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Abstract

Why do some banks fail in financial crises while others survive? This article answers this question by analysing the effect of the Dutch financial crisis of the 1920s on 142 banks, of which 33 failed. We find that choices of balance sheet composition and product market strategy made in the lead-up to the crisis had a significant impact on banks' subsequent chances of experiencing distress. We document that high-risk banks – those operating highly-leveraged portfolios and attracting large quantities of deposits – were more likely to fail. Branching and international activities also increased banks' default probabilities. We measure the effects of board interlocks, which have been characterized in the extant literature as contributing to the Dutch crisis. We find that boards mattered: failing banks had smaller boards, shared directors with smaller and very profitable banks and had a lower concentration of interlocking directorates in non-financial firms.

Keywords

Financial crises; bank failures; bank business models; interlocking directorates; the Netherlands; the interwar period.

JEL codes

G01; G21; G33; G34; N24.

1. Introduction

The Dutch economy suffered a sharp recession in the early 1920s after it had experienced a period of exceptional performance in the 1910s. Following Fisher's (1933) debt-deflation theory of great depressions, Jonker and Van Zanden (1995) argue that this recession's principal cause was over-indebtedness combined with price deflation. Dutch businesses had benefited greatly from the First World War, a conflict in which the Netherlands remained neutral (De Jong, 2005); a short post-war boom prolonged their prosperity (Van Zanden, 1997a). The large and sustained declines in aggregate demand and prices that followed were the consequence of falling export demand and monetary policy due to the gold standard. Debt-deflation put pressure both on Dutch businesses and on the banking sector that they had come to rely on. Instability for banks has since been widely classified as constituting a financial crisis (e.g. Bernanke and James, 1991; Reinhart and Rogoff, 2009). Jonker and Van Zanden (1995) estimate that 35 banks suffered financial distress in this crisis; De Vries (1989) puts the number closer to 70. Of the 142 banks considered in this article, which together constitute 83 per cent of the nominal equity value of the Dutch financial services sector, we document 33 that suffered distress at some stage in the crisis.

This article quantitatively investigates the determinants of this unequalled bank distress in the Netherlands by using discrete choice models to "predict the past". Bank-level financial accounting, product market competition and board data included in popular contemporary investor manuals are used to assess how policy decisions influenced banks' fate. In particular, we ask how banks' choices made before the debt-deflationary downturn affected their subsequent performance in the banking crisis. This article complements De Vries (1989) and Jonker and Van Zanden (1995) by systematically distinguishing between the characteristics of distressed and non-distressed banks. As such, this article adds a new and more nuanced understanding of this period in Dutch economic history. Though we agree that the crisis of the 1920s was caused by extensive deflationary pressures, our methodology shows that its consequences for the country's financial service providers stem from

bank-specific risk factors, including the characteristics of their relationships with other banks and non-financial firms.

While our main goal is to shed new light on an unresolved historical question, finding an answer to the role of pre-crisis conditions for crisis-period performance is interesting for three further reasons: (1) it facilitates the economic identification of the roots of bank distress because its causes were largely exogenous, but its effects on the banking sector were partly determined endogenously; (2) because of the absence of prudential supervision in the Netherlands at the time of the crisis, this historical episode illustrates how banks may behave when there is little expectation of state intervention; and (3) it provides a better understanding of product market competitive choice and the workings of relationship banking in times of crisis.

The methodology we employ follows work which uses discrete choice models to determine why banks fail (Kolari et al., 2002; Ravi Kumar and Ravi, 2007). Following Meyer and Pifer (1970), Martin (1977), and Pettaway and Sinkey (1980), we use bank-level accounting data to measure capital adequacy, asset quality, earnings and liquidity. Our data on the determinants of failure are taken from 1917, while the failures start in 1920. This implies that all decisions were taken in 1917 or earlier, but the crisis was caused by the troubles the banks' clients and business connections faced in 1920 and later. All banks in our sample – failing or not – were confronted with the same economic conditions, but not all banks failed. Our empirical strategy explores the possibility that failing banks made bad lending and financing decisions up to 1917 and suffered their consequences in the 1920s. In other words, we document bad policy decisions, conditional on changing economic circumstances. Although the precise developments after 1917 were not foreseeable for the bankers, those making good decisions anticipated a worsening of conditions.

In this article we take a broad view of bank distress. We include many of the standard balance sheet-based and control variables found in the literature on banking crises. The Dutch financial sector was highly fragmented at the time of the crisis and the banks in our sample exhibit wide variation in their product market choices and positioning. We incorporate variables which describe

market structure and the presence of international activities in order to measure these effects. Descriptions of the Dutch financial services sector in this period suggest that bank directors were positioned strategically on the boards of related financial and non-financial corporations with the explicit task of safeguarding their employers' interests (e.g. De Graaf, 2012). We use information from banks' boards, and in particular their networks of interlocking directorates, to explore the impact of a form of relationship banking that emerged in the Netherlands in the 1910s.

Our results are as follows. We find that the balance sheet composition of banks before the crisis period had a significant impact on their probability of suffering distress in the 1920s. In particular, banks with higher leverage and more deposits were at greater risk of suffering distress. Much in line with the established view of this crisis, we attribute this to the combined exposure to debt-deflation – which rendered long-term loans riskier – and the post-war boom that came immediately before it – which caused a short-lived banking bubble. We find that younger and exchange-listed banks were more vulnerable in times of crisis.

The effects of banks' product market strategies and competition are mixed. On the one hand banks with branches and international activities were more likely to suffer distress. We take this to be evidence of the risk of doing business further away from banks' headquarters, a strategy which is associated with higher monitoring costs. On the other hand, we find no effect of competition, measured as the relative market representation over the regions where a bank is active in the domestic market.

In exploring how interlocking directorates influence banks' performance, we find that banks with smaller boards had a higher probability of suffering distress. When we control for the effects of board size and the attributes of interlocking directorates, we find evidence for the interdependency of the Netherlands' banks. In particular, banks which positioned their managerial connections in other financial firms that were smaller and highly profitable immediately prior to the crisis were most at risk. We find that interlocks with non-financial firms had a weak impact on the probability of

suffering distress; we find only that banks which concentrated such interlocks were better able to safeguard their interests during the crisis.

The findings of this article relate to a wider literature on universal or relationship banking in the early twentieth century, in particular to Fohlin (1999) for the case of Germany and to Van Overfelt et al. (2009) for the case of Belgium. More specifically, we re-examine the problems associated with mixed banking in the crises of the interwar period, much as White (1986) and Kroszner and Rajan (1994) do for the case of the US.

Our results relate to an already existing body of work on the Dutch crisis of the 1920s. De Vries (1989) gives a detailed historical narrative of its unfolding from the perspective of De Nederlandsche Bank (DNB), the Netherlands' bank of issue. Jonker (1989, 1991) argues that close ties between bankers and their corporate borrowers via interlocking directorates soon extended the crisis from the non-financial to the financial sector. Colvin (2014) describes how conflicts of interest arising from one such interlock resulted in the near failure of the country's second-largest bank. We find that the crisis was mainly caused by the internal choices made by banks in terms of financial structure (leverage and deposits) and product market strategy (branching and internationalization), as well as by the relations between banks.

This article is closely related to various other works in banking and finance. Most importantly, it relates to work on the causes and consequences of financial crises – a theme which, given recent bank failures, has lately been revived (for a review, see Acharya et al., 2009; and Lo, 2012). Of specific relevance in this literature are two studies which, like ours, attempt to "predict the past": Jordan et al. (2010), who, on the basis of data pertaining to banks one year prior to the 2007 crisis, predict recent bank failures with 88 per cent accuracy; and Fahlenbrach et al. (2012), who find that there is a general persistence in banks' risk-taking culture between 1998 and the present which renders their performance very sensitive to crises.

The article proceeds as follows. First, the historical and institutional context necessary to understand our arguments is introduced in Section 2. Our bank-level accounting and corporate

governance data and the empirical strategy used in the analysis are discussed in Section 3. Section 4 defines the variables constructed for our regression exercises and presents their descriptive statistics, and Section 5 discusses the results of our regression models for bank failure. Section 6 concludes by assessing the importance of a bank's policy decisions, in terms of balance sheet composition and interlocking directorates, for its performance during a deflationary recession.

2. Historical and institutional context

At the turn of last century, the Netherlands' banks played second fiddle to the country's capital markets. Commercial banks were nothing like those in neighbouring Germany (Fohlin, 2007). Indeed, the Netherlands went in very little for banking: 64 per cent of the kingdom's money supply on the eve of the First World War was in the form of paper money, versus 37 per cent in Germany, 29 per cent in Belgium and just 4 per cent in Britain (Van Zanden, 1997b). Jonker (2002) argues that the Netherlands had not produced banks because its sophisticated financial inheritance could do without them. Amsterdam's merchants had developed a flexible credit source called *prolongatie*, a short-term credit instrument which demanded financial securities – primarily exchange-listed shares – as collateral. This highly liquid on-call money market, which operated in a similar way to modern repurchase agreements (repos), was unique to the Netherlands and outcompeted banks on cost. It enabled firms to meet both short-term and long-term credit requirements, since the instrument could be easily rolled over.

From about 1911, and in particular during the First World War, the country started to look more like a bank-based economy. A wave of bank mergers had built sophisticated multi-branch networks with a wide portfolio of clients (Jonker, 1995). The *prolongatie* market gave way to bank finance when Amsterdam's stock exchange closed in 1914 due to the outbreak of war (De Vries, 1976).[1] The war itself and the subsequent short post-war economic boom hastened the move by banks to widen their services; they now took a direct part in industrial ventures, not merely bringing

[1] Although the *prolongatie* market continued to be used after the war (Euwe, 2010), it never fully recovered.

them to market. The regulatory regime at the time remained *laissez faire*: the absence of corporate laws specifically governing banking corporations enabled them to engage in a variety of different business activities, including investment banking, without being inhibited by minimum bank capitalisation requirements, or constrained by specific shareholder liability rules. Moreover, the country lacked a modern central bank; while DNB as the bank of issue monopolised the printing of paper money, it remained a private business answerable to private shareholders, had no formal duty of regulatory oversight and neither a *de facto* nor a *de jure* function as a lender of last resort in crises (Jonker, 1996).[2]

By tradition, Dutch firms employed a dual board structure similar to the German model, with a management board made up of *directeuren* (executive directors) and a supervisory board of *commissarissen* (non-executive directors).[3] Jonker (1989, 1991) uses the number of interlocks between banks and industry to measure financial development, or banking scope. He argues that an increase in interlocks suggests a move towards universal service provision, where banks simultaneously do business as both commercial and investment banks, since banks install directors in the firms which they finance. He argues that bankers sitting on the boards of multiple firms positioned themselves as "bearers of capitalism", able to control the trajectory of the country's economic development.[4] He finds that in the early 1920s interlocks more than doubled, from 200 in

[2] However, DNB did supervise the banking sector in three informal ways: (1) its governors were sent news of changes in the board composition of all Dutch financial institutions; (2) like other shareholder-owned banks, it actively participated in the corporate policy formation of other firms by parachuting its directors onto the boards of corporate clients; and (3) it could choose the financial terms for its short-term debt instrument, access to its bill rediscounting facility. The last was especially controversial at the time; some private banks complained that it was abusing its position as the Dutch state's bank of issue by allegedly offering loans at terms that no other bank could match (Communication between the director of the Bond Geld- en Effectenhandel and the Minister of Finance, December 1917, Archief van de Bond voor de Geld- en Effectenhandel te 's-Gravenhage, Access No. 2.19.042.14, Nationaal Archief, The Hague).

[3] Members of both boards were normally appointed at shareholders' meetings on the advice of sitting *directeuren* (De Jong and Röell, 2005); as a rule, their appointment could be assumed.

