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Crisis or Consolidation? Predicting Bank Distress in Sweden 1917-1923

by

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Crises are inherently connected to the strengths and functions of the financial system in creating and expanding credit (Broberg and Ögren, 2019). They are as much products of the innovation and expansion which precede them as they are a cause of the realignment and adjustment that follows them. For this reason, Marx, Minsky and Kindleberger have all regarded financial instability as a fundamental feature of the capitalist economic and financial system. In the context of this broad debate, the Swedish commercial banking crisis of during the period 1917-1923 takes on particular historical interest. Sweden's commercial banking system has been seen as an integral part of its economic modernisation, whilst also being regarded as largely stable and successful (Ögren, 2021). However, a total of 36 of the 69 banks which were in operation during the period 1917-1923 exited the system and a further eight banks experienced severe distress in 1922, requiring support of the state to retain solvency. This paper will therefore study the post-WWI Swedish commercial banking crisis by using ex-ante balance sheet data to predict crisis performance at the bank-level, and in doing so contribute towards the ongoing debates regarding the nature and causes of financial crises.

Key Words: Financial Crises, Commercial Banking, Financial Instability, Bank Distress.

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1 Introduction

Their association with inherent weakness and instability within the capitalist financial system has made financial crises the subject of immense attention from economists and economic historians. In spite of this, the persistence with which crises have continued to occur underlines the elusive nature of an understanding which is sufficient to prevent them. Indeed, Reinhart and Rogoff (2008) argue that the only thing which ties all financial crises together is a "this-time-is-different" syndrome, a trick of the mind that can justify the fundamental presupposition that a financial crisis is not about to occur. This, in turn, makes them appear as a "bolt from the blue" which shocks our confidence and challenges our understanding of the stability of our financial system. Taken together, the shock with which they occur, and the elusiveness of an understanding has made the historical study of crises an alluring prospect which may help to limit and abate their future incidence. Lönnborg, Ögren and Rafferty (2011, p.234) contend "if economics is to provide any useful advice that can be employed to help control any tendencies toward such crises, understanding the history of crises that have occurred is vital."

Crises are important to understand as they precipitate more than just an emotional reaction, but have a real, lasting effect on the economy in which they occur. Studies on the effects of banking panics have found them to have a significant effect on industrial production and output growth rates, often increasing unemployment and reducing growth in the subsequent decade after the panic (Bernanke and James, 1991; Reinhart and Rogoff, 2009). Additionally, banking crises have attracted particular interest as unlike stock market and currency crises, they disrupt and threaten the payments system, whilst also increasing the cost of credit by increasing the asymmetry of information faced by banks (Kenny, Lennard and Turner, 2017). Therefore, the purpose of this paper is to help fulfil the clear need to better understand the nature and causes of financial crises, through an empirical study of a specific banking crisis.

In light of this lack of consensus, the spate of commercial bank failures which afflicted the Swedish system in the aftermath of WWI takes on particular historical interest. The extent of the bank failures in this period has ensured its notoriety in Swedish financial history as a major crisis, described by Ögren (2017, p.63) as "the most profound Swedish crisis in terms of GDP fall and financial costs." Similarly, Lönnborg, Ögren and Rafferty (2011, p.234) describe the episode as Sweden's "most severe crisis, which was industrial and structural in nature, caused by economic policies and accompanied by heavy deflation." As such, the post-WWI Swedish financial crisis represents an ideal case study insofar as offering an opportunity to address the lack of clarity which has characterised the literature on financial crises. By using ex-ante bank balance sheet data to assess the characteristics of both distressed and non-distressed banks, it is possible to move towards a closer understanding of financial crises.

The key research issue is to what extent the series of Swedish bank failures during the period 1917 to 1923 represented a crisis or consolidation. Commercial banks were at the forefront of Sweden's financial revolution during the late nineteenth and early twentieth centuries, which saw them play a leading role in the financing of Sweden's industrialisation, not least during a boom of credit and industry during WWI (Häggqvist, Hedberg, Karlsson and Larsson, 2019; Ögren, 2017; Broberg and Ögren, 2019). Subsequently, after the war the commercial banking

system became highly concentrated, with banking groups growing much stronger and both the Swedish banking system and economy being "comparatively unaffected" by the international downturn from 1929-1930 (Häggqvist et al, 2019, p.14). Similarly, Grodecka-Messi, Kenny and Ögren (2021) have suggested that the 1907 crisis to a large extent rid the Swedish commercial banking system of banks which made poor or costly portfolio decisions, resulting in high shares of non-performing assets and low returns on equity. This followed a period which Broberg and Ögren (2019, p.83) characterise as a "financial revolution" as commercial banks in Sweden changed their asset portfolios, engaged in a more formalised and standardised valuation processes and traded securities which were more easily monitored and had a greater degree of transferability. Given this preceding period of transformation and purported stability, the issue emerges of whether the post-WWI Swedish banking crises should be seen as an exception or continuation of this process. Accordingly, the research question being answered in this paper is 'to what extent did distressed banks share observable balance-sheet characteristics or was their distress a product of the wider circumstances'. Answering this question will provide insight on the extent to which this period be viewed as a crisis which affected observably sound banks, or a process of concentration and consolidation during which unviable and unsound banks were forced to leave the market.

The research contribution of this paper is to use ex-ante bank balance sheet data to predict the crisis performance of Swedish banks during the period 1917-1923, and in doing so contribute to the 'early-warning model' literature which attempts to establish underlying vulnerabilities and common patterns which precede financial crises (Betz, Oprica, Peltonen and Sarlin, 2014). This is a novel contribution insofar as being the first study, to the author's knowledge, to study the post-WWI Swedish banking crisis in this manner.

The results of this study suggest the post-WWI period was one of consolidation for the Swedish commercial banking system when smaller banks left the population. Whilst there is limited evidence for observable differences in pre-crisis balance sheet characteristics amongst the banks which left the population, over-expansion may have been a source of vulnerability for a group of eight larger banks which survived the period but experienced severe distress.

The following section will detail the theoretical approach and previous research which informed this study. Subsequently, the sources, data and methodology will be described in detail, before the results of the empirical analysis are presented. Finally, these results will be discussed with relation to the theories being tested, before a concluding section.

2 Theory

2.1 Theoretical Approach

The distinction between crisis and consolidation made in this paper reflects a fundamental taxonomic weakness in the literature on financial crises. For all of the literature on the subject, a clear and universally agreed upon definition of crises has largely evaded the grasp of economic historians. Whereas Reinhart and Rogoff (2009) contended that crises are triggered by bank runs leading to closure, merging, takeover or government takeover of an important institution or group of institutions, Kenny, Lennard and Turner (2017) criticised this definition on the grounds that it implied a single failure constitutes a crisis. Moreover, they argue that the failure of imprudent banks may have improved the overall stability of the system, which in turn justifies a historical qualitative approach to identifying crises, as contemporaries would have been unlikely to view the failure of a bank or multiple banks a crisis if these banks were imprudent (Kenny, Lennard and Turner, 2017). Similar issues have applied to the historiography of Swedish financial crises, with Lönnborg, Ögren and Rafferty (2011, p.244) concluding "given the regularity of financial disruptions, definitional issues about what constitutes a financial crisis are surely important but open." The difficulty associated with defining crises feeds into problems with identification and measuring, as well as with disentangling the causal effects (Kenny, Lennard and Turner, 2017). Consequently, a discussion of the phraseology is beneficial to help explain the theoretical approach taken in this paper.

The ambiguity and subjectivity of financial crises is reflected in the etymological origins of the term "crisis", which is defined by the Oxford English Dictionary as "the point in the progress of a disease when an important development or change takes place which is decisive of recovery of death; the turning point of a disease for better or worse; also applied to any marked or sudden variation occurring in the progress of a disease" (OED Online, 2020). The medical origins of the term hinted at by this definition are traced in more detail by Besomi (2011) back to the eighteenth century. She argues that increased application of metaphors of disease in reference to commercial distress were indicative of the sentiment that economic crises constituted a failure of the body politic (Besomi, 2011). Aside from its etymological importance, the medical metaphor reflected a belief that crises were caused by "disease" during otherwise normal, "healthy" conditions.

The use of the medical metaphor also allowed for a distinction to be made between different causes of disease, with Jean-Edmond Briaune observing in 1840 "similar to the human body, the social body is subject to diseases, some of which originate from external accidental causes and only temporarily trouble the vital functions, while others originate instead from organic defects and, on becoming chronic, affect the constitution and development of individuals and societies" (quoted in Besomi, 2011, p.78). This illustrates the emergence of one of the fundamental splits in thinking on financial crises, between those who regarded them as a result

of exogenous causes, such as bad policies, and those who regarded them as endogenous and inherent features of the financial system.

The emergence of "crisis" as an umbrella term which is applicable to different types and causes of distress can therefore explain its pervasiveness in a field otherwise characterised by a lack of consensus. This paper therefore refers to "crisis" with reference to the bank failures and distress which afflicted the Swedish system in the period 1917-1923, but with recognition of the subjectivity of the term, as one of the aims of the paper is to establish the appropriateness of "crisis" as a means of framing our understanding of the period.

2.2 Previous Research

As previously mentioned, the longstanding interest in financial crises stems in part from their irregular and costly nature, but also from the difficulty of reaching a satisfactory understanding of their nature and causes. This literature review will give a more detailed overview of the history of economic thought relating to financial crises and explain how the theoretical origins of the major theories on crises have defined their limitations. In turn, it will explain how these have informed the approach taken in this paper, as well as why the post-WWI Swedish banking crisis is a suitable case study. Finally, it will provide an overview of the existing literature on the Swedish banking crisis by relating it to the dominant schools of thought on financial crises and explain how this has shaped the expectations for this study.

The post-WWI Swedish banking crisis has been associated with excessive speculative activity by commercial banks, including the increased utilisation of less formal collateral in order to meet demands for credit (Broberg and Ögren, 2019, p.100). However, it has also been attributed to the instability and deflation which characterised the post-war period, and placed pressure on the Swedish macroeconomy and banking system (Häggqvist et al, 2019). This raises questions regarding to what extent the crisis arose out of endogenous instability or exogenous uncertainty. Such questions are concomitant to long running debates on the nature and causes of distress, which can be traced back to the nineteenth century adoption of etiological approaches towards explaining crises. Juglar was an early pioneer of this approach, as he distinguished between persistently present cause of crises, and those which were only important insofar as determining the specific nature of a crisis but not its occurrence and as he controversially argued that a major war would not instigate a crisis in the absence of credit and speculation (Besomi, 2011, p.101). Rather than being regarded as disconnected instances, economic crises could then be viewed as instances of a class of events, allowing for the formulation of laws of crises, which by necessity would be consistent with the general laws of economics (Besomi, 2011).

However, the contention that crises were endogenous and endemic was not universally supported, and so emerged a fundamental split amongst economic theorists which represents the foundation of contemporary discord on the subject. On the one hand, Fisher developed the "quantity theory" and "debt deflation theory" as a means of accounting for severe recessions, which can be seen as the early origins of the monetarist theories which were later revived by Friedman and Schwartz (Backhouse, 2002, p.448). Conversely, proponents of the "real bills doctrine" placed the onus on overextension of credit as the fundamental cause of financial crises and by extension argued that monetary expansion in response to downturns would only increase

the velocity of circulation. Similar theories later appeared under the guise of Minsky (1977) and Kindleberger and Aliber (2015).

Whilst Minsky (1977) was not the first to suggest that speculation and overtrading lay at the heart of financial crises, his work marked an important challenge to the prevailing economic consensus of the 1970's. Writing in a decade characterised by financial turmoil, Minsky (1977) contended that instability was a fundamental and endogenous feature of the financial system, which would be generated even in the absence of shocks. The core of his argument was that the ability to debt-finance new investments hinges on expectations that future investments and cash flows will be sufficient to ensure that debt issued in the present period will be repaid or refinanced in the future (Minsky, 1977). Over time, as existing debts are easily validated, confidence increases and the margins of safety built into debt structures are reduced in accordance with changing views of suitable debt structures, which has the effect of increasing the market price of capital assets and driving increased investment. It therefore follows that "the fundamental instability of a capitalist economy is upwards, the tendency to transform doing well into a speculative investment boom is the basic instability of a capitalist economy" (Minsky, 1977, p.24). Only by accounting for speculative investment booms as a natural tendency, Minsky (1977) argued, could the historical frequency with which crises have occurred by explained.

Kindleberger and Aliber (2015, p.13) put forward a similar argument, describing a process whereby "rational exuberance morphs into irrational exuberance as economic euphoria develops and investment spending and consumption spending increases." Their phrasing of "exuberance, euphoria, manias, bubbles and panic" emphasizes the emotional connotations of the financial cycle, but their basic argument is largely the same as earlier narratives of speculation, overtrading and crises. This linguistic preference appears to be little more than a matter of rhetoric, but highlights the extent to which narrative has been central to these theories of crises. As such, arguably the greatest weakness of the theories of Minsky and Kindleberger is how far they can be extended beyond narrative and therefore be used to offer meaningful contributions to our understanding of financial crises in such a way that could help to prevent them. The implication of narratives which focused on greed and irrationality as leading to overtrading is that there was an appropriate level of trading which was surpassed. They fail, however, to clearly define what this level might be and only in hindsight is it ever obvious that conditions were unstable and unsustainable. Accordingly, Minsky's (1977) policy recommendation is for the enforcement of a "good financial society", a notion which is somewhat vague beyond curbing the tendencies of businesses and banks to engage in speculative finance. Here, the approach taken in this paper comes into focus as a means of empirically testing these theories which can offer some indication of how practically applicable they are.

