A Historic(al) Run on Repo?

Causes of Bank Distress during the Austro-Hungarian "Gründerkrach" of 1873

Kilian Rieder

PhD Candidate

University of Oxford

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Abstract

Short-term collateralized debt markets may freeze in the face of shocks which trigger the production of information about the opaque quality of pledged assets hitherto accepted as safe. The literature on "runs on repo" during the recent financial crisis analyzed how these sudden regime switches could push borrowing financial institutions to the brink of default. However, little is still known about whether and under which circumstances these runs ultimately affect the financial health of repo lenders. The (micro-)economic incentives for lenders to accept collateral that might suffer from illiquidity in times of distress also remain to be further explored. The present paper addresses these questions from a historical perspective by focusing on the Austro-Hungarian "Gründerkrach" of 1873, a financial crisis whose run-up was coined by a proliferation of repo loans. Investment banks granted repo loans to stock market investors in order to boost the offer prices of their IPOs during the financial boom 1868-1873, encouraging high leverage on the Viennese Bourse. This lender-borrower relationship resulted in an apparent win-win situation as long as asset prices kept increasing. In April 1873, revealed poor performance of newly founded companies triggered margin calls on repos and finally ended with large-scale repossessions of depreciated collateral. Insights from the legal environment, archival evidence on strategic trade-offs between repo lenders and survival analysis based on new bank-level data suggest that bank failures occurred in the context of forced repo collateral liquidation due to severe liquidity mismatches on repo lenders' balance sheets.

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1 Summary

Why did 40% of all Austro-Hungarian joint-stock banks fail during the "Gründer-krach" of 1873? In order to answer this question, I draw on new bank-level and stock market data as well as on qualitative archival evidence. My sources are the Compass (financial yearbook), the Viennese stock market reports and the archives of the central bank, the Ministry of Finance, the stock market commit-tee, various commercial banks and the general press.

I show that bank closures during the "Gründerkrach" were tightly connected to the fate of the Viennese repo market. The run-up to the "Gründerkrach" was coined by a proliferation of repo loans which banks granted to brokerage firms in order to secure the easy placement of initial public offerings on the stock market. This relationship encouraged high leverage of brokers and investors and resulted in a win-win situation as long as asset prices kept increasing. Stock prices began to fall in April 1873, triggering first margin calls and insolvencies among brokers' clients. The repo market organized around the Viennese bourse collapsed on 9 May 1873 when a major brokerage firm announced bankruptcy. Subsequently, no repo transaction was recorded for seven months. Banks linked to the stock market were targeted by their depositors and had to liquidate repossessed repo collateral at fire sale prices due to severe liquidity mismatches on their balance sheets, causing large losses for the banks and worsening the liquidity squeeze on the stock market. Controlling for bank-level financial characteristics, I use Cox proportional hazard regressions to uncover the economically and statistically significant role of repos in banks' demise. These results are robust to qualitative and statistical checks for omitted variable, simultaneity and selection bias.

My paper fills the gaps in the literature left by earlier works which discounted the explanatory power of economic theory or neglected to investigate the rela-tionship between repos and banks' demise in a systematic and empirical way (e.g. Matis 1971, Kövér 2000). It also contributes to the scarce literature on the role of repos in historical financial markets (Flandreau and Sicsic 2003, A'Hearn 2005, and White 2007). Finally, the paper also sheds more light on the impor-tance of microstructures of particular repo markets in explaining their reactions to moments of extreme financial distress (Gorton and Metrick 2012, Copeland et al. 2014). Comparable in its set-up to the US tri-party repo market during the crisis of 2007-08, the Austro-Hungarian market was populated by lenders who were unprepared to cope with large amounts of repossessed collateral and who risked suffering from withdrawals of their own investors (retail depositors). Together with the daily unwind of repos on the Bourse and the legal obstacles to raising margins for longer term repos, these features appear to have played an important role in causing the precipitous break-down of the market, rather than a gradual tightening of margins, following 9 May 1873.

Contents

2   Introduction

The "Gründerkrach" dominates the economic historiography of Austria-Hungary as the most severe stock market crisis which hit the Habsburg Empire during the 50 years of dualism (1867-1918). Following a pronounced financial boom episode starting as early as 1867, investor sentiment began to revert in April 1873 until the Viennese Stock Exchange finally ground to complete halt on Black Friday, May 9th 1873. On this day, a famously empty list of stock price quotations heralded a protracted financial turmoil whose consequences in terms of sluggish growth would later trigger an academic debate about the existence of a "Long Depression" in the Habsburg lands[1]. Undoubtedly, the Gründerkrach stands out as a particularly long-lived stock market meltdown, especially if contrasted to other major negative shocks during this period, such as the panic in autumn 1869 or the outbreak of the Franco-Prussian War in July 1870 (c.f. Figure 1).

Figure 1: Mean market-to-book ratio* of stocks traded in Vienna (12/1867 - 12/1874).
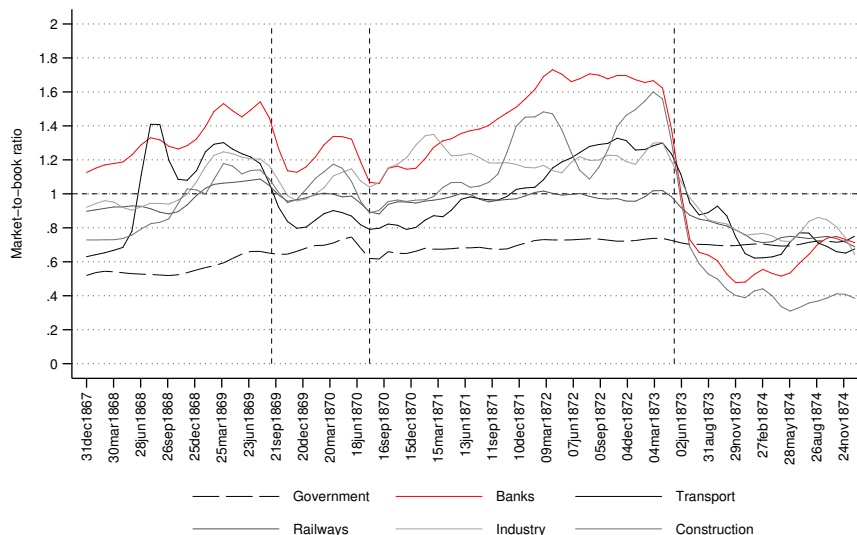
Source: own calculations; Compass and Coursblatt des Gremiums der k.k. Börse–Sensale and Wiener Zeitung

*End–of month quotes; par values adjusted to account for not paid up capital and fluctuations in silver prices where necessary.

Although this traditional narrative on the Austro-Hungarian Gründerkrach is well documented[2], the fully-fledged banking crisis which ravaged the Empire from May 1873 onwards has not yet received much detailed, let alone separate

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[1]c.f. David F. Good, 'The Great Depression and Austrian Growth after 1873', *Economic History Review*, 31/2 (1978), 290-94; John Komlos, 'Is the Depression in Austria after 1873 a "Myth"?', *Economic History Review*, 31/2 (1978), 287-89.

[2]For two standard references, c.f. Herbert Matis, *Gründerzeit, Börsenkrach und Wirtschaftskrise in der Habsburgermonarchie I & II* (Studien zur Wirtschafts- und Sozialgeschichte Österreichs im 19.Jahrhundert; Vienna: Hochschule für Welthandel, 1971), 737; Franz Baltzarek, *Die Geschichte der Wiener Börse: Öffentliche Finanzen und privates Kapital im Spiegel einer österreichischen Wirtschaftsinstitution* (Veröffentlichungen der Kommission für Wirtschafts-, Sozial- und Stadtgeschichte; Wien: Verlag der Österreichischen Akademie der Wissenschaften, 1973), 173.

attention by modern economic historians[3]. This gap is surprising given that the Empire's banking sector contracted severely in response to the Gründerkrach. By 1878, 30% of all Austro-Hungarian credit institutions in operation at the end of 1872 had terminally suspended their activities and 40% of the banking sector's total equity had evaporated. In fact, the Austro-Hungarian banking sector represented one of the economy's branches most affected by the boom and the crash. As shown in Figure 1, shares issued by industrial, construction and transport companies also climbed to unprecedented heights but none of these sectors reached average market-to-book ratios matching the stock market performance of the banking sector in the run-up to the Gründerkrach. In the aftermath of May 1873, only construction firms had a comparable or worse standing than joint-stock credit institutions.

What caused the wave of bank failures during the Austro-Hungarian Gründerkrach? The apparent correlation between the fate of real estate development and banking has invited some to liken the Gründerkrach to a bursting real estate bubble which subsequently compromised the financial health of banks. However, real estate lending boomed during the crisis rather than before. In the decade from 1868 to 1878, mortgage loans on Austro-Hungarian bank balance sheets almost tripled. The most pronounced year-on-year increase in aggregate mortgage loans took place between December 1872 and December 1873[4]. In addition, qualitative evidence from banks' board meeting minutes imply that real estate was de facto considered as the only remaining creditworthy collateral after the stock market had collapsed[5]. Indeed, not only private banks saw their mortgage portfolios soar during the crisis. In a report on its activities during the apex of the crash, the Privilegirte Oesterreichische Nationalbank (OeNB, Austria-Hungary's single central bank) mentioned a "non-ordinary upswing" in its mortgage loan portfolio between May 1873 and October 1874[6]. This preference for mortgage loans constitutes an important aspect which suggests that received wisdom on the origins of bank distress during the Gründerkrach may need to be reconsidered.

To be sure, authors writing during or shortly after the Gründerkrach still saw a direct connection between asset price erosions and the causes of bank distress. Yet, their reports hint at an association that was more subtle than simply defaulting mortgages. Whereas real estate loans are suspiciously absent from their accounts, contemporaries accord a decisive role in establishing the link between stock market crash and banking sector distress to so-called "Kostgeschäft" loans. The Kostgeschäft constituted an early version of repurchase (repo) agreements, which credit institutions had generously granted to

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[3]Two early exceptions are Fritz G. Steiner, *Die Entwicklung des Mobilbankwesens in Österreich* (Wien: C. Konegen (E. Stuelpnagel), 1913), 271. and Egon Scheffer, *Das Bankwesen in Österreich* (Wien: Deutschösterreichische Bücherei, 1924), 408. More recently, Kövér (2000) focused on Hungary only, c.f. György Kövér, 'Das Jahr 1873: Die Wirtschaftskrise und die Banken in Ungarn', in Richard Tilly (ed.), *Bankenkrisen in Mitteleuropa im 19. und 20. Jahrhundert* (Stuttgart: Steiner Verlag, 2000), 49-68.

[4]For the provenance of these numbers, c.f. Section 5.1 below.

[5]CA executive committee meeting on August 2nd 1873, Creditanstalt archives.

[6]Siegfried Pressburger and Hans Kernbauer, 'Kapitel 4. Das dritte Privilegium 1863-1877', *Das Österreichische Noteninstitut 1816-1966* (1; Wien: Österreichische Nationalbank 1962), 979-1430 at 1220.

stock-market agents during the Gründerboom. One voice among many others[7], Wirth (1874) draws a particularly clear picture of the intriguingly modern form of financial turmoil which hit the Habsburg Empire in 1873:

> "Repos of securities were done systematically, just like the discounting of bills of exchange in normal times. Banks provided investors and brokers with millions and millions of Gulden for whatever purposes the latter pursued [. . .]. On the eve of the Krach, most of the banks' capital was employed in repos and precisely this caused the crisis to have such a fatal origin and evolution. [. . .] [I]nvestment banks, which held repo portfolios ten times as high as their equity capital, intended to gain some room for maneuver by selling collateral into the market, but the securities offered could not be sold even at the very lowest prices."[8]

Contemporary accounts such as this one did find their way into the general historiography of the Gründerkrach[9], but their main message has never been thoroughly examined. Can exposure to repos effectively explain bank closures during the Gründerkrach? Did the Kostgeschäft play an important role in the business model of Austro-Hungarian banks, and if yes, which one? Is there evidence for a systematic repo market in Austria-Hungary? How did this market react to the crash (if at all)? Why did this reaction affect repo lending banks? Bringing to bear a large array of new data, the main goal of the present study is to propose a theoretically and empirically grounded micro structure of the banking crisis during the Austro-Hungarian Gründerkrach. Its econometric results show a strong and robust statisical relationship between banks' repo exposure and their survival performance. Insights from the legal environment, financial constraints of and strategic interactions between banks suggest that repo lender distress occurred mainly in the context of severe liquidity mismatches on banks' balance sheets. These findings challenge the received wisdom that the Gründerkrach banking crisis derived from a bursting real estate bubble.

This paper is structured as follows. Section 3 provides a brief literature review on the economics and economic history of banking crises, with a particular

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[7]Joseph Neuwirth, *Bank und Valuta in Österreich-Ungarn: Die Speculationscrisis von 1873*, 2 vols. (2; Leipzig: Duncker & Humblot, 1874), 376 at 6-7; Albert Schäffle, 'Der grosse Börsenkrach des Jahres 1873', *Zeitschrift für die gesammte Staatswissenschaft*, 1874/30 (1874), 1-94 at 26-27; Volkswirtschaftlicher Ausschuss des österreichischen Abgeordnetenhauses, 'Bericht des volkswirtschaftlichen Ausschusses über den Antrag des Abgeordneten Lienbacher und Genossen, betreffend die Krisis von 1873', *Beilagen zu den stenografischen Protokollen des Abgeordnetenhauses*, VIII. Session/445 (1874), 1-70 at 33; Benno Weber, *Einige Ursachen der Wiener Krisis vom Jahre 1873* (Leipzig: Veit, 1874), 131 at 64; Peter Welzl, *Die Speculation an der Wiener Börse: praktische Darstellung und Anleitung zur Ausführung von Börsespeculationen für Private und Speculanten* (Wien: Bermann & Altmann, 1881), 73 at 34-35.

[8]Max Wirth, *Geschichte der Handelskrisis im Jahre 1873* (Frankfurt: J.D. Sauerländer's Verlag, 1874), 270 at 139-41.

[9]Steiner, *Die Entwicklung des Mobilbankwesens in Österreich* at 216-17; Scheffer, Das Bankwesen in Österreich at 217-18; Annelies Rohrer, 'Die Wiener Effektenbörse und ihre Besucher in den Jahren 1867 bis 1875', *Unpublished PhD dissertation* (Faculty of History; Wien: Universität Wien, 1971), 371 at 65-67; Baltzarek, *Die Geschichte der Wiener Börse: Öffentliche Finanzen und privates Kapital im Spiegel einer österreichischen Wirtschaftsinstitution* at 82-83.

focus on the role of repos. In addition, Section 3 proposes an informal theoretical framework to structure the analysis of repo lender distress. In Section 4, the Gründerkrach banking crisis is embedded in its wider historical background. Section 5 constitutes the empirical analysis of this paper. Section 6 explains how the Kostgeschäft fitted into the "Gründerbanking" business model. Section 7 offers a narrative investigation into specific channels to repo lender distress during the Austro-Hungarian Gründerkrach. Section 8 concludes.

3 Bank distress and repo lending

3.1 Literature review

In the light of contributions from the last decade, an earlier controversy between defendants of the so-called "illiquidity hypothesis"[10] and proponents of the "insolvency hypothesis"[11] over which of these two approaches constitutes the more accurate explanation for historical banking crises increasingly turns into a "straw-man" debate[12]. Amongst others, Calomiris and Mason (2003) and Richardson (2007) show that the illiquidity and insolvency hypotheses are complementary rather than mutually exclusive in the context of the Great Depression 1929-1933. Instead of advocating a "one-explanation-fits-all" approach, these scholars are taking a more micro-level perspective by testing which of the channels comes closer to explaining specific episodes within longer periods of banking distress. For example, Calomiris and Mason (2003) conclude that, while earlier phases of crisis during the Great Depression can be accounted for by bank fundamentals, at least the final episode of distress in 1933 was largely driven by panic-induced illiquidity.

Inspired by the bankruptcy of Lehman Brothers, a US investment bank which was forced to suspend payments when its short-term repo funding suddenly dried up in autumn 2008, Gorton and Metrick (2012a) suggest another precise sense in which illiquidity and insolvency are complementary and may even have to go hand-in-hand in order for certain types of banking sector distress to occur. They argue that bank runs in our modern systems of "securitized

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[10]According to this school, bank defaults can be ascribed to to self-fulfilling panic runs on sight liabilities in the absence of deposit insurance. These runs arise from a combination of liquidity shocks to depositors and their subsequent coordination failure triggered by so-called "sunspots". The seminal theoretical contributions are Douglas W. Diamond and Philip H. Dybvig, 'Bank Runs, Deposit Insurance, and Liquidity', *Journal of Political Economy*, 91/3 (1983), 401-19; Hans Carlsson and Eric van Damme, 'Global Games and Equilibrium Selection', *Econometrica*, 61/5 (1993), 989-1018.

[11]Bank distress is perceived as an outgrow of widespread losses on the asset side of banks' balance sheets, where targeted deposit runs respond to clearly observable signs of banks' individual weaknesses. c.f. Gary Gorton, 'Banking Panics and Business Cycles', *Oxford Economic Papers*, 40/4 (1988), 751-81; Charles W. Calomiris and Joseph R. Mason, 'Fundamentals, Panics, and Bank Distress During the Depression', *American Economic Review*, 93/5 (2003), 1615-47.

[12]The illiquidity vs. insolvency divide originally started from Friedman's and Schwartz's characterization of the banking crises during the Great Depression as panics produced by a "contagion of fear", c.f. Friedman and Schwartz, *A monetary history of the United States*, 1867-1960 at 308.

banking"[13] manifest themselves as wholesale funding withdrawals from invest-ment and dealer banks in the form of rapidly increasing haircuts on repurchase agreements[14]. Repos constitute short-term secured loan agreements which are composed of two separate transactions: the borrower sells usually high quality, liquid securities to the lender in exchange for cash (1) and simultaneously agrees to repurchase them for a slightly higher price in the future (2). If expressed as a percentage of the initial sale price, the difference between repurchase price and sale price represents the interest rate for the repo loan (the "repo rate"). Should her counterparty default on the commitment to repurchase the securities at maturity, the creditor may be forced to sell the securities to other market participants at uncertain prices in the future. Hence, lenders in the repo mar-ket usually apply a so-called "haircut". In this case, the amount the lender agrees to pay in step (1) merely corresponds to some fraction of the actual value of the acquired securities. The haircut thus provides the lending party with a safety buffer against future price declines of the collateral[15]. Depending on their degree of sophistication, repo contracts may also contain a clause that enables the lender to place a margin call, i.e. to demand additional securities from the borrower if the market price of the collateral falls significantly at any moment before step (2) is completed. Since repos often have short maturities (mostly overnight) and are over-collateralized, these loans are considered very safe. They usually get rolled over at maturity, providing a continuous source of short-term funding for the borrower as well as stream of interest payments for the lender.

As Gorton and Metrick (2012a) argue, the augmentation of repo loans with collateral substitutes for deposit insurance in the wholesale funding markets of present day securitized banking systems[16]. Only a combination of concerns about counterparty insolvency and market illiquidity can lead to a failure of this insurance mechanism. In theory, an anticipated economic downturn, ru-mors or even outright knowledge about its borrower's insolvency alone should not represent a sufficient motivation for the lending party to withdraw secured repo funding, as long as the collateral exhibits low price volatility and benefits from a liquid market. High market liquidity and low price volatility of the col-lateral enable lenders to terminate the repo contract without losses even if their counterparty defaults. The mere possibility to sell the collateral freely at stable prices if need be reduces lenders' incentives to call in repo loans in anticipation of heightened counterparty risk. The inverse is true as well: in a world without counterparty risk, the quality of repo collateral should be irrelevant as borrowers always pay their dues at maturity. Hence, "runs on repo"[17] should only occur when lenders, instead of rolling over the loan on equal terms at maturity, decide to withdraw funding from borrowers because high counterparty risk coincides or is anticipated to coincide with market illiquidity.

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[13]c.f. Gary Gorton and Andrew Metrick, 'Securitized banking and the run on repo', *Journal of Financial Economics*, 104/3 (6/2012a), 425-51.

[14]A 100% haircut corresponds to a total withdrawal of funds from borrowers.