[4] Jonker revisits earlier notions of the relevance of interlocking directorates put forward by Wibaut (1913), who argues that the Netherlands' largest banks were gradually starting to dominate the economy by buying equity stakes in

1920 to 431 in 1923. Many of these were due to changes at the Netherlands' second-largest bank, the Rotterdamsche Bankvereeniging (Robaver): from 20 interlocks in 1910 to 127 in 1923.[5] But the trend included others: De Jong and Röell (2005) find that in 1923 the proportion of non-financial exchange-listed firms with no bank interlocks was 40 per cent, while 22 per cent had one interlock, 12 per cent had two, 8 per cent had three and 18 per cent more than three.[6]

The structure of Dutch banking had changed quite significantly at the beginning of the twentieth century: an increasing trend towards concentration, the market entry of new banks and the adoption of a universal banking business model by various incumbents changed the banking landscape. However, the scale and scope of the Netherlands' banks remained highly diverse. Although the size of the five largest banks increased in relation to the rest, they by no means dominated;[7] a host of smaller, often specialised, banks co-existed. These included smaller *algemene banken* (general commercial banks),[8] which, like Robaver, operated as full-service financial firms, but to more limited geographical markets. Other players included private banking houses, such as Hope & Co.; unit-independent provincial banks offering a narrower range of services, such as bill discounting; and scores of specialist mortgage banks. Cooperative rural banks (*boerenleenbanken*) and banks for small-scale urban enterprises (*middenstandsbanken*) were emerging with the turn of the century.[9] In addition a handful of overseas banks operated as free-standing companies servicing firms in the Dutch colonies and elsewhere. Branching was a relatively new strategy for Dutch banks; about 70 per cent of the banks in our sample were unit-independent on the eve of the 1920s crisis.

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industry and increasing credit supply. Wibaut saw this as a conscious strategy by the bankers to strive for hegemony, which led to a prominent role for them in the decision making process of industrial firms.

[5] This was described on the eve of the crisis by the son of Robaver's president as part of an expansionary strategy to emulate Germany's universal banks (Westerman, 1920).

[6] Most interlocks were between the supervisory boards of banks and non-financial firms (47 per cent), but a substantial portion involved a *directeur* of a bank sitting as a *commissaris* of a non-financial firm (29 per cent).

[7] The Netherlands' Big Five comprised: Amsterdamsche Bank, Incasso-Bank, Nederlandsche Handel-Maatschappij, Robaver and Twentsche Bank. All five eventually merged into what is now ABN AMRO (DNB, 2000).

[8] Such as the Rotterdam-based Marx & Co.'s Bank, and the Amsterdam-based Bank-Associatie and Algemeene Spaar- en Depositobank.

[9] A separate analysis of cooperative banks can be found in Colvin (2011) and Colvin and McLaughlin (2014).

Between 1920 and 1924, De Vries (1989) counts the (near-) failure of at least four *algemene banken* (including Robaver), 26 provincial banks and two overseas ones. He estimates that at least 200 million guilders was lost between 1920 and 1922, a figure largely confirmed by our research.[10] The history of Marx & Co. and Robaver are particularly enlightening: the former for DNB's (lack of) involvement when it failed in 1922; the latter for the poisonous relationship between the bank and the non-financial firms which it had helped to finance (Colvin, 2014). Jonker (1991, 1995) argues that many banks performed badly because they lacked the knowledge and experience to finance industries; he finds that close ties between bankers and their borrowers worsened the crisis. Jonker and Van Zanden (1995) argue that the 1920s taught bankers that management ties carry risks; in the late 1920s, many banks abandoned the very ties that they had earlier established to control their financial interests. The sector as a whole was largely able to avoid banking failures in the Great Depression of the 1930s, due in no small part to crisis-induced consolidation, corporate restructuring and policy changes.

A major source of the economic decline which acted as the backdrop to the Netherlands' 1920s crisis was reduced international demand following a global post-war slump. Consumption statistics suggest that domestic demand remained quite stable, or even increased (Barro and Ursúa, 2008), and so much of the blame can be put on consumers located in Germany and the UK, the Netherlands' principal export markets. The reason for the Netherlands' post-war problems was therefore largely exogenous. Why was the drop in foreign demand felt so sharply by banks in particular? The Netherlands' interest rate structure (Van der Bie and Smits, 2001) had encouraged firms to finance their rapid war-time demand-led expansion using short-term rather than long-term debt instruments, as the former became relatively cheap (Figure 1). The type of project that had traditionally found long-term financing was now being paid for with riskier short-term debt, which

[10] This is likely an underestimate of the true damage done: just the 18 banks in our sample which failed outright were valued at 208 million guilders immediately prior to the crisis, approximately 1.2 billion euros in today's money.

then had to be rolled over. When, in the early 1920s, these loans were called in *en masse*, they simply could not be repaid.

The Netherlands' 1920s debt-deflationary crisis is best understood in a British mirror, where the blame for deflation has been put squarely at the door of monetary policy (Solomou, 1996). The UK's large trade deficit and low gold reserves resulted in the formal abandonment of gold in March 1919. However, the expectation persisted that policymakers would restore pre-war parity as soon as feasible. Although sterling was only officially re-linked to gold in 1925, the damage had already been done in the preparation for this return; expectations did all the work (Solomou, 1996, pp. 39-40). The Dutch case differs from Britain's in that the country had accrued large balance of payments surpluses during the war, which had led to a significant increase in gold reserves (Boeschoten, 1992) and the overall money supply (DNB, 2000) (Figure 2). The guilder's return to gold was coordinated with that of sterling, and the guilder-sterling exchange rate was fixed throughout the first three decades of the twentieth century. Economic policies had to be coordinated with the hegemon; the decision-making process which led to the deflation was determined on Horse Guards Road and Threadneedle Street, not the Kneuterdijk and the Oude Turfmarkt. Dutch monetary policy, and thus by extension the decision to embrace a deflationary path, was exogenous.[11]

3. Data and empirical strategy

The macroeconomic cause of the Dutch crisis is relatively well understood, and so we explore the contribution of decisions made at the level of individual banks. We use discrete choice models to estimate whether pre-crisis bank-level characteristics can predict crisis performance. Formula 1 depicts the discrete choice (logistic) model used:[12]

[11] The Dutch commitment to gold was not unusual and must be seen in the context of Eichengreen's (1992) argument that the interwar gold exchange standard was an exercise of blind faith yearning for the era of pre-war prosperity, or Bordo and Rockoff's (1996) argument of the gold standard as a "good housekeeping seal of approval", with the Netherlands aligning itself with the region's geopolitical power for economic reasons.

[12] We also estimate linear probability models in order to determine whether imposing assumptions of linearity and normality changes our results. We find they do not.

$$Log_e \frac{\pi_i(Distress)}{1 - \pi_i(Distress)} = \alpha + \beta_1 F_i + \beta_2 MS_i + \beta_3 I_i + \varepsilon_i \quad (1)$$

Distress is defined as a binominal variable that takes the value of one if a bank has experienced distress during the period 1920 to 1927 and zero otherwise.[13] Subsequently F_i is a vector of bank-specific financial characteristics, MS_i is a vector of bank-specific market structure variables and I_i is a vector of bank-specific management and interlock characteristics. Moreover, ε_i is the bank-specific prediction error stemming from the choice of regression model and is clustered by region and bank type.[14] Subsequent regressions report marginal effects at the median.[15]

We use four sources in the construction of the dependent variable, i.e. the measure of distress resolved through liquidation, merger or reorganisation. These sources are: (1) Kramer (1926), a PhD dissertation on firm reorganisations during the crisis period; (2) De Vries (1989), an official history of DNB in the crisis period, written using the archives of this bank; (3) DNB (2000), a list of all banks operating in the Netherlands throughout the nineteenth and twentieth centuries; and (4) news and commentary from the financial press which we compile using an online newspaper database.[16] While we find a significant overlap between the four sources, we find source (4) to be particularly useful; unlike the others, it enables us to systematically search for evidence of distress for all 142 banks in our sample, and it allows us to identify those banks that needed to be reorganised financially, but did not exit the market altogether through liquidation or merger. Overall we identify

[13] We define three mutually exclusive types of distress: liquidation (including bankruptcy), distressed merger and financial reorganisation. We treat these categories as one because we are interested in predicting the incidence of distress rather than the manner in which the distress is resolved.

[14] While the variables chosen in our analysis are generally applicable, there are regional and bank-type differences which may render measurement error particular to specific regions or bank types. To facilitate the identification process we therefore limit the correlation of measurement errors to the specific region and bank type for which they are relevant using a one-way clustering methodology. This results in the use of twelve potential separate clusters, consisting of four region types (Noord-Holland, Zuid-Holland, Groningen, elsewhere in the Netherlands) and three bank types (general, mortgage, shipping banks). As there are no shipping banks located outside of Noord-Holland, Zuid-Holland or Groningen, we use 11 clusters. Overall, our clustering methodology leads to conservative estimates of standard errors.

[15] We report marginal effects at the median rather than the mean to ensure our results are less affected by outliers (e.g. very large banks).

[16] We use the searchable historical newspaper collection of the Koninklijke Bibliotheek (http://kranten.delpher.nl).

33 banks that suffered distress. Figure 3 is a graph depicting the timing of the various distress events, categorized by their method of resolution.

The data used in the construction of our independent variables contains information on a sample of banks pertaining to the fiscal year 1917, extracted from the 1920 and 1921 editions of the *Van Oss' Effectenboek*, an investor manual published annually. We choose 1917 because it is the last stable year preceding the crisis. We aim to predict distress from data pertaining to a time when shareholders did not yet foresee it, and banks had not yet anticipated it. Figure 4 shows the weighted stock price index of distressed and non-distressed banks,[17] along with the Consumer Price Index (CPI),[18] illustrating the depth of the deflationary crisis. The figure helps to justify the selection of 1917 as our point of reference on the grounds that it offers a middle road between setting the date too late and thus already incorporating crisis effects, and setting it too early, running the risk that the data are unrepresentative of pre-crisis conditions. In 1917, stock prices are still at levels comparable to previous years; the major changes to stock prices set in only after 1920 and the CPI does not show signs of deflation before 1919.

The exact dating of crisis periods is often controversial, and the Dutch crisis is no exception. Bernanke and James (1991) and Van Zanden (1997b) date it to 1921 and 1922 only; Reinhart and Rogoff (2009) follow their example, while Colvin (2011) considers the crisis to run from 1920 to 1927. This much longer period is preferable, because signs of bank distress were observed long after the Dutch economy had stabilised; some problems caused by the crisis took many years to fully manifest or be disclosed to the public; distress events were revealed only after the distress was resolved through liquidation, merger or reorganisation. The longer period encompasses the earliest signs of bank distress before the major failure of Marx & Co.'s Bank in 1922, extends the period

[17] Stock prices (including dividends) are weighted to reflect a hypothetical portfolio which includes all the listed financial firms weighted by the book value of their equity on 31 December 1917. Our index therefore reflects what a possible investor who composed his portfolio in 1918, and kept this portfolio fixed, would observe when looking back at his investments.

[18] CPI is taken from the Centraal Bureau voor de Statistiek Statline database (http://statline.cbs.nl/).

beyond the Robaver debacle in 1924, and finally includes the government-backed reorganisation of the *middenstandsbanken* in 1927 which forever changed expectations about the role of the state in crisis resolution in the Netherlands (Colvin, 2011). Figure 4 suggests that the recovery of the banking sector began in 1926 for banks that experienced distress, and 1924 for those that did not.

The *Van Oss* investor manuals bring together balance sheets, profit-and-loss accounts and detailed corporate governance information. Moreover, they include the location of banks' headquarters, their year of foundation, corporate statement, stock listing and stock prices. Table 1 summarises the relative importance of various balance sheet items in our sample, which constitutes all the financial institutions for which sufficient data were available in *Van Oss*, and includes the vast majority of banks that were listed on Amsterdam's stock exchange during the period. Our database comprises 142 unique banks, where we distinguish between general (commercial) banks, specialised mortgage banks and shipping banks that specialised in financing international trade.[19] These 142 banks amount to 89 per cent of the banks in the Netherlands counted by *Van Oss*, which equates to 83 per cent of the sector's nominal equity value.