Whereas the Minsky (1977) model was criticised for failing to account for the uniqueness of each crisis, Kindleberger and Aliber (2015, p.34) sought to apply this model in a historical perspective so as to demonstrate that "the more something changes the more it remains the same. Details proliferate, structure abides". Where Minsky (1977) had been informed by the financial turmoil of the 1970's, Kindleberger and Aliber (2015) saw this as merely one episode in the long history of financial crises, the common defining feature of which was always the implosion of a credit bubble. They identify stages through which these bubbles passed, which were related to pro-cyclical changes in the supply of credit. Kindleberger and Aliber's (2015) contention that "history is particular, economics is general" was used to underline the need for a historical approach to understanding financial crises. This type of understanding, which

emphasises the uniqueness of each crisis, has been characterised by Lönnborg, Ögren and Rafferty (2011, p.232) as the "heterogeneity thesis" and proponents of this view contend that the best economists can do is to look for early warning indicators of financial distress.

Conversely, these historical understandings of financial crises have been criticised in accordance with broader criticisms of historical economics. For example, Popper was especially critical of "the poverty of historicism" and "backwardness of the social sciences" (quoted in Boumans and Davis, 2016, p.86). The fundamental issue was that future observations might not conform to past experiences. In attempt to address this weakness, Friedman (1953) advocated for positive methodology in empirical research, arguing controversially that models should be evaluated for their predictive capabilities rather than on how realistic they were. Although he still relied on historical data to substantiate his theories, Friedman's work marked a departure from the qualitative reasoning which had informed the narratives of speculation and overtrading and was instead grounded in the traditions of detailed statistical work established by the National Bureau of Economic Research (Backhouse, 2002).

In spite of their differing scientific foundations, the approaches of historians and positivists shared important similarities. Friedman and Schwartz's (1963) famous *A Monetary History of the United States* argued that the quantity of money was the main factor behind inflation, but still made room for the role of expectations and confidence, as they attributed the banking crisis of the 1930's to a "contagion of fear spread among depositors" (Friedman and Schwartz, 1963, p.308). However, rather than advocating for "good financial behaviour" they saw it as a government's responsibility to prevent a widespread loss of confidence by ensuring a known, stable supply of money. Schwartz's (1987) argument hinged on a distinction between "real" and "pseudo" crises and the associated implication that manias, panics and crashes were only threats of crises. "Pseudo" crises would only become "real" in the event that fears that payment would be unobtainable at any price would lead to a scramble for high powered money and a run on banks. Schwartz (1987, p.283) played down the significance of credit bubbles and financial distress however, insisting that a bank run "need not occur because there is a well-understood solution to the problem: assure that deposits can be converted at will into currency whatever the difficulties banks encounter." In practice then, the different schools of thought boiled down to whether money or credit was the central source of financial instability.

Overall, the historical qualitative theories of Minksy and Kindleberger have made important progress in describing the development of financial crises and in doing so demonstrating the endemic and inherent instability which has characterised the global financial system. The fundamental premise which unites them is that to acknowledge the ability of banks "to create credit also means an acknowledgement of the inherent instability of the banking system" and so the key question which transpires is how banks can perform this fundamental role of credit creation in such a way that does not attenuate the stability of the system (Broberg and Ögren, 2019, p.82). They are, however, inherently retrospective and so largely ineffective when it comes to defining and identifying bubbles. Consequently, whilst the historical persistence of crises has reaffirmed their argument regarding the inherent instability of the capitalist financial system, their recommendations for enforcing "good financial behaviour" appear to have been largely ineffective as far as addressing this instability. By contrast, the monetarist and positivist perspective has made clear the importance of detailed statistical work, but difficulty accounting for differences between crises has limited the effectiveness of predictions.

In light of these limitations the approach taken in this paper, using ex-ante bank balance sheet data to predict crisis performance, has emerged as a popular theoretical approach for studying

and understanding financial crises where sufficient data is available. This is because by constructing predictive models for individual crises, it is possible to a certain extent to account for both the uniqueness associated with time and place, whilst retaining the benefits of an empirical positive approach. The belief (or optimism) which underpins such approaches is that discerning common causal characteristics of crises will help to reach a previously elusive understanding of financial crises which will allow us to insulate the financial system from future distress. As such, Lönnborg, Ögren and Rafferty (2011, p.232) term those who wish to pursue this approach as the "holy grailers". Furthermore, this methodology has the benefit of being broadly relevant to a wide scope of literature, as it allows for several different theories and explanations of crises to be tested.

Although the debates outlined above have informed much of the literature on financial crises, there are three main strands to the literature specific to bank-level crises causes. Firstly, the "bank-run" view in which the funding (liability structure) of a bank is of central importance. While the bank run view relates more closely to monetarist explanations of crises, the second "fundamentals" view regards portfolio choices and other observable characteristics as indicative of a bank's economic condition, making it more closely related to theories which focus on credit as the source of financial instability. Thirdly, the "institutional characteristics" explanation suggests that liability regime or bank age is a significant factor in determining crisis performance.

Proponents of the "bank run" view focus on panics which precipitate unwarranted withdrawals and subsequently bank failures. There are generally three scenarios in which a bank run may come to pass. Diamond and Dybvig (1983) developed a banking model in which one of the equilibria involved a systemic bank run where depositors rushed to withdraw in response to the simple belief that others would do the same. A second scenario sees depositors fear bank insolvency after receiving "noisy" information regarding the health of several banks, which leads to extensive withdrawals from even "unobservably solvent" banks in response to the risk (Calomiris, 2007). The third scenario involves an exogenous shock (unrelated to the bank's asset condition) to depositor liquidity preferences, which causes an excess demand for cash and scramble for reserves and potentially systemic runs (Calomiris, 2007). In all three scenarios a contagion of fear leads to the accumulation of withdrawal pressures which is central to Schwartz's (1987) description of how a "pseudo" crisis becomes a "real" crisis. Studying this view necessarily involves assessing the liability side of the balance sheet in order to gauge how far banks' liquidity pressure and leverage is a source of vulnerability, both at the onset and during the crisis.

There is an issue with causality associated with this explanation however, as depositors may also rush to withdraw as part of a rational response to information pertaining to the underlying bank condition, that is the fundamentals. Advocates for the "fundamentals" view regard bank failures as a result of observable deterioration in the economic conditions of banks (Calomiris, 2007). This view stressed the importance of losses on the assets side of the balance sheet leading to an intrinsic weakening of the bank's condition, which has the potential to magnify the effects of a macroeconomic shock by encouraging banks to limit loans and deposits in response. An essential difference to the bank run view is that it leads towards policy recommendations of limited government assistance and protection of banks on the grounds of preserving market discipline and good risk management. This view is therefore central to the distinction between crisis and consolidation being made in this paper. To a certain extent, there is room for these two interpretations to coexist, as in their study of the Chicago banking panic of June 1932, Calomiris and Mason (1997) found that the panic resulted in a temporary

contraction of deposits in both solvent and insolvent banks, consistent with the bank run view, but fundamentals still determined which banks survived. Similarly, Calomiris and Wilson (2004) found that New York banks during the interwar period experienced distress in accordance with a market response to observable balance sheet weaknesses.

A third approach assigns significance to the institutional structures of banks. Shaffer (1988) has suggested that bank age is an advantage, as new market entrants are likely to receive a weaker pool of loan applicants due to adverse selection, while Colvin, de Jong and Fliers (2015) found that board composition and branch banking played an important role. Poor management may play a role in crisis performance as it is associated with cost-inefficiencies and imprudent lending. Similarly, overextended branch networks may lead to increased monitoring costs. Esty (1998) suggests that limited liability regimes may see increased risk taking, which would make a bank more prone to distress. This argument is corroborated by empirical studies which have suggested that deposit insurance and policies which protect banks from market discipline have become a source of bank instability due to misaligned incentives (Calomiris, 2007). However, Ögren (2017) has suggested that in the Swedish banking system during the 1920's unlimited liability (*Enskilda*) banks were as likely as their limited liability (*Aktiebanker*) counterparts to engage in excessive risk taking and experience distress. Nonetheless, the liability regime argument has important theoretical grounding which is relevant to both historical free banking literature and contemporary debates regarding bank stability, hence it will be assessed in this study.

Of the studies which have relied on a similar methodology, Grodecka-Messi, Kenny and Ögren's (2021) study of the 1907 banking crisis in Sweden holds the most relevance in informing this paper. This is due to similar locational and institutional characteristics, which mean that although important differences remain to be accounted for, their results have served as a guide for the variables which are likely to be significant in predicting bank distress after WWI. Grodecka-Messi, Kenny and Ögren (2021) found that bank's asset structures, along with observable fundamental and institutional characteristics played the most significant role in predicting incidents of distress. High rates of lending against share collateral, low liquidity, poor operational efficiency and poor credit choices were closely associated with bank distress, but foreign borrowing was only of marginal consequence. Institutional characteristics, including weak internal corporate governance, proxied by smaller boards and widely extended branch networks, also increased the probability of experiencing distress (Grodecka-Messi, Kenny and Ögren, 2021). These findings were consistent with modern studies which stressed the role of asset quality and profitability, but not those which highlighted the importance of funding, leverage and liquidity in determining bank vulnerability.

The 1907 crisis was itself a catalyst for regulatory change and therefore provides important context for the crisis under review here. The impetus for change was to ensure greater stability of the banking system, characterised by bigger and therefore more stable banks (Ögren, 2021). The banking law of 1911 was enacted with the goal of controlling banks' establishment, solidity and liquidity so as to better protect depositor's capital, which included stipulations that banks should hold funds covering at least 20% of all deposits, 75% of which should be in the form of bonds and 25% as legal tender cash reserves (Ögren, 2021). However, the law also included stipulation allowing larger commercial banks to own and trade shares in the bank's name as a concession to those who sought for a more universal banking system (Häggqvistet al, 2019). Ögren (2021) observes that these policies which curbed competition clearly benefited bigger banks, as did the enactment of a toxic asset fund adopted following the 1921/22 crisis, which reflected the political influence of these bankers. This paved the way for commercial banks to

become involved in the structural transformation of Swedish industry through affiliated investment companies (*emissionbolag*), they enabled greater speculation based on growing share values and activity on the stock exchange (Häggqvistet al, 2019). Furthermore, continued inflation and the boom of WWI led to an amendment of the law requiring commercial banks to cover their deposits to the extent required by the 1911 Banking Act, which meant that banks holding five million SEK did not have to comply (Ögren, 2021, p.283).

One of the key changes of the period was the development and extension of branch banking, which had the benefit of allowing banks to diversify both their investments and liabilities (Ögren, 2021, p.285). This involved a gradual shift away from the "church spire principle" (*kryktornsprincipen*) which advocated only extending credits to customers whose residence was visible from the local church spire (Grodecka-Messi, Kenny and Ögren, 2021, p.19). There is a body of literature which suggests that there are significant risks and costs associated with branch network expansion to the extent that authorities should seek to limit the expansion of domestic banks into new territories (Ingves, 2010; Bernhadstson and Billborn, 2010). This proved to be a significant variable in Grodecka-Messi, Keny and Ögren's (2021) study, and so the effect of a more widely extended branch network will also be measured in this paper. Lönnborg, Ögren and Rafferty (2011) also attribute the post-WWI crisis to the behaviour of several small regional banks throughout the 1910's which had received large deposits and began to expand outside of their regional markets in response to increased competition for market share, which adversely affected their ability to discriminate in lending decisions, which further suggests the potential importance of this variable in explaining the crisis.

Although no study using balance sheet data has been undertaken for the post-WWI crisis in Sweden as yet, there are a limited number of papers on the subject which will inform the expectations of this paper. An industrial boom caused by increased export surpluses during WWI combined with persistent inflation led to increased credit advances and speculation in the banking system, with Lönnborg, Ögren and Rafferty (2011, p.234) assessing the fundamental causes of the crisis to be a combination of external displacement due to the war and endogenous structural institutional factors. The Bolshevik revolution of 1917 destroyed Sweden's biggest export market in Russia, which had an adverse effect on several Swedish companies, at the same time as the quick recovery of international production after the war led to a deflation of the general price level by about 35% from 1921 to 1923 (Lönnborg, Ögren and Rafferty, 2011, p.235). This fall in share prices was exacerbated by the government's monetary policy of attempting to restore the Swedish crown to the pre-war gold parity. The deflation impacted industry heavily, thus hitting the majority of the commercial banks which were by this were lending heavily to industrial companies, resulting in widespread losses on outstanding credits (Häggqvistet al, 2019). The transition towards universal banking meant that many commercial banks were not only financing industrial firms through lending, but were also significant equity holders, with their lending and investment increasingly concentrated in a few interlocking firms to the extent that by 1918 there were 14 listed equity companies with close connections to one or more commercial banks (Lönnborg, Ögren and Rafferty, 2011, p.236).

In 1922 the prices of industrial shares on the stock market began to decline, which impacted those banks which had begun to lend against share collateral as well as those banks which had invested in those shares (Lönnborg, Ögren and Rafferty, 2011, p.237). In order to guarantee the overall stability of the system, and avoid a bank run, some of the larger banks agreed to guarantee the capital of failing banks. *AB Kreditkassan* (the Credit Institute) was established by the Bank of Sweden so as to act as a lender of last resort and transfer capital to distressed banks, and specifically helped *Smålands Enskilda Bank, Värmlands Enskilda Bank, Sydsvenska*

Kreditaktiebolaget, *Svenska Lantmännens Bank* and *Nordiska Handelsbanken* (Häggqvist et al, 2019). Meanwhile, *Stockholms Enskilda Bank*, *Skandinaviska Kreditaktiebolaget* and *Göteborgs Bank* assisted in the reconstruction of *Mälarprovinsernas Bank*, *Kopparbergs Enskilda Bank* and *Handelsbanken* (Häggqvist, et al, 2019). *Skandinaviska Kreditaktiebolaget* also experienced extensive distress and was subject to a government takeover proposal, although it was able to avoid this outcome.