[15]Depending on the legal treatment of repos, it may be incorrect to speak of "collateral" in the context of a repo transaction. In most of the economic literature on the topic, however, "collateral" has become the standard term to designate the securities sold to the lender.

[16]Ibid., at 428.

[17]Ibid.

Judging by the implicit or explicit focus of post-2008 contributions to the literature, Lehman's demise made it fashionable to explain the advent of borrower distress in the repo market[18]. In contrast, less attention has been paid to financial malaise on the lending side in the direct aftermath of repo runs. Trying to answer the question "who ran on repo" during the recent financial crisis, Gorton and Metrick (2012b) suggest the "statistical discrepancy ran on repo"[19], alluding to the fact that a large percentage of lenders in the bilateral repo market consists of unregulated hedge funds not captured in official flow-of-funds data. This lack of information is discomforting since there seems to be an agreement that the prevention of disorderly collateral liquidations should be one of the top priorities of policy responses to emerging repo crises[20]. Ultimately, lenders, not defaulting borrowers, proceed to large-scale collateral liquidations into overstrained markets with potentially severe macroeconomic consequences. For example, Antinolfi et al. (2015) have recently argued that asset price implosions driven by collateral fire-sales may depress net worth of financial and non-financial institutions even outside the repo market and thereby affect the loan supply to the real economy.

Despite the interesting questions these latter contributions raise, clear-cut judgments on policy implications remain notoriously out of reach because encompassing information on the size of repo markets, the quality of collateral and the motivation for granting specific repo loans is generally scarce. One of the reasons why we still know comparatively little about repos and their role in banking sector distress simply is the literature's strong bias towards the present. Repo loans are commonly considered to be a product of the recent past, with the received wisdom seeming to be that "repos as we know them were introduced to the U.S. financial market by the Federal Reserve in 1917"[21]. This proposition is unfortunate because it glosses over important episodes of historical crises, such as the Gründerkrach of 1873, during which financial instruments very akin to modern day repos played an essential role. Who ever wondered whether "repo" is a logical acronym for "repurchase agreements" is well advised to look out for contemporary literature on 19th century financial markets in Germany, France, or Italy, where these sale and repurchase operations, known as *Report*, *report* and *riporto* respectively, represented standard transactions among brokers, but also between investors and banks[22]. In fact, there is a small literature on the

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[18]c.f. Viral V. Acharya, Douglas Gale and Tanju Yorulmazer, 'Rollover Risk and Market Freezes', *Journal of Finance*, 66/4 (2011), 1177-209; Gary Gorton and Guillermo Ordoñez, 'Collateral Crises', *American Economic Review*, 104/2 (2014), 343-78 at 344; Antoine Martin, David Skeie, and Ernst-Ludwig von Thadden, 'Repo Runs', *Review of Financial Studies*, 27/4 (2014), 957-89.

[19]Gary Gorton and Andrew Metrick, 'Who Ran on Repo?', *National Bureau of Economic Research Working Paper*, 18455/2012 (2012b), 18 at 2.

[20]Viral V. Acharya and Sabri T. Öncü, 'The Repurchase Agreement (Repo) Market', in Viral V. Acharya (ed.), *Regulating Wall Street: the Dodd-Frank Act and the new architecture of global finance* (Hoboken, N.J.: John Wiley, 2011), 319-50 at 345; Martin Oehmke, 'Liquidating illiquid collateral', *Journal of Economic Theory*, 149 (2014), 183-210 at 184.

[21]Acharya and Öncü, *The Repurchase Agreement (Repo) Market* at 323.

[22]Marc Flandreau and Pierre Sicsic, 'Crédits à la spéculation et marché monétaire: le marché des reports en France de 1875 à 1914', in Olivier Feiertag and Michel Margairaz (eds.), *Politiques et pratiques des banques d'émission en Europe (XVIIe-XXe siècles) - Le bicentenaire de la Banque de France dans la perspective de l'identité monétaire européenne* (Paris: Albin Michel, 2003), 197-222 at 198; Brian A'Hearn, 'Finance-led divergence in the regions of Italy', *Financial History Review*, 12/1 (2005), 7-41 at 34-35. For Paris more specifically, c.f. Alex

role of repos in French stock market booms and busts between 1870 and 1900. Bouvier (1968), Flandreau and Sicsic (2003), White (2007) and Riva and White (2010) suggest repo loans fueled the stock market mania leading up to the crash of 1882, enabling bullish speculators invested in forward markets to repeatedly sustain their upward bets by drawing on credit granted by brokers and banks.

The present paper contributes to the economic history literature on banking crises, and repos more specifically, by investigating an even earlier episode of crisis that allegedly led to widespread failure of repo lenders: the Austro-Hungarian Gründerkrach of 1873. First, this study speaks directly to the black and white character of the debate between the insolvency and the illiquidity schools of banking crises. If repos played an essential role in banks' demise, borrower default and liquidity squeezes should both turn out to have been characteristic features of the Gründerkrach which cannot be meaningfully separated. By definition, lender distress in the aftermath of "runs on repo" is connected to both, insolvency and illiquidity. Second, this investigation contributes to the literature stressing the role of repos in the history of financial crises well before 1917. Repurchase agreements have been standard features in financial markets for centuries. Third, whereas recent work in financial economics focuses on the advent and consequences of repo borrower default, the present paper invites researchers to think more in depth about the causes of lender distress in the repo market. In order to shed more light on the possible channels to lender distress, the following subsection will spell out an informal theoretical framework which attempts to summarize the dynamics involved in a simple but systematic way.

3.2   Channels to repo lender distress

What causes lender distress in the direct aftermath of a "run on repo"? This study focuses on lender distress in the repo market as a direct consequence of the formal seizure and sale of collateral upon borrower default. Repo lender distress as understood in this paper occurs whenever the act of selling seized collateral generates losses which are either large enough to endanger the lender's financial viability immediately or create tangible prospects that the lender's business might become financially unsustainable in the future. Borrower default is broadly defined and covers the seizure of collateral by the lender due to either the borrower's inability to pay back a repo loan which is not rolled over at maturity or the latter's inability to meet a margin call in the case of longer-term loans.

This paper argues that repo lender distress is directly connected to the driving forces behind a lender's decision whether and when to liquidate seized collateral upon borrower default. Lenders' leverage over the timing of collateral liquidation is so crucial because it is the market price of collateral at the moment of its sale which determines whether the proceeds from the liquidation net out the defaulted loan (or even lead to a residual liability of the lender vis-à-vis the

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Viaene, *L'efficience de la Bourse de Paris au XIXe siècle: une confrontation théorique face aux données empiriques des marchés à terme et à prime* (Paris: Connaissances et Savoirs, 2004), 453 at 108-09; Eugene White, 'The Crash of 1882 and the Bailout of the Paris Bourse', *Cliometrica*, 1/2 (2007/07/01 2007), 115-44 at 119.

borrower) rather than resulting in a residual claim on the borrower. Flexibility in terms of choosing the "right moment" for selling seized collateral can thus be a precious good.

Which factors increase or decrease this flexibility? First, the timing of collateral liquidation is inextricably linked to how exactly repos are handled legally in a given (historical) context. For example, if repurchase agreements are treated as loan contracts corresponding to the right of lien frequently applied to secured loans[23] rather than being separable into two different sale and purchase contracts, the lender never actually repossesses the collateral in the event of borrower default. Instead of legally acquiring the collateral, which remains the sole property of the borrower throughout, the lender may merely use it to compensate his outstanding debt claim where the compensatory action necessarily entails a sale of the collateral. This constellation explains why "seized" collateral must often be sold in the first place rather than being simply appropriated and substituted for the pending loan amount. Moreover, there might be stark differences among legal regimes concerning the authorization and execution of collateral liquidation. It is surprisingly often forgotten that the exemption of repo collateral from automatic stay during borrower bankruptcy proceedings, i.e. the lender's right to immediate and free disposal over the repo collateral despite the opening of a bankruptcy procedure on the borrower, is only a fairly recent phenomenon even in the U.S. It was not until 1984 when Congress first legislated to exempt certain highly liquid collateral classes from automatic stay; and it took twenty more years until the exemption from automatic stay was extended to mortgage-related securities in 2005[24].

Besides the legal provisions governing repo collateral management, one would also expect the timing of collateral liquidation to obey certain (micro-)economic dynamics. In a model shedding light on the evolution of collateral prices during large-scale sales of illiquid securities, Oehmke (2014) parameterizes lenders' control over the timing of liquidation by drawing on so called "balance sheet constraints"[25]. The author thinks of balance sheet constraints as either characteristics of a lender's current financial position which limit her capacity to hold onto seized collateral (e.g. a pressing need to convert assets into cash in order to respond to funding withdrawals) or regulatory requirements that force the lender to sell the collateral in order to meet minimum standards (e.g. an obligation to swap collateral securities for high quality liquid assets (HQLA) to satisfy the liquidity coverage ratio (LCR)).

Repo lenders are prone to perceive some balance sheet constraints, in particular those related to ad hoc funding liquidity stress, to be binding more often than financial institutions whose long-term collateralized loan portfolios are part of a permanent business strategy which leaves cash reserves largely unaffected. What makes repo loans so special is the fact that they usually represent very short-term (overnight) investments of lenders' excess cash reserves. Repurchase agreements are traditionally perceived as convenient and virtually risk-free instruments for financial institutions to park and capitalize on idle cash in their

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[23] *Pfandrecht* is the corresponding German terminus technicus.

[24] Acharya and Öncü, *The Repurchase Agreement (Repo) Market* at 330.

[25] Oehmke, 'Liquidating illiquid collateral', at 184.

vaults[26]. Repo lenders therefore tend to run the downside risk of encumbering liquidity reserves that would otherwise be available to buffer ad hoc funding withdrawals. To be sure, even among repo lenders there are large discrepancies as to how strictly binding balance sheet constraints might become. Small commercial banks, which are recently gaining ground in (European) repo markets[27], differ strongly from conventional repo lenders, such as money market funds (MMFs), in terms of their asset composition and liquidity. Generally, commercial banks hold various types of relatively illiquid loans, while MMFs mainly invest in highly liquid assets such as government treasuries. Ceteris paribus, funding withdrawals are likely to be more easily addressed by MMFs offloading government bonds than by commercial banks trying to re-sell long-term mortgages, leaving the latter with less room for maneuver in deciding when to liquidate seized repo collateral[28].

Strategic interactions between repo lenders represent a third important element for understanding the timing of liquidations. For example, the creditor structure of a given borrower funded by repos against one single type of collateral asset may have a direct bearing on the respective lenders' decision to liquidate this very collateral asset upon debtor default. A higher number of creditors might be expected to soften the binding character of individual lenders' balance sheet constraints because each lender has a smaller exposure relative to the case where she funds the borrower entirely on her own. Hence, one can imagine a positive correlation between the number of creditors and the flexibility of individual lenders in choosing the moment of liquidation. According to Oehmke (2014), however, there is a trade-off involved in this situation. Lenders may still proceed to sell the collateral in an inefficient "rush to the exit"[29] despite nonbinding balance sheet constraints, if they fear their homologues will push down the market price permanently by selling the seized collateral before they themselves enter the market. In the presence of a downward sloping demand curve, all lenders might have an incentive to liquidate as soon as possible to secure a higher value for their repossessed share of collateral. The theoretical ability to postpone liquidation is of little use if the market price of the underlying collateral stagnates at low levels and never recovers. Under certain circumstances, the strategic interaction between multiple creditors secured with the same collateral asset can therefore considerably reduce each individual creditor's actual room for maneuver when it comes to the timing of liquidation.

Strategic interactions between creditors do not only affect the timing of liquidation; they simultaneously affect the recovery values of repo loans, hence the amount of losses lenders have to bear and eventually the likelihood of lender

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[26]Acharya and Öncü, *The Repurchase Agreement (Repo) Market* at 322-23.

[27]International Capital Market Association (ICMA), 'Frequently Asked Questions on Repo', *Market Practice and Regulatory Policy* (London: ICMA, 2015), 1-49 at 8.

[28]The stark differences are also related to the fact that commercial banks benefit from deposit insurance, whereas MMFs are excluded from these schemes. However, guarantee schemes only extend to retail depositors and wholesale creditors of commercial banks do not generally benefit from the same type of insurance. Furthermore, deposit insurance is limited in scope too. In the European Union, deposit insurance has recently been standardized to yield a uniform minimum protection cover of €100000 for deposits in the single market. The directive in question, 2014/49/EU, was officially published on June 12th 2014 (L173/149).

[29]Oehmke, 'Liquidating illiquid collateral', at 185.

distress. So far, repo lenders have been implicitly assumed to act as price-takers when selling seized collateral: as long as they are able to choose the moment of liquidation in their favor, lenders were presumed to be in a position to eliminate or at least limit losses. This assumption does not reflect reality because strategic interactions between repo lenders do impact on price dynamics. When they rush to the exit, repo lenders further dampen falling asset prices of the collateral by selling into an already drying-up market (market illiquidity or anticipation thereof being a prerequisite for a run on repo and the large scale seizure of collateral to occur in the first place). Collateral prices can become severely depressed by "cash-in-the-market pricing"[30] making it increasingly difficult for repo lenders to honor their own obligations.

4   From Compromise to "Gründerboom"

4.1   Historical background

Flandreau (2001) argues the Austro-Hungarian dual monarchy "operated [during fifty years, from 1867 until 1914] without major disruption, providing for a doubling of incomes per head"[31]. Although dualism brought long term interior political stability after the Austro-Hungarian Compromise of 1867[32], the Empire did experience an early episode of crisis which is traditionally viewed to have represented "a watershed in many economic areas"[33]. The stock market crash of 1873, commonly known as the Gründerkrach in allusion to its origins in a start-up frenzy of joint-stock companies, abruptly ended the boom that had coined the first years of Austro-Hungarian dualism. The underlying causes of the strong, but with hindsight unsustainable financial sector expansion between 1868 and 1873 (the so-called "Gründerzeit") are reminiscent of the work on drivers of speculative boom episodes in economic history[34].

    The era of dualism began with a sequence of high-yielding harvests that boosted exports and railway profits, conveying an economic incentive to expand existing railway infrastructure[35]. However, the supposedly real economic origins

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[30] "Cash-in-the-market pricing" occurs when the total liquidity available in the market at a specific moment in time is (much) smaller than the total value of assets offered for sale, c.f. Franklin Allen and Douglas Gale, *Understanding financial crises* (Clarendon lectures in finance; Oxford: Oxford University Press, 2007), 303 at 255.

[31] Marc Flandreau, 'The Bank, the States, and the Market: An Austro-Hungarian Tale for Euroland, 1867 - 1914', *OeNB Working Papers*, 2001/43 (2001), 1-58 at 7.

[32] The Compromise separated the monolithic monarchy into two political entities, Cisleithania (the Austrian crownlands) and Transleithania (the Hungarian lands of the Crown of Saint Stephen), with independent Parliaments and fiscal autonomy. This paper uses the terms Cisleithania and Austria, as well as Transleithania and Hungary interchangeably.

[33] Scott M. Eddie, 'Economic policy and economic development in Austria–Hungary, 1867–1913', in Peter Mathias and Pollard Sidney (eds.), *The Cambridge Economic History of Europe* (Volume 8; Cambridge: Cambridge University Press, 1989), 814-86 at 824.

[34] For a classic general survey, c.f. Charles Poor Kindleberger and Robert Z. Aliber, *Manias, panics, and crashes: a history of financial crises* (5. edn.; Basingstoke: Palgrave Macmillan, 2005), 355.

[35] Alois Gratz, 'Die österreichische Finanzpolitik von 1848 bis 1948', in Hans Mayer (ed.), *Hundert Jahre österreichische Wirtschaftsentwicklung 1848-1948* (Wien: Springer Verlag,

of the Gründerboom in railway construction were distorted by moral hazard to the extent that the state, which had sold out this initially entirely publicly run sector in the mid-1850s due to acute financial needs, guaranteed large parts of annual railway dividends despite shallow public oversight of private railway companies[36]. At the same time, the years after the Austro-Hungarian Compromise of 1867 heralded the high tide of liberal economic policy in the Habsburg Empire. During the Gründerzeit, every month a large number of poorly managed start-ups were converted into officially licensed joint-stock businesses, while almost no standardized supervisory framework was in place. Applications for new businesses were submitted to the ministerial commission for associations (*Ministerielle Vereinscomission*) located at the Ministry of the Interior which reviewed them but, due to the lack of normative legislation in this matter, did not follow any transparent, standardized procedure in examining these submissions[37]. The total number of joint-stock businesses from the banking, construction, industrial and transport sectors quoted in the Viennese Stock Exchange, the Empire's main Bourse where the large majority of Austrian and Hungarian companies' shares were traded, amounted to 39 in 1867; at the peak of the boom in 1873, 378 of these companies were officially listed[38].

What enabled financial markets to soak up this steadily increasing supply of equity? Liquidity was abundant in the markets from the very beginning of dualism and even more so when the boom was already on its way. The historiography traditionally refers to two independent exogenous forces driving the liquidity in circulation. First, the Austro-Prussian War in 1866 had forced the Empire to inflict the burden of debt monetization on the central bank. The new state notes in circulation represented a permanent increase[39] of the currency in circulation by more than 50%. According to contemporaries, the second major impulse arrived in 1871. French war reparations following the Franco-Prussian War in 1870 enabled the newly founded German Empire to redeem a large part of its sovereign debt, thus freeing German private capital in search for placement opportunities in the Habsburg lands[40]. Kindleberger (1990) mentions that a considerable part of German debt had been held directly by Austrians who now reinvested their wealth in the newly stabilized and economically flourishing home country.

In contrast to these exogenous shocks to the liquidity supply, accounts of sources of endogenous liquidity increases are discussed in hardly any of the available works on the Gründerkrach. The present paper defines endogenous increases in funds available for reinvestment in speculative ventures as increases

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1949), 222-309 at 256.

[36]Gratz, *Die österreichische Finanzpolitik von 1848 bis 1948* at 270.

[37]Neuwirth, *Bank und Valuta in Österreich-Ungarn: Die Speculationscrisis von 1873* at 31.

[38]Gustav Leonhardt, Compass - *Finanzielles Jahrbuch für Österreich-Ungarn (1876)* (1876, 2.Teil, 9; Wien: Commissions-Verlag von Alfred Hölder, 1876), 510 at 103.

[39]The OeNB regained full control over the Empire's paper money only after 1892, when the monetary reform for the adoption of the gold Crown ordered the full redemption of state notes in circulation, c.f. Michael Pammer, *Entwicklung und Ungleichheit: Österreich im 19. Jahrhundert* (Vierteljahrschrift für Sozial- und Wirtschaftsgeschichte, 161; Wiesbaden: Franz Steiner Verlag, 2002), 318 at 134.

[40]Max Wirth, *Österreichs Wiedergeburt aus den Nachwehen der Krisis* (Wien: Manz'sche Buchhandlung, 1876), 522 at 28.

which occurred partly in order to accommodate the higher demand for liquidity in response to the already ongoing financial boom. Despite their limited circulation (100 million Gulden), Austrian treasury bonds (the so-called *Salinenscheine*) had a direct impact on the amount of liquidity available for alternative reinvestment at the Viennese Bourse. Whenever the interest rate paid on the Salinenscheine fell below the market rate[41], investors had an incentive to cash them in to place their funds in higher yielding securities on the market. During the Gründerzeit, when the market rate began to climb as new profitable investment opportunities opened up[42], a migration of capital from treasury bonds into the stock market occurred, endogenously creating demand for even more emissions. Figure 2 shows that the outstanding debt on the Salinenscheine fell drastically as soon as the market rate topped the nominal interest rate on treasury bonds[43].