Our financial information is based on the annual reports published by banks and firms themselves, which were used by the compilers of *Van Oss* in the production of their manuals. In order to facilitate comparative financial ratio analysis, we standardised and converted the accounting information to categories used in modern balance sheets and profit-and-loss accounts, adopting a procedure outlined in the appendix to this article.[20] In the 1910s, Dutch financial accounting practices differed from modern standards. Camfferman and Van den Brand (2010) provide a critical assessment of the usefulness of annual reports for empirical analyses and argue that prudence and

[19] We exclude DNB and Javasche Bank from our sample, since they acted as banks of issue for the Netherlands and the Dutch East Indies.

[20] Appendix Table A1 shows the balance sheet of Marx & Co. as an example of the sector, including both original (Panel A) and standardised (Panel B) balance sheets.

conservatism induced an undervaluation of assets and, as a consequence, of equity.[21] Many firms and banks had so-called silent or secret reserves. The creation of these reserves was accompanied by an underrepresentation of the profits, which were partially channelled into these reserves. We argue that financial ratios based on the accounting information can be useful in a comparative setting because results will be influenced only by the accounting practices in cases of systematic mis-valuation for particular firms. Camfferman and Van den Brand (2010, pp. 99-110) do not document such systematic effects. Furthermore, we agree with Camfferman and Van den Brand (2010, p. 115) that annual report information is a useful source because it describes the way in which directors present their firms to outsiders.

In addition to reporting financial accounting data, *Van Oss* supplies comprehensive lists of all banks' directors (*directeuren* and *commissarissen*). We digitised and cross-referenced these lists with all other banks and non-financial firms for the same fiscal year to map any interlocking directorates. We use the *Financieel Adresboek* (1917), a financial gazetteer, to identify 2,579 locations (headquarters or branches) of financial institutions active in the Netherlands.[22] For the 142 banks in our sample we identify the 350 branch locations. These data are used to map the market structure of the Dutch financial services sector and banks' product market choices in the 11 provinces that constituted the Netherlands at the time.[23]

Ideally, we would prefer to use information about banks' asset portfolios, including their loans and equity participations, but this information is not available to us. Interlocking directorates instead help us to proxy for these portfolio characteristics. Therefore, we collect information from *Van Oss* about 232 non-financial firms quoted on the Amsterdam stock exchange, in addition to the

[21] See Zeff, Van der Wel and Camfferman (1992) for a detailed description of the development of financial reporting practices and rules in the Netherlands.

[22] We count 1,073 unique bank locations; many financial institutions held more than one branch in one particular location in the Netherlands.

[23] We measure competition on the basis that: (1) general banks compete only with other general banks; (2) mortgage banks compete with mortgage banks and general banks; and (3) shipping banks compete only with shipping banks. We found that our results were not sensitive to alternative market definitions.

142 banks in our sample.[24] The board information of the 374 banks and non-financials is used to map the relationships among banks and between banks and other firms based on interlocking directorates. Consequently we can quantify the effect of interlocks hypothesised by Jonker (1991) by using these firm and bank characteristics (size, leverage and profitability) in conjunction with the interlocks held by banks.

The data described above are used to construct a range of variables which capture different aspects of balance sheet composition and corporate governance characteristics, described in the next section. We pitch these models against one another in a series of binomial regressions in order to arrive at a specification which does the best job of "predicting the past". As standard goodness-of-fit measures do not perform well with binomial regression models (Hosmer and Lemeshow, 2000), we adopt an approach popular in the medical literature; we calculate the so-called area under the receiver operating characteristic curve (abbreviated to AUC).[25] This method is used in Taylor (2012) as a means of assessing the predictive ability of his models of global financial crises. Additionally, we use Shapely variance decomposition to explore how much power each variable category (bank characteristics, management structure and interlock characteristics) has in each model specification. We follow a procedure similar to Grömping (2007) and Shorrocks (2012) in this respect.

4. Variables and hypotheses

As our core dependent variable indicating distress, we define a dummy variable which equals one if

[24] The 232 non-financial corporations are representative of the stock-listed population of non-financial corporations. Our results are therefore particular to banks that interlock with publicly-listed firms.

[25] We calculate the proportion of banks which we predicted to fail and actually did fail, or the proportion of true positives that our models classify as being positive (called the "sensitivity" of the model), and compare this with the proportion of banks which we predicted to survive and did survive, or the proportion of true negatives classified as being negative (called its "specificity"). We plot the sensitivity against the false positive fraction (1 – specificity) for all models in our analysis. The curve in such a graph is called the receiver operating characteristic (ROC). Any model that traces an ROC curve above the 45-degree line has a better predictive ability than a random assignment of observations. The larger the area under the ROC curve (abbreviated to AUC), the better is the predictive ability of the model. Metz (1978) describes the method used here in the context of medical statistics.

and only if a bank experiences and discloses distress in the period 1920 to 1927. We define three mutually exclusive types of distress resolution: liquidation (including bankruptcy), distressed merger and financial reorganisation.[26] Notice that the crisis came in two phases (Figure 3): 1920 to 1922 as the first phase of bank distress, when a high proportion of failures were resolved through merger; and 1923 to 1927 as the second, when by far the most crisis-stricken banks looked to reorganisation.[27] Table 2 reports by category concise definitions of all the variables used in the analysis that follows.

Financial variables: For *asset quality*, we use the variable size (natural logarithm of total assets) to proxy for the possibility that large banks are less likely to fail because of a broader portfolio of investments, and age (natural logarithm of the difference between the year of foundation and 1917) to proxy for banks' asset selection experience (following Thornhill and Amit, 2003). For *loan book quality,* we use the ratio of long-term loans outstanding to total assets (following Martin, 1977; Thomson, 1991). For *earnings sufficiency,* we use return on assets and a measure of interest rate dependency (following Kolari et al., 2002). For *liquidity and solvency*, we capture the liquidity of banks' assets by constructing a measure of how well banks manage to match the maturity of their assets with the maturity of their financing instruments, a measure of stability popular among contemporaries (Verrijn Stuart, 1921; Klijnveld, 1922; Sternheim, 1925). Additionally, we posit that banks whose stock was regularly quoted on Amsterdam's official listing were more liquid since investors could sell their stake more easily in times of high volatility (following Kalev et al., 2003). To capture the effects of differences in *capital structure* we use total leverage (debt to total assets) and deposits to total assets (following Zmijewski, 1984).

Market structure variables: The nature of the relationship between market structure, competition and bank stability is controversial. A dynamic model of asymmetric information of the

[26] We define reorganisations as one or any combination of asset restructuring and debt restructuring.

[27] We used alternative specifications of these phases in order to explore the possibility that distress events which became public in 1923 might merely have remained hidden for longer. We find that banks which were seen to be affected by the crisis in 1923 were more likely to: (1) have no interlocking directorates with DNB; and (2) be interlocked with more profitable and bigger non-financials. We conclude that banks which experienced distress in 1923 had more in common with banks which experienced distress after 1923.

type proposed in Keeley (1990), and used more recently in Allen and Gale (2004), suggests that there is a trade-off between competition and risk. But models which explore the possibility that bankers have little influence over the riskiness of their customers, such as that of Boyd and De Nicolò (2005), find the opposite result. Empirical applications to US Depression-era banking markets abound (Calomiris and Mason, 2003; Carlson, 2004; Carlson and Mitchener, 2009). We construct three measures that map the degree of competition in the Dutch banking sector. We first define a dummy variable that equals one only if a bank had branches in the Netherlands. Consistent with Calomiris and Mason (2003) and Carlson (2004), we expect branching to increase the probability of suffering distress due to increased monitoring costs since the branches are farther removed from their headquarters. Second we identify banks that had international activities and posit that they will be more exposed to the macroeconomic shock of the early 1920s and hence face a higher probability of distress. To determine the structure of the banks' product market, we define 11 geographic markets, being the provinces constituting the Netherlands. Then for each bank with presence in a province, we calculate the ratio of the number of locations (headquarters *and* branches) of the bank and the number of locations of all banks in our extended sample. For each bank we use the average of these ratios over all the regions where a bank is branched. We call this variable relative representation.[28] As the literature has no firm conclusion on the competition-stability relationship, we remain agnostic about the influence of this variable.

[28] This metric takes into account the number of branches that each bank holds in different provinces and the importance of each of the provinces for each bank. For example, Robaver has 13 branches plus one headquarters, in total 14 locations spread over two provinces. In Noord-Holland the bank has two branches; in Zuid-Holland the bank has 12. There are 253 other banks and branches active in Noord-Holland. As the branches of a bank do not compete with one another, the bank faces competition from 251 rather than 253 other bank-branch locations. The relative representation of the bank in Noord-Holland is therefore 0.79% (2/251). For Zuid-Holland the bank has a relative representation of 4.25% (12/300). We weigh these relative representation measures by the number of branches the bank has in each of the two provinces, which yields 1.5% (0.79*2) and 51% (4.25*12) for Noord-Holland and Zuid-Holland. We sum these two and normalize by the number of banks that generates our final indicator of relative representativeness, which yields a value of 3.8% ((1.5% + 51%)/14).

Management structure and characteristics of interlocks: We introduce managerial influences by looking at the management structure and interlocking directorates of banks and the connectedness of banks and non-financial firms.[29] We define *management structure* as the board size and the number of interlocking directorates. We expect that management structure variables negatively affect the risk of failure, in line with Darrat et al. (2010). In much the same way as Dittmann et al. (2010), we posit that bankers on the boards of other corporations are capital market experts and provide know-how and better access to funds (Byrd and Mizruchi, 2005), act as monitors (Morck and Nakamura, 1999), and promote their own business (Booth and Deli, 1999). Interlocking directorates measure the relative independence of a bank or firm's board, since banks with more interlocks are potentially more powerful in terms of financial and industrial dominance, but may have a higher chance of suffering from possible conflicts of interest for bankers on the board (Kroszner and Strahan, 2001).

In addition to the governance roles of interlocks, we use the information as a proxy for banking relations. The economic effects of relationship banking is somewhat ambiguous, in that bank ties allow for information sharing, while they may also create hold-up problems (Braggion and Ongena, 2013). Indeed, some have gone so far as to argue that relationship banking has no measurable impact on firm financing or stability (Elyasiani and Goldberg, 2004). As an approximation of a bank's portfolio we measure the average across interlocks of asset size, leverage and profitability of all banks and all the non-financials that a bank is related to.[30] We calculate a

[29] In the ensuing analysis of interlocking directorates, we treat connections involving either *directeuren* or *commissarissen* as identical; we found that separately measuring interlocks involving each tier of banks' management boards did not affect our results and yielded no additional insight.

[30] We use balance sheet characteristics of banks or non-financial firms (size, leverage and ROA) and construct a value-weighted average using total assets at the beginning of 1918 for each. The bank characteristics are presented in Table 3. The median non-financial firm in our sample has three million guilders in assets, financed by 34 per cent of debt, generating a profit of five per cent in 1917. The largest non-financial sectors are industrial firms (20 per cent) and agricultural firms (24 per cent).

Herfindahl-Hirschman index (HHI) to measure the level of the concentration of investments within banks' portfolios. In particular, we measure asset size concentration[31] and industry concentration.[32]

Additionally we incorporate the external financing demand of industries averaged across interlocks to correct for the financial dependence of industries on the Dutch financial sector (after Rajan and Zingales, 1998). Quantifying the costs and benefits associated with bank relationships is done by looking at the number and type of interlocks held by each bank.

5. Understanding bank distress

Table 3 summarises the mean values for all variables as specified across the full sample of 142 banks and sub-samples organised by bank type. We find that general commercial banks make up the largest portion in terms of asset size, while mortgage banks dominate in terms of number. Mortgage banks were highly specialised in long-term funds, while general banks held approximately equal totals of short- and long-term loans. We find that general banks were better able than mortgage and shipping banks to match the maturity of their assets with their liabilities and held significantly higher amounts in deposits. Furthermore, general banks interlocked more with non-financial corporations held significantly more directorates than more specialised banks.

5.1 A univariate analysis of bank distress, timing and resolution

Table 4 reports the mean and median values of all variables as specified across the full sample of 142 banks, categorised by distress experience during the 1920s. We find that banks which experienced

[31] With respect to asset size concentration, we calculate an HHI as the sum of squared portions of each interlock's total assets relative to the sum of total assets of all interlocked banks or non-financials. For example, assume that bank A has interlock-relations with B and C, both with a size of 500 thousand guilders in assets. The total size of the related banks is therefore 1,000 thousand guilders. The index will then be 0.5, or $(500/1000)^2 + (500/1000)^2$. Obviously, the concentration index increases when bank A becomes interlocked with additional banks and when the size of bank B or C increases.