Overall, the existing literature on the post-WWI Swedish banking crisis can be used to lend support to any of the major schools of thought on financial crises. On the one hand, the expansion of credit seen throughout the 1910's can be regarded as evidence for overtrading and speculation creating a Minsky or Kindleberger style weakness on the asset side of the balance sheet. Furthermore, the exit of small, potentially unsound, banks from the population may be interpreted as part of the consolidation and evolution of the system. On the other hand, the panic of 1921-22 and efforts to guarantee the stability of the system support a monetarist, bank-run interpretation of the crisis. Finally, the expansion of branch banking may be seen as evidence of institutional weakness amongst failed banks. How this study will be assembled so as to disentangle these narratives will be further explained in the coming sections.

3 Data

3.1 Source Material

The primary aim of this paper is to assess the factors which might have caused banks to fail or experience distress during the post-WWI period in Sweden. The following section will outline and discuss the data which was used to meet this aim.

The principal source used in this paper is the Swedish Commercial Bank Database, 1866-1994, put together by Häggqvist, Persarvet, Hedberg, Karlsson and Larsson (2020). This dataset has been very useful as it contains information on the Swedish commercial banking system during the period 1866-1994, which was compiled from various official sources. The data relevant to the period under consideration in this paper was compiled from the *Statistika Meddelanded, Serie E, Uppgifter om bankerna*, 1912-1967. The *Uppgifter om bankerna* (information about the banks) itself is available in digitised form at scb.se, grouped into yearly volumes made up of monthly reports. Although the availability of monthly balance sheet information would allow for the construction of a more granular database, as was the approach taken by Grodecka-Messi, Kenny and Ögren (2020) in their study of the 1907 Swedish crisis, time constraints meant that it was beyond the scope of this paper to construct a dataset which included monthly data. Similar studies by Colvin, de Jong and Fliers (2015) and Postel-Vinay (2016) used only annual and semi-annual data respectively, and so it is not expected that the use of yearly rather than monthly balance sheet data will impinge on the validity of the results of this paper, although the construction of a dataset using monthly data remains a potentially valuable future contribution to the field.

The origins of the *Uppgifter om bankerna* can be traced back to the nineteenth century, when it was mandated that Swedish banks submit their balance sheets for inspection and subsequent collation in specific volumes known as *Sammandrag af Bankernas Uppgifter* (Summary of the Banks Activities) (Ögren 2006). Although banks may have had incentives to appear structurally sounder than they actually were, especially during times of crisis, any concerns over accuracy of reporting are abated as during the 20th century supervision became closer and tighter, with inspectors increasingly conducting unannounced examinations and accurate monthly reporting of figures required in order to avoid sanctions (Wendschlag, 2012).

The Häggqvist et al (2020) dataset is comprised of data taken from the month of December each year for consistency. As such no data is available for banks in the year they were acquired or liquidated, and in some instances where the bank is winding down before an acquisition or liquidation in the following year the data is limited. In these instances, the year of failure was recoded to be a year earlier, and the incomplete data was dropped from the sample so as to avoid potentially biasing the results. The dataset contains information from the balance sheets and profit and loss accounts for Swedish commercial banks. The bank-level information recorded for each year of the period under consideration in this paper includes: total lending, total deposits, total capital, total holdings of bonds and stocks, total general expenses, total loan

losses, net profits as a percentage share of total capital (return on capital), total tax-expenses, total gross income, net profits and total dividends.

In this study distressed banks are defined as those which were acquired by other banks, or went into liquidation, whilst a separate group of seven banks is identified which did not fail but experienced significant distress in 1922 to the extent of requiring restructuring and loans to ensure their survival. Häggqvist et al (2020) provide a supplementary description of the dataset, in which they list all mergers, acquisitions, restructurings, name changes and liquidations which occurred throughout the period. Delimiting distressed from non-distressed banks can be problematic in studies such as this, but in the period under consideration there was no mergers listed, whereas acquisitions were listed when a distressed bank was acquired by a more financially sound bank and so every instance in which a bank left the population was considered as a result of distress. In order to clearly establish the population of the banks which failed, this information was crosschecked with the datasets itself, which largely confirmed that the description was consistent with the data. In ten instances during the period under consideration a bank exit from the population was unexplained by the source supplement, but their failure was corroborated by the total number of liquidations listed in the aggregate data of the database.

In the dataset the banks are categorised as either *Enskilda* or *Aktiebanker (AB)*. This is a crucial distinction which reflects the liability regime of the banks, with the *Enskilda* banks taking on unlimited liability. In the dataset this categorisation reflects the liability regime of each bank at its inception (or in 1866 when the dataset begins) however mergers, acquisitions and restructurings mean this classification was not entirely accurate for the period under study. It was therefore necessary to trace all of the relevant changes which occurred so as to ensure an accurate categorisation of the liability regime on the eve of the crisis. This necessitated the reclassification of three banks: *Mälarprovinserna*, *Göteborgs* and *Christianstads* from *Enskilda* to *Aktiebanker (AB)*. There were no banks which changed their liability regime during the period of study and all new banks created were *Aktiebanker*. The source used for branch numbers and foundation dates was also used here to crosscheck the information, and in all cases corroborated the liability regimes given in the dataset.

This additional source was used for information pertaining to the branch networks and year of foundation for all banks which were active in 1918. This source was a summary document issued by the *1917 års bankkommitté* (Banking Committee of 1917), which was submitted on 17th January 1918 as part of an investigation into "certain issues concerning the Swedish credit and banking system". The investigation was set up in light of concerns regarding the soundness of banking operations and the public's protection against losses of funds, and included information on the number of branches each bank operated, as well as dates of establishment.

The information on branch numbers was useful, but limited to the 53 banks which were in operation when the report was published in January 1918, as such branch numbers are not available for any of the five banks which were established after the report, or the 11 banks which exited the population before its publication. No additional source for branch numbers after 1918 could be found, and so branch numbers from 1918 were used for the years 1919-1921. The information on year of foundation was useful for all banks in the database which were formed after 1866, however this raised some issues as the foundation date in the source often reflected the date of a merger, acquisition or name change, rather than the date of establishment of the acquiring bank. The intention of including a variable for bank age is to proxy for asset selection experience, consequently, to take the year of establishment of a bank as the year in which it changes structure, name or acquired another bank would be disingenuous

in this regard. In the instances where an accurate date of establishment was not available, the year of establishment was taken from the appendix of the Grodecka-Messi, Kenny and Ögren (2020) paper, which listed the establishment year as the date of incorporation. This data was further used to cross-check the establishment dates for all banks which were established before 1907, which in all cases corroborated the dates from the banking committee report. There is therefore a complete and, to the extent of the author's knowledge, accurate set of dates for all of the banks in the population. One of the contributions of this project has been to combine data from separate sources into a single dataset to allow for an analysis of the causes of the post-WWI Swedish banking crisis which will account for both bank age and the extent of a bank's branch network.

The most significant weakness of this dataset is that the balance sheets are not broken down to a greater extent. This is especially noticeable on the liabilities side of the balance sheet, which only includes data for total deposits. This has been particularly limiting insofar as constructing measure of banks asset and liability structures relative to the size of the bank that do not correlate as a result of bank size, which is problematic in this case as one of the basic assumptions of a logit model is that predictors are uncorrelated with each other (Hilbe, 2016). Consequently, the total capital of a bank was used as the preferred denominator in many of the ratios, as it remained relatively constant for most banks and reflects the extent of a bank's financial backing. Whilst this is recognised as a clear limitation of the data, there is reason to believe that it will not significantly impinge on the validity of the results. Deposits are the most important liability, as they are of direct relevance to assessing to what extent bank failures were causes by banks vulnerable to bank-runs, which is one of the major schools of thought on banking crises. Moreover, deposits can be subject to external contagion, and so may not be entirely indicative of a bank's soundness. Additionally, Grodecka-Messi, Kenny and Ögren's (2021) paper found that asset structures were more significant in predicting bank distress, and so the asset side of the balance sheet could be expected to be more significant in explaining distress.

Aside from the aforementioned classification issues which had to be accounted for, there are a few other notable caveats to the database. The loan loss data, which will be used to measure the loan book quality of each bank, is missing for the years 1914 and 1915, and thereafter reflects the entry "*avskrivning av fordringar*" (depreciation of claims) from the profit and loss statements, meaning that the data is a proxy of loans not paid back to the banks, rather than an exact figure. The data for total capital is the sum of base funds, reserve funds and disposal funds. The significance of this is that capital was used as a proxy for bank size in computing many of the variables, where base funds would have been a preferred measure of bank size, especially as limits on holdings of bonds and stocks were connected to the size of the base funds. Similarly, lending data is a summation of all loans, credits and bills of exchange, and deposits the sum of all categories of deposits. Overall, the tendency of the database to use broader categorisations so as to facilitate long-term comparisons of trends is a limitation on the ability of this study to construct non-correlated measure of bank balance sheet characteristics. However, the size, completeness and accessibility of the dataset, in the context of the time-constraints involved in this project, have made it the most appropriate available source, which still allows for a significant level of analysis.

3.2 Data Description

Table 1: Numbers of banks distressed, acquired or liquidated in Sweden 1917-1923

	Distressed	Acquired/ Liquidated	Never Distressed
All Banks	8	36	25
Old Banks	5	9	12
Young Banks	3	27	13
ULB	2	5	8
LLB	6	31	17
Big Banks	8	30	25
Small Banks	0	6	0

Sources: Häggqvist et al (2020), 1917 års bankkommitté (1918).
Note: Old banks are defined as those established before 1895 and big banks as those with more than 1 million Kronor capital. All banks established before 1924 included. ULB refers to unlimited liability banks, LLB refers to limited liability banks.

Table 1 depicts the number of commercial banks which were active during the period 1917-1923, grouped by their distress outcomes and various institutional characteristics, to give an indication of the sample size and characteristics. The following section will detail which variables were computed from the available balance sheet data so as to test the "bank-run", "fundamentals" and "institutional" explanations of banking crises.

Funding Structure

The "bank run" view suggests that funding structure is the key explanatory variable for predicting distress. Accordingly, a group of variables are constructed as measures for the liquidity profile of bank balance sheets.[1] The capital ratio and deposit ratio are calculated respectively as the total capital and total deposits as a percentage of total assets. Capital ratio accounts for the proportion of capital (base funds, reserve funds and disposal funds) in total assets (which includes total lending, total capital and total holdings of bonds and stocks). The variable is computed in the same way as Postel-Vinay's (2016) study, who found it to have a negative but insignificant effect on failure probability. The "bank-run" view suggests that if the capital ratio is to have a significant effect on distress probability it is expected to be negative as capital is the most liquid of the three assets for which data is available and in times of distress, specifically during a bank-run, banks with greater liquidity on the asset side of the balance sheet will be better able to meet their obligations. Conversely, the deposit ratio is expected to have a positive effect on distress probability, as banks which relied heavily on callable deposits (the most liquid form of liability) might be more vulnerable to a bank-run. This variable is computed in the same way as Colvin, de Jong and Fliers (2015, p.110), who found it to be positively and significantly associated with failure probability to the extent that a 1% increase in deposits relative to assets increased the probability of failure by roughly 45%.

[1] These variables are primarily linked to the "bank run" view but can also be interpreted as related to a bank's fundamental condition. Warranted deposit withdrawals linked to a bank's underlying condition can be considered fundamental in nature, however this dataset does not allow for a distinction to be made between warranted and unwarranted withdrawals. Similarly, the asset structure (capital ratio and holdings of bonds and stocks relative to capital) is closely related to the Minsky/ Kindleberger credit expansion narratives. Awareness is therefore given to these views in the interpretation of the results.

As explained further in the next section, given the relatively small sample size being used for a logit regression, it is beneficial to restrict the number of explanatory variables used in the regression models. For this reason, an additional variable was computed for the deposit to capital ratio, which involved simply calculating deposits as a percentage of total capital. The expected effect on failure probability, informed by the bank-run view, is positive as a greater proportion of demandable debt relative to liquid assets is expected to make a bank more vulnerable to a run. Significant results for this variable would be consistent with the findings of Calomiris and Mason (1997) who took total capital divided by total deposits (the inverse of the variable used here) as a measure of low-risk liquid assets relative to demandable debt which they found to have a significant negative effect on failure probability.

A variable for a bank's holdings of bonds and stocks as a percentage of total capital is used to assess the possibility that bank's increasingly acquiring shares in commercial companies throughout the 1910's made the banking system more vulnerable to the effects of industrial crises at the end of WWI and in 1922 (Lönnborg, Ögren and Rafferty, 2011). The effect of this variable is of relevance to the Minsky/ Kindleberger view that exuberance and speculation in pursuit (and expectation) of increasing profits during the pre-crisis period was a source of instability and fragility, as well as the debate concerning the stability of universal banking and the appropriateness of commercial deposit holding banks investing in private companies. Accordingly, the expected value of this variable is positive in the event that increased holdings of bonds and stocks increased fragility.

Fundamentals

Turning to the "fundamentals" view, measures of bank profitability have had an ambiguous effect on distress probability. Colvin, de Jong and Fliers (2015) interpreted return on assets as a proxy for the riskiness of a bank's activities, as they found a significant positive effect on failure probability and reasoned that higher earnings in good times were indicative of a higher degree of riskiness in a bank's activities. However, an equally compelling explanation is that higher earnings reflect better asset selection and more efficient operation, and Postel-Vinay's (2016) results suggested that higher pre-crisis retained earnings (return on assets) increased survival probability. The dataset used here allows for the use of either return on capital (ROC) or return on assets as a measure of profitability, however the high degree of correlation (0.9270 across all observations) suggests that the distinction is immaterial, and ROC was used throughout for consistency.