Figure 2: Treasury bonds in circulation and the market-to-treasury rate spread (01/1869-12/1874).
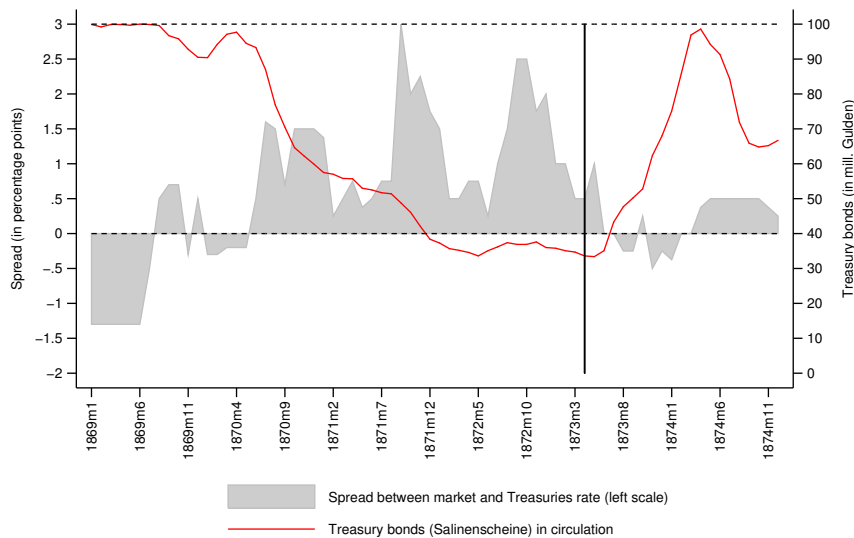
Source: Compass and Coursblatt des Gremiums der k.k. Börse–Sensale

Rates and outstanding amounts measured at the end of each month.

Austro-Hungarian monetary policy provided the second source of endogenous liquidity during the Gründerzeit. This outcome followed from a peculiar combination of the OeNB's policy target and an already booming financial market fueled by abundant cheap money. The OeNB's single most important mone-

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[41]The "market rate" referred to is the average open market short-term discount rate for bills with a maximum maturity of three months. This rate was computed and reported daily in the official stock market report of the Viennese Bourse.

[42]Legislation protecting debtors from usury rates had already been abrogated in 1869 in the broader context of arising political and economic liberalism, c.f. Reichsgesetzblatt für das Kaiserthum Österreich, '62.Gesetz vom 14. Juni 1868', *24.Stück, 62.Gesetz* (Gesetz, wodurch die gegen den Wucher bestehenden Gesetze aufgehoben werden; Vienna, 1868a), 192.

[43]The nominal interest rate should provide a fair approximation of the yield on these short-term debt instruments. Although there was no official secondary market for Salinenscheine, archival evidence on bequests suggests that they traded closely at par value. The author is indebted to Michael Pammer for this comment.

tary policy rule had a direct bearing on the Bank's credit supply to the economy. According to §14 of its charter, the OeNB was not allowed to issue paper notes worth more than 200 million of Austrian currency in excess of the silver it held: every Gulden emitted beyond the 200 million ceiling would have to be covered by reserves in specie[44]. Between 1868 and 1873, OeNB monetary policy displayed a strong commitment to this rule. As shown in Figure 3, every time the reserve requirement undershot or risked to undershoot a lower bound in the near future, the central bank increased interest rates for its lending activities. Vice versa, once reserves exceeded the threshold again, rates were immediately lowered.

Figure 3: OeNB interest rates, the market rate and §14 reserves* **(01/1868-12/1873).
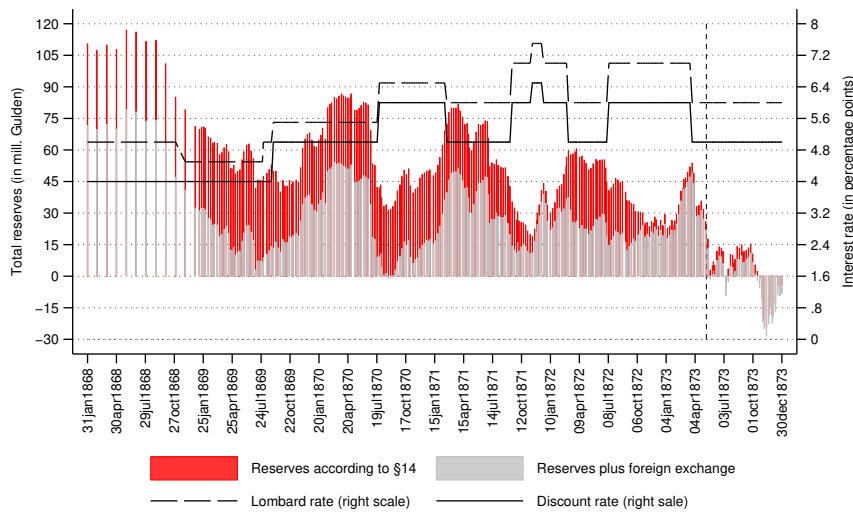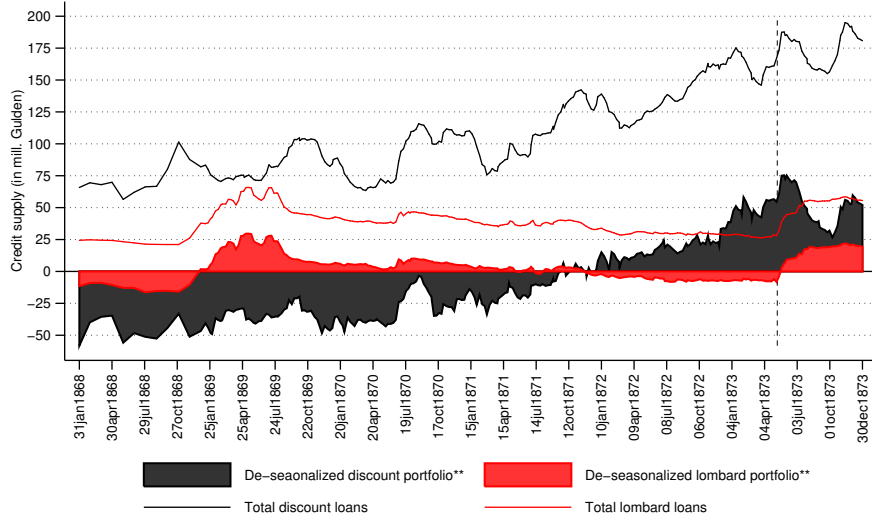

Source: own calculations; Lucam (1876)

*Between 28/07/1870 and 11/03/1871, §14 reserves include foreign exchange reserves
as decreed by the imperial regulation of 28 July 1870.
**Before 1869 only monthly data is available.

The target in §14 of the Bank's statutes, which may be compared to the provisions of Peel's Act as the corresponding regulation for the Bank of England, imposed an absolute limit on the loan supply to the economy given a fixed amount of specie reserves. However, if the central bank did not see any risk of violating its reserve requirements and observed its excess reserves standing at levels it deemed comfortable, it was in a position to prop up its interest earnings by decreasing the respective interest rates or easing quantitative restrictions on credit. At the same time, there was no particular policy space dedicated to countercyclical intervention other than the mechanism of self-regulation dictated by a dry-up of excess reserves. In fact, the bank management even strictly refused the idea that central banks had a responsibility to prevent crises or prick bubbles[45].

[44]c.f. §14 of Reichsgesetzblatt für das Kaiserthum Österreich, 'Gesetz vom 27.December 1862', *2.Stück, 2.Gesetz* (Gesetz in Betreff der Abschließung eines Uebereinkommens mit der österreichischen Nationalbank (incl. Statuten und Reglement); Vienna, 1862), 95-137.

[45]Joseph Neuwirth, *Bank und Valuta in Österreich-Ungarn: Bankacte und Bankstreit in*

Figure 4: OeNB credit supply* **(01/1868-12/1873).

Between 1867 and 1873, there were two distinct episodes when this mechanistic policy rule contributed to the build-up of a pro-cyclical central bank credit supply. The first minor one preceded the so called small stock market crash of autumn 1869 (c.f. the evolution of the OeNB's lombard loan portfolio in Figure 4). The second period, which is of more specific interest for this paper, began in the third quarter of 1871. The high demand at the discount window had provoked repeated protective action by the Bank. In November 1871 interest rates for discounts and lombards reached an all time high of 6.5 and 7.5 percent respectively[46]. According to the board's minutes, the Bank's management implemented these hikes explicitly with the aim of counteracting overly strong fluctuations of its excess reserves[47]. When prompted by supervisory board members, the OeNB's general secretary strictly discarded any allegations that the Bank's real intention was to curb the strong upward trend on the stock market[48]. At this point, commercial banks keen to avoid further increases in their refinancing costs stepped up to the OeNB to propose the introduction of a repurchase liquidity program: the big banks would pledge gold and silver to the central bank in return for cash[49]. The deal produced an apparent win-win situation given that it stabilized the provision of liquidity to the market while not endangering the central bank's policy target. Simultaneously, the OeNB displayed a remarkable willingness to cash in its foreign exchange holdings and

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Österreich-Ungarn 1862-1873, 2 vols. (1; Leipzig: Duncker & Humblot, 1873), 461 at 240.

[46]Wilhelm Ritter von Lucam, *Die Oesterreichische Nationalbank während der Dauer des 3. Privilegiums* (Wien: Manz'sche Buchhandlung, 1876), 210 at 121; 37.

[47]Pressburger and Kernbauer, *Kapitel 4. Das dritte Privilegium 1863-1877* at 1066.

[48]Ibid.

[49]Ibid., at 1058.

the marketable securities from its reserve funds in order to further strengthen the official specie cover[50]. Despite repeated interest rate hikes in 1872, the Bank's rediscount portfolio continued to grow and remained at a level approximately 55 million Gulden above its long term seasonal trend until the eve of the Gründerkrach (c.f. Figure 4). In other words, the OeNB resorted to alternative means to reconcile its policy target with the accommodation of an ever growing demand for its lending facilities.

4.2   A brief overview of banking in Austria-Hungary

Figure 5: Long-run evolution of the Austro-Hungarian banking sector (1840-1880).

Source: Brazda (2001), Compass, Gyula (1885) and Österreichische Statistik

* Joint–stock banks: pawn, mortgage and joint–stock banks stricto sensu.
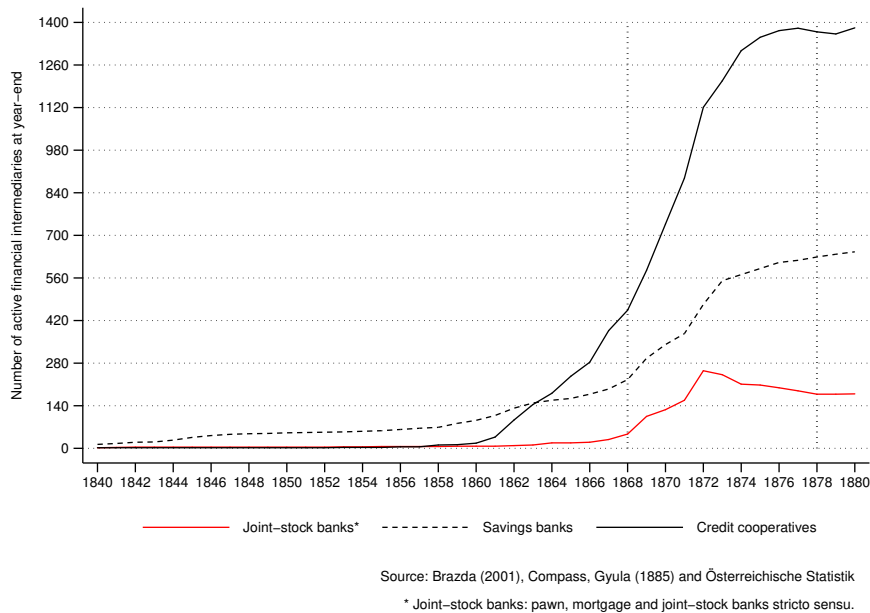
Figure 5 displays the long term evolution of the three major types of financial intermediaries which together shaped the Austro-Hungarian banking sector between 1840 and 1880[51]. It shows credit cooperatives mushrooming ever since the 1860s, when the number of savings banks also started to multiply on either side of the Leitha. In contrast, the joint-stock banking sectors of Hungary and Austria, which had remained almost inexistent until the Compromise of 1867, only started expanding very strongly in relative terms between 1868 and 1873. Whereas the Austro-Hungarian joint-stock banking sector contracted again in

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[50]Ibid., at 1078.

[51]Private banquiers are not discussed in any more detail by the present paper because no systematic financial records on their business activities are available. Besides a few exceptions such as the Rothschilds, Kövér (1992) suggests private bankers were of fairly little importance in the second half of the 19th century. They either vanished or incorporated larger joint-stock banks after the crisis of 1857, and even more so following the Gründerkrach. György Kövér, 'The Austro-Hungarian Banking System', in Rondo Cameron and V. I. Bovykin (eds.), *International banking 1870-1914* (Oxford: Oxford University Press, 1992), 319-44 at 322.

the immediate aftermath of the Gründerkrach, the other categories of credit institutions either merely stagnated or even increased in numbers. The number of institutions active in each category, however, masks the real balance of power which reigned among financial intermediaries in Austria-Hungary. During the Gründerzeit, the equity capital, defined as paid-up capital plus hedging reserves[52], of the Austrian joint-stock banking sector not only outgrew its Transleithanian homologue by many millions of Gulden, but also dwarfed the total own funds of all other types of financial intermediaries. Figure 6 shows that, as far as the expansion of the Austro-Hungarian banking sector is concerned, the period between 1868 and 1873 was largely driven by the Austrian joint-stock banking sector.

Figure 6: Decomposition of banking sector equity* ** (1868-1878)
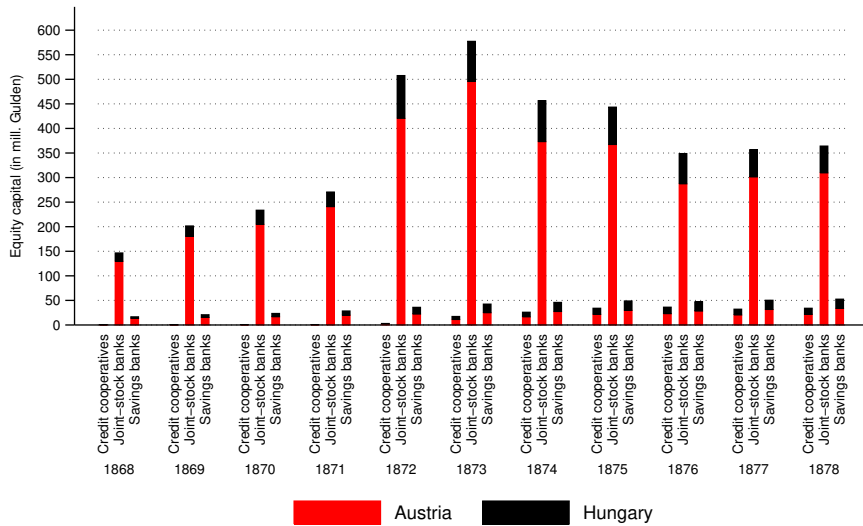
Source: Compass, Statistisches Jahrbuch and Österreichische Statistik

*Austrian savings banks did not emit share capital; thus, their own funds are fully represented by their reserve funds.
**Equity includes covered bonds of mortgage banks set up without share capital.

Austrian joint-stock banks more than doubled their numbers and paid-up equity between 1868 and 1873[53], only to see both contract again by more than 50% and 40% respectively during the years following the Gründerkrach. The number and total equity of Transleithanian joint-stock banks decreased too after May 1873, yet this contraction was less pronounced than in the Austrian case (c.f. Figure 7). Overall, the Gründerkrach represented a banking crisis very much limited to Austro-Hungarian joint-stock credit institutions, putting an end to the enormous boom this very sector had experienced since the Compromise. To be even more precise, the banking crash of 1873 and beyond amounted to a crisis of the joint-stock banking sector in the narrow sense. Table 1 corroborates this

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[52]Unless explicitly stated otherwise, this paper always uses the term "equity" to refer to paid-up capital plus hedging reserves.

[53]Equity capital peaks in 1873 rather than 1872 because surviving banks propped up their equity base following the crisis, either by increasing their stock capital or by retaining profits. Also, in many cases, losses were not written off definitely before 1874.

Figure 7: Long-run evolution of the Austro-Hungarian joint-stock banking sector* (1840-1880)

Source: Compass and Statistisches Jahrbuch

*The joint–stock banking sector includes pawn banks, mortgage banks and joint–stock banks stricto sensu.
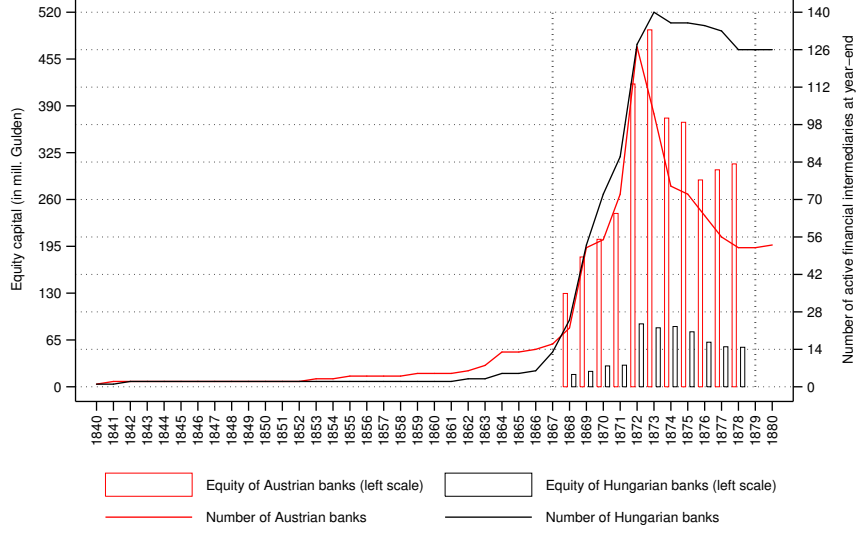
conclusion by summarizing the number of active banks as well as their equity capital for the three subcategories of the Austro-Hungarian joint-stock banking sector. While the number of active mortgage banks (*Hypothekenbanken* or *Hypothekarkreditbanken*) and pawn banks (*Pfandleihanstalten*) barely changed during the period in question, the boom and bust cycle of joint-stock banks stricto sensu (*Aktienbanken*) determined the trend of financial intermediation in the Habsburg Empire.

Table 1: Equity capital and number of joint-stock banks in Austria-Hungary (1868-1878)

	Joint-stock banks stricto sensu		Mortgage banks		Pawn banks	
	Equity in mill. fl.	Number at year-end	Equity in mill. fl.	Number at year-end	Equity in mill. fl.	Number at year-end
1868	98.1	36	44.9	9	3.7	2
1869	143.6	90	54.3	12	3.8	3
1870	155.9	110	72.9	13	5.0	4
1871	184.8	135	79.9	19	6.0	4
1872	378.6	222	122.4	27	6.8	6
1873	422.8	208	146.1	26	8.6	8
1874	300.5	183	149.9	21	6.3	7
1875	285.0	178	152.1	21	6.4	9
1876	213.3	169	129.3	20	6.5	10
1877	176.6	159	173.7	20	6.5	10
1878	169.0	150	188.7	18	6.6	10

Sources: Compass and Statistisches Jahrbuch

Given that the Gründerkrach represented a crisis of Austro-Hungarian joint-stock banking, the present paper will henceforth focus on the fate of this segment of the financial sector. Hence, a brief discussion of the legal framework govern-

ing joint-stock banks seems warranted. By definition, shareholders of Austro-Hungarian financial intermediaries founded as joint-stock companies benefitted from limited liability. Shareholders could not be made personally liable for the payables of their firm, *mis à part* their one-off contribution in the form of bank capital. As was the case for any other form of joint-stock company in Austria or Hungary after 1852[54], the establishment of financial intermediaries operating with joint-stock capital required the official approval by the Ministry of the Interior or its representations in the crownlands (*politische Landesbehörde*). In addition, the notarized statutes laying out the organizational details of the firm demanding approval had to be submitted to the competent local commercial court for recording in the trade register.

The resolution of distressed credit institutions unable to master their predicament by restructuring their business alone was also handled alike in Cis- and Transleithania. The relevant laws explicitly regulated the differences between liquidations (*Liquidation*) and bankruptcies (*Concurs*), while treating mergers (*Fusion*) as a special case of bank liquidation[55].