[32] Similarly, we measure industry concentration using an HHI based on share of banks' interlocks in each of the 11 industries listed in *Van Oss* (industrial; agriculture; mining; oil; rubber; shipping; tobacco; tea; railways; tram transport; and other).

distress during this period were younger, more likely to have a stock listing and held more deposits. Additionally we find that banks suffered more when they had more branches, were active internationally and had a larger market share. When we separate early (1920 to 1922) from late (1923 to 1927) distress events, we find that: (1) bigger and older banks failed during the second rather than first part of the 1920s, which corroborates the claim made by one contemporary observer (Verrijn Stuart, 1921) that larger banks are likely able to weather a crisis for longer; (2) banks which better matched the maturity of their (short-term) assets with that of their (short-term) liabilities were more prone to debt-deflationary shock and subsequently suffered distress earlier; (3) banks which had fewer interlocking directorates experienced distress earlier; (4) banks which had interlocking directorates with large banks were more likely to experience distress during the latter part of the crisis; and (5) banks which had large and concentrated interlocking directorates with non-financial firms failed later in the crisis.

5.2 A baseline model of distress

A series of four regressions is reported in Table 5. We examine the effect of five categories of variable independently and then together. In model (1) we find that bank age has a significant negative effect, which shows that younger banks were more likely to fail. We also find that exchange-listed banks were about 25 per cent more likely to experience distress. This may be driven by the liquidity of the stock and the resulting volatility, consistent with Kalev et al. (2003); it may, however, reflect the possibility that unlisted banks were better able to hide their distress.

We find a strong effect for profitability. Profits in 1917 are in our view an indication of the riskiness of the banks' activities, which in good times bring higher earnings, but lead to a backlash under worsened conditions, much in line with Fahlenbrach et al.'s finding (2012) for US banks in the modern era. We find that banks which failed were also more highly valued before the crisis than those that did not; from 1916 to 1919, the stock prices of banks which would go on to experience distress increased by about ten per cent, versus 0.6 per cent for non-distressed banks (see Figure 4).

This suggests that banks which did best out of the Netherlands' neutrality during the First World War and the short post-war economic boom had most to lose in any ensuing economic reversal. For each percentage increase in leverage, we find that the probability of banks' distress increases by about 50 per cent, showing that lower equity buffers make banks vulnerable to shocks. This is consistent with the argument in Jonker and Van Zanden (1995) that this crisis was debt-deflationary. We control for bank size and long-term loans, but find no significant effects.

In model (2) we add the four variables and find that deposits have a significant positive effect, where each additional percentage of deposits relative to assets increases the probability of failure by about 45 per cent. As is common to many financial crises, banks which relied more heavily on callable deposits rather than other types of financing stood a greater chance of failure. The other three variables show no effects that are statistically significant.

Model (3) introduces our three product market variables. We find that branching has a significantly positive effect, which indicates that banks with branch networks faced significant monitoring problems and increased risk exposure as the branches became more removed from their headquarters. This finding is consistent with Calomiris and Mason (2003) and Carlson (2004) where bank branching induces higher failure rates. We find that banks with international activities were about 20 per cent more likely to experience distress because they were more exposed to pressures exogenous to the Dutch economy. We find no effect of banks' relative representation, our domestic market structure variable. This is a very interesting finding; it suggests that bank distress was driven by the joint effect of the economic shock and strategic choices *within* banks, rather than any competitive pressures from one another. In model (4) we retain all variables with an absolute *t*-value above unity and rerun our model.[33] This specification suggests that, after controlling for the product market choices of banks, long-term loans also significantly affect distress probability.

[33] This model includes only statistically relevant variables and can therefore be said to be the most parsimonious specification. The statistical power of this model remains unaffected by this choice in terms of pseudo R-squared or AUC.

The reported AUC values demonstrate that our model specifications in Table 5 perform ("predict the past") significantly better than random assignments. We find that measures of asset quality, earnings sufficiency, stock listing and bank capital structure have the largest explanatory power.

5.3 The effects of interlocking directorates

Panel A of Table 6 shows the results of logistic regressions with respect to our hypotheses, where: model specification (5) encapsulates the effect of banks' management structure on the probability of experiencing distress during the 1920s; model (6) focuses on the characteristics of interlocked banks; model (7) introduces three additional characteristics of interlocked non-banks; and model (8) combines all these effects. Again we omit each variable with a *t*-value below one or with an obvious correlation with subsequently introduced variables.

Management structure: We find that a bank with a large board stood significantly less chance of experiencing distress; a one per cent increase in board size results in a reduction of distress probability in the range of 12 to 26 per cent.[34] This is somewhat contrary to Simpson and Gleason (1999), who find that, for publicly listed banks, the size of a bank's board negatively affects costs and efficiency and increases the probability of distress. We suggest that a larger board signifies more "in-house experience" to cope with crisis management.

Characteristics of interlocked banks: We find that interlocks with large banks reduce the failure risk (by about 6 per cent), while the profitability of these banks has an adverse effect. Our results imply that banks with ties to smaller and more profitable banks were engaging in relations with riskier peers, which negatively affect their survival chances. Together, these results suggest that the mere presence of an interlock does not in itself result in a conflict of interest. Intrinsically, then,

[34] The results remain robust after controlling for potential non-linear properties.

interlocking directorates have risk-reducing properties; however these risk properties depend on the corporate characteristics of the interlocks.[35]

Characteristics of interlocked non-banks: We find that banks that concentrated their interlocks with non-financials were significantly less at risk during the crisis than those banks that held well diversified portfolios. The effect is relatively large as we find that a 1 per cent increase in concentration leads to an increased failure probability of 17 per cent. This result suggests that banks with concentrated interlocks were better able to monitor their interests through their networks.

Using variance decomposition in Panel B of Table 6 we find that banks' financial characteristics explain over 70 per cent of the variation in the probability of their distress. Additionally we find that the characteristics of interlocks explain approximately 21 per cent of the variation. This is driven by interlocks with banks rather than non-financials. We show that the quality of our model improves by about seven per cent – comparing the AUCs of models (4) and (8) – because we add interlocking characteristics (see Figure 5).[36] In summary, we find evidence that Jonker (1989, 1991) was correct but incomplete in believing that interlocks added to the riskiness for banks. We show that Jonker's ideas can be expressed more precisely in terms of the characteristics of interlocked banks and non-financial firms, such as firm size, leverage, profitability and concentration.

5.4 Robustness

Tables 7 and 8 report a number of additional results intended to determine whether our findings are robust to alternative model specifications and sample selection biases. Together they suggest that our

[35] We find that the effect of return on assets disappears when we take the profitability of interlocked banks into account. This may be due to either: (1) the presence of a competitive advantage which other banks want to benefit from by interlocking with these more profitable banks; or (2) these more profitable banks have superior asset selection and monitoring abilities in terms of selecting firms that are able to meet their bank obligations; or (3) both of these. This being the case, the profitability of a bank is associated with the profitability of its interlocks.

[36] For the AUC, a common rule-of-thumb is that values between 0.9 and 1 should be considered outstanding; between 0.8 and 0.9 excellent; and between 0.7 and 0.8 acceptable (Hosmer and Lemeshow, 2000, pp. 156-164).

main results on banks' balance sheet characteristics, management structure and interlocking directorates are not sensitive to the inclusion of additional variables or the use of restricted samples.

Model (9) is for the sub-sample of banks for which sufficient historical data were available to calculate asset growth. We find that asset growth has a non-significant positive effect, while the goodness-of-fit increases and all bank characteristics keep their sign and significance. We find that asset growth shows significant correlation (21 per cent) with the size of interlocked banks, which subsequently becomes (though only marginally) insignificant.[37]

The results of model (10) are consistent with the idea that sharing a director with a large and influential private bank has risk-reducing properties: one such interlock reduces failure risk by approximately 11 per cent from the median – though this is not statistically significant at standard levels. Model (11) includes a dummy variable that equals one only if some portion of a bank's equity capital remained unpaid. It is included to test the hypothesis that uncalled capital can act as an equity buffer in times of crisis (Turner et al., 2005). Its inclusion has no discernable impact on our results.

The discrete choice model in our analyses does not take into account the timing of distress. Potentially, the weakest banks are the first to enter distress, while stronger banks fail at a later stage of the crisis. In order to test for the relevance of the timing of distress we present a Cox proportional hazards model in Table 8, specifications (12) through (15).[38] We find that our earlier results (in Table 6) are consistent with those of the hazards models; the signs and significance of the variables remain stable. Additionally the variance decomposition shows a similar distribution of explanatory power across the variable categories; the majority of the variance is still explained by bank characteristics, followed by the characteristics of interlocked banks. Two expected changes occur when using the hazards models: (1) the size of interlocked banks becomes (marginally) non-significant, which is

[37] Accordingly we argue that prior asset growth was industry wide, hence the correlation.

[38] The estimation equation of the Cox proportional hazards model is given by $h(t, X) = h_0(t)\exp(\sum_{i=1}^{p} \beta_i X_i)$, where $h_0(t)$ is the baseline hazard and X_i a vector of firm-specific variables concerning bank characteristics, management structure and characteristics of interlocked banks and non-banks. We report marginal effects at the median to keep the findings comparable to earlier results.

consistent with our findings, presented in Table 4, that banks interlocked with large banks are better able to longer withstand the crisis; and (2) our long-term loans variable has become (marginally) non-significant, which is consistent with our findings presented in Table 4 that banks that fail later in the crisis hold more long-term loans.

6. Conclusion

This article adds to the historiography of the 1920s by systematically measuring the differences between the banks that suffered financial distress in the Netherlands' biggest twentieth-century financial crisis and those that did not. While the root debt-deflationary macroeconomic cause of the 1920s crisis was largely exogenous to the Netherlands, this article shows how factors endogenous to the Dutch financial services sector were crucial in explaining banks' differing fates. Our analysis explains why some banks failed in the 1920s while others survived unscathed, something Jonker and Van Zanden (1995) omit to specify precisely in their analysis. We suggest that debt-deflation's impact depended on banks' balance sheet characteristics and management structure. Decisions made before the deflationary shock were indicative of banks' ensuing probability of survival; their exposure to distress was partly attributable to past policies. We find that younger banks, banks that were stock listed, banks that had high leverage ratios, banks that engaged in branching and international activities, and banks with large quantities of deposits were more at risk during the 1920s.

In particular we find that the characteristics of the financial firms with which a bank shares managerial ties have a high predictive power. Jonker (1989, 1991) uses the number of interlocking directorates as an indicator of the developmental path of the Dutch banking system. He implies that the Dutch banking sector's retreat from universal banking in the late 1920s is proof that this corporate governance mechanism did not operate well in times of crisis. Our article contributes to Jonker's analysis by exploring the mechanism through which managerial interconnectedness had an impact on banking stability. We provide evidence that it was the characteristics – size and

profitability – of the banks rather than the non-financial firms at the other end of interlocks that drove Jonker's hypothesised relationship. As such, we argue that conflicts of interest found in case studies of the crisis (in particular, Colvin, 2014) are best understood as a function of the corporate characteristics of those interlocks.