The data for loan losses was divided by a bank's total lending so as to compute a measure of a bank's loan loss ratio (LLR). In this case a higher value is indicative of lower quality lending and is therefore expected to have a positive effect on distress likelihood. An issue here is that LLR is highly (negatively) correlated with ROC, although this is largely driven by the huge loan losses (and negative returns on capital) in 1921 and 1922, to the extent that the correlation between these variables drops from -0.926 across all observations to -0.577 for all years before 1922 and just -0.122 for all years before 1921. Nonetheless, the preferred specifications used include only one of these variables included in each model.

Institutional Characteristics

The institutional features of the banks have been measured in three ways. The liability regime is measured by a simple dummy variable ULB taking the value of 1 for unlimited liability

Enskilda banks and 0 for the limited liability *Aktibanker* (AB). The size and age of the banks was taken as a log value of the total assets and years since establishment respectively. The size of the bank is expected to be negatively associated with distress probability in accordance with the view that larger banks will have a broader portfolio of investments and so will be less likely to fail (Colvin, de Jong and Fliers, 2015). The age of the bank is also expected to be negatively associated with distress probability on the grounds that older banks will have greater asset selection experience and no adverse selection issues weakening the pool of loan applicants. However, it might also be argued that newer banks might have a better understanding of current circumstance as well as greater adaptability to changing market conditions. Furthermore, the lack of correlation with ROC (-0.0084 across all observations) and lack of significance found in the studies of either Colvin, de Jong and Fliers (2015) or Grodecka-Messi, Kenny and Ögren (2021) tempers expectations for this variable. Moreover, its relatively high correlation with bank size (0.648 across all observations) and ULB (0.584) means that the preferred specifications have included size but not age as a variable. It is expected that differences in age will be more significant with regards to asset selection experience and adverse selection problems amongst younger banks and so to account for this effect the natural log of the age was computed.

Finally, two measures of branching were constructed. The first involved dividing the number of branches in each year by the total assets so as to gauge how widely extended a bank's branch network was relative to its size. The second measure involved multiplying the number of branches by the deposit to capital ratio. Although this variable is somewhat contrived, it is intended to proxy for the vulnerability of a bank to a run on deposits, as a larger number of branches increased the liquidity of a bank's liabilities by making deposits more accessible and easily withdrawn. A counter argument could be made that a widely extended branch network was a form of conspicuous consumption which could have reassured depositors of the accessibility of their deposits and quelled the impetus to run. These variables will both be considered for their effect on distress probability and in turn to test the explanation of the crises which centres on excessive competition and branch network expansion in the 1910's becoming a source of vulnerability (Häggqvist et al, 2020).

4 Methods

The methods used in this paper have to a large extent been guided by similar papers which have attempted to predict bank distress, then adapted to make best use of the data available in this example. As is typical of quantitative studies, this project is based around deductive reasoning. Theories and expectations of the causes of bank distress guided by previous research and literature were tested using the available data, which in turn guided further theorising and testing in order to move towards a closer understanding of the nature and causes of the Swedish post-WWI banking crisis.

4.1 The Logit Model

The analysis in this paper centres on a series of logistical regression models (logit models). Logit models are the most appropriate regression models to be used in such a study as the dependent variable is a binary indicator of whether or not a bank experienced distress in a given period. In all cases, banks which experienced distress took the value of 1 whilst those which did not took the value of zero, therefore the coefficients generated for the independent and control variables are indicative of their association with a banks *distress probability* rather than their *survival probability*. The use of logit models means that the coefficients of interest illustrate the log odds of bank distress. Consequently, they are not as readily interpreted as the equivalent values in a linear regression model, which further complicates the external application of the results. However, due to the use of a binary dependent variable, logit regressions are the most appropriate which can be used. This is consistent with other papers which seek to use ex-ante bank balance sheet data to predict distress (Grodecka-Messi, Kenny and Ögren, 2021; Calomiris and Mason, 1997; Postel-Vinay, 2016; Colvin, de Jong and Fliers, 2015).

The 69 banks are divided into four cohorts: 26 banks which were acquired or liquidated from 1917-1919, ten banks which were acquired during from 1920-1923, eight banks which experienced severe distress in 1922 but survived, and the remaining 25 banks which did not experience distress. Although the exact choice of these time windows was inevitably somewhat arbitrary, it was informed by the existing literature on the post-WWI Swedish banking crisis, which generally treats the failures of the final years of the war as separate to those which occurred at the start of the 1920's. Furthermore, Häggqvist et al (2020, p.13) detail how in 1922 a total of five commercial banks "would have encountered great difficulties to survive without support from *Kreditkassan*", which included *Smålands Enskilda Bank, Värmlands Enskilda Bank, Sydsvenska Kreditaktiebolaget, Svenska Lantmännens Bank* and *Nordiska Handelsbanken*. In addition, *Mälarprovinsernas Bank* and *Handelsbanken* required reconstruction and assistance from three of the largest banks, whilst *Skandinaviska Kreditaktiebolaget* only narrowly escaped failure and acquisition (Häggqvist et al, 2020). The cohort of each bank is necessarily determined by ex-post outcomes, and so particularly for the distressed in 1922 cohort it is likely that decisions taken during the crisis period regarding who

to save and who to let fail, which are exogenous to the model proposed here, influenced the outcomes. However, this should not impinge on the likelihood of the incidence of distress itself, only the resolution of distress (liquidation, acquisition or continuation). Nonetheless, this important dynamic will be recognised in the discussion of the results.

Formula 1 depicts the discrete choice logit model estimated:

$$(1)\ ln\frac{\pi_i(Distress)}{1-\pi_i(Distress)} = \alpha + x_i'\beta$$

Distress is a binominal variable which takes the value of 1 if a bank experienced distress (either liquidation or acquisition in the period 1917-1919 or 1920-1923, or distress without failure in 1922). Different types of distress are categorised in the same way as the aim of the paper is to predict incidence of distress rather than the manner in which it is resolved (merger, acquisition, liquidation or financial assistance). α is a constant and x a vector of bank specific variables. β is a coefficient which quantifies the contribution of associated bank specific variables to the probability of bank distress. The bank specific variables are either relating to the funding structure, fundamentals or institutional characteristics. Where these coefficients are positive, the models suggest that a higher realisation of the variable increases the probability of distress, and where they are negative the models suggest that a lower realisation of the variable increases the probability of distress. In order to assess whether bank distress could be predicted in advance of the crises, regressions were run using data from 1915 and 1916 with exits from 1917-1919 as the dependent variable, and from 1919, 1920 and 1921 with exits from 1920-1923 and distress in 1922 as dependent variables.

4.2 Limitations of the logit regression

Whilst a logit regression was considered to be the most appropriate statistical model for this study, owing to the need to model the probability of the outcome variable (bank distress), there are limitations associated with the application of this model with the available data. The primary limitation regards sample size, as logit regressions typically require large sample sizes to produce significant results. In practice, this means that consolidated banking systems which experience significant financial distress but only a small number of failed institutions, which would conform to Reinart and Rogoff's (2009) definition of crises, do not lend themselves well to this type of analysis. Betz, Oprica, Peltonen and Sarlin (2014, p.26) concede that "given actual bank failures are rare in Europe, identification of bank distress events is challenging" which forces them to broaden their criteria for bank distress to account for failures state intervention and forced mergers.

Epidemiological literature has leaned heavily on the use of logit regressions, and a rule of thumb of using one variable per ten events in the logit regression has often been applied (Vittinghoff and McCulloch, 2007; van Smeden, de Groot, Moons, Collins, Altman, Eijkemans and Reitsma, 2016). Strict adherence to this rule would limit the number of variables per regression to two or three for the banks which failed in the period 1917-1919 and just one for the 1920-1923 distressed banks. More recent medical and epidemiological literature has permitted the relaxation of this rule of thumb, and so this paper follows recent banking distress literature in allowing for a higher ratio of variables to distress events (Vittinghoff and McCulloch, 2007;

van Smeden et al, 2016; Grodecka-Messi, Kenny and Ögren, 2020; Colvin, de Jong and Fliers, 2015). Nonetheless, there remains a delicate balance to be struck between including all potentially relevant variables and over-specifying the models, which is why different predictors of bank distress (funding structure, fundamentals and institutional characteristics) are estimated in separate regressions.

Aside from the aforementioned practical difficulties, a lack of consensus on the most important or relatively most important causal factor of a crises suggest that financial crises have unique features that vary across time and space. Therefore, these studies typically encounter a trade-off between internal and external validity which is common across econometric studies. It is likely that by better accounting for the specific nature of a crisis and building a more accurate model, that increases the internal validity, that the wider applicability of the results, i.e. the external validity, will be diminished. Nevertheless, the output of such models remains more readily comparable than qualitative narrative interpretations, and so there is still considerable value to be found in a study which used this methodology in attempt to understand the specific nature and causes of a financial crisis. Firstly, the Swedish banking system was "uniquely diverse" with regards to capital structures, size and shareholder regimes, meaning that a study of Swedish banking can provide valuable insight into contemporary debates on liability, capital legislation and corporate governance structures (Groecka-Messi, Kenny and Ögren, 2021). Secondly, the Swedish banking system underwent a process of concentration and consolidation during the 1920's but remained relatively diffused at the onset of the crisis, which somewhat helps to address identification issues. Thirdly, as has been discussed, bank balance sheet data is more readily accessible for Swedish banks, which has practical advantages.

In recognition of these limitations, efforts were made to validate the results by including a comprehensive set of robustness checks. The results are themselves discussed in close connection to the existing literature on Swedish banking during the period to further validate the findings. Thus, there remains considerable value in this study and its contribution to the literature on financial crises.

5 Empirical Analysis

5.1 Summary Statistics

Table 2: Summary statistics for distressed and surviving banks as of 1915.

	1917-1919 Exits			Survivors		
	Obs.	Mean	St. dev.	Obs.	Mean	St. dev.
Capital Ratio	26	21.494	4.205	26	19.853	3.839
Deposit Ratio	26	56.901	15.671	26	59.502	12.734
Deposit to Capital Ratio	26	277.299	100.518	26	312.101	105.344
Bonds & Stocks/ Capital	26	35.371	23.337	26	36.059	16.304
ROC	26	6.718	2.486	26	8.133	1.822
Log(Age)	25	2.717	0.803	26	3.444	0.936
ULB	26	0.115	0.326	26	0.385	0.496
Log(Size)	26	9.430	1.523	26	10.639	1.531
Branches/Assets	15	0.000320	0.000227	26	0.000295	0.000182
Branches*Deposits/ Capital	15	26.137	50.003	26	69.797	83.064

Table 3: Summary statistics for distressed and surviving banks as of 1919.

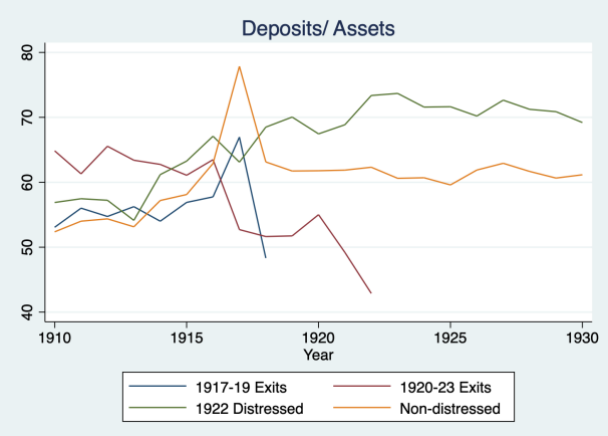
	1920-1923 Exits			Distressed in 1922			Survivors		
	Obs.	Mean	St. dev.	Obs.	Mean	St. dev.	Obs.	Mean	St. dev.
Capital Ratio	10	24.858	8.330	8	14.702	1.593	24	20.288	8.389
Deposit Ratio	10	51.742	15.850	8	70.043	2.926	24	61.738	17.601
Bonds & Stocks/ Capital	10	9.500	5.453	8	21.273	6.767	24	25.080	25.838
Deposit to Capital Ratio	10	244.153	126.632	8	483.442	75.460	24	357.690	167.606
ROC	10	8.090	4.372	8	12.775	6.497	24	7.883	3.914
LLR	10	0.031	0.076	8	0.258	0.339	24	0.157	0.228
Log(Age)	10	1.726	1.517	8	3.496	1.251	24	2.789	1.564
ULB	10	0.100	0.316	8	0.250	0.463	24	0.333	0.482
Log(Size)	10	9.937	1.055	8	12.965	0.798	24	10.560	1.506
Branches/Assets	7	0.000373	0.000506	8	0.0001629	0.0000857	19	0.000176	0.000114
Branches*Deposits/ Capital	7	22.532	29.024	8	339.372	253.249	19	74.906	98.710

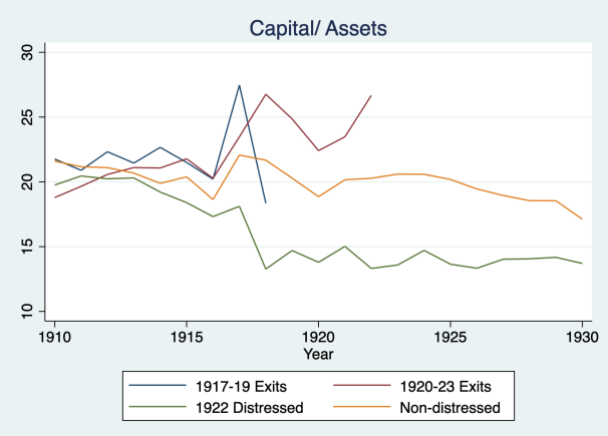
The summary statistics presented in tables 2 and 3 suggest that the characteristics between banks which exited the population from 1917-1919 and those that survived were relatively similar. By contrast, the banks which experienced distress in 1922 appeared to be the most distinct subpopulation. These generalised patterns are corroborated by the graphs of mean values for all of the variables between 1910 and 1930, grouped by distress type shown below.