In order for a liquidation to take place, the shareholders of a given credit institution first had to agree to hold an extraordinary general assembly, unless the liquidation was decided on the occasion of the main annual shareholder meeting. The proposal to convene the extraordinary assembly could be put forward by the supervisory board (*Aufsichtsrat*), the bank management (*Vorstand*) and any shareholder or group of shareholders who represented at least ten percent of the bank's total nominal capital. During the extraordinary general assembly, the proposal to liquidate the bank was subsequently put to the vote, following an explanation of the proposing party why shareholders should proceed to liquidation. Liquidation had to receive a qualified majority of votes under the presence of a quorum, the exact details of which were specified in each bank's statutes. Once decided upon by the shareholders, the liquidation still needed to be approved by the regional representation of the Ministry of the Interior (the *politische Landesbehörden* mentioned before). Upon ministerial approval, the bank's assets were liquidated, creditors repaid and shareholders received a fraction of their initial contribution, the amount of which depended on how much equity had been lost. The committee of people executing the liquidation of assets and the repayment of creditors was appointed by the shareholders on the basis of a proposal by the executive board. Thus, the liquidation of a joint-stock bank represented a more or less orderly, extrajudicial bank resolution controlled by the credit institution itself.

The only exception to this ordinary way of proceeding towards liquidation

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[54]c.f. Reichs-Gesetz-Blatt für das Kaiserthum Österreich, 'Kaiserliches Patent vom 26. November 1852', *253.Gesetz* (Patent wodurch neue gesetzliche Bestimmungen über Vereine (Vereinsgesetz) angeordnet werden; Vienna, 1852), 1109-16. §207-§249 in Ministerium für Justiz und Handel (ed.), *Das allgemeine Handelsgesetzbuch vom 17.Dezember 1862, sammt dem Einführungsgesetze allen darauf bezüglichen ergänzenden und erläuternden Verordnungen*; §54-§67 of Law XVIII in Orosz (ed.), *Gesetzesartikel des ungrischen Reichstages 1839-1840, nebst dem Wechselrechte und den übrigen Creditgesetzen für das Königreich Ungarn.*

[55]c.f. §242 et seqq. Ministerium für Justiz und Handel (ed.), *Das allgemeine Handelsgesetzbuch vom 17.Dezember 1862, sammt dem Einführungsgesetze allen darauf bezüglichen ergänzenden und erläuternden Verordnungen.*

consisted of the case in which the management board of a given bank became aware that more than 50% of paid up capital had been lost during the current business year. For these particular circumstances, the Code of Commercial Law stipulated that the bank's management board would have the obligation to convene an "extraordinary assembly" by its own initiative, while also having to inform the politische Landesbehörde about the credit institution's financial situation. Moreover, in this special case, the Code of Commercial Law endowed the politische Landesbehörde with considerable discretionary authority, as the latter was given the right to force and implement the liquidation of the bank in question, even without the agreement of its shareholders.

Mergers of joint-stock banks represented de jure liquidation procedures during which shareholders of the target bank agreed to accept shares of an acquiring institution in return for their own holdings in a predetermined ratio. For a merger to take place, the politische Landesbehörde had to be notified and agree to the intended acquisition. After the exchange of shares, the acquired institution was deleted from the commercial register and the acquiring bank took over all assets and liabilities of its target. If two firms merged with the intention of creating an entirely new bank, the two founding institutions both formally liquidated, pooling assets and liabilities once the two types of old shares were replaced by one new set of stocks.

Finally, outright bankruptcy applied when a bank's total liabilities exceeded its total assets[56]. In other words, by its very definition, bankruptcy signaled a state of affairs in which losses had outgrown the total amount of a given bank's equity. Whenever total liabilities exceeded total assets, the managing board was under the obligation to notify the local commercial court to open a bankruptcy procedure. Alternatively, creditors could report a bank's de facto suspension of payments to the local commercial court and demand the imposition of bankruptcy procedures upon verification of the financial situation of the denounced institution. The court then set a date for the convocation of the bank's creditors to decide upon the most effective way to liquidate the remaining assets. Since the case of bankruptcy required a complete wipe-out of equity, shareholders had no claim on remaining assets.

Figure 8 provides an overview of the distribution of bank closures across the three types of failures for the period from 1868 until 1878[57]. Starting in 1873, the impact of the Gründerkrach on the banking sector is clearly visible. Bank closures were clustered strongly in the Empire's major cities and the overwhelming majority of bank closures took the form of liquidations.

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[56]c.f. §240 and §5 respectively in Ministerium für Justiz und Handel (ed.), *Das allgemeine Handelsgesetzbuch vom 17.Dezember 1862, sammt dem Einführungsgesetze allen darauf bezüglichen ergänzenden und erläuternden Verordnungen* at 89; Orosz (ed.), *Gesetzesartikel des ungrischen Reichstages 1839-1840, nebst dem Wechselrechte und den übrigen Creditgesetzen für das Königreich Ungarn* at 189.

[57]Since no bank failures were recorded in 1868 and 1869, these two years are not included in Figure 8.

Figure 8: Terminal bank closures in Budapest, Prague, Vienna and the Provinces (1870-1878)
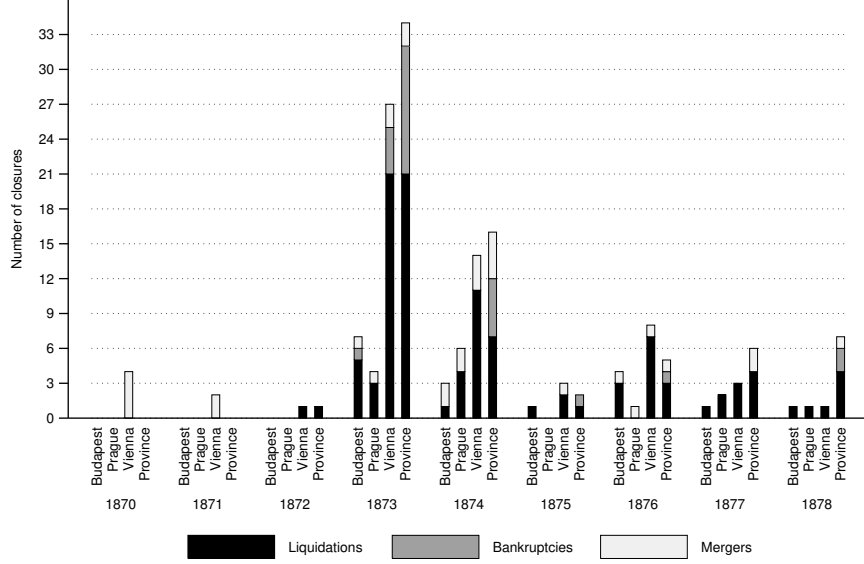
Source: Compass and Statistisches Jahrbuch

5 Causes of bank closures during the "Gründerkrach"

5.1 Primary sources and data

The present paper brings to bear a large array of new financial and archival data. At the core of this paper figures a bank-level panel data set which contains more than 130 variables covering background information, balance sheets as well as profits and loss statements of joint-stock banks, mortgage banks and pawn banks operating in Austria-Hungary between 1868 and 1878. The data for the panel was retrieved from two independent primary sources: on the one hand, the official statistical yearbooks for Austria and Hungary compiled by the imperial statistical commissions for the two halves of the Empire; and a financial yearbook edited by a private publishing house, the so-called "Compass", on the other hand. The annual reporting frequency for balance sheets and profits and loss statements determines the time index of the data set, while its panel component is given by the number of banks operating and reporting each year.

The Compass plays an equally crucial role in the compilation of secondary data sets employed in this paper. Most noteworthy in this regard are the summaries of credit institutions' general and extraordinary shareholder assemblies which enable the reader to extract information on business links between banks (foundations of banks from within the banking sectors, mutual provision of banks' payment services on each other's behalf, correspondence networks, joint participation in investment consortia or underwriting syndicates). For a con-

siderable number of financial intermediaries which closed down following the crash in May 1873, the summaries edited by the Compass also mention descriptive reasons for failure in the case of bankruptcy and / or the motivation for the board's proposal to liquidate or merge. This qualitative data proves useful for understanding the driving forces behind different types of bank failure (c.f. Table 4 in the appendix).

Newspapers and specialized finance magazines helped satisfying diverse supplementary data needs. "Der Tresor", a review on economic and financial statistics of the Austro-Hungarian Empire published on a weekly basis between 1872 and 1918, was drawn upon to assemble data on the monthly status of retail (deposit) funding and yield curves on retail deposits for a subsample of banks from Cis- and Transleithania. Data availability limits the series on retail funding to the period from March 1872 to April 1874 while interest rates on retail deposits are at disposal only for the short period between December 1872 and May 1873.

In order to capture both the origins and the extent of the Gründerboom as well as the severity of the crash after May 9th 1873, this study created a new panel data set containing individual monthly stock market prices for all stocks and bonds, public and private, traded on the Vienna Stock Exchange (VSE) between January 1867 and December 1874. In addition to the three conventional types of quotes reported (average, bid and ask), the panel records the industry type of the issuing firm, the nominal amount of the stock or bond as well as its currency denomination and the actual amount already paid on the quoted stock by the shareholders for each financial instrument. The two sources feeding into the stock market panel data set are the daily official stock market reports of the VSE, the "Coursblatt des Gremiums der k.k. Börse-Sensale", on the one hand and the daily issues of the "Wiener Zeitung", a daily newspaper which exists since 1703, on the other hand.

Apart from banks' balance sheets and income statements, the Coursblatt is the only quantitative source that delivers direct evidence for the existence of a dynamic repo market during the first years of Austro-Hungarian dualism. Albeit only for very small number of stocks, the Coursblatt provides daily interest costs for overnight repos which can be collected and converted into annualized repo rates in order to generate a continuous picture of the market's evolution during the Gründerzeit. These rates have been collected on a weekly basis between December 1868 and December 1874 alongside the prices of stocks serving as collateral. The data is unique in that it likely summarizes the only systematically available information on the state of the Austro-Hungarian repo market during the Gründerzeit conserved until the present day. Carefully interpreted, the calculated rates may serve as a barometer for the repo market in the Habsburg Empire.

Weekly and monthly balance sheet data of Austria's National Bank (OeNB) was retrieved from the Wiener Zeitung and the annual reports which were compiled by the OeNB for the occasion of its shareholder meetings. The annual reports are available at the OeNB's historical archives in Vienna[58], whose wealth

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[58]Oesterreichische Nationalbank (OeNB), 'Dokumentationsmanagement und Kommunikationsservice, Bankhistorisches Archiv', *Supervisory board and board of directors meeting min-*

of qualitative evidence in the form of protocols from the board of directors'
and the supervisory council's meetings also served as valuable input in order to
document the monetary policy response to the crisis.

Additional qualitative evidence was retrieved from the Viennese archives
of the Creditanstalt. The Creditanstalt archives contain the only systemati-
cally preserved documents produced by commercial banks in business while the
Gründerkrach was still ravaging. Since the bank merged with and acquired
some of the most important financial institutions operating in Austria during
the second half of the 19th century, its archives inherited a wealth of historical
documents issued by the Bodencreditanstalt, the Allgemeine Depositenbank,
the Wiener Bankverein and the Anglo-Oesterreichische Bank[59]. This study
engages with material drawn from the protocols of the Creditanstalt's and Bo-
dencreditanstalt's directorates as well as supervisory councils to corroborate the
econometric analysis and robustness checks with insights from qualitative case
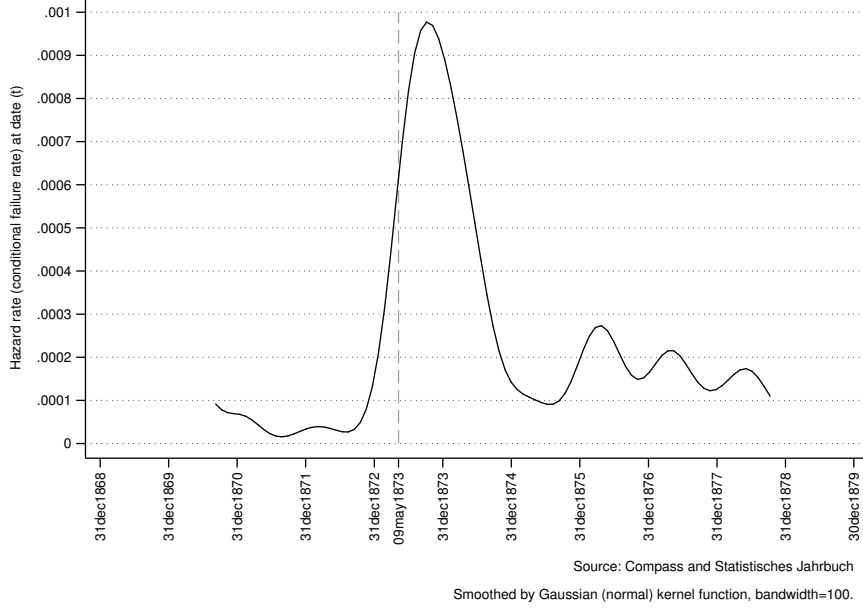study evidence.

5.2   Methodology

The Kaplan-Meier estimator constitutes the standard non-parametric estimator
employed to compute the empirical survivor function of a given data set. Figure
9 shows the empirical hazard rate underlying this study's bank-level data. The
probability of bank failure peaks around seven months after the start of the
Gründerkrach, at the end of 1873. Outside a window of 24 months between
December 1872 and December 1874, the hazard rate stagnates at low levels,
although smaller local maxima in 1876, 1877 and 1878 hint at a protracted
instability of the banking sector in the years following May 1873. Most impor-
tantly, Figure 9 strongly suggests that the normality assumption is violated by
the panel data covering Austro-Hungarian banks between December 31st 1868
and December 30th 1879. Any hazard rate derived from a sample of normally
distributed failure times would be exponentially increasing with analysis time.
This feature is clearly missing in the empirical hazard rate plotted in Figure 9.
Hence, an explanation of the bank failures in the aftermath of the Gründerkrach
should resort to econometric models which are unconstrained by the normality
assumption of OLS regressions. This paper therefore draws on semi-parametric
survival analysis methods to investigate the causes of bank closures during the
Austro-Hungarian Gründerkrach.

Two more reasons underpin this paper's methodological choice. First, sur-
vival analysis is able to accommodate day-to-day changes in the intensity of the
baseline failure process. Survival analysis, and in particular semi-parametric
modeling, can deal with changes in the overall transition probability over time
without having to rely on distributional assumptions about the evolution of the
baseline risk of failure. It effectively separates the changes in the probability
of failure of individual subjects from shifts in the underlying, general baseline

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utes (Vienna: Rotenhausgasse 4, A-1090 Wien, Austria, 2015).

   [59]8899/Historical Section Bank Austria - Member of UniCredit, 'Creditanstalt and Boden-
creditanstalt historical archives', *Supervisory board and board of directors meeting minutes*
(Vienna: Z114, Lassallestraße 1, A-1020 Vienna, Austria, 2015).

Figure 9: Non-parametric estimate for the hazard function of Austro-Hungarian banks

Source: Compass and Statistisches Jahrbuch

Smoothed by Gaussian (normal) kernel function, bandwidth=100.

probability of failure[60]. Second, some form of controlling for fixed effects at the bank-level or another fine degree of disaggregation should be important for this study since available balance sheets as well as profits and loss statements alone are unlikely to capture the entirety of credit institutions' characteristics relevant for their failure experience. Survival analysis is an excellent econometric tool for handling panel data sets which would suffer from incidental parameter bias as well as collinearity problems when treated by fixed effects methods in logit or probit models. Its toolbox contains methods akin to fixed effects estimation which neither rely on the inclusion of individual dummies, nor require the same restrictive preconditions as conditional panel logits. Fixed effects estimation in survival analysis goes by the name of "baseline hazard stratification". Stratification on group variables amounts to allow for different baseline hazards across these groups and therefore represents a neat way of controlling for (time-varying) "fixed effects" in the panel data.

Given the geographic clustering of bank failures in large cities (c.f. Figure 8 in Section 4.2), stratification on the city-level is crucial for this paper's econometric analysis. Also, taking into account the discussion of the varying propensity of bank types to suffer from liquidity shortages in response to funding withdrawals (c.f. Section 3.2), stratification on the type of credit institutions (joint-stock banks stricto sensu, mortgage banks and pawn banks) should be helpful for singling out the effect of the time-varying covariates of interest on banks' survival experience. The only trade-off involved in stratification is the

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[60]Charles W. Calomiris and Joseph R. Mason, 'Contagion and Bank Failures During the Great Depression: The June 1932 Chicago Banking Panic', *American Economic Review*, 87/5 (1997), 863-83 at 876.

loss of the ability to include the grouping (i.e. cities and bank types) variables directly into the model[61]. As long as the focus of research rests on the remaining regressors rather than the exact effect of grouping variables, this trade-off should not be too worrying. To be sure, by construction, stratification on the bank-level is not possible if one intends to include explanatory variables in the model. If each bank were granted its own baseline hazard, no variation would remain left to be explained by the regressors.

Apart from informing baseline model selection, the non-parametric analysis also conveys a compact overview of the distribution of bank failures in the observation period spanned by this study's panel data. Figure 10 summarizes the Gründerkrach banking crisis in one single graph, the empirical survivor function. Overall, banks approximately had a 50% chance to survive the crash, with the strongest decrease in survival probability occurring during the 12 months following Black Friday. On average, banks stayed in operation until the end of 1876 and half of the bank population had disappeared by December 1877. Full sample mean and median survival times are only partly representative, however, given that they take into account both Gründerkrach "closures" and "survivors".

Figure 10: Kaplan-Meier estimator for the survivor function of Austro-Hungarian banks

Source: Compass and Statistisches Jahrbuch
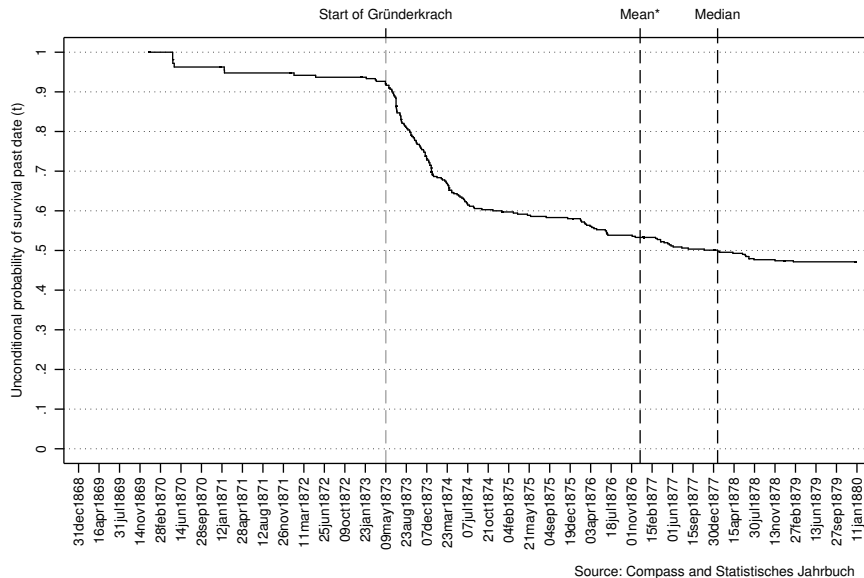
*Restricted mean; exponentially extended mean at 07 November 1883 (t=5424)

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[61] Mario Alberto Cleves et al., *An Introduction to Survival Analysis Using Stata* (3 edn.; College Station Texas: Stata Press, 2010), 412 at 200.

5.3 Model and variable choice

From the range of available survival analysis techniques, this study employs semi-parametric methods. More precisely, the present paper analyses the determinants of bank failure during the Austro-Hungarian Gründerkrach by drawing on Cox proportional hazard regression. The really defining feature of Cox proportional hazard regression is the so called proportionality assumption. Cox regression models the individual hazards of the subjects in the data set as multiplicative replica of the baseline hazard and, therefore, of each other[62]. There is a large array of graphical and formal statistical tests which can be drawn upon post estimation to check whether the data fits the proportionality constraint of Cox regression. Hence, the satisfaction of the proportionality requirement boils down to a testable empirical condition of the data.