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Table 1: Relative importance of balance sheet items for full 142-bank sample, 1 January 1918

Balance sheet item	Full sample	Distressed banks	Non-distressed banks
Assets			
Fixed assets	1%	1%	1%
Long-term debt	32%	24%	35%
Equity investment	7%	4%	8%
Short-term debt	43%	54%	40%
Receivables	10%	13%	9%
Cash	5%	5%	6%
Other non-cash	2%	0%	2%
Liabilities			
Equity capital	15%	17%	15%
Reserves	4%	4%	4%
Provisions	2%	0%	2%
Bonds and mortgages	27%	20%	29%
Deposits	15%	14%	16%
Other long-term liabilities	1%	2%	0%
Short-term credits	30%	32%	29%
Payables	2%	3%	2%
Other short-term liabilities	4%	8%	3%
Combined size of balance sheets			
In millions of guilders (1918 prices)	3,277	806	2,471
In millions of euros (approx., 2014 prices)	24,500	6,000	18,500

Table 2: Definitions of all variables used in analysis

Variable	Unit	Definition
Asset quality		
Bank size	Guilders	Balance sheet size, in millions of guilders
Bank age	Years	Bank age
Loan book quality		
Long-term loans	Ratio	Sum of all outstanding (long-term) loans to equity and cash
Earnings sufficiency		
Interest dependency	Ratio	Receivable interest minus payable interest to total equity
Return on assets	Ratio	Profits to total assets
Liquidity and solvency		
Maturity matching	Ratio	Current liabilities to financial assets
Stock listing	Dummy	Dummy equals one if bank has a stock listing in Amsterdam
Capital structure		
Leverage	Ratio	Total debt to total assets
Deposits	Ratio	Total deposits to total assets
Market structure		
Branches	Dummy	Dummy equals one if bank has branch network
International activities	Dummy	Dummy equals one if bank has activities abroad
Relative representation	Ratio	Average number of provincial branches, relative to the number of branches in a provinces held by other banks. Weighted by the number of branches in a particular province
Management structure		
Board size	Number	Total number of members of the board of directors
Interlock with DNB	Dummy	Dummy equals one if interlock with DNB
Total interlocks with banks	Number	Total number of bank-bank interlocks
Total interlocks with non-banks	Number	Total number of bank-firm interlocks
Characteristics of interlocked banks		
Size of interlocked banks	Guilders	Average total assets of interlocked banks, in millions of guilders
Size of interlocked banks (log)	Guilders	Average log of total assets of interlocked banks
Profitability of interlocked banks	Ratio	Average profitability of interlocked banks
Leverage of interlocked banks	Ratio	Average leverage of interlocked banks
Concentration of interlocked banks	Ratio	Herfindahl-index in terms of bank size
Characteristics of interlocked non-banks		
Size of interlocked non-banks	Guilders	Average total assets of interlocked non-financials, in millions of guilders
Size of interlocked non-banks (log)	Guilders	Average log of total assets interlocked non-financials
Profitability of interlocked non-banks	Ratio	Average profitability of interlocked non-financials
Leverage of interlocked non-banks	Ratio	Average leverage of interlocked non-financials
Concentration of interlocked non-banks	Ratio	Herfindahl-index in terms of firm size
Industry concentration of interlocked non-banks	Ratio	Herfindahl-index, measuring concentration of a bank interlocks non-financials in any one industry
External financing demand	Ratio	Average amount of capital expenditure minus net profits, scaled by capital expenditures
Additional variables		
Asset growth	Ratio	Change in total assets over financial year 1916-1917
Interlock with influential private bank	Dummy	Dummy equals one if bank is interlocked with influential private bank*
Liability regime	Dummy	Dummy equals one if bank has unpaid capital

* Influential private banks defined here are Mees & Zoonen, Ooyens & Co, Hope & Co, Eeghen & Co, Ogtrop & Co, Heldring & Co, and Pierson & Co.

Table 3: Mean values of all variables, for full sample and by bank type

Variable	Full sample (N=142)	General banks (N=63)	Mortgage banks (N=71)	Shipping banks (N=8)
Asset quality				
Bank size	22.309	36.768	10.781	10.757
Bank age	20.528	22.111	19.845	14.125
Loan book quality				
Long-term loans	0.621	0.216	0.945	0.932
Short-term loans	0.146	0.314	0.011	0.013
Capital adequacy				
Working capital	0.094	-0.044	0.198	0.260
Equity reserves	0.038	0.056	0.023	0.031
Earnings sufficiency				
Interest dependency	-0.024	-0.084	0.044	-0.146
Return on assets	0.022	0.019	0.024	0.029
Liquidity and solvency				
Asset liquidity	0.903	0.881	0.922	0.916
Maturity matching	0.167	0.340	0.029	0.033
Stock listing	0.289	0.508	0.127	0.000
Capital structure				
Leverage	0.834	0.738	0.908	0.929
Deposits	0.061	0.137	0.002	0.000
Market structure				
Branches	0.352	0.508	0.239	0.125
International activities	0.296	0.286	0.324	0.125
Relative representation	0.007	0.011	0.002	0.025
Management structure				
Board size	10.993	10.175	11.549	12.500
Interlock with DNB	0.197	0.238	0.155	0.250
Total interlocks with banks	6.634	6.905	6.239	8.000
Total interlocks with non-banks	4.873	6.191	3.662	5.250
Characteristics of interlocked banks				
Size of interlocked banks	48.382	56.170	40.030	61.184
Size of interlocked banks (log)	2.260	2.198	2.230	3.017
Profitability of interlocked banks	0.022	0.020	0.023	0.025
Leverage of interlocked banks	0.797	0.769	0.816	0.847
Concentration of interlocked banks	0.237	0.229	0.235	0.314
Characteristics of interlocked non-banks				
Size of interlocked non-banks	12.030	12.259	10.785	21.264
Size of interlocked non-banks (log)	1.139	1.198	0.982	2.062
Profitability of interlocked non-banks	0.053	0.053	0.050	0.068
Leverage of interlocked non-banks	0.277	0.281	0.266	0.331
Concentration of interlocked non-banks	0.137	0.126	0.141	0.183
Industry concentration of interlocked non-banks	0.375	0.331	0.391	0.575
External financing demand	0.061	0.074	0.047	0.075
Additional variables				
Asset growth	0.085	0.166	0.025	0.029
Interlock with influential private bank	0.183	0.175	0.197	0.125
Liability regime	0.676	0.397	0.887	1.000

* Additional variables pertain to smaller sub-samples.

Table 4: Univariate statistics for distressed and non-distressed banks, with discrimination between early and late resolution timing

	Panel A: Full sample by distress event				
	Distressed banks (N=33)		Non-distressed banks (N=109)		Equality of means
Variable	*(mean)*	*(median)*	*(mean)*	*(median)*	*(t-value)*
Asset quality					
Bank size	23.667	6.572	21.898	6.893	-0.805
Bank age	13.394	12.000	22.688	19.000	2.884***
Loan book quality					
Long-term loans	0.551	0.887	0.642	0.915	1.064
Short-term loans	0.176	0.013	0.136	0.001	-0.746
Capital adequacy					
Working capital	0.032	0.164	0.113	0.101	1.147
Equity reserves	0.032	0.027	0.040	0.025	0.714
Earnings sufficiency					
Interest dependency	-0.021	-0.001	-0.024	-0.004	-0.032
Return on assets	0.033	0.035	0.019	0.016	-1.207
Liquidity and solvency					
Asset liquidity	0.876	0.883	0.912	0.951	1.602
Maturity matching	0.224	0.040	0.150	0.030	-1.295
Stock listing	0.455	0.000	0.239	0.000	-2.224**
Capital structure					
Leverage	0.837	0.895	0.833	0.910	-0.112
Deposits	0.104	0.000	0.048	0.000	-1.861*
Market structure					
Branches	0.515	1.000	0.303	0.000	-2.15**
International activities	0.485	0.000	0.239	0.000	-2.529**
Market share	0.012	0.000	0.006	0.000	-1.410
Management structure					
Board size	10.424	11.000	11.165	11.000	0.900
Interlock with DNB	0.242	0.000	0.183	0.000	-0.742
Total interlocks with banks	6.758	5.000	6.596	6.000	0.129
Total interlocks with non-banks	4.546	2.000	4.973	2.000	-0.026
Characteristics of interlocked banks					
Size of interlocked banks	38.426	17.380	51.397	16.293	0.926
Size of interlocked banks (log)	2.246	2.469	2.265	2.272	0.088
Profitability of interlocked banks	0.028	0.029	0.231	0.207	-0.471
Leverage of interlocked banks	0.813	0.864	0.792	0.862	-0.484
Concentration of interlocked banks	0.254	0.271	0.020	0.025	-1.389
Characteristics of interlocked non-banks					
Size of interlocked non-banks	9.144	3.785	12.903	4.299	1.307
Size of interlocked non-banks (log)	0.980	1.040	1.187	1.244	1.047
Profitability of interlocked non-banks	0.056	0.050	0.051	0.048	-0.431
Leverage of interlocked non-banks	0.265	0.310	0.138	0.000	0.153
Concentration of interlocked non-banks	0.132	0.000	0.280	0.322	0.388
Industry concentration of interlocked non-banks	0.408	0.375	0.364	0.278	-0.641
External financing demand	0.061	0.000	0.061	0.000	-0.005
Additional variables[†]					
Asset growth	0.145	0.059	0.065	0.040	-1.379
Interlock with influential private bank	0.152	0.000	0.193	0.000	0.532
Liability regime choice	0.576	1.000	0.706	1.000	1.337

[†] Additional variables pertain to smaller sub-samples. [††] Banks defined as early distress did so between 1920 and 1922; banks defined as late distress did so between 1923 and 1927. [*] T-statistics for bank size, bank age, board size and total interlocks are calculated using logaritmic transformations of the variables. Significance levels are indicated as follows for a two-tailed t-test: *** p<0.01, ** p<0.05, * p<0.1.

Table 4 (cont.): Univariate statistics for distressed and non-distressed banks, with discrimination between early and late resolution timing

	Panel B: Distressed banks by timing ††				
	Early distress (N=10)		Late distress (N=23)		Equality of means
Variable	*(mean)*	*(median)*	*(mean)*	*(median)*	*(t-value)*
Asset quality					
Bank size	6.938	5.381	30.941	8.041	1.998*
Bank age	10.700	9.500	14.565	12.000	0.715
Loan book quality					
Long-term loans	0.498	0.543	0.574	0.894	0.452
Short-term loans	0.164	0.123	0.182	0.002	0.179
Capital adequacy					
Working capital	-0.124	-0.150	0.100	0.171	1.674
Equity reserves	0.032	0.014	0.031	0.030	-0.083
Earnings sufficiency					
Interest dependency	-0.017	0.000	-0.022	-0.016	-0.036
Return on assets	0.029	0.023	0.034	0.039	0.79
Liquidity and solvency					
Asset liquidity	0.878	0.890	0.876	0.869	-0.061
Maturity matching	0.387	0.331	0.153	0.031	-1.861*
Stock listing	0.500	0.500	0.435	0.000	-0.336
Capital structure					
Leverage	0.819	0.841	0.846	0.915	0.552
Deposits	0.075	0.030	0.117	0.000	0.851
Market structure					
Branches	0.500	0.500	0.522	1.000	0.111
International activities	0.200	0.000	0.609	1.000	2.416**
Market share	0.012	0.005	0.012	0.000	-0.033
Management structure					
Board size	9.500	10.500	10.826	11.000	0.963
Interlock with DNB	0.300	0.000	0.217	0.000	-0.495
Total interlocks with banks	3.500	2.000	8.174	6.000	2.751***
Total interlocks with non-banks	1.200	1.000	6.000	3.000	2.913***
Characteristics of interlocked banks					
Size of interlocked banks	33.964	5.849	40.366	17.903	0.324
Size of interlocked banks (log)	1.808	1.756	2.436	2.494	1.736*
Profitability of interlocked banks	0.092	0.000	0.325	0.355	2.905***
Leverage of interlocked banks	0.752	0.801	0.839	0.876	1.032
Concentration of interlocked banks	0.030	0.028	0.028	0.030	-0.274
Characteristics of interlocked non-banks					
Size of interlocked non-banks	3.340	0.854	11.668	4.894	2.414**
Size of interlocked non-banks (log)	0.569	0.049	1.159	1.236	1.607
Profitability of interlocked non-banks	0.201	0.098	0.292	0.335	1.204
Leverage of interlocked non-banks	0.045	0.014	0.061	0.057	0.766
Concentration of interlocked non-banks	0.000	0.000	0.189	0.000	3.364***
Industry concentration of interlocked non-banks	0.456	0.500	0.387	0.333	-0.451
External financing demand	0.063	0.000	0.060	0.012	-0.07
Additional variables†					
Asset growth	0.196	0.109	0.122	0.041	-0.503
Interlock with influential private bank	0.000	0.000	0.217	0.000	2.472**
Liability regime choice	0.500	0.500	0.609	1.000	0.566

† Additional variables pertain to smaller sub-samples. †† Banks defined as early distress did so between 1920 and 1922; banks defined as late distress did so between 1923 and 1927. * T-statistics for bank size, bank age, board size and total interlocks are calculated using logaritmic transformations of the variables. Significance levels are indicated as follows for a two-tailed t-test: *** p<0.01, ** p<0.05, * p<0.1.