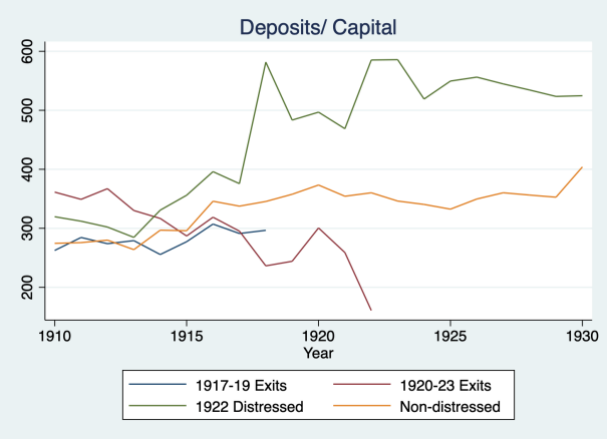
Broadly, the graphs depict similar patterns amongst all bank groups in the pre-war period, which gives way to more turbulence and divergence in the years following WWI. Especially notable is the divergence of trends between the banks which experienced distress but did not fail in 1922, and the remaining banking population. These trends will be further unpacked with the help of the logit results, but there are a few key points to be discussed here. In the post WWI years this group of banks rapidly increased their holdings of deposits relative to capital whilst decreasing their capital relative to total assets. This occurred in the context of a much more pronounced increase in size of these banks relative to the rest of the banking population. Whereas the banks which failed in the final years of WWI and early 1920's were clearly amongst the smallest and youngest in the population, those which experienced distress but did not fail were amongst the largest and eldest. Alongside the divergence of trends seen in capital and deposit ratios, this serves to justify the treatment of these distressed banks as separate in the logit models.

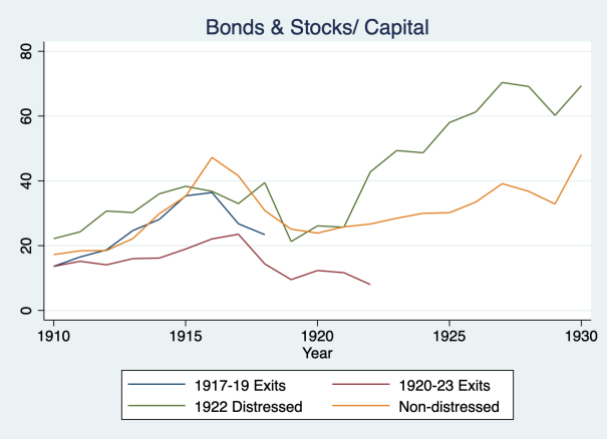
Although the banks which experienced distress but did not fail in 1922 were on average older and bigger, they were less likely to be unlimited liability. Given the correlation between age, size and liability status in the banking population (*enskilda* banks were not established after 1903 meaning new banks were necessarily *aktiebanker*) this observation takes on greater significance.

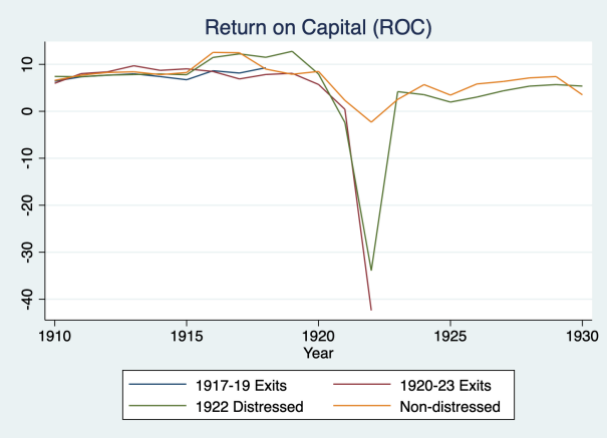
One of the most striking features of the mean values grouped by bank is the spike in LLR and ROC for the year 1922. These graphs illustrate both that the banks which left the population experienced the most extensive loan losses relative to total lending, as well as the most severely negative returns on capital during the crisis. By comparison, the banks which were distressed but survived, and those which did not experience distress performed incrementally better by these measures, although both cohorts experienced their most significant losses during the period in 1922. The absence of similar spikes, for all banks, during the 1917-1919 period suggests that this crisis was rather different in character, as although a greater number of banks failed during this period, losses were more acute in 1922, which can explain why the 1921-22 crisis has achieved greater notoriety.

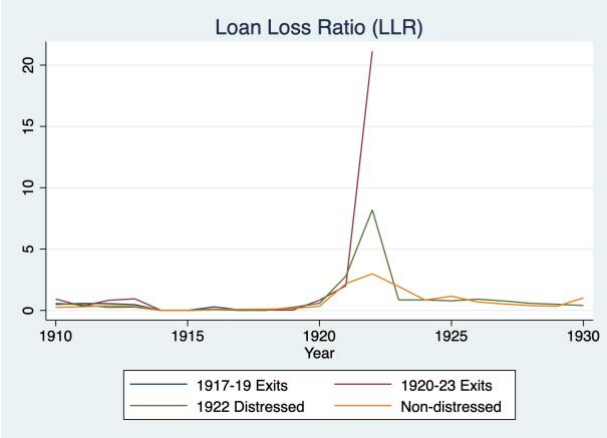


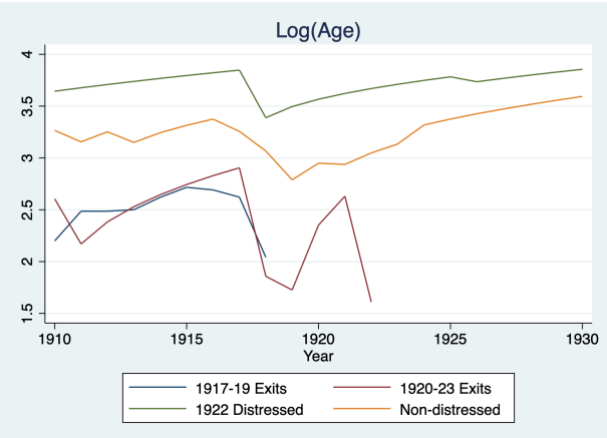


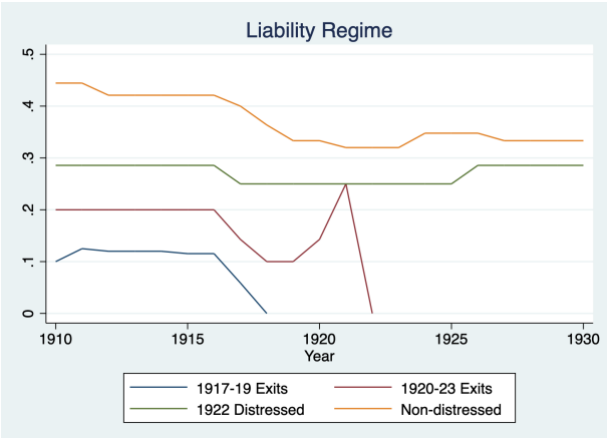

Deposits/ Capital
200
300
400
500
600
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed

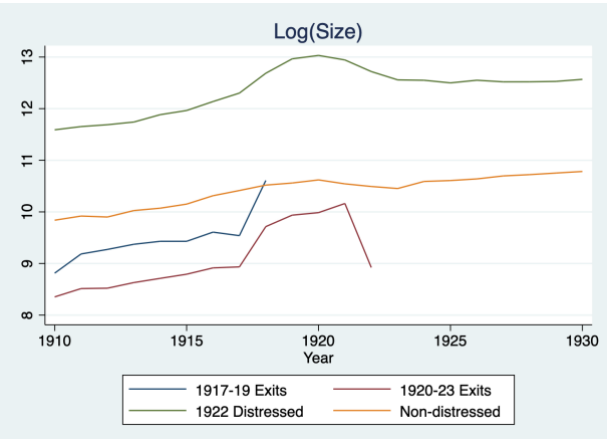

Bonds & Stocks/ Capital
0
20
40
60
80
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed

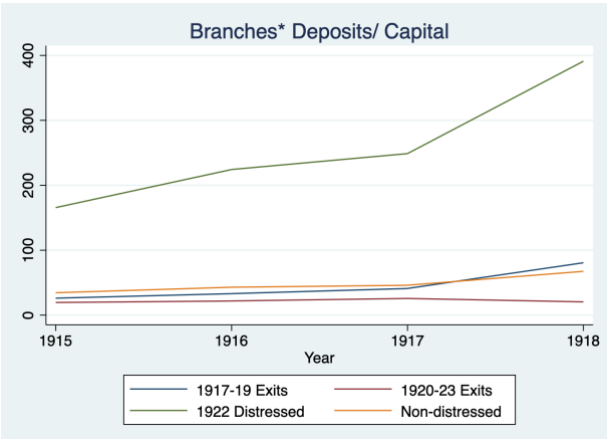

Return on Capital (ROC)
-40
-30
-20
-10
0
10
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed


Loan Loss Ratio (LLR)
0
5
10
15
20
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed


Log(Age)
1.5
2
2.5
3
3.5
4
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed


Liability Regime
0
.1
.2
.3
.4
.5
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed


Log(Size)
8
9
10
11
12
13
1910
1915
1920
1925
1930
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed


Branches* Deposits/ Capital
0
100
200
300
400
1915
1916
1917
1918
Year
1917-19 Exits
1920-23 Exits
1922 Distressed
Non-distressed

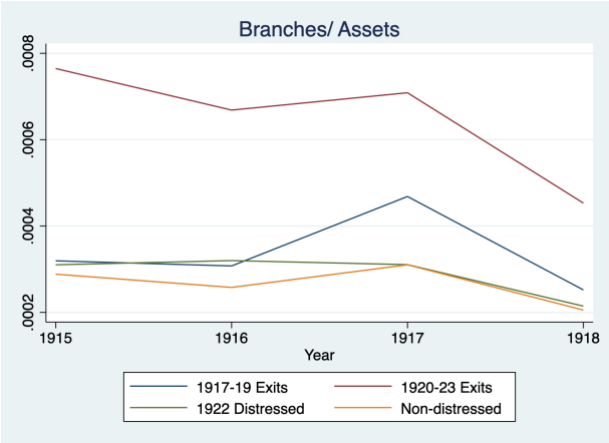


Figure 1: Mean values for variables, grouped by distress type. Note that the population of banks changes over time as new banks are formed and distressed banks exit the population. Consequently, amongst the two cohorts of banks which exited the population, averages are driven by smaller numbers of banks towards the end of the sample periods.

5.2 Results

Overall Summary

The logit results largely corroborate the inferences which can be made from the summary statistics, namely that there were relatively few observable pre-crisis balance sheet characteristics which would effectively predict the likelihood of a bank experiencing distress. The results highlight that bank distress in the period 1917-1919 was distinctly different in character than the crisis of 1922. Perhaps the most surprising feature of the results is the contrasting effect of bank size on distress probability. A closer analysis of the results aims to disentangle the effects of bank size on distress probability and in turn to explain the differing nature and causes of bank distress across the period under consideration.

The full logit results from each year are presented in appendixes A, B and C. From the area under curve (AUC) and pseudo R-squared statistics it can be inferred the data from the eve of each crisis (1916 and 1921) was no more effective at predicting bank distress than the data taken in the years prior. The AUC and pseudo R-squared values are relatively constant, showing much more variation between model specifications than they do between years.[2] There are two principal reasons for this. The first is the general lack of significant predictors of distress, which is consistent with narratives of the crises which emphasize the role of a short and sharp decline in industrial production in 1917 and a collapse of industrial shares in 1922 (Lönnborg, Ögren and Rafferty, 2011). The balance sheet data is taken from December of each year, and so it is entirely plausible that a bank which appeared to be sound in December 1916

[2] The area under curve (AUC) statistics are included as a measure of the overall goodness of fit of each model, by providing the probability that a randomly selected pair of subjects will be correctly ordered by the test, meaning that distressed banks have a higher probability than non-distressed banks of being predicted by the model as distress. The number given reflects the predictive power of the model, with a value of 1 indicative of perfect predictive power, whilst a "coin toss" choice of model would be expected to yield an AUC of 0.5. The AUC is the area under the receiver operating characteristic curve which plots true-positive rate (distressed banks predicted by the model as distressed) against the false-positive rate (non-distressed banks predicted by the model as distressed) for every possible classification threshold of the model (Grodecka-Messi, Kenny and Ögren, 2020).

or December 1921 would have exited the sample by December of the following year after experiencing acute distress. Of course, the use of monthly balance sheet data would help to better uncover the indicators of distress as they emerged, but this would not change the basic results here that there were no significant indicators of distress of the bank balance sheets before the onset of the crisis. The second reason is that the most effective predictors of distress, both with regards to the statistical significance of the coefficients and the overall fit of the models, are the institutional characteristics of the banks, which by their nature remain relatively constant from one year to the next. Taken together, these results validate Lönnborg, Ögren and Rafferty's (2011, p.234) assessment that "the driving forces behind the crisis were a combination of external displacement due to the war and more endogenous structural and institutional factors".