Before spelling out the precise Cox model specification for this paper's baseline regression, a brief discussion of the general set-up and the relevant variables is warranted. In order to include as many control cases as possible, this study covers bank-level panel data from 1868 until 1878. To be sure, the fact that this paper takes into account bank closures which occurred from up to three years before and five years after the crash in May 1873[63] considerably raises the stakes against econometric findings matching the narrative in the following sections. As will be discussed in Section 6.2, the Kostgeschäft played a particularly important role in "Gründerbanking" only during the high noon of the boom in 1872 and 1873. The inclusion of bank closures outside a narrow window after the crash in May 1873 should make it more difficult to identify banks' exposure to repos as a statistically and economically significant predictor of failure, especially after controlling for more traditional indicators of financial weaknesses such as, for example, banks' leverage ratios.

In the Cox regressions, the onset of risk is on December 31st 1868 – the first date for which bank-level data has been collected[64]. Therefore, credit institutions which preexisted this date enter the econometric model right from the beginning of analysis time. Members of the Austro-Hungarian banking population founded at a later moment between December 1868 and December 1879 only enter the study at the end of their foundation year, when their financial statements become available for the first time. Covariates extracted from banks' balance sheets as well as profits and loss statements on December 31st of year y are used to predict the risk of failure in the following twelve months until December 30th of year $y + 1$. On this date the values of the independent variables change to reflect the new information available from financial statements for the estimation of the hazard rate in year $y + 2$ and so forth. Since the last set of bank-level information stems from December 31st 1878, all bank closures that occurred before December 30th 1879 enter the estimation sample. Banks which managed to survive until after this date are right-censored. Right-censoring is the standard way of dealing with non-failing subjects in studies running for a

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[62]Ibid., at 129.

[63]The first bank failure in the sample occurs on May 2nd 1870 and the last closure happens on February 16th 1879; c.f. Table 4 in the appendix.

[64]For the non-parametric estimates presented above the same onset of risk was used.

pre-specified length of time[65].

Time to failure represents the dependent variable for all the regression models estimated in this study. Time to failure is measured in days because the data set records the exact date of each bank's terminal closure. Figure 8 in Section 4.2 has already highlighted that terminal bank closure in Austria-Hungary between 1868 and 1878 necessarily took one of three forms: liquidation, merger or bankruptcy. This paper pools all three types of bank closures when examining the causes of bank distress during the Austro-Hungarian Gründerkrach. There are two distinct reasons for this way of proceeding. The first one is purely technical. The explanatory power of semi-parametric survival analysis hinges on the number of failures, rather than the number of observations in the analyzed data. The more failures occur, the more comparisons between banks can be implemented by the Cox regression set-up in order to estimate the effect of covariates on the time to failure. To be sure, all the results discussed below hold if the dependent variable is limited to liquidations only. Unfortunately, a similar separate analysis cannot be conducted for mergers and bankruptcies as they do not occur in numbers large enough to enable the estimation of separate models. Yet, the second rationale provides an alternative line of defense for pooling over failure types. The qualitative evidence in Table 4 and the discussion thereof in the appendix strongly suggests that mergers and liquidations did not represent types of bank closures which were driven by underlying causes fundamentally different from those triggering outright bankruptcy. The difference between these forms of bank closure appears to amount to a difference in the extent of losses rather than any kind of essential difference in the nature of the failure process. During the Austro-Hungarian Gründerkrach, mergers, liquidations and bankruptcies were located alongside a continuum of loss intensity; all three paths to closure constituted manifestations of bank distress. While bankruptcy by definition incarnated situations in which losses had already surpassed total disposable equity, liquidations and mergers constituted reactions to ongoing or anticipated losses with the aim of preemptively foreclosing bankruptcy as the worst case scenario.

Banks' exposure to Kostgeschäft represents the main regressor of interest in all Cox model specifications estimated for this study. For the purpose of measuring the intensity of exposure, the independent variable is defined as the ratio of a bank's repo portfolio to its equity. Specified in this way, credit institutions' repo exposure proxies for the extent of potential cuts into a bank's equity due to defaulting Kostgeschäft borrowers and subsequent damaging collateral liquidations.

The control variables selected for the econometric analysis of this paper are almost exclusively time-varying and reflect two types of regressors. The first group of regressors consists of a set of financial characteristics and bank weaknesses which emerge as particularly relevant predictors from previous work on the causes of bank distress in similar historical contexts[66]. The selected covari-

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[65]Ibid., at 30.

[66]c.f. David C. Wheelock and Paul W. Wilson, 'Why Do Banks Disappear? The Determinants of U.S. Bank Failures and Acquisitions', *Review of Economics and Statistics*, 82/1 (2000), 127-38; Charles W. Calomiris and Joseph R. Mason, 'Fundamentals, Panics, and Bank Distress During the Depression'. A more recent example is Christopher L. Colvin, Abe de

ates respond to the need of controlling for bank-level weaknesses in the most encompassing way possible in order to single out the impact of Kostgeschäft exposures on the risk of failure. Controlling for these variables identifies statistically relevant channels to bank distress. This way of proceeding also allows for a judgment on whether balance sheet constraints such as liquidity mismatches directly drove bank failure or whether their effect was largely through losses accumulated by damaging Kostgeschäft collateral liquidations (or anticipations thereof).

The first group contains the following control variables. The natural logarithm of banks' total assets is included to control for bank size. Previous work generally finds that the risk of failure decreases with bank size. Bank age represents a second generic control variable which other contributions find to be negatively correlated with the probability of bank demise. The share of illiquid assets in total assets is one of two control variables[67] that intend to capture liquidity mismatches on bank balance sheets. Illiquid assets include banks' participation in investment syndicates and consortia, investments in real estate and companies, mortgage loans, and other long-term loans. Intuitively, the share of illiquid assets in total assets should be positively correlated with the risk of failure. The share of callable debt in total liabilities proxies for the share of funding on bank balance sheets which is susceptible to disappear quickly in times of distress due to its short maturity and mostly unsecured nature. Callable debt is defined as the sum of repo funding[68], total retail deposits (normal deposits plus Cassenscheine), and other sources of unsecured short-term funding (including interbank loans). Total liabilities represent the difference between total assets and equity. Ceteris paribus, higher callable debt ratios should be correlated with a heightened risk of bank closure.

In order to control for the size of the available capital buffer relative to total bank assets, the present paper draws on the leverage ratio which is defined as the ratio of banks' total assets to equity. Higher leverage ratios signal a lower equity buffer and, therefore, increased risk taking on the part of banks. One would expect higher leverage ratios to be positively related to the odds of bank distress. Sixth, credit institutions' overall profitability as proxied by the bank-level return on equity is taken into account. This study defines return on equity as the ratio of net profits after taxes to bank equity. A higher return on equity in a given year should allow banks to build up more contingency reserves to cover losses in bad times: high profitability increases the capacity of banks to build up reserve funds in addition to satisfying their shareholders' demands

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Jong, and Philip T. Fliers, 'Predicting the past: Understanding the causes of bank distress in the Netherlands in the 1920s', *Explorations in Economic History*, 55 (2015), 97-121. For a survey of earlier work, c.f. Calomiris and Mason, 'Contagion and Bank Failures During the Great Depression: The June 1932 Chicago Banking Panic'.

[67]This study also experimented with including the cover ratio (reserves-to-callable-debt ratio) discussed in the context of Figure 20 in Section 7.3. Due to collinearity problems with the share of illiquid assets, an inclusion of the cover ratio alongside the illiquid assets and callable debt shares in total assets resulted in a non-converging log-likelihood. When included instead of the illiquid asset share, the cover ratio remained very insignificant. It increased the standard errors on the callable debt ratio but did not affect the coefficients on other regressors.

[68]Some banks financed themselves via repos. However, the ratio of Kostgeschäft liabilities to Kostgeschäft assets in the banking sector never exceeded 5%. This corroborates the narrative presented in Section 7.2 according to which most repo borrowers were investors at the Bourse.

for dividend payments. Hence, return on equity is expected to be negatively correlated to the probability of failure. The ratio of loss loan provisions to total loans serves as an indicator of asset quality which is anticipated to be positively correlated to the hazard rate of a given bank. Loss loan provisions appear directly in the expenditures rubric of credit institutions' profits and loss statements. Total loans include discount loans, lombard loans, mortgage loans and unsecured loans, such as interbank loans. Finally, the baseline specification of the Cox regression also harbors a binary variable indicating whether banks operated a branch network in Austria-Hungary in a given year. The existence of a branch network could have either a negative or a positive effect on the survival performance of banks as the net impact of geographic diversification in terms of assets and liabilities cannot be determined a priori.

The second category of regressors consists of a set of bank characteristics which represent control variables corresponding to Gründerkrach specifics other than Kostgeschäft. The first variable from this group is credit institutions' real estate loan share. Given the strong development of the construction sector reflected in Figure 1 in Section 2, banks' exposure to mortgage loans might be suspected of having played an instrumental role in bringing about financial distress. The real estate loan share is computed as the ratio of mortgage loans to total loans. Mortgage loans constitute an independent position on banks' balance sheets and the sum of total loans is defined as above. More extensive exposure to mortgage loans is expected to induce a higher risk of failure.

Since only very few credit institutions provided a break-down of their securities portfolio by type, it is impossible to create a variable targeting any specific class of securities holdings. Yet, proprietary trading more generally appears as a potentially important structural feature of the Gründerbanking business model (c.f. Section 6.1). Therefore, this study draws on the ratio of banks' aggregate securities portfolios to equity in order to proxy for the loss potential deriving from proprietary trading accounts in the aftermath of the stock market crash.

Tightly woven interbank relations constitute another particular feature of the Austro-Hungarian banking sector during the Gründerzeit. There is no obvious ex ante expectation associated to the sign of these covariates' effect. Controlling for them appears to be worthwhile nevertheless, not least in order to check the robustness of other coefficients to their inclusion. A binary dummy is generated to flag credit institutions which were founded by other banks in the sample rather than constituting creations of founders from outside the banking sector. The baseline Cox regression also comprises a cardinal covariate which measures the total number of credit institutions involved in the foundation of a given bank. Turning to the other side of the coin, banks which acted as founders of other credit institutions and then organized the initial public offering (IPO) for their fosterlings are also flagged by a binary dummy in the baseline model. This dummy switches on only if the bank in question became active as a founder in a given year. For the purpose of measuring the impact of such IPO activities more precisely, this study also constructs a second time-varying variable which compares the total nominal amount of the stocks of banks founded by a particular credit institution in a given year to that credit institution's own equity. This ratio is adjusted to account for the number of banks involved

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in the foundation process. For a better understanding of how this covariate is constructed, consider a simple example. Bank A, equipped with 2 million Gulden of equity, founds bank B and C in 1872. Bank B and C each have a nominal stock capital of 1 million Gulden. Bank A founds bank B alone but bank C is set up together with two other credit institutions. For Bank A, the covariate of interest in 1872 would be calculated in the following way: $ratio_{A,1872} = \frac{1000000 + \frac{1000000}{3}}{2000000} \cdot 100\% = 67\%$.

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Model 1 summarizes the baseline specification for the Cox regressions estimated in this paper:

$$
\begin{aligned}
h_{i,t_y}(t) = h_0(t)_{t_y} \cdot exp(&\beta_1 \cdot kostratio_{i,y-1} + \beta_2 \cdot size_{i,y-1} + \beta_3 \cdot age_{i,y-1} \\
&+ \beta_4 \cdot illiquid_{i,y-1} + \beta_5 \cdot callable_{i,y-1} + \beta_6 \cdot lev_{i,y-1} + \beta_7 \cdot roe_{i,y-1} + \beta_8 \\
&\cdot llp_{i,y-1} + \beta_9 \cdot branch_{i,y-1} + \gamma_1 \cdot mortgage_{i,y-1} + \gamma_2 \cdot secratio_{i,y-1} + \gamma_3 \\
&\cdot founded_i + \gamma_4 \cdot nfounded_i + \gamma_5 \cdot founder_{i,y-1} + \gamma_6 \cdot iporatio_{i,y-1})
\end{aligned}
$$

$$(1)$$

where $h_{i,t_y}(t)$ represents the hazard rate of bank i on day t of year y, $h_0(t)_{t_y}$ is the baseline hazard faced by all banks on day t of year y, $kostratio_{i,y-1}$ stands for the Kostgeschäft-to-equity ratio at year-end of year $y-1$, $size_{i,y-1}$ is the natural logarithm of total assets at year-end of year $y-1$, $age_{i,y-1}$ constitutes the age of bank i at year-end of year $y-1$, $illiquid_{i,y-1}$ represents the share of illiquid assets in total assets at year-end of year $y-1$, $callable_{i,y-1}$ captures the share of callable debt in total liabilities at year-end of year $y-1$, $lev_{i,y-1}$ symbolizes the leverage ratio at year-end of year $y-1$, $roe_{i,y-1}$ is the return on equity at year-end of year $y-1$, $llp_{i,y-1}$ stands for the ratio of loss loan provisions to total loans at year-end of year $y-1$, $branch_{i,y-1}$ is a binary variable taking the value of one if bank i operated a branch network at year-end of year $y-1$, $mortgage_{i,y-1}$ represents the ratio of mortgage loans to total loans at year-end of year $y-1$, $secratio_{i,y-1}$ is the ratio of the proprietary trading portfolio to equity at year-end of year $y-1$, $founded_i$ constitutes a time-invariant dummy taking the value of one if bank i was founded by another credit institution, $nfounded_i$ is also time-invariant and acts for the number of banks involved in the foundation of bank i, $founder_{i,y-1}$ stands for a dummy taking the value of 1 if bank i founded any credit institutions in year $y-1$, and finally, $iporatio_{i,y-1}$ constitutes the bank stock IPO-to-equity ratio for the year $y-1$. Of course, all independent variables are measured at the bank-level, that is, they correspond directly to bank i.

Table 2 contains the descriptive statistics for all variables included in the baseline Cox model. Besides the usual statistics, column 7 in Table 2 also displays the p-values and the suggested direction resulting from mean comparison tests

between surviving and failing banks during the Gründerkrach. Except for the securities portfolio-to-equity ratio (rejection of equality at the 10% level), the null of mean equality is always rejected at the 1% level.

Table 2: Summary statistics for baseline Cox models

Variable	Obs	Mean	Std. Dev.	Min	Max	P-value*
kostratio	1526	2.85	20.92	0.00	666.23	0.00*** (S<C)
size	1526	14.13	1.79	9.12	19.06	0.00*** (S<C)
age	1526	4.92	5.23	0.00	38.00	0.00*** (S>C)
illiquid	1526	32.93	28.6	0.00	100.00	0.00*** (S<C)
callable	1526	69.92	30.7	0.00	100.00	0.00*** (S<C)
lev	1526	370.23	311.18	100.44	2525.34	0.00*** (S>C)
roe	1526	8.10	16.01	-88.76	108.77	0.00*** (S>C)
llp	1526	0.88	6.44	0.00	140.81	0.00*** (S<C)
branch	1526	0.16	0.36	0.00	1.00	0.00*** (S<C)
mortgage	1526	14.91	28.57	0.00	100.00	0.00*** (S>C)
secratio	1526	19.44	43.21	0.00	655.90	0.06* (S<C)
founded	1526	0.30	0.46	0.00	1.00	0.00*** (S<C)
nfounded	1526	0.47	1.01	0.00	8.00	0.00*** (S<C)
founder	1526	0.05	0.21	0.00	1.00	0.00*** (S<C)
iporatio	1526	4.52	35.65	0.00	808.33	0.00*** (S<C)

*P-values and direction of mean equality test (t-tests) between survivors (S) and closures (C).

The difference between the formal specifications of Model 1 and Model 2 below consists in the fact that the latter allows the baseline hazard $h_0(t)_{t_y,c,b}$ on day t of year y to vary for each city c and each bank type b in the sample. The stratifications of the baseline hazard according to bank type and city result in 384 different possible baseline hazards on day t of year y. On top of controlling for bank type and city-level fixed effects, Model 2 also corrects standard errors for serial correlation on the bank-level over time (clustered standard errors):

$$h_{i,t_y}(t) = h_0(t)_{t_y,c,b} \cdot exp(\beta_1 \cdot kostratio_{i,y-1} + \beta_2 \cdot size_{i,y-1} + \beta_3 \cdot age_{i,y-1}$$
$$+ \beta_4 \cdot illiquid_{i,y-1} + \beta_5 \cdot callable_{i,y-1} + \beta_6 \cdot lev_{i,y-1} + \beta_7 \cdot roe_{i,y-1} + \beta_8$$
$$\cdot llp_{i,y-1} + \beta_9 \cdot branch_{i,y-1} + \gamma_1 \cdot mortgage_{i,y-1} + \gamma_2 \cdot secratio_{i,y-1} + \gamma_3$$
$$\cdot founded_i + \gamma_4 \cdot nfounded_i + \gamma_5 \cdot founder_{i,y-1} + \gamma_6 \cdot iporatio_{i,y-1})$$
$$(2)$$

5.4 Results

Table 3 conveys the results for the baseline and the stratified baseline specifications of this study. The regressions cover a sample of 302 individual banks corresponding to 1526 observations between 1868 and 1878. One third of these banks, exactly 100, closed down during the Gründerkrach. In both models, the LR-chi2 and Wald-chi2 tests for the overall significance of the models indicate considerable predictive power with p-values of 0 up to the fourth decimal place. The link test based on re-estimation of the equation with squared linear predictors cannot reject the null of correct specification at conventional confidence levels in any of the two cases (p-values of 0.95 and 0.73 for the baseline and the stratified baseline model). The Schoenfeld residual test checks whether the proportional hazard assumption is likely to be violated by the model. The null

hypothesis of proportionality is rejected in the baseline model without stratification at the 5% level; yet, the very high p-value of 0.93 strongly suggests that the assumption of proportionality holds for the stratified baseline model. This difference in results between the baseline model and the stratified baseline specification hints at the importance of controlling for stratification of the baseline hazard according to bank type and location. The fact that the proportionality of bank-level hazards with regard to the baseline hazard can only be guaranteed at a granular level does not come as a surprise: Table 1 and Figure 8 in Section 4.2 already hinted at the stark differences between failure dynamics across bank types and in different locations.

Table 3: Results for baseline Cox regressions (Models 1 and 2)

	(1) baseline	(2) stratified baseline
kostratio	1.008***	1.009***
	(4.93)	(4.35)
size	1.111	0.758**
	(1.06)	(-2.23)
age	0.830***	0.825***
	(-3.39)	(-2.92)
illiquid	1.026***	1.019***
	(5.25)	(3.38)
callable	0.995	1.002
	(-1.35)	(0.36)
lev	1.001***	1.001*
	(3.56)	(1.73)
roe	0.963***	0.964***
	(-7.63)	(-4.99)
llp	1.007	1.007
	(1.06)	(1.15)
branch	1.000	1.109
	(-0.00)	(0.33)
mortgage	0.968***	0.984
	(-4.82)	(-1.56)
secratio	1.003	1.000
	(0.78)	(0.07)
founded	1.839**	1.890*
	(2.05)	(1.87)
nfounded	0.765**	0.685***
	(-2.29)	(-3.02)
founder	0.469	0.663
	(-1.62)	(-0.77)
iporatio	1.000	1.002
	(0.30)	(1.35)
City fixed effects	×	✓
Bank-type fixed effects	×	✓
Clustered standard errors	×	✓
N	1526	1526
Banks	302	302
Failures	100	100
Total time at risk	539009	539009
Log-likelihood	-433.50317	-138.81084
Prob-Chi2	0.0000	0.0000
Schoenfeld residuals test	0.0130	0.9283
Link test	0.954	0.735

Coefficients reported in hazard ratio form;
Robust (clustered) standard errors in (2); z-statistics in parentheses.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Coefficients on the variables are reported in the form of hazard ratios, which is the traditional way of displaying the marginal effects in survival regressions. The interpretation of the hazard ratio is simple: it represents the percentage increase (or decrease) in the bank-level hazard rate triggered by a one unit

increase in the respective independent variable. Hazard ratios above one indicate an increasing risk of failure with increasing values of the corresponding covariate while hazard ratios below one signal that the bank-level hazard rate falls as the regressor's values increase.

