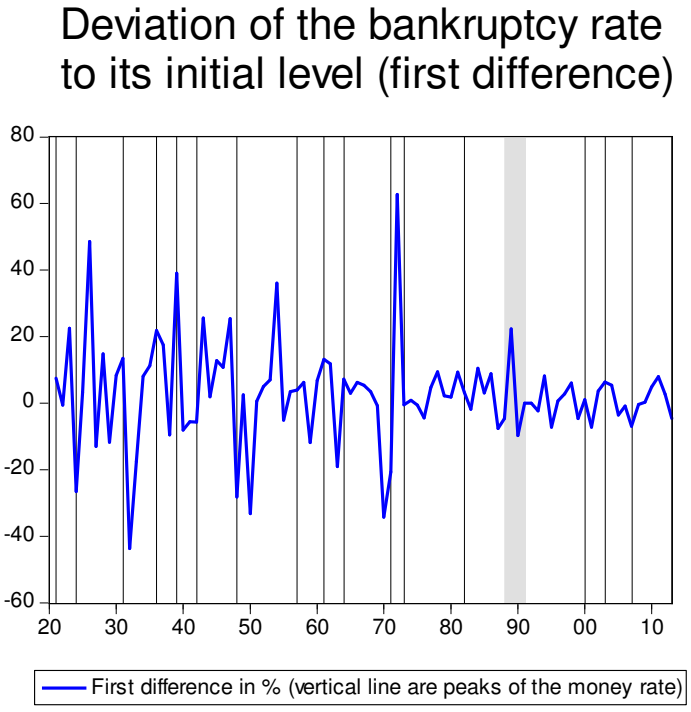
Table V: Crises' years according to various indicators.

Note: Six observations are missing for computing the implicit short-term interest rate in 1830 (the second semester) which seems to result from the occurrence of the 1830 revolution. This may explain why 1830 is not the local maximum of the interest rate series. Interpreting the absence of prices as an infinite price, 1830 must be taken as the peak year for the 1830-1831 period. The same situation holds in 1870.

Source: See text for all sources except the stock index which comes from Arbulu (2006). The negative evolutions are judged as variations of the stock index to its trends



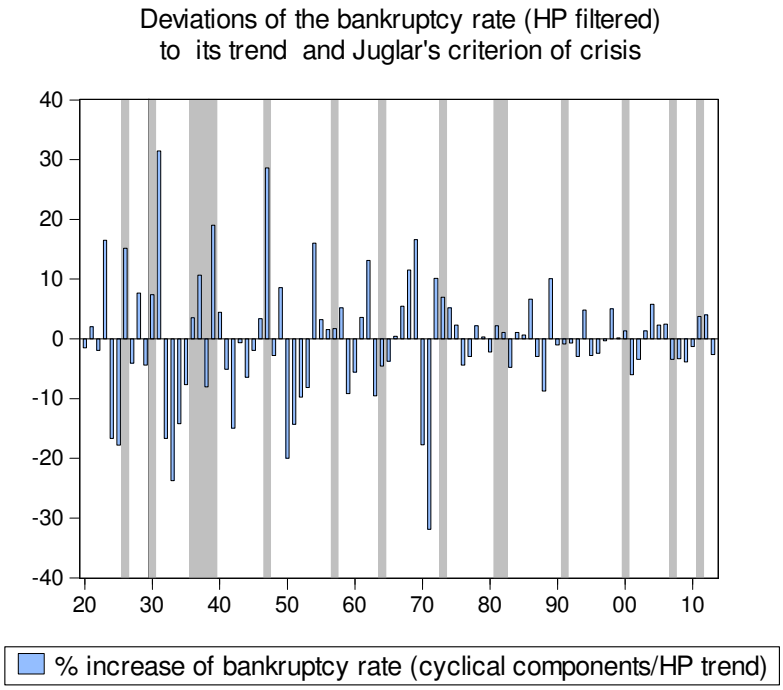
(a)



(b)

Figure XV: Pannel (a): The growth rate of bankruptcy rate and the crisis years according to Juglar's criteria. (b) The growth rate of the bankruptcy rate and the crisis years according to peaks of the money-market rate

(a)



(b)

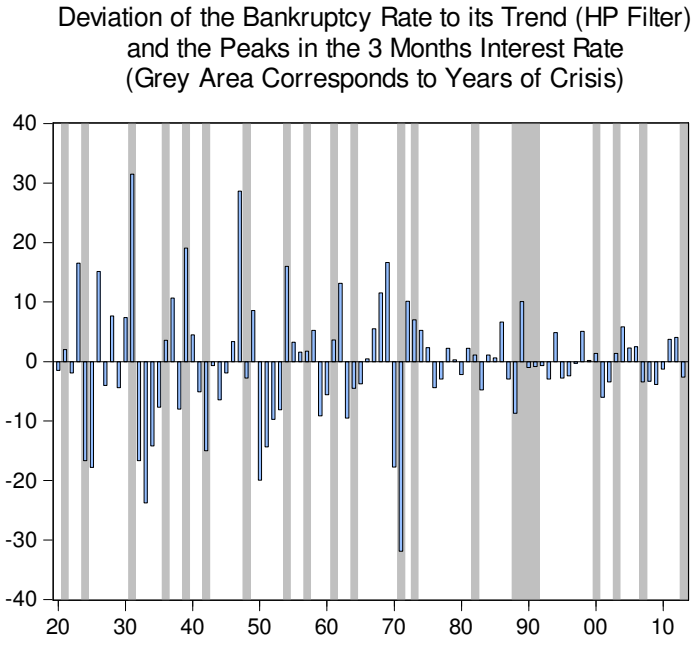


Figure XVI: Pannel (a) Deviations of the bankruptcy rate to its trend and the crisis years according to Juglar's criteria; Pannel (b) Deviations of the bankruptcy rate to its trend and the crisis years according to local maximum of the money market rate