1917-1919 Bank Exits

	1916						
	Funding Structure		Fundamentals	Institutional			
Variable	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Deposit Ratio	-0.022						
	(0.023)						
Capital Ratio	0.089						
	(0.090)						
Bonds & Stocks Capital Ratio	-0.012	-0.014					
	(0.014)	(0.013)					
Deposit Capital Ratio		-0.004					
		(0.003)					
Return on Capital			-0.087				
			(0.061)				
Log(Age)				-0.907**			
				(0.448)			
Liability Regime				-0.437	-1.075	-1.468	
				(0.913)	(0.779)	(1.186)	
Log(Size)					-0.406**	-0.506*	-0.633*
					(0.205)	(0.264)	(0.345)
Branches/ Assets						-522.154	
						(2,068.766)	
Branches*Deposits/ Capital							-0.000
							(0.006)
Constant	0.119	1.940*	0.877	2.930**	4.405**	4.983*	5.830*
	(2.812)	(1.084)	(0.655)	(1.342)	(2.085)	(2.844)	(3.214)
Observations	52	52	52	52	52	41	41
N distressed banks	26	26	26	26	26	15	15
AUC	0.635	0.62	0.725	0.742	0.744	0.774	0.754
Pseudo R-sq.	0.0671	0.0562	0.0467	0.140	0.132	0.188	0.151
Prob > chi2	0.184	0.132	0.0665	0.00634	0.00853	0.0174	0.0169

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

In the case of the banks which failed between 1917 and 1919, institutional factors are especially important. Although the return on capital (ROC) has a negative and significant effect on distress probability in 1915 (indicating that the banks which subsequently failed were less profitable in the year before the crisis), this variable is no longer a significant predictor of

distress in 1916. By contrast, log size is consistently statistically significant across different years and specifications. The group of banks which exited the population in 1917-1919 was significantly younger and smaller than those which did not, which could either indicate the role of less asset selection experiences or less diverse portfolios of assets in increasing their vulnerability. Although the results for age were more significant in 1916, the effect of size was more consistent across both 1915 and 1916 and the models had slightly more predictive power. Moreover, there is little evidence that asset selection experience had a significant influence on return to capital. The banking crisis at the end of WWI therefore appears to be a story of small banks exiting the population as they likely lacked the diversity in their portfolios to offset the losses of 1917.

1920-1923 Bank Exits

Turning to the banks which exited the population in the period 1920-1923, it is even harder to predict their distress using balance sheet data taken from the years 1919, 1920 and 1921. Across all of the models for all three years, the only statistically significant predictors of distress are ROC and LLR in 1920, with positive and negative coefficients respectively. This reflects that distressed banks experienced lower returns to capital and higher loan losses relative to total lending in 1920, which adds further weight to the interpretation of profitability as indicative of asset selection quality rather than riskiness, although this interpretation is severely tempered by the lack of statistical significance seen in other years. Aside from these results, the coefficients for both deposit ratio and bonds and stocks relative to total capital are weakly significant (at the 90% level) for 1921, but both covariant are negative which is contrary to expectation. The lack of significance must be at least partly attributed to the small sample size, as only ten banks exited the population during this period and logistic regressions are known to require large sample sizes. Additionally, the results are largely consistent with the graphs of summary statistics, which largely show that the 1920-1923 failed banks to be similar to non-distressed banks during the pre-crisis period. Much like the banks which failed during the period 1917-1919, the 1920-1923 failures were generally younger and smaller than the banks which did not fail, although the regression results do not show this to be a statistically significant relationship.

1922 Distressed Banks

	1921							
	Funding Structure		Fundamentals			Institutional		
Variables	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Deposit Ratio	-0.097							
	(0.065)							
Capital Ratio	-0.765**							
	(0.350)							
Bonds & Stocks Capital Ratio	-0.072*	-0.028						
	(0.038)	(0.028)						
Deposit Capital Ratio		0.007*						
		(0.004)						
Return on Capital			-0.024					
			(0.028)					
Loan Loss Ratio				0.055				
				(0.117)				
Log(Age)					-1.236			
					(1.014)			
Log(Size)					2.528**	1.761**	2.041**	1.633
					(1.121)	(0.741)	(1.021)	(1.069)
Liability Regime					-0.018	-1.266	-1.148	
					(1.606)	(1.185)	(1.239)	
Branches/ Assets							1,483.475	
							(1,769.016)	
Branches*Deposits/ Capital								0.009*
								(0.006)
Constant	19.929**	-3.414**	-1.131***	-1.275**	-27.139**	-21.636**	-25.416*	-22.534*
	(9.813)	(1.495)	(0.411)	(0.506)	(11.916)	(9.210)	(13.030)	(13.393)
Observations	33	33	33	33	33	33	28	28
N distressed banks	8	8	8	8	8	8	8	8
AUC	0.865	0.73	0.67	0.635	0.945	0.93	0.919	0.931
Pseudo R-sq.	0.319	0.117	0.0193	0.00579	0.545	0.498	0.470	0.516
Prob > chi2	0.00859	0.118	0.401	0.645	0.000175	0.000112	0.00128	0.000177

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Of the three subsamples of distressed banks identified in this study, the group of banks which experienced distress but did not fail in 1922 appeared to be the most distinct with regards to their balance sheet and institutional characteristics in the summary statistics graphs. This is reflected in the regression results which show more statistical significance, with lower p-values for both individual coefficients and the overall models.[3]

The coefficient on the variable for capital ratio is positive and significant at the 95% level across all three years, indicating that the banks which experienced distress had lower capital ratios than those which did not. The deposit to capital ratio coefficients are also weakly significant (at the 90% level) but both of these variables use capital as a denominator so the effect may be driven by this rather than the numerators. Once more the fundamentals do not play a significant role in predicting distress, with the exception of ROC in 1919 being strongly significant in

[3] The chi-squared p values are generated to test the null hypothesis that all of the independent variables taken together have no effect on the dependent variable. A p-value less than a pre-specified alpha level, usually 0.01, 0l.05 or 0.1 indicates that the null hypothesis can be rejected.

1919. This potentially indicates greater risk taking by subsequently distressed banks, although this is not reflected in the results for 1920 or 1921.

Regarding the institutional characteristics of the banks, in spite of the suggestions of the summary statistics, liability regime is not statistically significant in predicting distress. This is consistent with the findings of Grodecka-Messi, Kenny and Ögren (2020) who found no effect for liability regime in the 1907-1911 crisis in Sweden. Once more, the most consistently significant predictor of distress is bank size (although age is not significant). However, in contrast to the 1917-1919 results, size is positive, indicating that distressed banks were significantly bigger than non-distressed banks. It does not follow that where size was a source of stability in 1917 it would be a source of vulnerability in 1922, and so two explanations for this reversal of effect are put forward here.

The first is based on the observation that when the variable for branches multiplied by deposits divided by capital is included in the models, this becomes significant (albeit only at the 90% level) whilst size ceases to hold statistical significance. This suggests that it was not the size of the banks which was a source of vulnerability, but rather the liquidity of their liabilities relative to their assets which led to instability, an effect which is further suggested by the results for the capital ratio variable. This explanation could therefore lend support to the bank-run view of crises, as the liquidity profile of these banks' liabilities was greater than that of their assets, which conceivably left them more vulnerable to distress in 1922.

A second explanation is that the banks which experienced distress in 1922 were engaging in riskier behaviour, which generated vulnerability on the assets side of their balance sheets. Whilst the distressed banks expanded all aspects of their balance sheets, it is clear that capital was increased to a lesser extent, as sharp increases in deposits relative to assets and deposits relative to capital can be observed alongside a notable decline in capital as a percentage of assets. These banks had much more extensive branch networks, which grew significantly during the three years for which branch network data was available. This was accompanied by a dramatic increase in general expenses, which continued to 1920, intimating that rapid branch network expansion continued to at least 1920.

5.3 Robustness checks

Evaluating the robustness of the results involves evaluating the models in the context of the assumptions required for logit regressions. These requirements are: 1) observations are independent, 2) no important variables are omitted and no extraneous variables are included, 3) the independent variables are not linear combinations of each other, 4) the log-odds of the outcome variable are a linear combination of the independent variables (Osborne, 2015). The first assumption of independence is satisfied by the use of individual bank data, which was checked for duplicates during the data cleaning stage, but the remaining assumptions require more detailed checking.

As previously stated, the AUC and pseudo r-squared are included as measures of goodness of fit, which in turn gives an indication of whether any important observations have been omitted. There is no pre-specified alpha level for assessing whether this assumption has been satisfied, but a general rule of thumb proposed by Hosmer and Lemeshow (2000, pp.156-164) is that

values of between 0.9 and 1 are outstanding, between 0.8 and 0.9 excellent and between 0.7 and 0.8 acceptable. By this measure all of the models from which conclusions have been inferred (those which included statistically significant coefficients) perform very well.

The assumption of no collinearity between independent variables is evaluated with collinearity diagnostics. The variance inflation factor (VIF) indicates how much inflation of the standard error could be caused by collinearity. If all of the variables are completely uncorrelated, then the VIF will be equal to one, but will become much larger where collinearity is an issue. A general rule of thumb is that multicollinearity is an issue when the VIF is greater than 10. Collinearity statistics for all multivariate model specifications for the years 1915 and 1921 are reported in appendix D, confirming that in no instances is multicollinearity an issue.

The assumption that there is a linear relationship between continuous predictor variables and the logit of the outcome is tested using Box-Tidwell tests, which test whether the logit transformation is a linear function of the predictor. This involved adding a non-linear transformation of the original predictor as an interaction term t the regression to test whether this can make a significant prediction (Osborne, 2015). In order for the linearity assumption to be satisfied the results for the interaction terms in this test should be non-significant (a high p-value indicates there is no non-linearity in the model). The Box-Tidwell results for the models which predict distress from 1917-1919 using 1916 data, and 1922 distress using 1919 data are presented in appendix E and confirm that there are no non-linear effects in any of these models.

5.4 Discussion

The finding that smaller banks were more likely to experience distress during the period 1917-1919 corroborates much of the existing literature on the period, which helps to illuminate the specific reasons why smaller banks were more vulnerable. Some of these reasons can be traced back to the period before the 1907 crisis, which saw a growth in the number of smaller banks possessing less resources, with the total number of commercial banks in Sweden growing from 46 in 1895 to a peak of 84 in 1908 (Häggqvist et al, 2020). Both the 1907-1911 and 1917-1919 periods can therefore be interpreted as periods of consolidation during which conditions became less well suited for the operation of several smaller banks. That these conditions became less favourable to smaller banks can be seen as partly a response to Sweden's economic transformation, but also the endogenous development of banking regulation. Ögren (2021, p.283) describes the 1907 crisis as "a window of opportunity for regulatory change" with the banking committee behind the 1911 Banking Act including several leading bankers and their focus being "to ensure a stable banking system where size and stability went hand in hand". The regulations which emerged were clearly favourable towards the operation of a smaller number of larger banks, including stricter requirements for minimum equity capital and stipulation that banks should hold funds which covered at least 20% of all deposits, of which 25% had to be legal tender cash reserves (Ögren, 2021, p.283). During the boom of WWI, many of the commercial banks struggled to cover their deposit to the extent required by law, precipitating a 1917 amendment which exempted commercial banks which held over 5 million SEK from deposit limits (Håkansson, 2009). This amendment helps to explain the dramatic increase in deposits relative to total capital which can be seen amongst the eight distressed but survived banks after 1917.

Another key aspect in which the regulatory environment had become geared towards larger banks was through the permission of larger banks to hold and trade shares on their own account, which was in response to calls for a move towards the German model of universal banking (Häggqvist et al, 2019, p.37). For all banks which survived the period, a gradual increase in holdings of bonds and stocks can be observed after the 1911 Banking Act and in the existing literature on the crisis much attention had been paid to the role of this development, as well as more generally closer ties between commercial banks and the industrial sector in attenuating stability. The results presented in this paper however suggest that holdings of bonds and stocks had no role insofar as predicting distress, and in the case of the banks which were distressed in 1922, increased holdings of bonds and stocks is actually suggested to have reduced distress. Likewise, the mean values for holdings of bonds and stocks relative to capital suggest that there were minimal differences between distressed and non-distressed banks during the pre-crisis period.

If the closer connections between commercial banking and industry were a source of vulnerability, it does not seem likely that this was related to holdings of bonds and stocks, but rather to increased lending to industrial firms against share collateral. Although there is no ex-ante balance sheet data available in this dataset which can be used to predict this development, the dramatic increase in holdings of bonds and stocks after 1922 amongst the surviving distressed banks hints at this development. Broberg and Ögren (2019) detail how the late nineteenth and early twentieth century saw a process of formalisation of lending through increased use of standardised and transferable collateral, which was driven by increased demand for credit during the prolonged industrialisation of the Swedish economy. Consequently, when many of these industrial companies were unable to meet their obligations in 1921-1922, the commercial banks which had lent to them against share collateral acquired much larger holdings of shares after the crisis (Häggqvist et al, 2019, p.29). The increased holdings of bonds and stocks after 1922 amongst the banks which experienced distress but did not fail can therefore be seen as an ex-post indicator that their distress was rooted in the struggles of the industrial companies to whom they lent, which is corroborated by the graph for LLR which further suggests a strong correlation between distress and loan losses in 1922.