Both baseline models estimate a statistically and economically highly significant effect of the Kostgeschäft-to-equity ratio on bank-level hazard rates. Even after controlling for time-varying bank type and city fixed effects, the variable measuring banks' exposure to repos remains statistically significant at the 1% level. The hazard ratios of 1.08 and 1.09 in the baseline and the stratified baseline specification indicate that a 1% increase in the repo-to-equity ratio translates into an almost 1% increase in the hazard rate. In other words, increases in the ratio of Kostgeschäft to bank equity basically trigger a one-to-one increase in the corresponding instantaneous rate of failure.
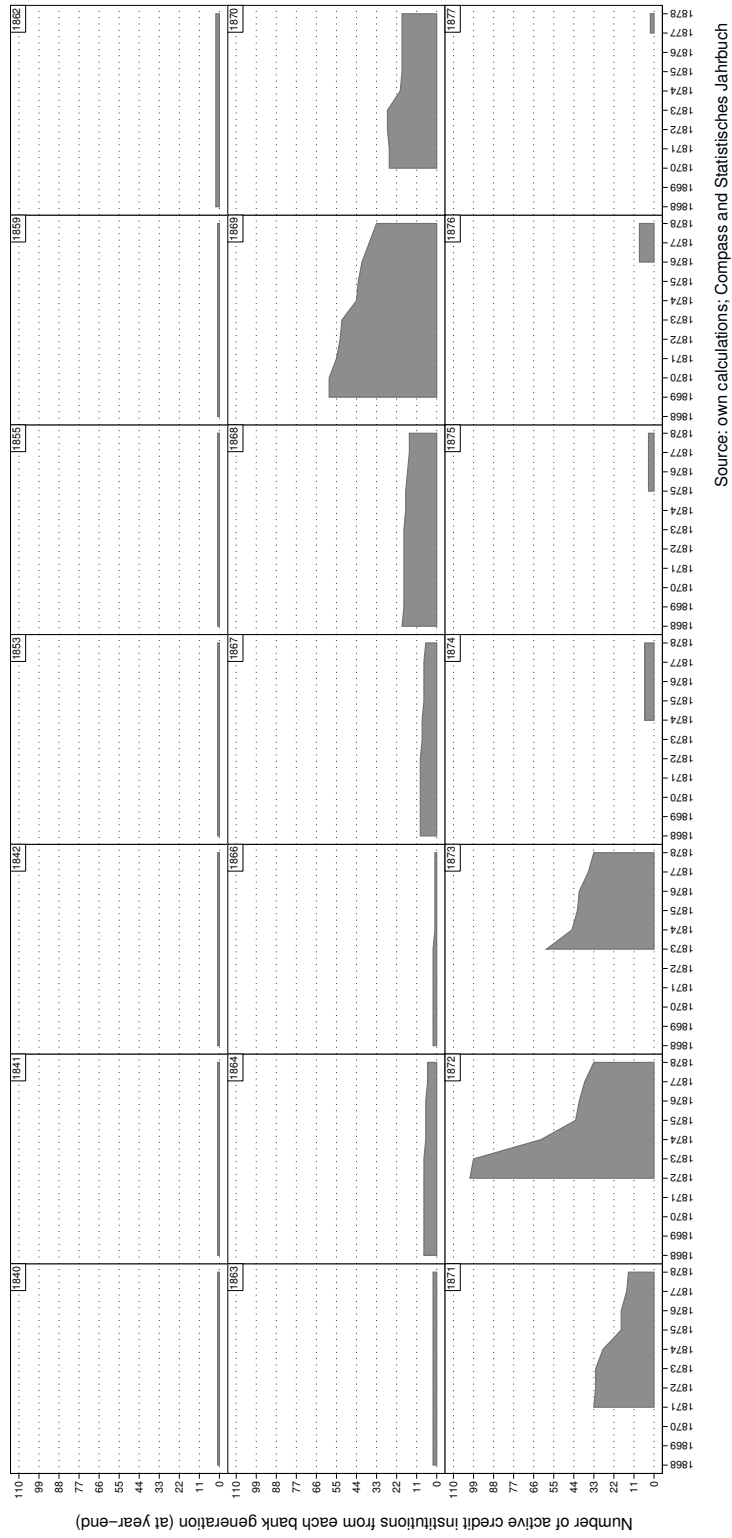
In the non-stratified baseline model bank size is statistically insignificant and bears a counterintuitive sign. This result is puzzling as it would stand in stark contrast to prior work on the causes of bank distress in similar historical contexts[69]. After allowing for city-level and bank type fixed effects, however, the natural logarithm of total assets becomes significant at the 5% level and receives the expected sign. This radical change suggests that the covariate for bank size in the baseline model is strongly correlated with either bank type or location. Both hypotheses are plausible as the largest banks of the Empire were both concentrated in the main cities (Vienna, Budapest and Prague) and took the form of joint-stock companies. Due to the logarithmic form of the covariate, the effect of bank size on the hazard rate appears to be misleadingly large. A one percentage point increase in total assets translates into a 0.01 unit increase on the logarithmic scale. Hence, a 1% increase in total assets only leads to a 0.3% lower hazard rate in the stratified model.

The coefficient on bank age is statistically highly significant in both baseline specifications. Its large economic effect is further corroborated by Figure 11. The graph provides a breakdown of banks' survival performance according to their foundation year, testifying to the fact that younger bank generations were more likely to suffer from the Gründerkrach than older ones.

The share of illiquid assets in total assets also bears the expected sign and exhibits high statistical as well as economic significance. In contrast, the ratio of callable debt to total liabilities turns out to be surprisingly insignificant in both baseline specifications. The statistical insignificance of the callable debt ratio in the baseline models may result from either or both of the following two factors. First, as discussed further in Section 7.3, retail funding still more than doubled between the end of December 1872 and April 1873. Thus, the snapshot captured by the balance sheets at the end of December 1872 might not be representative of banks' financial situation just before the crisis. Second, it might well be the case that the inclusion of other covariates purges the share of callable debt in

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[69] Calomiris and Mason, 'Contagion and Bank Failures During the Great Depression: The June 1932 Chicago Banking Panic', at 873-77; Calomiris and Mason, 'Fundamentals, Panics, and Bank Distress During the Depression', at 1628; Colvin, de Jong, and Fliers, 'Predicting the past: Understanding the causes of bank distress in the Netherlands in the 1920s', at 114-17.

Figure 11: Survival performance of different banking generations (1868-1878)

Number of active credit institutions from each bank generation (at year-end)

Source: own calculations; Compass and Statistisches Jahrbuch

total liabilities of its explanatory power. For example, the ratio of mortgage loans to total loans and the callable debt ratio share the highest one-to-one correlation of any pair of covariates in the sample (-0.62)[70]. Case-wise deletion of covariates from the model shows that the callable debt ratio becomes at least significant at the 10% level as soon as Gründerkrach-specific control variables, such as the exposure to mortgage loans and the proxies for strategic interactions are dropped.

Highly significant in the baseline model, the leverage ratio turns out to matter statistically only at the 10% level as soon as stratification is introduced. Its relatively small effect on the hazard rate is comparable to the coefficient on bank size rather than to the impact of the repo exposure or the degree of asset illiquidity. Bank profitability, on the contrary, fits into the ball park provided by the latter two variables. Highly predictive both in terms of statistical and economic significance, the coefficient on the bank-level return on equity has the expected sign and is stable across the two baseline specifications. The ratio of loss loan provisions to total loans and the binary variable indicating the operation of a branch network do not play a statistically significant role in predicting bank failure during the Gründerkrach. The branch dummy changes sign between the baseline and stratified baseline specification; yet, it remains so insignificant that this change is statistically meaningless.

Turning to Gründerkrach specifics, the coefficient on banks' exposure to mortgage loans harbors an unexpected twist. In both baseline scenarios, banks' exposure to mortgage loans has an economically strong, decreasing effect on the hazard rate. Reliance on mortgage loans had a positive impact on the survival experience of banks during the Gründerkrach. Although this seems puzzling, qualitative evidence from banks' board meetings does indeed suggest that real estate was the only source of collateral apart from government bonds still considered worthy of leverage after all other types of securities had suffered from steep price erosions (c.f. Figure 1 and the discussion in Section 2). For example, the Creditanstalt almost exclusively accepted real estate – ranging from private houses to fabric grounds – as collateral during the high noon of the Gründerkrach[71].

The ratio of banks' proprietary trading portfolio to equity does not yield any significant results in the baseline models. Although armed with the anticipated sign, the multiplicative effect of this covariate on the bank-level hazard rate is not statistically different from zero. As discussed above, one problem might be that market risk contained in credit institutions' trading portfolios is only vaguely reflected by the relative size of this balance sheet position. Ideally, one would like to draw on a detailed break-down of the portfolio's composition to estimate the effect of propriety trading on a bank's rate of failure more precisely. Yet, the conclusion that the sheer quantity of securities relative to bank equity did not matter for banks' survival strengthens the central role of the Kostgeschäft-to-equity ratio. Despite the fact that the latter cannot rely on an exact break-down of collateral types and quality either, it still has a

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[70]This high negative correlation again speaks to the importance of controlling for bank type as discussed above.

[71]CA executive committee meeting on August 2nd 1873, Creditanstalt archives.

statistically and economically important impact on the probability of failure. This stark difference suggests that mean collateral quality was probably much lower than the average quality of proprietary securities holdings. Rather than merely representing a simple story of losses on speculative investments in stocks, the banking crisis during the Gründerkrach gained momentum due to the more complex channel of defaulting repo borrowers on the stock market.

Finally, the proxies for strategic interactions yield mixed results. On the one hand, credit institutions which were founded by other banks in the sample turn out to be almost twice as much at risk than financial intermediaries set-up by founders from outside the banking sector. However, this fairly large impact decreases to zero as soon as more than two "mother institutions" were involved in the foundation process. These results suggest that the underlying motivation for founding a bank differed from case to case. If a single credit institution set out to found a bank, the motive was most likely the generation of easy money from the fosterling's IPO. Yet, whenever a bank foundation constituted a joint enterprise of several financial intermediaries, the newly founded bank appears to have had an existence grounded in a longer-term business plan. Alternatively, banks founded by several rather than one single peer, may have benefitted from increased support by their "parents" in times of turmoil. On the other hand, neither the mere fact of acting as a founder in a particular year, nor the adjusted ratio of the founded banks' equity to a credit institution's own funds emerge as significant predictors from the two baseline models. The foundation of one or several banks in a given year appears to have reduced the risk of failing, whereas the sign of the coefficient on the IPO-to-equity ratio corresponds to intuition: it indicates a higher risk of failure as the variable's value increases.

Overall, the two baseline scenarios provide a first set of interim answers to the questions raised in the introduction. The baseline specifications suggest that the Kostgeschäft played a statistically and economically significant role in pushing credit institutions to the brink of failure. The repo-to-equity ratio appears to have had an essential impact on bank closure in the sense that it exhibits a robust ceteris paribus effect on the bank-level hazard rate, even after a wide range of control variables and time-varying fixed effects are included in the model. As should have been expected, other factors equally possess considerable explanatory power. Bank size and age, asset illiquidity, leverage, bank profitability as well as certain types of interbank connections co-determined credit institutions' chances of surviving the Gründerkrach. However, judging by its marginal effect on the hazard ratio, the relative economic importance of the Kostgeschäft-to-equity ratio not only competes with those of other highly significant predictors; it is surprisingly high given the very specialized channel it represents in comparison to the other more conventional measures of bank weaknesses.

Nevertheless, there are still several good reasons to remain skeptical concerning a potential causal relationship between banks' repo exposure and their ability to fend off closure during the Gründerkrach. In order to show that this paper's statistical results are not merely incidental, convincing evidence for a clear historical mechanism connecting Kostgeschäft to bank failures has to be marshaled. This task will be taken up in the following two sections. From

an econometric point of view, this study conducted a wide range of statistical checks to rigorously challenge the robustness of the results obtained from the two baseline models. These robustness checks are part of a more encompassing version of this paper, but can be briefly summarized as follows.

In a first set of tests, the paper investigated the impact of changes in the functional form and construction of regressors; it included additional control variables; it proceeded to the elimination of outliers in the data by drawing on systematic identification strategies (DFBETA, likelihood displacement and LMAX) and it allowed for random effects (shared frailty) in the Cox proportional hazard regressions. None of these robustness checks compromised the conclusions derived from the baseline regressions.

Second, some banks did not publish their financial data for the year preceding failure. Therefore, these credit institutions cannot be included in the estimation sample of the semi-parametric Cox regressions in this study[72]. If there was a systematic relationship between the omission to publish financial statements and bank closure, selection bias should be taken into account in the interpretation of the econometric results of this study. In this respect, the paper marshals two lines of defense. On the one hand, missing balance sheets are an issue almost exclusively for "wild-cat" banks that had been founded in 1872 and failed in 1873. Their business model (c.f. Section 6.1 below) is likely to have been similar to or even more extreme than that of banks which are contained in the sample[73]. Consequently, their omission from the estimation sample probably induces a downward bias in the economic and statistical significance of important predictors singled out above, reinforcing this paper's conclusions. On the other hand, potential selection into the sample was tackled by a two-stage Heckman-type correction technique drawing on (non-financial) variables that are not part of the baseline Cox models, but observed even for banks with missing balance sheets. The inclusion of a time-varying selection correction term into the baseline models did not result in any noteworthy changes of the results.

Third, the paper addressed four different possible sources of endogeneity bias induced by potentially omitted variables from the baseline model. It controlled for the evolution of real economic conditions by relying on available annual GDP data from Schulze (1997) and Ciccarelli and Missiaia (2014). In addition, it constructed new time series from monthly railway revenues, transported passengers and freights to proxy for intra-year real economic volatility. Furthermore, controls for banks' participation in private-sector emergency funds, liquidity support by the central bank and outright government bail-outs were included in the regressions. These robustness checks did not have an impact on the results obtained in the baseline regressions. As far as endogeneity arising from reverse causality is concerned, the paper can draw on lagged GDP and disaggregated bank-level data as a complementary line of defense against potential bias deriving from covariates reflecting economic conditions. If any, the

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[72]However, these banks do enter the non-parametric procedure discussed above, because their opening and closure dates are known. This fact explains the higher number of banks underlying the sample for the Kaplan-Meier estimations.

[73]This observation is clearly borne out in qualitative evidence from final shareholder assemblies published in the Compass and discussed in more depth in a longer version of the present paper.

impact of reverse causality bias induced by policy interventions is also likely to remain very limited due to the small overall amount of direct liquidity support and bail-outs granted by the central bank and the governments respectively.

5.5   Robustness checks

This section is currently being reorganized. For a summary, c.f. previous paragraphs.

6   "Gründerbanking": business model and the role of repos

6.1   Business model

Between 1867 and 1873, an increasingly large majority of Austrian joint-stock banks operated according to a business model which placed investment banking at the core of their commercial activities (contemporaries refer to these activities as the *crédit mobilier* business[74]). Naturally, the *crédit mobilier* business included proprietary trading, that is, the purchase and sale of securities for banks' own profit / account. Yet, for many credit institutions the single most important source of income during the Gründerzeit consisted in underwriting and introducing newly emitted securities on the stock exchange. Banks, either alone or together with their peers in so called investment syndicates and consortia, organized initial public offerings on behalf of the founders of recently created joint-stock companies in a variety of different sectors (e.g. banks, construction, industry and infrastructure). The high profits credit institutions were able to generate in the first years of the boom led to an increasing reallocation of capital away from traditional banking business towards investment banking.

Since Figure 12 relies on data from all banks active at the end of each year, it also includes banks which survived the crash of 1873. Yet, even the aggregated, weighted averages of the variables depicted in Figure 12 display some clear trends. Gründerbanking in Austria-Hungary was visibly profitable with a mean return on equity between 10-20% ever since 1868. There is little doubt, however, that 1872 represented an extraordinary year for Cisleithanian banking, when profits reached their absolute climax. In 1872, investment banking (underwriting / IPOs, proprietary trading, Kostgeschäft and investment depots) accounted for 60% of total income while traditional banking activities (here defined as the discounting of bills, goods commissioning and inventories, bank,

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[74]Jakob Kautsch, *Das Bank- und Börsenwesen mit besonderer Berücksichtigung deutscher und österreichischer Verhältnisse* (Wien und Budapest: Hartleben's Verlag, 1871), 364 at 97-98; Max Wirth, *Österreichs Wiedergeburt aus den Nachwehen der Krisis* (Wien: Manz'sche Buchhandlung, 1876), 522 at 40-42.

Figure 12: Gründerbanking business model in Austria-Hungary (1868-1878)

Source: Compass and Statistisches Jahrbuch

*Investment banking business: underwriting & IPOs, proprietary trading, Kostgeschäft and investment depots.
**Traditional banking business: bills discounting, goods commissioning & inventories, lombard, bank and mortgage loans, real estate, exchange business.

lombard and mortgage loans, real estate and exchange business) plummeted to around 30% of total assets.

The apparent correlation between an increasing share of traditional banking activities and lower profitability post 1872 in Figure 12 must not be misinterpreted. Results from a panel regression run on the bank-level return on equity in a more encompassing version of this paper suggest that a commitment to traditional banking business rather than investment banking had a very different impact on profitability before and after the Gründerkrach. From 1868-1872, traditional banking only played an insignificant role in the accumulation of profits. Yet, in order to achieve positive returns after the crash, financial intermediaries were well advised to bethink themselves of old-established banking forms such as the discounting of bills of exchange or mortgage lending. Thus, although lower returns on equity between 1873 and 1878 coincide with an overall increasing mean share of traditional business activities, the evidence at the micro-level suggests that the return to traditional banking pushed profits rather than reducing them. In fact, low profits between 1873 and 1878 were at least partly due to the complete turnaround in the profitability of investment banking. In the years following the Gründerkrach, these business activities influenced banks' returns negatively. Credit institutions not quick enough to restructure their asset portfolio towards more traditional commercial banking had to accept losses.

The climax of investment banking in Austria-Hungary coincided remarkably with an enormous year-on-year expansion of the Cisleithanian banking sector from 1871 to 1872. Banks had begun to set-up other banks in order to generate income from IPOs without even having to guarantee a fixed income to an

external founder by previously purchasing the shares from the latter. However, 1872 was not only a special year for bank IPOs. On the contrary, Figure 13 shows that offer prices of IPOs on the Viennese Stock Exchange exceeded the nominal share price consistently for almost all private sector IPOs from January 1872 onwards until the crash in May 1873. Although this development may simply reflect an accounting trick (the par value could literally take any possible denomination), nominal stock prices were almost exclusively set to 100 or 200 Gulden at the Viennese Bourse. Since these reference par values did not change at all in 1872, the evolution of the ratio of IPO offer prices to the nominal price of stocks is still informative. Considering that between 1867 and 1871 the 100% mark functioned as a strict upper bound to mean IPO prices, the structural change which occurred in 1872 is really enticing. The puzzle is how investment banks were able to push offer prices visibly higher than in the pre-1872 episode, while simultaneously introducing more new stocks to the Bourse than ever before. Even contemporaries noticed how "the demand side [for new shares] was not taken into account anymore, so that one founded only for the sake of founding"[75]. Why did investors become increasingly willing to overpay all these new shares and where did they take their resources from in a financial market that was already bursting at its seams?

Figure 13: IPO prices on the Viennese Stock Exchange (01/1868 - 04/1873)
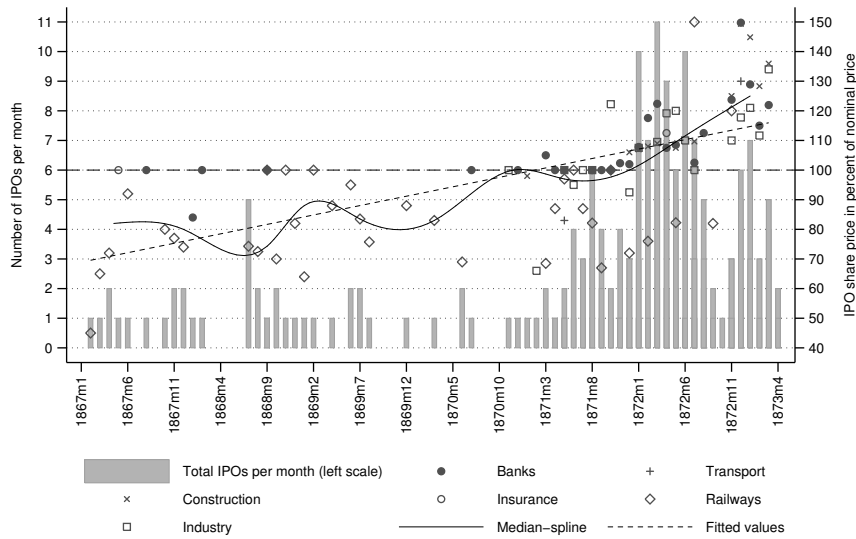
Source: own calculations; Compass and Neue Freie Presse

Price ratios calculated on the basis of monthly averages within each sector; secondary public offerings are not included.