Table 5: Logistic regressions of bank distress using balance sheet characteristics†

Variable	(1)	(2)	(3)	(4)
Bank size (log)	-0.005	-0.009	-0.051	-0.051
	(-0.129)	(-0.258)	(-1.096)	(-1.140)
Bank age (log)	-0.095***	-0.090***	-0.053**	-0.052***
	(-4.605)	(-4.688)	(-2.409)	(-2.701)
Long-term loans	0.091	0.122	0.190*	0.188*
	(0.810)	(1.258)	(1.701)	(1.851)
Stock listing	0.246***	0.211***	0.135***	0.136**
	(3.596)	(3.618)	(3.061)	(2.286)
Return on assets	2.842***	2.618***	2.075	1.944**
	(4.102)	(2.678)	(1.464)	(2.308)
Leverage	0.307***	0.294***	0.506***	0.497***
	(3.419)	(3.080)	(3.615)	(3.705)
Interest dependency		0.025	0.015	
		(0.661)	(0.221)	
Asset liquidity		-0.259	0.043	
		(-0.514)	(0.076)	
Maturity matching		-0.059	0.186	0.168***
		(-0.377)	(1.073)	(2.689)
Deposits		0.446***	0.622***	0.615***
		(4.344)	(7.733)	(5.394)
Branches			0.104*	0.098*
			(1.892)	(1.909)
International activities			0.206**	0.206***
			(2.522)	(3.233)
Relative representation			-0.410	
			(-0.274)	
Observations	142	142	142	142
No. of distressed banks	33	33	33	33
Headquarter region indicators	YES	YES	YES	YES
Bank type indicators	YES	YES	YES	YES
Pseudo R-squared	0.189	0.208	0.257	0.256
AUC	0.797	0.812	0.827	0.828

† The dependent variable is a binominal variable that equals one if and only if a bank has gone into distress during the period 1920-1927. Measures of size and bank age are logaritmic transformations. Marginal effects are calculated at the median. All specifications include bank type and headquarter region indicators. Robust z-statistics are reported in parentheses. Standard-errors are clustered using eleven groups comprised of relevant bank type and headquarter region combinations. Significance levels are indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Influence of management and interlock characteristics on the probability of bank distress, logistic regressions†

Panel A: Marginal effects				
Variable	(5)	(6)	(7)	(8)
Management structure				
Board size (log)	-0.122*	-0.214***	-0.252***	-0.257***
	(-1.722)	(-2.612)	(-3.597)	(-3.321)
Interlock with DNB	-0.002			
	(-0.017)			
Total interlocks with banks (log)	-0.037			
	(-0.386)			
Total interlocks with non-banks (log)	-0.052			
	(-1.042)			
Characteristics of interlocked banks				
Size of interlocked banks (log)		-0.042	-0.055**	-0.058**
		(-1.237)	(-1.968)	(-2.198)
Profitability of interlocked banks		8.678***	10.231***	10.137***
		(4.421)	(4.251)	(4.394)
Leverage of interlocked banks		0.018		
		(0.117)		
Concentration of interlocked banks			0.211	0.212
			(1.149)	(1.223)
Characteristics of interlocked non-banks				
Size of interlocked non-banks (log)		-0.048		
		(-0.531)		
Profitability of interlocked non-banks		0.449		
		(0.644)		
Leverage of interlocked non-banks		0.025		
		(0.065)		
Concentration of interlocked non-banks			-0.151	-0.173**
			(-1.600)	(-2.225)
Industry concentration of interlocked non-banks			0.032	
			(0.261)	
External financing demand			-0.104	
			(-0.313)	
Bank characteristics				
Bank size (log)	0.000	-0.019	-0.025	-0.024
	(0.008)	(-0.722)	(-0.639)	(-0.649)
Bank age (log)	-0.075**	-0.079***	-0.087***	-0.088***
	(-2.135)	(-3.731)	(-3.912)	(-4.483)
Long-term loans	0.128	0.219***	0.228**	0.229**
	(1.621)	(3.719)	(2.416)	(2.201)
Stock listing	0.145***	0.165***	0.166***	0.153***
	(3.095)	(3.053)	(2.980)	(4.191)
Return on assets	1.357	0.407	0.788	0.800
	(1.232)	(0.385)	(0.844)	(0.847)
Leverage	0.368**	0.554***	0.623***	0.616***
	(2.301)	(3.148)	(4.811)	(4.708)
Maturity matching	0.059	0.187*	0.212*	0.212**
	(0.507)	(1.925)	(1.908)	(2.141)
Deposits	0.562***	0.784***	0.805***	0.823***
	(2.749)	(3.877)	(3.310)	(3.565)
Branches	0.075	0.069	0.089**	0.090***
	(1.269)	(1.459)	(2.141)	(3.970)
International activities	0.231***	0.265***	0.275***	0.278***
	(2.620)	(4.612)	(4.006)	(4.840)
Observations	142	142	142	142
No. of distressed banks	33	33	33	33
Headquarter region indicators	YES	YES	YES	YES
Bank type indicators	YES	YES	YES	YES
Pseudo R-squared	0.295	0.389	0.403	0.402
AUC	0.862	0.894	0.893	0.893
Panel B: Shapely decomposition of explained variance				
Management structure	11%	5%	7%	7%
Characteristics of interlocked banks		17%	20%	20%
Characteristics of interlocked non-banks		4%	1%	1%
Bank characteristics	89%	73%	72%	72%

† The dependent variable is a binominal variable that equals one if and only if a bank has gone into distress during the period 1920-1927. Measures of size and bank age are logaritmic transformations. Marginal effects are calculated at the median. All specifications include headquarter region and bank type indicators. Robust z-statistics are reported in parentheses. Standard-errors are clustered using eleven groups comprised of relevant bank type and headquarter region combinations. Significance levels are indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 7: Additional logistic regressions of bank distress, marginal effects†

Variable	(9)	(10)	(11)
Additional variables			
Asset growth	0.134		
	(1.270)		
Interlock with influential private bank		-0.082	
		(-1.244)	
Liability regime			0.078
			(0.808)
Variables from previous analysis			
Bank size (log)	-0.028	-0.023	-0.022
	(-0.564)	(-0.633)	(-0.572)
Bank age (log)	-0.143***	-0.082***	-0.093***
	(-2.675)	(-3.936)	(-4.136)
Long-term loans	0.312***	0.206**	0.244***
	(2.947)	(2.041)	(2.576)
Stock listing	0.152***	0.184***	0.206**
	(3.248)	(4.445)	(2.555)
Return on assets	0.209	0.880	0.788
	(0.317)	(0.948)	(0.850)
Leverage	0.529***	0.587***	0.536**
	(3.394)	(4.816)	(2.541)
Maturity matching	0.173	0.181**	0.235**
	(1.440)	(2.290)	(2.380)
Deposits	0.738***	0.749***	0.821***
	(2.954)	(3.717)	(3.326)
Branches	0.091***	0.086***	0.083***
	(4.179)	(3.658)	(5.522)
International activities	0.256***	0.281***	0.278***
	(3.276)	(4.849)	(4.750)
Board size (log)	-0.278***	-0.267***	-0.273***
	(-3.637)	(-3.432)	(-3.411)
Size of interlocked banks (log)	-0.044	-0.052**	-0.057**
	(-1.163)	(-1.969)	(-2.129)
Profitability of interlocked banks	10.644***	10.087***	10.657***
	(3.110)	(4.460)	(4.109)
Concentration of interlocked banks	0.255	0.212	0.231
	(1.232)	(1.233)	(1.299)
Concentration of interlocked non-banks	-0.180**	-0.130	-0.179**
	(-2.060)	(-1.189)	(-2.355)
Observations	133	142	142
No. of distressed banks	33	33	33
Headquarter region indicators	YES	YES	YES
Bank type indicators	YES	YES	YES
Pseudo R-squared	0.419	0.406	0.405
AUC	0.904	0.898	0.894

† The dependent variable is a binominal variable that equals one if and only if a bank has gone into distress during the period 1920-1927. Measures of size and bank age are logaritmic transformations. Marginal effects are calculated at the median. All specifications include headquarter region and bank type indicators. Robust z-statistics are reported in parentheses. Standard-errors are clustered using eleven groups comprised of relevant bank type and headquarter region combinations. Significance levels are indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

Table 8: Influence of management and interlock characteristics on the probability of bank distress, Cox proportional hazards models†

Panel A: Marginal effects				
Variable	(12)	(13)	(14)	(15)
Management structure				
Board size (log)	-1.185	-1.613**	-1.801***	-1.755***
	(-1.478)	(-1.994)	(-2.832)	(-2.817)
Interlock with DNB	-0.029			
	(-0.041)			
Total interlocks with banks (log)	-0.097			
	(-0.164)			
Total interlocks with non-banks (log)	-0.320			
	(-0.982)			
Characteristics of interlocked banks				
Size of interlocked banks (log)		-0.176	-0.224	-0.278
		(-0.707)	(-1.316)	(-1.611)
Profitability of interlocked banks		48.563***	65.317***	63.198***
		(4.438)	(4.337)	(4.546)
Leverage of interlocked banks		-0.293		
		(-0.209)		
Concentration of interlocked banks			0.948	1.134
			(0.911)	(1.040)
Characteristics of interlocked non-banks				
Size of interlocked non-banks (log)		-0.579		
		(-1.051)		
Profitability of interlocked non-banks		5.530		
		(1.241)		
Leverage of interlocked non-banks		0.546		
		(0.230)		
Concentration of interlocked non-banks			-1.527*	-1.683**
			(-1.745)	(-2.300)
Industry concentration of interlocked non-banks			0.622	
			(0.891)	
External financing demand			0.022	
			(0.008)	
Bank characteristics				
Bank size (log)	-0.130	-0.228	-0.350	-0.379
	(-0.383)	(-1.374)	(-1.053)	(-1.242)
Bank age (log)	-0.412***	-0.557***	-0.553***	-0.549***
	(-3.741)	(-5.668)	(-5.665)	(-6.319)
Long-term loans	1.198	1.942	2.000*	1.902
	(1.261)	(1.482)	(1.647)	(1.616)
Stock listing	1.251**	1.623**	1.675**	1.564***
	(2.357)	(2.414)	(2.324)	(3.055)
Return on assets	10.231	1.135	7.181	6.839
	(1.112)	(0.225)	(0.988)	(0.998)
Leverage	2.357*	3.783	4.946***	4.590***
	(1.671)	(1.445)	(3.148)	(3.105)
Maturity matching	1.110*	1.750***	2.135**	2.350***
	(1.862)	(3.751)	(2.308)	(2.662)
Deposits	2.869*	4.283**	4.694**	4.774***
	(1.845)	(2.327)	(2.478)	(2.648)
Branches	0.598**	0.742**	1.098**	1.057***
	(2.070)	(2.023)	(2.551)	(3.041)
International activities	1.246	1.259***	1.453***	1.433**
	(1.542)	(2.580)	(2.906)	(2.447)
Observations	142	142	142	142
No. of distressed banks	33	33	33	33
Headquarter region indicators	YES	YES	YES	YES
Bank type indicators	YES	YES	YES	YES
Pseudo R-squared	0.142	0.192	0.197	0.194
Chi-squared	101	173	6,553	183
Panel B: Shapely decomposition of explained variance				
Management structure	13%	5%	6%	7%
Characteristics of interlocked banks		9%	11%	11%
Characteristics of interlocked non-banks		9%	2%	0%
Bank characteristics	87%	76%	81%	82%

† The dependent variable is a binominal variable that equals one if and only if a bank has gone into distress during the period 1920-1927. Measures of size and bank age are logaritmic transformations. Marginal effects are calculated at the median. All specifications include headquarter region and bank type indicators. Robust z-statistics are reported in parentheses. Standard-errors are clustered using eleven groups comprised of relevant bank type and headquarter region combinations. Significance levels are indicated as follows: *** p<0.01, ** p<0.05, * p<0.1.