Whilst the ex-ante predictors of bank distress are somewhat ambiguous, the above ex-post evidence suggests that banks which were distressed in 1922 had lent more extensively to industrial companies against share collateral. This can be seen as indicative of greater risk taking by these banks, which was reflected in the growth of their balance sheets and branch networks. Although branching allows a bank to diversify both its investments and liabilities, it has also been considered unsound due to the monitoring costs and risks associated with geographical expansion. During the 1910's many smaller banks had expanded their branch network outside of their regional markets, and in the face of increased competition, lending decisions became less discriminate (Grodecka-Messi, Kenny and Ögren, 2020). Similarly, Ögren (2021) observes a huge increase in branch banking at the same time as the number of banks decreased, which was driven by the merger and acquisition movement. Mergers and acquisitions were used as a tool through which banks could increase turnover and expand geographically in a less costly manner than setting up new branches in a region (Lönnborg, Ögren and Rafferty, 2011). Indeed, part of the reason as to why the demise of smaller banks at the end of the 1910's has not been regarded as a crisis in the same regard as 1921-22 is that for the most part these smaller banks were acquired by larger commercial banks which were able to guarantee the capital of the failing banks (Häggqvist et al, 2019, p.12). Across the entire period under study only one bank (*Stockholms Privatassistans*) was liquidated without takeover, as distressed commercial banks were acquired by more solvent competitors. Of the

banks which exited the population between 1917 and 1922, a total of 22 were acquired by the eight banks which were subsequently distressed in 1922, whilst 11 were acquired by non-distressed banks (Häggqvist et al, 2020). It is clear that the distressed banks experienced a much greater rise in general expenses, as well as a growth in their branches and deposits relative to capital. Accordingly, their expansion appears to have been riskier, leaving them more vulnerable to distress during the deflation of 1920-22.

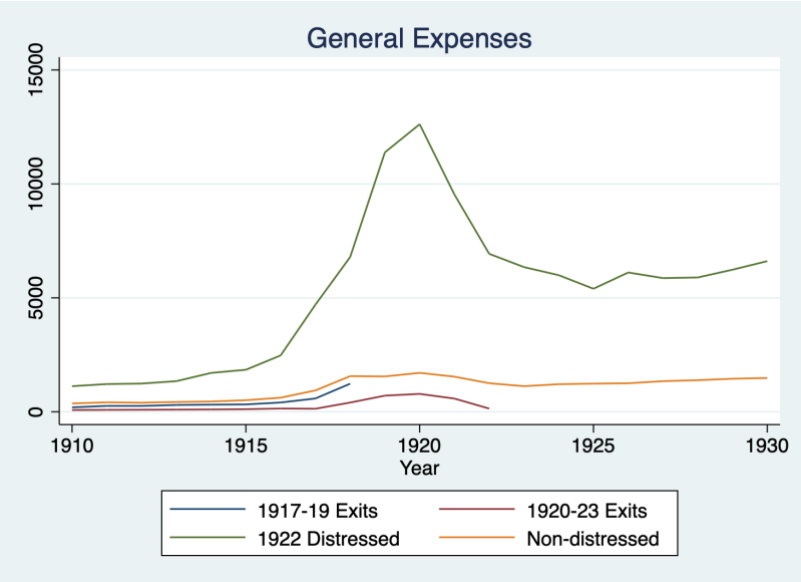


Figure 2: Mean general expenses grouped by distress type.

The key difference in 1922 was that the biggest banks in the commercial system began to experience distress, at which point there were no banks large enough to guarantee their capital. Consequently, the state, through *Kreditkassan* was forced to act as a lender of last resort and stepping in to assist reconstructions. The establishment of *Kreditkassan* underlines the benefits which emerged for being a bigger, older bank during the period, as the CEOs of the distressed *Skandinaviska Kreditaktiebolaget* and *Handelsbanken* were involved in the design and implementation of the fund alongside the CEO of *Stockholms Enskilda* and governor of the Bank of Sweden (Ögren, 2017, p.64). However, Lönnborg, Ögren and Rafferty (2011) stressed the importance of *Kreditkassan* in preventing the fire sale of equity and other assets, as well as abating fears that if the stock market fell much further the deposits of the public would be threatened. In this regard, the actions of *Kreditkassan* as a lender of last resort were similar to those advocated by Schwartz (1987) to prevent a "pseudo" crisis from becoming "real" in the event of a panic. Alongside the significant results for the branches*deposits/ capital variable, the actions of *Kreditkassan* could be seen as evidence that distressed banks had left themselves vulnerable to a run on deposits. However, these coefficients were only significant at the 90% level and the response to the crisis in 1922 was consistent with the actions of larger commercial banks during the post-war years. That the larger commercial banks such as the *Stockholms Enskilda* and *Skandinaviska kreditaktiebolaget* (before it reported its own losses) recognised the importance of ensuring stability of the commercial system by acting as guarantors to the distressed banks, underlines the interconnectedness of the banking system and the threat posed by the bankruptcy of any bank, regardless of its soundness (Lönnborg, Ögren and Rafferty, 2011, p.238).

6 Conclusion

6.1 Key Findings

The aim of this paper was to assess whether ex-ante bank-level data could predict distress likelihood for Swedish banks during the period 1917-1923. This was undertaken with view to the broader objective of assessing whether this episode should be considered a period of crisis or consolidation, which has implications for our broader understanding of the nature and causes of financial crises and how they can be mitigated.

The logit results reaffirm the ambiguity of financial crises, as there are relatively few observable differences in pre-crisis balance sheet characteristics between distressed and non-distressed banks. This is especially the case for predicting the distress of banks which exited the population, either in the period 1917-1919 or 1920-1923. The results from the banks which exited the population from 1917-1923 therefore fail to provide any support for either the "bank run" or "fundamentals" view of crises. These cohorts were most clearly defined by their size and age, lending support to the view that this was a period of consolidation during which smaller banks struggled to remain solvent in spite of no significant differences in their balance sheet compositions or fundamental performance relative to the banks which survived. Their exit from the population may therefore be seen as part of the endogenous evolution of the commercial banking system. However, it should be noted that the selection mechanisms which defined this evolution were a product of the macroeconomic conditions of the post-war period, and the endogenous development of banking regulation which came to favour bigger banks, meaning that this evolution potentially undermined stability in the early 1920s.

In contrast, the banks which experienced distress but did not fail in 1922 displayed slightly more observable ex-ante differences in their balance sheet composition. These banks were much more active in mergers and acquisitions during the post-war consolidation of the Swedish banking system, and as such expanded their balance sheets and branch networks much more rapidly. This left them vulnerable on two fronts. On the one hand, they had much higher ratios of branches and deposits relative to capital, which could have left them vulnerable to a bank-run in 1922. Their vulnerability in this regard is reaffirmed ex-post by the actions of *Kreditkassan* and other large banks, such as *Stockholms Enskilda*, to abate fears of deposit holders by stepping in to guarantee the capital of distressed banks. However, the ex-ante statistical evidence for the "bank run" view is relatively weak and the actions of *Kreditkassan* and *Stockholms Enskilda* were consistent with those of the larger commercial banks throughout the post-war period. They should be seen as reflective of the interconnectedness of the banking system and fears that any bank failure could disrupt the entire system irrespective of the soundness of the remaining banks.

On the other hand, there is more convincing evidence for the Minsky/ Kindleberger hypothesis regarding overextension of credit. This is demonstrated by lower capital ratios amongst distressed banks, driven by the rapid growth of their balance sheets and expansion of branch

networks before 1920, whilst capital reserves remained relatively constant. There is strong ex-post evidence to verify that the vulnerability of these banks was on the asset side of their balance sheets, as loan losses in 1922 were much more severe amongst distressed banks than non-distressed. Additionally, the rapid growth in holdings of bonds and stocks after 1922 suggests that these banks had lent extensively against share-collateral to industrial companies which were unable to meet their obligations in 1922. Consequently, the distress of 1922 can be seen as a crisis rather than consolidation, as it arose out of the overextension of credit and risk taking of the banks which experienced distress. The behaviour and performance of these banks suggests that exogenous shocks, such as the deflation of the post-war period, do not necessarily or indiscriminately cause bank distress, but rather afflict specific banks based on their patterns of business and asset structures.

It is somewhat paradoxical that of the three cohorts of distressed banks identified in this study, the cohort that engaged in the riskiest pre-crisis behaviour were the ones which survived. It is also somewhat surprising that the crisis appeared to have a consolidating effect as the economy and banking system recovered relatively quickly and would be characterised by close ties to industrial companies most of the twentieth century (Lönnborg, Ögren and Raffertty, 2011, p.238). This can in part be attributed to the benefits of being a bigger bank, which creates a greater incentive for regulatory authorities and competitors to step in to provide assistance. It also highlights the importance of the endogenous development of banking regulation, which partly created the conditions of consolidation in which bigger banks were able thrive.

6.2 Practical Implications

This paper further emphasises the ambiguity associated with predicting crises and highlights the difficulty of spotting early warning indicators of bank distress. Nonetheless, there are some practical implications of the results. Firstly, if early warning indicators are to be present, these are more likely to be found on the asset side of the balance sheet and detailed information is required. Secondly, the lack of significance associated with liability regime casts doubt on suggestions that unlimited liability may lead to a more stable banking system. Finally, whilst the acquisition of smaller distressed banks during the post-war period served to consolidate the banking system and abate fears of a bank run, it also resulted in the creation of bigger banks operating with lower capital ratios, more widely extended branch networks and likely higher levels of lending against share collateral. Consequently, consolidation created a different form of vulnerability, highlighting that even in a relatively diffused banking system acquisitions are not a costless resolution of distress.

6.3 Future Research

Whether the growth in size of these banks was connected to a realisation that they were becoming too big to fail, and so a form of moral hazard problem, remains open for future research. It should be stressed that the lack of significance found in this study for liability regime, or evidence that risk taking was connected to higher profitability undermines this argument. A more granular study of the monthly balance sheet data would be required to further determine how far distressed banks engaged in imprudent lending practices. Specifically, a

future study should focus on the role of lending against share collateral in predicting distress, so as to fully establish to what degree distressed banks did this more extensively, or whether this was a market wide response to increased demand for credit during a transformative period for the Swedish economy.

The conclusion of this paper that the post-war period was one of evolution and consolidation in the Swedish system raises questions regarding the nature of the selection mechanisms. In the Swedish example, closer analysis of the importance of lending against share collateral can help to better understand how this potential source of vulnerability arose out of necessity of financing Sweden's economic modernisation. More generally, there remains considerable room in the dominant theories of financial crises for a consideration of how macroeconomic conditions affect the functions and requirements of the banking system. Likewise, this paper has highlighted the role of the endogenous development of banking regulation in both the consolidation of the banking system and attenuating stability in 1922. Given the centrality of regulatory regimes and moral hazard dilemmas to existing banking crisis literature, it would also be beneficial to more closely consider the political economy of banking regulation and how this relates to the incidence and effects of financial crises.

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Appendix A- Full Logit Results for 1917-1919 Exits

	1915						
	Funding Structure		Fundamentals	Institutional			
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Deposit Ratio	-0.004						
	(0.022)						
Capital Ratio	0.111						
	(0.083)						
Bonds & Stocks Capital Ratio	0.006	-0.000					
	(0.016)	(0.015)					
Deposit Capital Ratio		-0.003					
		(0.003)					
Return on Capital			-0.334**				
			(0.159)				
Log(Age)				-0.784*			
				(0.431)			
Liability Regime				-0.528	-1.051	-1.469	
				(0.912)	(0.783)	(1.191)	
Log(Size)					-0.410**	-0.546**	-0.638*
					(0.206)	(0.272)	(0.350)
Branches/ Assets						-1,414.257	
						(1,920.601)	
Branches*Deposits/ Capital							0.000
							(0.008)
Constant	-2.255	1.010	2.493**	2.508**	4.366**	5.578*	5.754*
	(2.704)	(0.976)	(1.230)	(1.270)	(2.057)	(2.907)	(3.193)
Observations	52	52	52	51	52	41	41
N distressed banks	26	26	26	25	26	15	15
AUC	0.608	0.573	0.648	0.732	0.746	0.787	0.756
Pseudo R-sq.	0.0335	0.0211	0.0778	0.121	0.133	0.194	0.149
Prob > chi2	0.491	0.467	0.0179	0.0139	0.00836	0.0150	0.0182

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	1916						
	Funding Structure		Fundamentals	Institutional			
Variable	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Deposit Ratio	-0.022						
	(0.023)						
Capital Ratio	0.089						
	(0.090)						
Bonds & Stocks Capital Ratio	-0.012	-0.014					
	(0.014)	(0.013)					
Deposit Capital Ratio		-0.004					
		(0.003)					
Return on Capital			-0.087				
			(0.061)				
Log(Age)				-0.907**			
				(0.448)			
Liability Regime				-0.437	-1.075	-1.468	
				(0.913)	(0.779)	(1.186)	
Log(Size)					-0.406**	-0.506*	-0.633*
					(0.205)	(0.264)	(0.345)
Branches/ Assets						-522.154	
						(2,068.766)	
Branches*Deposits/ Capital							-0.000
							(0.006)
Constant	0.119	1.940*	0.877	2.930**	4.405**	4.983*	5.830*
	(2.812)	(1.084)	(0.655)	(1.342)	(2.085)	(2.844)	(3.214)
Observations	52	52	52	52	52	41	41
N distressed banks	26	26	26	26	26	15	15
AUC	0.635	0.62	0.725	0.742	0.744	0.774	0.754
Pseudo R-sq.	0.0671	0.0562	0.0467	0.140	0.132	0.188	0.151
Prob > chi2	0.184	0.132	0.0665	0.00634	0.00853	0.0174	0.0169

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix B- Full logit results for 1920-1923 Exits