6.2 The role of Kostgeschäft in "Gründerbanking"

In order to shed more light on these questions some notion of the techniques governing IPOs, and more particularly their treatment at the Viennese Stock

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[75]Ibid.

Exchange, is required. Akin to the London Stock Exchange (LSE) between 1914 and 1986, IPOs on the Viennese Bourse were implemented according to a fixed offer price regime. Chambers and Dimson (2009) define this regime as one in which emission consortia determine an offer price ex ante and do not adjust prices afterwards to "balance demand and supply once marketing has begun"[76]. As a corollary, Vienna also adhered to the principle of pro rata allocation in case an issue was oversubscribed[77].

In order to appropriate a larger share of the total value generated by an IPO (market value upon start of trading minus fixed purchasing price paid to the founder), and thereby securing a larger expected profit, the underwriter would have to be in a position to reduce the difference between offer price and market value, while simultaneously not scaring off potential customers. Therefore, an investment bank operating under a fixed offer price regime would need to credibly address investors' worries about the market liquidity and intrinsic value of the shares to be introduced. Investment banks' standard tool for reshaping the surplus distribution is "promotion". Yet, this strategy is problematic because any attempt to talk up offer prices ex ante by one way or another generates moral hazard if underwriting banks do not or cannot guarantee market prices ex post[78].

One way to address this dilemma consists of resorting to the creation of artificial demand. Emission banks may directly stabilize prices ex post by buying up or keeping shares for their own account. In addition, underwriting banks also have the alternative, arguably more elegant option to act upon the market liquidity of emitted shares, and thus their price, by generously lending against them. In other words, banks could accept the shares they previously introduced to the market as collateral in secured lending operations. From the perspective of underwriters, the liquidity mechanism may be preferable to directly intervening in the market due to several reasons. First, secured lending enables investment banks to earn additional income via the loan's interest rate. Second, it minimizes risk due to a higher degree of flexibility in comparison to outright purchases of securities. Banks can keep the maturity of loans short, adjust haircuts when rolling over loans or place margin calls if the collateral value has depreciated. From the perspective of investors, the possibility to take out loans against IPO securities might also harbor considerable advantages. Consider the example of an investor speculating *à la hausse* who runs out of short-term liquidity to cover her trading positions. Depending on the size of the portfolio, an underwriting bank could have an interest in stepping in as the buyer of last resort. Yet, in anticipation of increasing market prices, the investor may prefer to avoid a permanent liquidation of her holdings. Secured lending represents an

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[76] David Chambers and Elroy Dimson, 'IPO Underpricing over the Very Long Run', *Journal of Finance*, 64/3 (2009), 1407-43 at 1409.

[77] Ibid.

[78] For a list of relevant literature in this field, c.f. Chambers and Dimson, 'IPO Underpricing over the Very Long Run', at 1438-40. For the importance of trust in underwriting in 19th century financial markets for sovereign debt, c.f. Marc Flandreau, 'Caveat Emptor - Coping with Sovereign Risk under the International Gold Standard, 1871–1913', in Marc Flandreau, Carl-Ludwig Holtfrerich, and Harold James (eds.), *International financial history in the twentieth century: system and anarchy* (Cambridge: German Historical Institute and Cambridge University Press, 2003), 17-50.

attractive solution to the liquidity squeeze which enables the investor to honor her commitments without having to renounce her upward bet.

An important side-effect of this liquidity-enhancing mechanism consists of its amplification effect on the degree of financial leverage taken up by banks and investors. On the one hand, underwriting banks holding large arsenals of securities may themselves become more and more inclined to pledge (re-hypothecate) these securities as collateral to other credit institutions in order to obtain the necessary liquidity for meeting their own obligations[79]. Securities may thus become distributed in the whole financial system in quite opaque ways, with potential implications for systemic risk. Investors, on the other hand, are able to take advantage of lending facilities which in principle allow for the accumulation of unlimited leverage. As long as they can service interest costs and repay when loans are due, market participants can reinvest the cash obtained in order to buy up fresh securities which again may be pledged for renewed liquidity and so forth.

Figure 14: Underwriting and secured lending by Austro-Hungarian banks (pooled, 1868-1878)
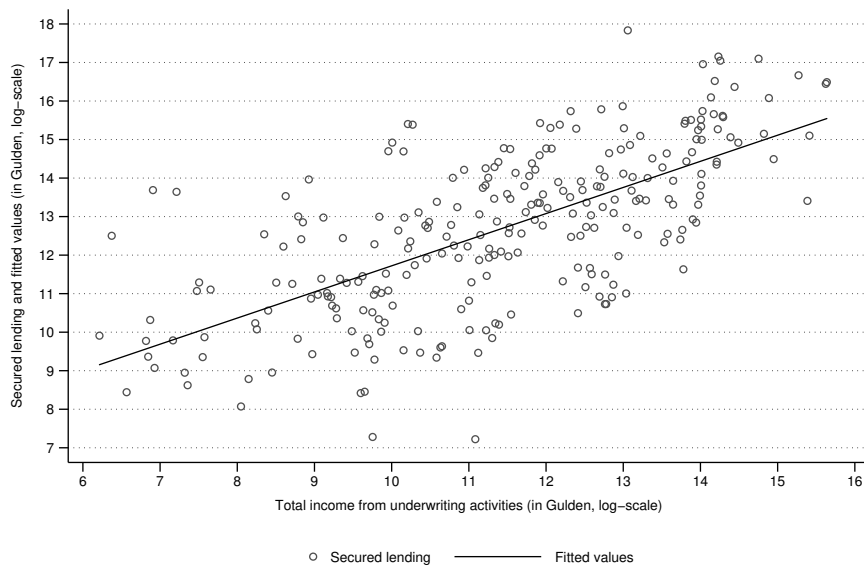
Source: Compass and Statistisches Jahrbuch

In the historical case of the Austro-Hungarian banking sector, this combination of investment banking and secured lending had coined the entire period of the Gründerboom but certainly intensified during the last 15 months before the crash of 1873. Figure 14 plots banks' secured loan portfolio collateralized by traded securities against the income generated via underwriting activities each year from 1868 until 1878. The fitted line shows a clear positive correlation between these two variables, suggesting that banks may have employed secured lending operations as complementary tools to boost profits deriving from un-

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[79]c.f. Section 7.1 for more details on the legal aspects of Kostgeschäft

derwriting business. Apart from adding a time dimension, the bar graphs in Figure 15 allow for a more detailed look into the nature of banks' secured lending portfolios. Generally, secured lending seems to have evolved alongside major general tendencies on financial markets in ways one would expect. Relatively large portfolios present during the first boom phase until the small crash of September 1869 were subsequently deleveraged in 1870, at a time when almost no IPOs took place (c.f. Figure 13 above). Securities lending then grew again from 1871 onwards, coinciding with renewed investment banking fervor. By 1872, total secured lending against traded securities had skyrocketed to previously unseen heights, after having almost doubled in size compared to the amounts outstanding 12 months before.

Figure 15: Secured lending and Kostgeschäft on Austro-Hungarian bank balance sheets (1868-1878)
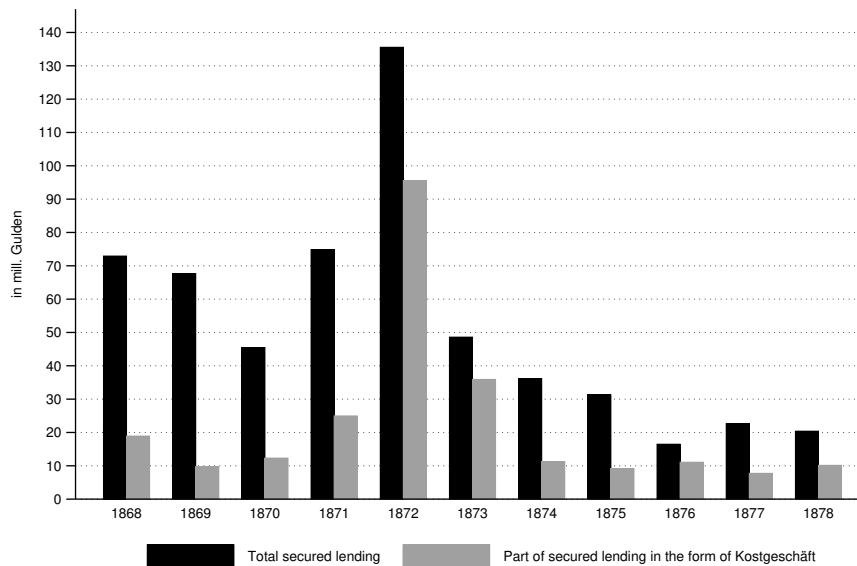
Source: Compass and Statistisches Jahrbuch

The peak in 1872 is interesting for two reasons. On the one hand, it occurred precisely at the time when banks implemented more IPOs than ever before and when the ratio of securities' offer prices to their nominal values started to permanently overshoot the 100% mark. Hence, secured lending could have played a role in easing the rich supply of new securities into the market by allowing for highly leveraged purchases. Similarly, there is at least suggestive evidence that an increase in the volume of liquidity-enhancing lending facilities correlated with the highest recorded offer prices. On the other hand, the increase in loans was driven by one particular component of secured lending portfolios, namely a 19th century version of overnight repurchase agreements, which Austrians called Kostgeschäft. Figure 15 shows that these repos accounted for roughly 70% of the banking sector's total secured lending on the eve of the Gründerkrach. On aggregate, this amount represented approximately one fifth of total bank equity at the end of 1872. Certainly considerable, this sum is still likely to underes-

timate the size to which these lending facilities had grown just before May 9$^{\text{th}}$ 1873. By definition, bank balance sheets only convey a snapshot of credit institutions' financial situation at a specific point in time, namely at year-end, when short-term lending and investments were probably settled more intensively in order to facilitate the computation of annual profits. Moreover, the balance sheets of 1872 do not capture a possible further build-up in the last four months before the crash.

Wirth (1874) intriguingly sketched out this interplay of underwriting and secured lending by paraphrasing the German newspaper "Frankfurter Actionär":

> "All clients first assured themselves easy and cheap secured loans for a longer period of time and, thus, syndicate investors were on the safe side until the agio[80] allowed for a profitable sale of their merchandise. Joint-stock companies were founded and their barely printed shares presented as collateral in exchange for bank loans in order to avoid market forces. The temptation [for investors] to subscribe to or buy into an IPO therefore became irresistible, because one did not even have to invest one's own capital, search for capital or permanently hold the securities [...]."[81]

Eventually, the prominence of this symbiosis was so generally acknowledged that some authors even spoke of underwriting banks' secured short-term lending as a moral obligation these institutions had vis-à-vis investors: "Due to their participation in the stock market business, they [the investment banks] are, one may say, morally bound to support speculators in particular securities, especially during times of crisis, which may put them into very embarrassing situations."[82]

7 Repo lender distress: a narrative approach

7.1 Legal aspects of Kostgeschäft

Section 3.2 provided a theoretical checklist for an investigation into the potential connection between the evolution of the Austro-Hungarian overnight repo market and bank distress during the Gründerkrach. A legal definition of the Kostgeschäft and its economic implications in the Habsburg Empire of the 1870s represents the logical starting point. The study of relevant journals, such as the "Gerichtshalle" (literally, the "court room"; the most prominent weekly journal of judicature of the time), reveals that practitioners and scholars alike discussed the legal nature of these repo transactions with increasing passion on the eve

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[80] "Agio" is a term used to describe a positive difference between securities' actual market price and their par value. The price of an asset displaying an agio therefore exceeds the asset's nominal amount.

[81] Max Wirth, *Geschichte der Handelskrisis im Jahre 1873* (Frankfurt: J.D. Sauerländer's Verlag, 1874), 270 at 139.

[82] Kautsch, *Das Bank- und Börsenwesen mit besonderer Berücksichtigung deutscher und österreichischer Verhältnisse* at 98.

of the Gründerkrach, after their economic importance had grown during the boom years. While some dissenting voices argued for different interpretations and while there was no specialized law dealing explicitly with the Kostgeschäft, the Austrian legal doctrine treated these 19th century repos as loan contracts regulated by the provisions for the so-called *pignus irregulare*[83] (in German, *irreguläres Pfandrecht*; irregular lien). Although technically the Kostgeschäft combined a sale with a subsequent repurchase of securities, its mainstream contemporary legal interpretation corresponded to that of a special sort of collateralized loan. This interpretation governed the Austrian repo market until 2003 when these loans were finally recognized as a financial transaction *sui generis*[84].

Pignus irregulare, as opposed to *pignus regulare*, deals with collateral which cannot be – or simply by convention, is not – separated from the creditor's own assets once it has been handed over by the borrower in exchange for a cash loan. In other words, it provides the legal framework for loans secured by fungible collateral. The very short-term, mostly overnight maturity of the Kostgeschäft made it impracticable to treat these repos legally as traditional secured loans (*pignus regulare*) because this would have disabled lenders to dispose freely of the collateral. Even though, strictly speaking, each single share acting as collateral could have been identified as it carried a unique serial number, Kostgeschäft collateral was perceived to commingle with the securities holdings of the lender[85]. Repo creditors could therefore re-sell or re-hypothecate Kostgeschäft collateral without running the risk of being accused of misappropriation as they would have been under the regime of *pignus regulare*. In fact, *pignus regulare* required not only the restitution of the very same collateral that was pledged upon maturity, instead of merely matching type and quantity as was the case for the Kostgeschäft; it also forbade any re-sale or re-hypothecation by the lender while the transaction was still ongoing[86]. Abeles (1871) argues that these differences explain why Kostgeschäft loans were generally cheaper and entailed lower haircuts than conventional lombard loans, at least during the early years of dualism[87].

Although Kostgeschäft lenders benefitted from the particular legal freedom to make use of the collateral at their discretion while the repo was still outstanding, the unambiguous contractual obligation to restitute the collateral at maturity, if their counterparty did not default, was shared with the provisions for regular lien. In this sense, both *pignus regulare* and *pignus irregulare* com-

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[83]For a discussion of this intepretation, c.f. Alexander Abeles, 'Die rechtliche Natur des Kostgeschäftes', *Gerichtshalle - Organ für Rechtspflege und Volkswirtschaft*, 15/76 (1871), 301-03; Josef Freiherr von Bezecny, 'Das Kostgeschäft', *Gerichtshalle - Organ für Rechtspflege und Volkswirtschaft*, 15/72-73 (1871), 288-90; Julius Ofner, 'Die Natur des Kostgeschäftes an der Börse', *Gerichtshalle - Organ für Rechtspflege und Volkswirtschaft*, 15/102 (1871), 406-07; Karl Adler, 'Zur juristischen Konstruktion des Kostgeschäftes', *Zeitschrift für das gesamte Handelsrecht*, 1889/35 (1889), 419-28; Julius Ofner, 'Zur Lehre vom Kostgeschäft', *Zeitschrift für das gesamte Handelsrecht*, 1890/37 (1890), 439-55.

[84]Maximilian Plattner, 'Von Bilateral zu Triparty: Repo-Transaktionen wirtschaftlich und rechtlich gesehen', *Österreichisches BankArchiv*, 2007/9 (2007), 679-96 at 683-84.

[85]Bank balance sheets show that the Kostgeschäft was generally categorized separately from a lender's own securities portfolio, at least as far as the banking sector is concerned.

[86]Abeles, 'Die rechtliche Natur des Kostgeschäftes'.

[87]This may have been the case during the early years of dualism. Yet, by 1872 Kostgeschäft repos did certainly not represent cheap money anymore (c.f. Figure 16 below).

prised mutual debt claims between borrower and lender, where the recognition
of the borrower's legal claim on the return of the collateral essentially served
the purpose of debtor protection. The presence of these mutual claims natu-
rally shaped the general regulation of borrower default, again shared by regular
and irregular lien, under the Code of Commercial Law ("Handelsgesetzbuch",
henceforth: HGB) of 1862. Under this regime, debtor default ruled out any type
of compensatory acquisition of the collateral by lenders[88]. On the contrary, a
breach of contract by the borrower necessarily triggered a sale of collateral in
order to match the outstanding debt claim. Liquidation of the collateral was
possible without a formal lawsuit but the provisions of §310 HGB had to be
met. First, the credit contract had had to be set up in writing. Second, the lo-
cal commercial court needed to approve of the sale of collateral upon borrower
default and liquidation was only possible after the creditor had informed the
debtor about the court's approval. Third, the court bore the authority to set
the date for the executive sale. Hence, since the decisive power upon borrower
default resided with the court, the stipulations of §310 HGB may be interpreted
as imposing a form of automatic stay on collateral in secured lending operations.

To be sure, the provisions in §310 HGB only set out the general framework
for collateral liquidation following credit contract breaches regulated by regular
and irregular lien. Indeed, §311 HGB allowed for a circumvention of any inter-
ference by the local court in the liquidation process, and thus an exemption of
automatic stay, as long as creditor and debtor mutually consented to do so in
the original contract. Under §311 HGB, the lender possessed the right to sell
the collateral at discretion either publicly (i.e. upon public advance notice in
official governmental journals) or privately if there was a market price for the
pledged securities. Also, there was no exact rule for when this collateral sale had
to occur. Principally, the lack of precision was perceived to act in favor of both
lender and borrower, as it endowed the parties with the flexibility to maximize
liquidation proceeds. Moreover, according to §311 HGB, the lender was only
obliged to inform the debtor after she proceeded to the sale of collateral. In
case the collateral liquidation resulted in a residual liability of the lender *vis-à-
vis* the borrower, the excess proceeds were added to the borrower's bankruptcy
assets; if, on the contrary, the liquidation ended with a residual claim on the
borrower, this claim could be held against the remaining bankruptcy assets[89].

The focus of this paper is on the banking sector in its function as a repo
lender to other financial institutions and stock market agents. As ascertained by
§312 HGB, lending banks benefitted from certain privileges in the application
of the right of lien. §3 of the Law of October 28th 1865 granted banks the right
to choose at will between the procedures of §310 and §311 HGB in response
to debtor default[90]. This right to choose between the procedures in §310 and

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[88]Compensatory acquisition of collateral was, and still is, forbidden by §1371 of the General
Austrian Civil Code ("Allgemeines bürgerliches Gesetzbuch", ABGB).

[89]c.f. commentary to §311, Ministerium für Justiz und Handel (ed.), *Das allgemeine
Handelsgesetzbuch vom 17.Dezember 1862, sammt dem Einführungsgesetze allen darauf
bezüglichen ergänzenden und erläuternden Verordnungen* (15 edn., Vienna: Manz'sche k.u.k
Hof-Verlags-und Universitäts-Buchhandlung, 1894), 546 at 108.

[90]Reichs-Gesetz-Blatt für das Kaiserthum Österreich, '110.Verordnung vom 28.Oktober
1865', *30.Stück, 110.Verordnung* (Verordnung des Staatsministeriums und des Justizministeri-
ums, über die, den Anstalten, welche Creditgeschäfte betreiben, zukommenden Ausnahmen

§311 HGB was not conditional on there being a written understanding between the bank and its debtor[91]. Thus, these provisions, which even pre-dated the Compromise of 1867, did not leave much room for ambiguity whenever banks intervened as lenders in the Kostgeschäft market. If banks chose to opt for §311 HGB, repo collateral was exempt from automatic stay. Borrower default then resulted in the liquidation of pledged securities by the lenders, where the exact timing of the collateral sale was at the discretion of banks, or at least not legally fixed. Hence, in principle the legal context of the late 1860s, early 1870s allowed Austro-Hungarian credit institutions to benefit from a maximum of flexibility concerning the timing of collateral liquidation.