Figure 1: Long and short interest rates, 1900 to 1929

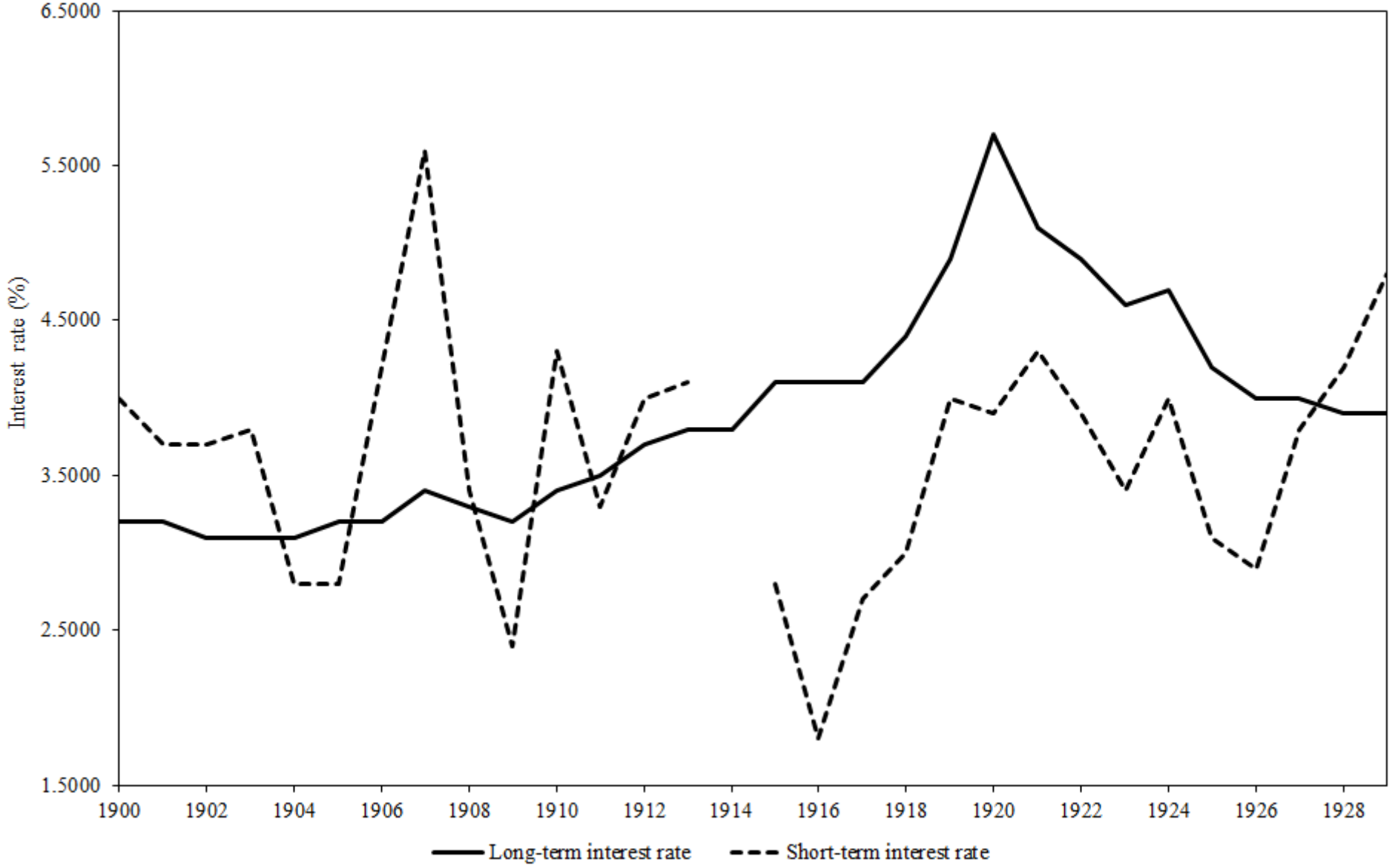


Figure 2: Dutch monetary developments, 1900 to 1929

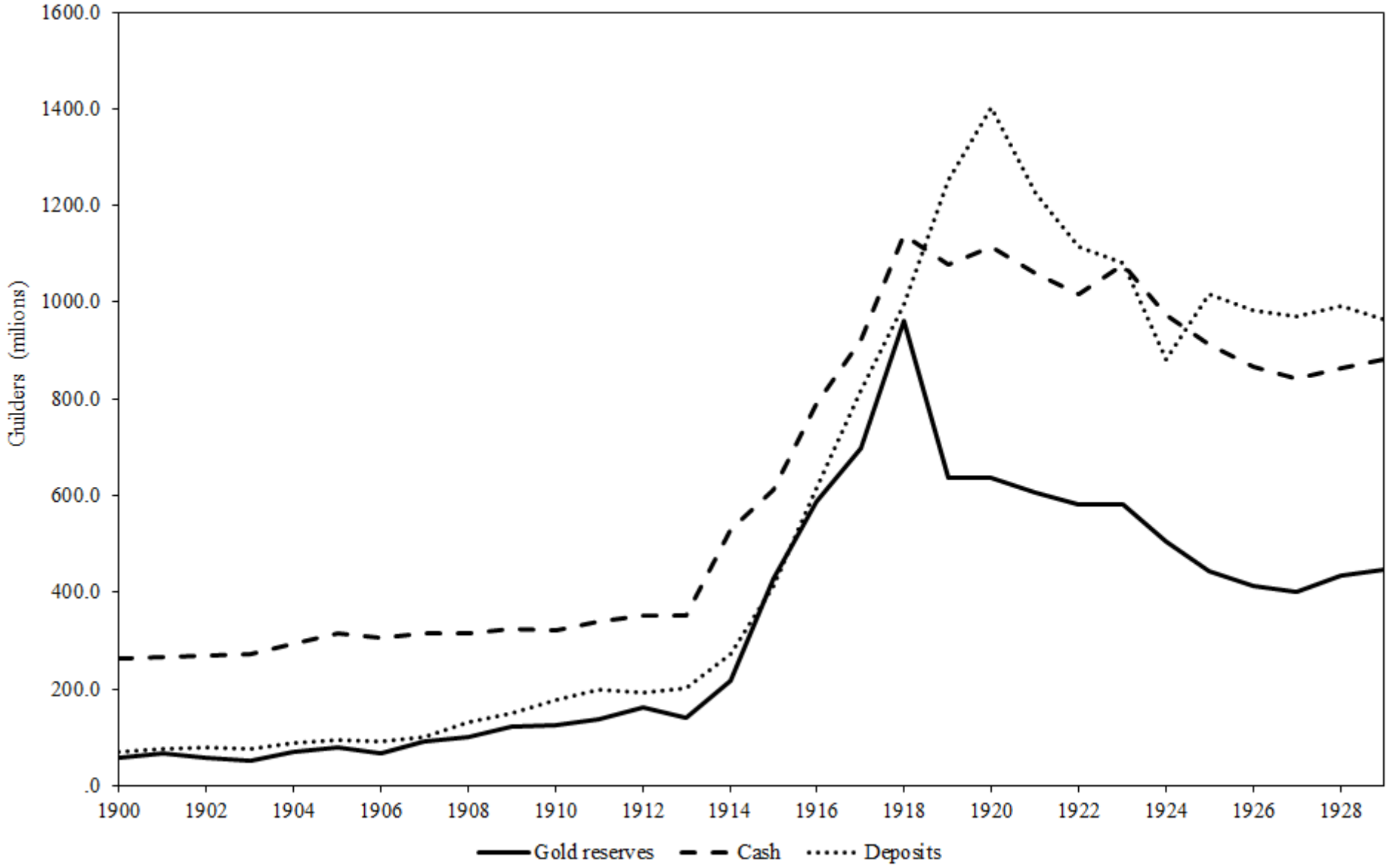


Figure 3: Timeline depicting the number of failures per year by method of resolution, 1920 to 1927

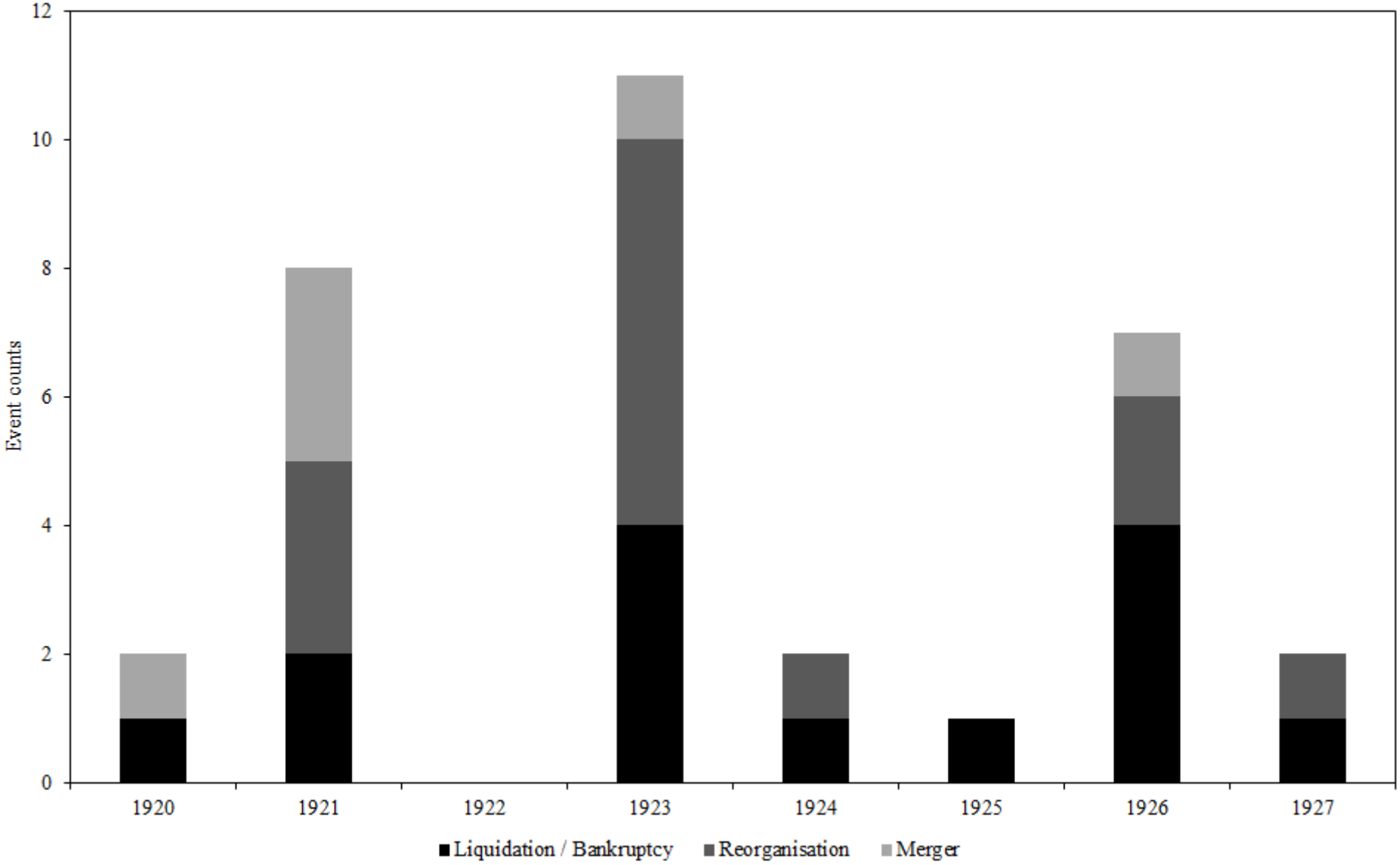


Figure 4: Indices of stock prices of distressed and non-distressed banks, and the Consumer Price Index (CPI), 1913 to 1929 (1913 = 100)