	1919							
	Funding Structure		Fundamentals			Institutional		
Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit Ratio	-0.067							
	(0.054)							
Capital Ratio	-0.077							
	(0.096)							
Bonds & Stocks Capital Ratio	-0.088	-0.067						
	(0.056)	(0.055)						
Deposit Capital Ratio		-0.004						
		(0.003)						
Return on Capital			-0.045					
			(0.077)					
Loan Loss Ratio				-11.274				
				(6.975)				
Log(Age)					-0.456			
					(0.288)			
Liability Regime					-0.385	-0.624	1.384	
					(1.329)	(1.276)	(2.149)	
Log(Size)						-0.442	-1.248*	-0.789
						(0.297)	(0.740)	(0.555)
Branches/ Assets							1,624.354	
							(1,935.673)	
Branches*Deposits/ Capital								-0.005
								(0.012)
Constant	5.738	1.108	-0.776	-0.404	-0.014	3.606	10.885	7.217
	(5.141)	(0.914)	(0.741)	(0.469)	(0.649)	(2.971)	(7.033)	(5.296)
Observations	42	42	42	42	42	42	34	34
N distressed banks	10	10	10	10	10	10	7	7
AUC	0.803	0.794	0.525	0.779	0.714	0.697	0.841	0.841
Pseudo R-sq.	0.212	0.204	0.00748	0.141	0.103	0.104	0.301	0.270
Prob > chi2	0.0207	0.00903	0.557	0.0107	0.0920	0.0900	0.0154	0.00942

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	1920							
	Funding Structure		Fundamentals			Institutional		
Variable	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Deposit Ratio	-0.056							
	(0.063)							
Capital Ratio	-0.049							
	(0.115)							
Bonds & Stocks Capital Ratio	-0.058	-0.047						
	(0.047)	(0.049)						
Deposit Capital Ratio		-0.002						
		(0.004)						
Return on Capital			-0.262*					
			(0.146)					
Loan Loss Ratio				1.752**				
				(0.876)				
Log(Age)					-0.374			
					(0.386)			
Liability Regime					-0.305	-0.002	1.429	
					(1.389)	(1.441)	(2.227)	
Log(Size)						-0.520	-1.140	-0.667
						(0.384)	(0.762)	(0.552)
Branches/ Assets							1,711.313	
							(1,950.372)	
Branches*Deposits/ Capital								-0.005
								(0.011)
Constant	3.828	0.175	0.354	-2.547***	-0.431	3.973	9.703	5.890
	(6.036)	(1.051)	(1.080)	(0.730)	(0.959)	(3.789)	(7.291)	(5.330)
Observations	39	39	39	39	39	39	33	33
N distressed banks	7	7	7	7	7	7	6	6
AUC	0.759	0.746	0.703	0.694	0.643	0.7143	0.833	0.815
Pseudo R-sq.	0.128	0.112	0.103	0.120	0.0514	0.0940	0.256	0.223
Prob > chi2	0.194	0.128	0.0515	0.0359	0.389	0.178	0.0457	0.0307

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	1921							
	Funding Structure		Fundamentals			Institutional		
Variable	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Deposit Ratio	-0.202*							
	(0.104)							
Capital Ratio	-0.314							
	(0.194)							
Bonds & Stocks Capital Ratio	-0.100*	-0.031						
	(0.055)	(0.048)						
Deposit Capital Ratio		-0.004						
		(0.004)						
Return on Capital			-0.005					
			(0.040)					
Loan Loss Ratio				-0.043				
				(0.215)				
Log(Age)					-0.340			
					(0.506)			
Liability Regime					0.361	0.846	0.708	
					(1.595)	(1.797)	(1.850)	
Log(Size)						-0.558	-0.952	-0.035
						(0.559)	(0.624)	(0.542)
Branches/ Assets							-7,844.377	
							(7,512.020)	
Branches*Deposits/ Capital								-0.019
								(0.020)
Constant	17.502*	-0.367	-2.106***	-2.017***	-1.234	3.561	9.445	-0.588
	(10.221)	(1.186)	(0.530)	(0.687)	(1.260)	(5.414)	(6.493)	(5.330)
Observations	37	37	37	37	37	37	32	32
N distressed banks	4	4	4	4	4	4	4	4
AUC	0.879	0.758	0.712	0.462	0.568	0.652	0.83	0.786
Pseudo R-sq.	0.300	0.113	0.000511	0.00181	0.0202	0.0603	0.203	0.178
Prob > chi2	0.0549	0.239	0.909	0.830	0.774	0.466	0.181	0.116

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix C- Full logit results for 1922 Distressed Banks

	1919							
	Funding Structure		Fundamentals		Institutional			
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Deposit Ratio	-0.015							
	(0.105)							
Capital Ratio	-0.807**							
	(0.403)							
Bonds & Stocks Capital Ratio	-0.093*	-0.083*						
	(0.056)	(0.048)						
Deposit Capital Ratio		0.015**						
		(0.007)						
Return on Capital			0.253**					
			(0.124)					
Loan Loss Ratio				1.393				
				(1.474)				
Log(Age)					-1.196			
					(0.940)			
Log(Size)					2.791**	1.925**	3.212**	1.713
					(1.242)	(0.842)	(1.615)	(1.121)
Liability Regime					0.406	-1.037	-1.251	
					(1.677)	(1.217)	(1.476)	
Branches/ Assets							16,940.404*	
							(9,543.694)	
Branches*Deposits/ Capital								0.010*
								(0.006)
Constant	14.984	-5.648**	-3.631***	-1.379***	-30.841**	-23.755**	-42.430**	-23.620*
	(10.270)	(2.692)	(1.350)	(0.524)	(14.029)	(10.530)	(21.377)	(13.937)
Observations	32	32	32	32	32	32	27	27
N distressed banks	8	8	8	8	8	8	8	8
AUC	0.854	0.781	0.667	0.708	0.948	0.938	0.954	0.954
Pseudo R-sq.	0.341	0.233	0.178	0.0242	0.569	0.510	0.598	0.544
Prob > chi2	0.00652	0.0151	0.0114	0.351	0.000135	0.000104	0.000204	0.000133

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	1920							
	Funding Structure		Fundamentals		Institutional			
Variables	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Deposit Ratio	-0.140							
	(0.089)							
Capital Ratio	-1.257**							
	(0.590)							
Bonds & Stocks Capital Ratio	-0.109*	-0.026						
	(0.058)	(0.035)						
Deposit Capital Ratio		0.008*						
		(0.005)						
Return on Capital			-0.061					
			(0.139)					
Loan Loss Ratio				1.663				
				(1.146)				
Log(Age)					-1.289			
					(1.040)			
Log(Size)					2.662**	1.891**	3.229**	1.785
					(1.191)	(0.838)	(1.585)	(1.190)
Liability Regime					0.157	-1.195	-1.264	
					(1.638)	(1.215)	(1.462)	
Branches/ Assets							18,645.824*	
							(10,597.374)	
Branches*Deposits/ Capital								0.011*
								(0.006)
Constant	29.946**	-4.053**	-0.595	-1.844***	-28.873**	-23.387**	-42.924**	-24.900*
	(14.951)	(1.807)	(1.196)	(0.692)	(13.407)	(10.526)	(21.174)	(15.029)
Observations	32	32	32	32	32	32	27	27
N distressed banks	8	8	8	8	8	8	8	8
AUC	0.885	0.719	0.573	0.662	0.948	0.928	0.961	0.947
Pseudo R-sq.	0.390	0.132	0.00558	0.0651	0.569	0.513	0.601	0.557
Prob > chi2	0.00287	0.0935	0.654	0.126	0.000136	9.83e-05	0.000194	0.000107

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	1921							
	Funding Structure		Fundamentals		Institutional			
Variables	(17)	(18)	(19)	(20)	(21)	(22)	(23)	(24)
Deposit Ratio	-0.097							
	(0.065)							
Capital Ratio	-0.765**							
	(0.350)							
Bonds & Stocks Capital Ratio	-0.072*	-0.028						
	(0.038)	(0.028)						
Deposit Capital Ratio		0.007*						
		(0.004)						
Return on Capital			-0.024					
			(0.028)					
Loan Loss Ratio				0.055				
				(0.117)				
Log(Age)					-1.236			
					(1.014)			
Log(Size)					2.528**	1.761**	2.041**	1.633
					(1.121)	(0.741)	(1.021)	(1.069)
Liability Regime					-0.018	-1.266	-1.148	
					(1.606)	(1.185)	(1.239)	
Branches/ Assets							1,483.475	
							(1,769.016)	
Branches*Deposits/ Capital								0.009*
								(0.006)
Constant	19.929**	-3.414**	-1.131***	-1.275**	-27.139**	-21.636**	-25.416*	-22.534*
	(9.813)	(1.495)	(0.411)	(0.506)	(11.916)	(9.210)	(13.030)	(13.393)
Observations	33	33	33	33	33	33	28	28
N distressed banks	8	8	8	8	8	8	8	8
AUC	0.865	0.73	0.67	0.635	0.945	0.93	0.919	0.931
Pseudo R-sq.	0.319	0.117	0.0193	0.00579	0.545	0.498	0.470	0.516
Prob > chi2	0.00859	0.118	0.401	0.645	0.000175	0.000112	0.00128	0.000177

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Appendix D- Collinearity Statistics

Collinearity Statistics 1915				
	VIF	SQRT VIF	Tolerance	R-Squared
Model 1				
Deposit Ratio	1.11	1.05	0.9009	0.0991
Capital Ratio	1.28	1.13	0.7787	0.2213
Bonds & Stocks Capital Ratio	1.22	1.11	0.8176	0.1824
Mean VIF	1.21			
Model 2				
Bonds & Stocks Capital Ratio	1.01	1.01	0.9856	0.0144
Deposit Capital Ratio	1.01	1.01	0.9856	0.0144
Mean VIF	1.01			
Model 4				
Log(Age)	1.69	1.3	0.5909	0.4091
Liability Regime	1.69	1.3	0.5909	0.4091
Mean VIF	1.69			
Model 5				
Liability Regime	1.19	1.09	0.84	0.16
Log(Size)	1.19	1.09	0.84	0.16
Mean VIF	1.19			
Model 6				
Liability Regime	1.22	1.1	0.8197	0.1803
Log(Size)	1.35	1.16	0.7422	0.2578
Branches/ Assets	1.14	1.07	0.8787	0.1213
Mean VIF	1.24			
Model 7				
Log(Size)	1.96	1.4	0.511	0.489
Branches*Deposits/ Capital	1.96	1.4	0.511	0.489
Mean VIF	1.96			

Collinearity Statistics 1921				
	VIF	SQRT VIF	Tolerance	R-Squared
Model 17				
Deposit Ratio	2.67	1.63	0.3752	0.6248
Capital Ratio	3.63	1.91	0.2754	0.7246
Bonds & Stocks Capital Ratio	1.72	1.31	0.583	0.417
Mean VIF	2.67			
Model 18				
Bonds & Stocks Capital Ratio	1.18	1.09	0.8445	0.1555
Deposit Capital Ratio	1.18	1.09	0.8445	0.1555
Mean VIF	1.18			
Model 21				
Log(Age)	1.53	1.24	0.6533	0.3467
Liability Regime	1.53	1.24	0.6533	0.3467
Mean VIF	1.53			
Model 22				
ULB	1.21	1.1	0.8245	0.1755
Log(Size)	1.21	1.1	0.8245	0.1755
Mean VIF	1.21			
Model 23				
ULB	1.15	1.07	0.87	0.2475
Liability Regime	1.22	1.1	0.82	0.5392
Branches/ Assets	1.1	1.05	0.912	0.1226
Mean VIF	1.16			
Model 24				
Log(Size)	1.75	1.32	0.57	0.43
Branches*Deposits/ Capital	1.75	1.32	0.57	0.43
Mean VIF	1.75			

Appendix E- Box-Tidwell Results

	1916				
	Funding Structure		Fundamentals	Institutions	
Variables	(1)	(2)	(3)	(4)	(5)
Ideprat_p1	0.000769				
	(0.00751)				
Icaprat_1	-0				
	(0)				
Icaprat_p1	0				
	(0)				
Ibondcaprat_1	0	-2.297e+08			
	(0)	(0)			
Idepcaprat_1		-2.04e-08			
		(5.49e-07)			
IROC_p1			-2.40e-06		
			(0.000625)		
Ilnage_1				-0.00108	
				(0.00523)	
Ilnage_p1				0.000192	
				(0.00363)	
Isize__1					-1.42e-05
					(0.000267)
Isize_p1					-1.22e-06
					(0.000103)
Observations	52	52	52	52	52

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

	1919							
	Funding Structure		Fundamentals			Institutional		
Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Ideprat_p1	1.613e+09							
	(0)							
Icaprat_1	-1.622*							
	(0.971)							
Icaprat_p1	1.057							
	(0.719)							
Ibondcaprat_1	-403,241	-3.554e+09						
	(290,831)	(0)						
Ibondcaprat_p1	2.493e+06							
	(1.801e+06)							
Idepcaprat__1		-700.8						
		(576.9)						
Idepcaprat_p1		613.5						
		(543.2)						
IROC__1			0					
			(0)					
IROC_p1			-0					
			(0)					
ILLR__1				-0.000215				
				(0.000212)				
ILLR_p1				-2.63e-05				
				(2.60e-05)				
Ilnage_1					-0.749			
					(3.291)			
Ilnage_p1					0.00102			
					(0.946)			
Isize__1						-105,359	0.630	
						(2.373e+06)	(26.05)	
Isize_p1						10,321	0.0520	
						(1.055e+06)	(8.110)	
Ilbranchassets_1							59.63	-2.07e-07
							(1,038)	(0)
Ilbranchcaprat_p1							-0.188	-5.57E-08
							(59.48)	(0)
Observations	32	32	32	32	32	32	27	27

Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1