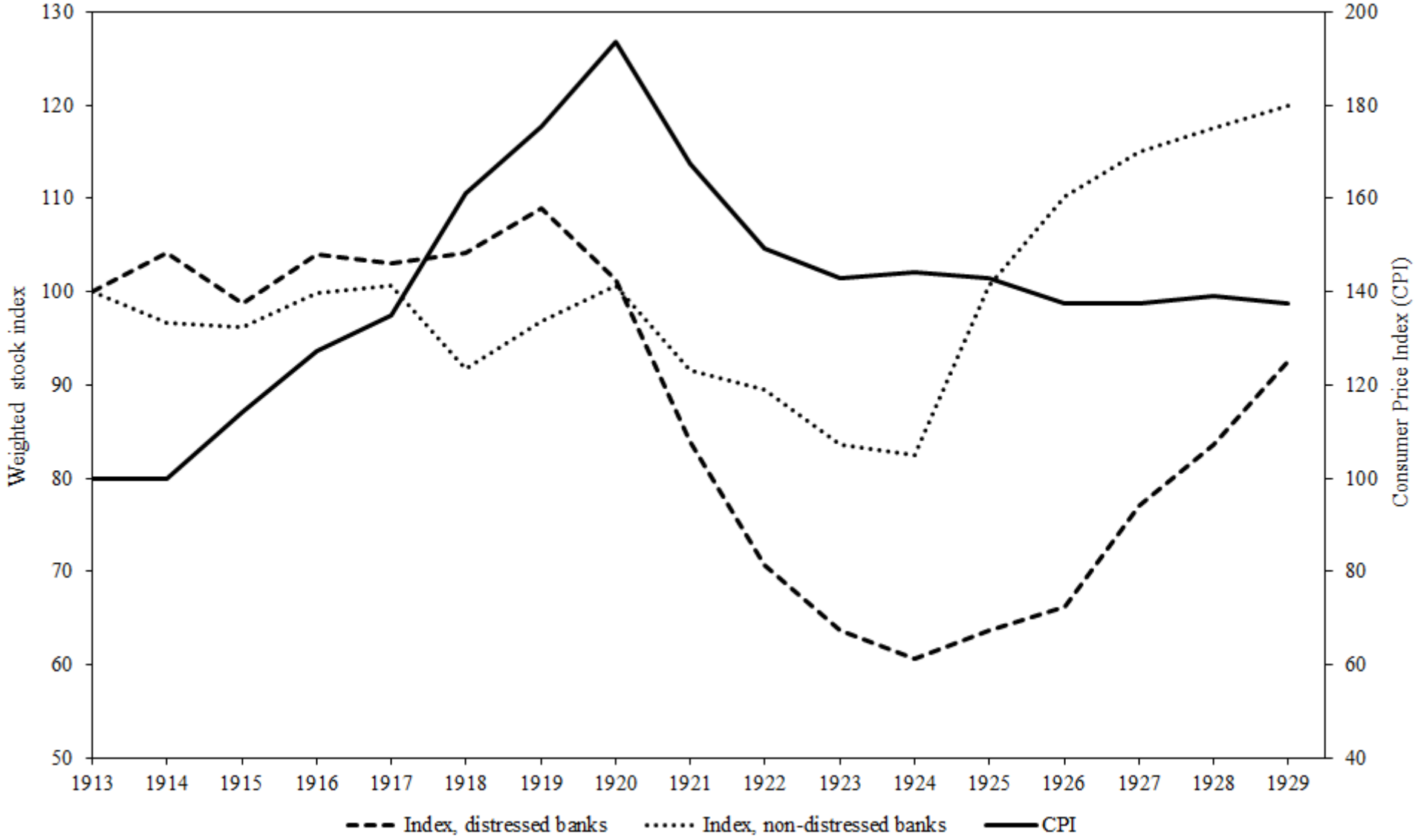
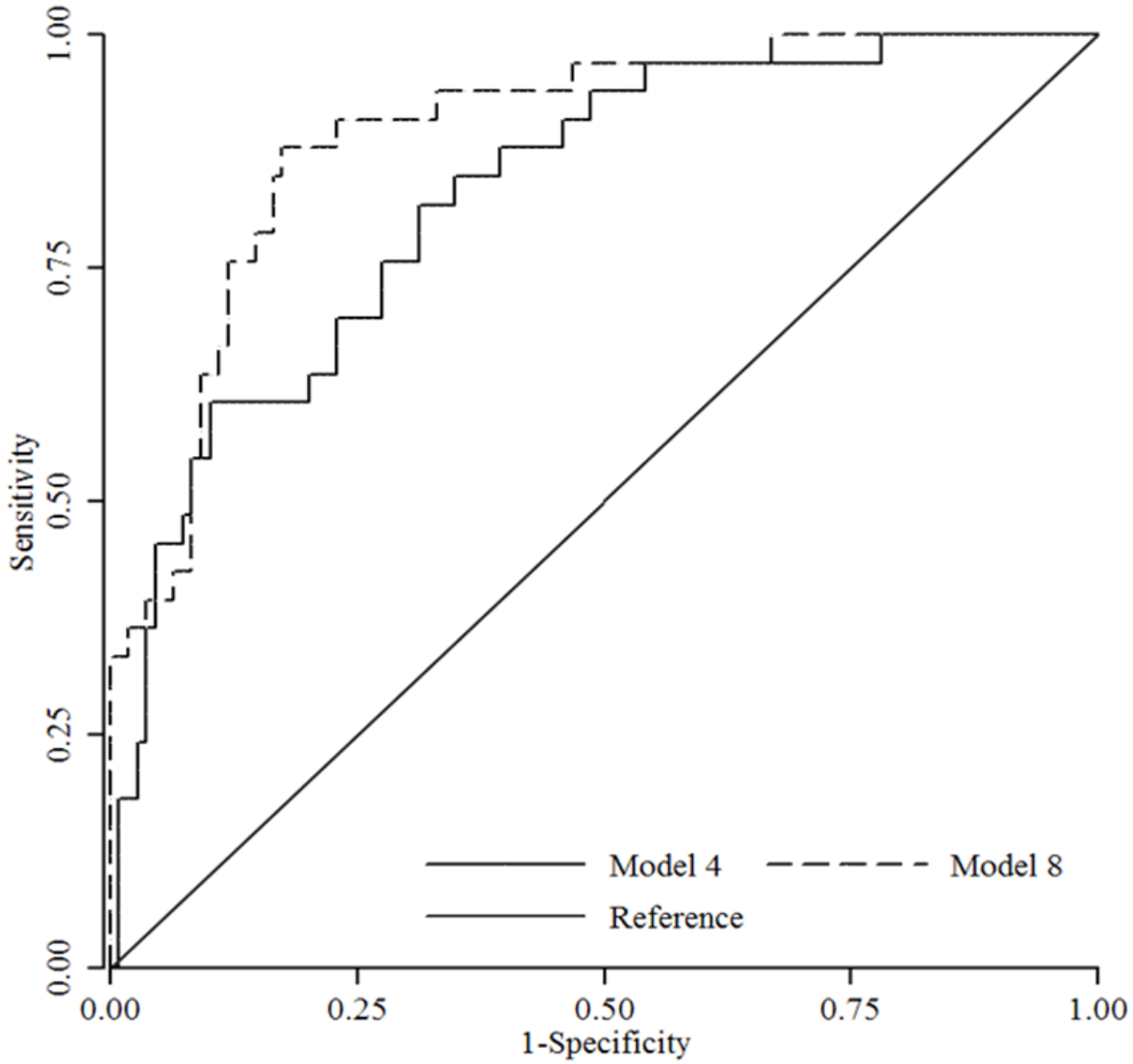


Figure 5: Receiver Operating Characteristics (ROC)



Data appendix

This appendix describes with the aid of an example how the accounting and governance data collected from *Van Oss* were standardised and converted to consistent categories across all firms: we use Marx & Co.'s Bank, probably the most high-profile casualty in the early part of the 1920s crisis.

Table 1, Panel A shows the 1918 balance sheet of Marx & Co.'s Bank, as published at the time. The bank's assets are noted in the left-hand panel and are divided into: *Aand. in portef.* (unplaced equity); *Kassa* (cash held in the firm); *Wiss., coupons en spec* (short-term loans); *Bankiers* (cash held at banks); *Effecten* (investments in financial assets); *Fondsen af te leveren* (deliverable funds); *Voorschot. in rek.-crt. tegen effecten en beleeningen op effecten* (advances against financial assets and/or accounts payable); *Voorschot. tegen goed., hyp of borgst.* (advances against goods, mortgages or bail); *Saldo's rek.-crt* (net accounts receivable); *Gebouwen en safes* (building and safes); and *Meubilair* (furniture). The bank's liability structure is listed in the right-hand panel and is divided into: *Kapitaal* (nominal equity capital); *Reserve* (equity reserves); *Personeelfonds* (funds available for employees); *Bankiers* (cash stored by other banks); *Effecten in beleening gegeven* (invested funds under management from third parties); *Saldo's r.crt. en dep.* (net accounts payable and deposits); *Id. v. rek. v. derden* (net payable accounts from third parties); *Accepten en traites* (accepted short term loans); *Dividend* (dividends); and *Onverdeeld* (retained profits).

Table 1, Panel B shows the same balance sheet converted to standardised categories which are consistent across all the sampled banks. Assets are divided into: fixed assets, financial assets and current assets; and the equity and liability structure consists of equity capital, provisions and long- and short-term liabilities. Short-term liabilities consist of accounts payable and short-term loans. The difference between equity reserves and

provisions is the nature of the reservation. Cases in which the purpose of a reserve was clearly stated have been classified as provisions. In some cases, the item *aandeelhouders* (shareholders) was found on the left-hand side of the balance sheet. This signalled that there is unpaid equity capital, which the bank could call upon in times of need. This item was subtracted from the balance sheet and the nominal equity capital was lowered accordingly. The same procedure was followed for all 143 banks in our sample and the 234 non-financial firms that were used in the calculation of the interlock characteristics.

For the governance data, we compiled a list of all directors and supervisors on the boards of all banks and non-financial corporations at the start of 1918. This yielded 1,269 individuals sitting on the boards of 143 banks and 1,625 individuals sitting on the boards of 234 non-financial corporations. Subsequently, we cross-referenced each individual and found that each bank had on average seven interlocks with other banks and non-financial corporations. We count multiple interlocks with one bank (or non-financial firm) as one interlock only.

Table A1: Balance sheet of Marx & Co.'s Bank, 1 January

Panel A: Contemporary categories

	Assets	Liabilities	
Aand. in portef.	4,000,000	12,000,000	Kapitaal
Kassa	756,252	1,700,000	Reserve
Wiss., coupons en spec.	12,220,201	99,743	Personeelfonds
Bankiers	4,442,787	8,412,586	Bankiers
Effecten	1,437,820	1,979,900	Effect in beleening gegeven
Fonds af te leveren	557,910	19,007,074	Saldo's r.ct en dep.
Voorschott. in rek-crt. tegen effecten en beleeningen op effecten	12,367,254	-	Id. v. rek. v. derden
Id. tegen goed., hyp. of borgst.	6,107,550	2,651,034	Accepten en traites
Saldo's rek.-crt.	4,178,309	660,000	Dividend
Gebouw en safes	450,000	7,747	Onverdeeld
Meubilair	1		
	46,518,085	46,518,085	Total liabilities

Panel B: Converted standardized categories

	Assets	Liabilities	
Fixed assets	450,001	8,000,000	Equity capital
Long-term debt	-	1,707,747	Reserves
Equity investment	1,437,820	99,743	Provisions
Short-term debt	34,873,315	-	Bonds and mortgages
Receivables	-	27,419,661	Deposits
Cash	5,199,039	-	Other long-term liabilities
Other non-cash	557,910	2,651,034	Short-term credits
		660,000	Payables
		1,979,900	Other short-term liabilities
Total assets*	42,518,085	42,518,085	Total liabilities*

* Total assets and liabilities quoted in coverted standardized balance sheets do not necessarily equal those in contemporary balance sheets. This is because they have been adjusted to reflect shareholder capital that has either not been placed, or not yet been called.