7.2 The Austro-Hungarian repo market during the "Gründerkrach"

How did the Austro-Hungarian Kostgeschäft market evolve before and during the Gründerkrach? Evidence on this front is scarce because bank balance sheets only provide a snapshot of the size of the repo portfolio at year-end. By definition, these snapshots cannot deliver a continuous picture of the market and they do not convey any information on the riskiness and profitability of the Kostgeschäft. Fortunately, there are other sources one can draw upon to construct an overview of the trends in the Kostgeschäft market during the boom and the crash of the early 1870s. As already been briefly mentioned in Section 5.1 of this study, repo rates can be obtained from the Coursblatt des Gremiums der k.k. Börse-Sensale. The Coursblatt published the average cost for an overnight repo transaction on the Viennese Bourse, expressed as the difference between the sale and the repurchase price for 25 pieces of a given stock[92]. The Coursblatt reported these repo costs averaged across counterparties for two railway stocks, the Nordbahn as well as the Staatsbahn, and two bank shares, the Creditanstalt and the Anglo-Austrian Bank. Following Haupt (1874-1877), individual repo rates can be calculated in the following way. Overnight price differences are multiplied by 360 to compute the annual cost of a repo transaction if it were rolled over for a whole year with interest paid at maturity. In order to account for the fact that borrowing costs were always reported for a repo carrying 25 shares as collateral, the annual sum is then divided by 25 times the average price of the security on the day for which the price difference was reported:

$$annualized\ repo\ rate_{i,t} = \frac{\Delta price_{i,t} \cdot 360}{25 * average\ quote_{i,t}} \cdot 100\%$$

The data from the Coursblatt allows for a systematic perspective on the evolution of the repo market. Figure 16 presents the average repo rate calculated on the basis of the difference between sale and repurchase prices for the four types of Kostgeschäft collateral published in the Coursblatt. The results

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von den allgemeinen Justizgesetzen; Vienna, 1865), 347-49.

[91]Ibid.

[92]Ottomar Haupt, *Arbitrage und Paritäten. Praktische Darstellung des Arbitragegeschäftes* (Wien: Beck'scher Buchverlag, 1874-1877), 278 at 260-271.

displayed in Figure 16 match contemporaries' reports of extremely high (annualized) repo rates of up to 50% per annum throughout the last two years before the Gründerkrach[93]. The surprisingly high peaks in repo rates are not easily identified as moments of increased counterparty risk or drying up market liquidity (or both), especially because no systematic data on repo haircuts is available. Data on bid-ask spreads (c.f. Figure 18 below), however, shows that peaks in repo rates do not generally seem to have coincided with moments of liquidity squeezes in the financial market. Thus, as suggested by Gorton and Metrick (2012), concerns about counterparty default risk were likely mirrored by movements in the repo rate, while the volatility of collateral prices found its way into haircuts[94]. While the small crisis of 1869 and the outbreak of the war in 1870 represented fairly short-lived disruptions which did not affect the continuous operation of the Kostgeschäft market, the Gründerkrach in May 1873 really stands out as a watershed. In fact, Figure 16 testifies to the complete break-down of the repo market on the Viennese Bourse for roughly seven months following Black Friday: not a single repo quote was reported by the Coursblatt for this period.

Figure 16: Average overnight repo rates on the Viennese Stock Exchange (12/1868-12/1874)
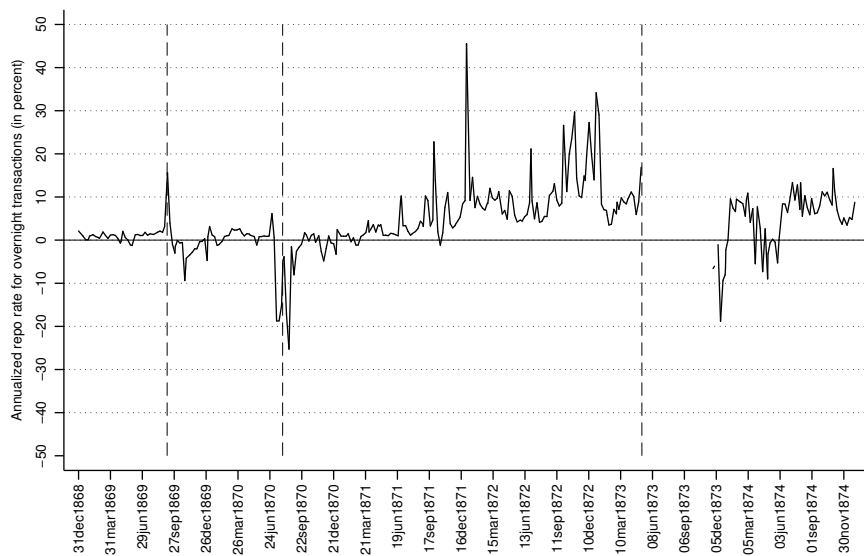
Source: own calculations; Compass, Coursblatt des Gremiums der k.k. Börse–Sensale and Wiener Zeitung

Weekly data; average interest rates on repos against Nordbahn, Staatsbahn, Creditanstalt and Anglo–Austrian Bank shares as collateral.

Zooming into the period immediately preceding May 9th 1873, Figure 17 documents the day-to-day evolution of the Kostgeschäft rate, the collateral's market price and the collateral's bid-ask spread for repos on Creditanstalt and

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[93]Joseph Neuwirth, *Bank und Valuta in Österreich-Ungarn: Die Speculationscrisis von 1873*, 2 vols. (2; Leipzig: Duncker & Humblot, 1874), 376 at 49 and 60. Max Wirth, *Geschichte der Handelskrisis im Jahre 1873* (Frankfurt: J.D. Sauerländer's Verlag, 1874), 270 at 139.

[94]Gary Gorton and Andrew Metrick, 'Securitized banking and the run on repo', *Journal of Financial Economics*, 104/3 (6/2012), 425-51 at 446.

Figure 17: Collateral price, repo rate and bid-ask spread on collateral (15/3/1873-17/5/1873)
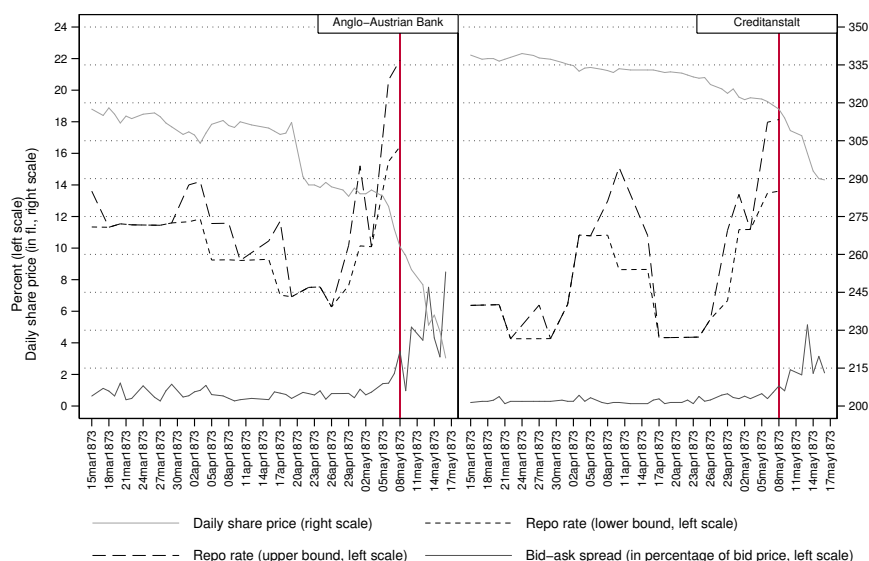
Source: own calculations; Compass, Coursblatt des Gremiums der k.k. Börse–Sensale and Wiener Zeitung

Daily data; rates on repos against Creditanstalt and Anglo–Austrian Bank shares as collateral.

Anglo-Austrian Bank shares. Figure 17 tells an interesting story which fits well into the picture contemporaries have drawn of the stock market's slide into the crisis. It is well established that stock market prices started to decline from the beginning of April 1873 onwards[95] when a number of joint-stock companies published disappointing results relative to the high expectations driven by the renewed boom in 1872[96]. Furthermore, the Creditanstalt, Austria's foremost joint-stock bank, fueled the downward trend in prices by liquidating a large portfolio of securities worth 20 million Gulden between April 20th and April 27th 1873. The bank's management supposedly reacted to rumors of a stock market panic in Paris where political quarrel threatened to resurface after the general elections[97].

For Kostgeschäft lenders, falling collateral prices signaled a need to increase haircuts for overnight roll-overs and triggered margin calls for repos with longer-term maturities[98]. Counterparties who were unable to meet these tighter requirements for prolonging their debts had their outstanding repo loans called in by the creditors[99]. Yet, caught on the wrong foot, most borrowers' financial position were far too leveraged and far too illiquid to enable them to honor

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[95]c.f. also Figure 1 in Section 2.

[96]Neuwirth, *Bank und Valuta in Österreich-Ungarn: Die Speculationscrisis von 1873* at 74.

[97]Franz Freiherr von Sommaruga (ed.), 'Der Oesterreichische Oekonomist (Oeconomist)', *Volkswirthschaftliche Wochenschrift*, (1873), 1-446 at 276.

[98]Abeles, 'Die rechtliche Natur des Kostgeschäftes'. and Ofner, 'Die Natur des Kostgeschäftes an der Börse'. both point to §458 ABGB which contains the exact legal requirements for placing margin calls when the underlying value of the collateral in secured loan transactions falls below the outstanding amount.

[99]Wirth, *Geschichte der Handelskrisis im Jahre 1873* at 140.

all their commitments almost simultaneously. Every day, starting in mid-April 1873, contemporary newspapers enlisted dozens of speculators as insolvent and expelled from the Bourse by the Viennese stock exchange's executive committee[100]. As a corollary, repo rates rose significantly within days, reflecting increased counterparty risk. Even for repos on highly liquid Anglo-Austrian and Creditanstalt collateral, interest rates shot up from 6% to 22% and from 4% to 18% respectively (c.f. Figure 17). At the same time, Kostgeschäft borrowers whose loans had been called in defaulted on their repurchase obligation en masse and the repo collateral ended up with the lending banks[101].
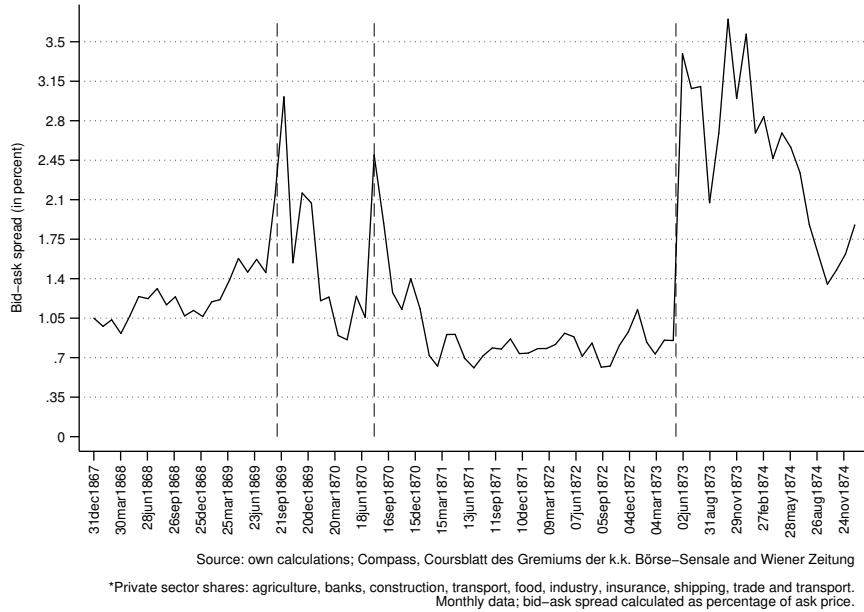
A striking feature of Figure 17 consists in the evolution of the bid-ask spread for both collateral types. Bid-ask spreads measure the difference between offer and demand prices for securities traded on the stock exchange as a percentage of their offer prices. They serve as indicators for the market liquidity of a particular asset: the higher the bid-ask spread, the lower the market liquidity of the asset in question. As shown in Figure 17, the time series of the spread on Creditanstalt and Anglo-Austrian Bank shares barely moved upwards before May 8th 1873, but rose considerably thereafter. Had there been large-scale liquidations of repossessed Creditanstalt and Anglo-Austrian Bank stocks before May 8th 1873, these sales would have likely driven a wedge between bid and ask prices of the securities. Figure 17 suggests that even though repo borrowers may have failed to repurchase their Creditanstalt and Anglo-Austrian Bank shares, their respective lenders did probably not proceed to extensive collateral liquidation before May 8th. Potentially, there was a cogent rationale behind this reticence. On the one hand, as discussed above, the legal situation provided ample room for maneuver in terms of the timing of collateral liquidation. On the other hand, the downward pressure on market prices prevailing during the last weeks and days before the Gründerkrach could have turned out to remain a temporary backslide only.

Of course, the low bid-ask spread on Creditanstalt and Anglo-Austrian Bank stocks before May 8th 1873 may have just reflected these securities' idiosyncratic characteristics. In this case, one would expect the rest of the marketable collateral to have shown different patterns of market illiquidity. Yet, the evidence in Figure 18 speaks against this hypothesis. Between January 1871 and May 1873, the average bid-ask spread for all private sector shares traded on the Viennese Bourse stagnated at a long-term low of around 0.7%. In particular, there is no discernible upward trend in the months immediately preceding the Gründerkrach. Figure 18 also sheds light on the magnitude and persistence of

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[100]For some snapshots of the lists of insolvencies on the stock exchange, c.f. Neue Freie Presse, 'Börsen-Insolvenzen', 27.04.1873, 1873e p.11; Neue Freie Presse, 'Wiener Börse vom 29. April 1873', 30.04.1873, 1873c p.12; Neue Freie Presse, 'Wiener Börse vom 1. Mai 1873', 01.05.1873, 1873a p.4; Neue Freie Presse, 'Opfer der Börse', 03.05.1873, 1873f p.11; Neue Freie Presse, 'Wiener Börse vom 9.Mai', 09.05.1873, 1873b p.4; Fritz G. Steiner, *Die Entwicklung des Mobilbankwesens in Österreich* (Wien: C. Konegen (E. Stuelpnagel), 1913), 271 at 243.

[101]Peter Welzl, *Die Speculation an der Wiener Börse: praktische Darstellung und Anleitung zur Ausführung von Börsespeculationen für Private und Speculanten* (Wien: Bermann & Altmann, 1881), 73 at 34-35. For example, Pressburger (1966) mentions as many as 150 insolvency declarations of investors by the stock exchange's executive committee between May 5th and May 8th 1873, c.f. Siegfried Pressburger, *Oesterreichische Notenbank, 1816-1966: Geschichte des Oesterreichischen Noteninstituts* (Wien: Oesterreichische Nationalbank, 1966), 556 at 1131.

Figure 18: Bid-ask spread for private sector shares* traded in Vienna (12/1867-12/1874)

Source: own calculations; Compass, Coursblatt des Gremiums der k.k. Börse–Sensale and Wiener Zeitung

*Private sector shares: agriculture, banks, construction, transport, food, industry, insurance, shipping, trade and transport.
Monthly data; bid–ask spread calculated as percentage of ask price.

the shock in May 1873 compared to the small crash in autumn 1869 and the onset of the Franco-Prussian War in July 1870. Whereas the latter two had been accompanied by a relatively short-lived, though pronounced hike in market illiquidity, the former saw the bid-ask spread soar to previously unattained levels which thereafter paralyzed the financial market for more than twelve consecutive months.

7.3 Balance sheet constraints, strategic trade-offs and the timing of collateral liquidation

If the bid-ask spread provides some indication on the intensity and timing of collateral liquidations, the question of why repo lenders should have reacted so suddenly and strongly from May 8th 1873 onwards remains hitherto undiscussed. This is where the concept of balance sheet constraints proves to be insightful. Whereas the econometrics of this paper control for a broader spectrum of potential balance sheet constraints by drawing on a set of covariates traditionally employed by economic history work on bank distress (c.f. Section 5.3), this section focuses specifically on liquidity-related constraints emphasized in Section 3.2. The reasons for the choice of this narrative focus are threefold. First, as discussed in Section 3.2, large repo portfolios are likely to deepen the liquidity mismatch between assets and liabilities due to their negative correlation with cash reserves. Hence, liquidity-related constraints may be particularly relevant in the context of the Gründerkrach. Second, ballooning liquidity mismatches on bank balance sheets attracted the attention of contemporaries who anticipated

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their potential negative consequences. Third, liquidity tensions experienced by banks are fairly well traceable and reflected by the data, which makes them a good illustration of how balance sheet constraints might have operated during the Gründerkrach.

In order to finance the fantastic expansion of highly lucrative underwriting business as well as their Kostgeschäft portfolio, investment banks increasingly drew on sight deposits with very short maturities and so called cash certificates (*Cassascheine*), an alternative form of unsecured callable retail debt. According to the final report of the Austrian House of Representatives' economic committee, cash certificates alone accounted for approximately 180 million Gulden of Cisleithanian bank funding at the end of April 1873[102]. The fact that the Austrian part of the bank level data compiled for this study only sums up to 91 million Gulden of cash certificates on December 31st 1872 certainly testifies to empirical limitations induced by the annual frequency of balance sheets; however, it also suggests that the banking system's funding via Cassascheine still multiplied by a factor of two over the last four months leading up to the Gründerkrach[103].

The correlation between the expansion of callable debt and the high noon of investment banking did not only resonate in contemporary reports on the causes of the crisis[104]; this mismatch already worried observers several months before the Gründerkrach broke loose. On the one hand, the introduction of cash certificates with very small denominations seemingly "democratized" the advantages of a booming stock market as it allowed the general public to reap its indirect benefits via high interest rates on call money deposited with financial intermediaries. On the other hand, there was no minimum reserve requirement, no guarantee scheme for retail deposits or cash certificates and creditors invested in these forms of bank debt had no legal entitlement whatsoever to be prioritized over other external funding providers in the case of bankruptcy[105]. Furthermore, according to Stein (1872), everybody knew that traditional banking, such as the discounting of bills of exchange or the mortgage business, would have never been profitable enough to motivate banks to compete for retail money at high rates[106]. In December 1872 he opined in an essay published in the Tresor,

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[102]Volkswirtschaftlicher Ausschuss des österreichischen Abgeordnetenhauses, 'Bericht des volkswirtschaftlichen Ausschusses über den Antrag des Abgeordneten Lienbacher und Genossen, betreffend die Krisis von 1873', *Beilagen zu den stenografischen Protokollen des Abgeordnetenhauses*, VIII. Session/445 (1874), 1-70 at 33.

[103]Figure 19 below corroborates these conjectures to the extent that it shows that certain banks, in particular those which failed in the aftermath of the Gründerkrach, exhibited very high deposit growth rates on the eve of the crash.

[104]c.f. Volkswirtschaftlicher Ausschuss des österreichischen Abgeordnetenhauses, 'Bericht des volkswirtschaftlichen Ausschusses über den Antrag des Abgeordneten Lienbacher und Genossen, betreffend die Krisis von 1873', at 33; Neuwirth, *Bank und Valuta in Österreich-Ungarn: Die Speculationscrisis von 1873*, at 361; Wirth, *Geschichte der Handelskrisis im Jahre 1873*, at 50.

[105]Volkswirtschaftlicher Ausschuss des österreichischen Abgeordnetenhauses, 'Bericht des volkswirtschaftlichen Ausschusses über den Antrag des Abgeordneten Lienbacher und Genossen, betreffend die Krisis von 1873', at 29.

[106]From a modern depositor's point of view, the rates banks paid for luring new funds into their vaults almost invite to dream of Cockaigne. For a subsample of Austro-Hungarian banks, yield curves can be constructed to depict the relationship between the interest rate paid and the maturity of cash certificates. For example, between December 1872 and April 1873 the

a weekly magazine for economics and statistics, that only highly lucrative Kost-geschäft lending and proprietary trading on the Viennese Bourse could explain this frenzy[107]. As a corollary, the author argued, "the effective value of cash certificates gradually reduces to the value of the securities which are bought for them. This means of course that the value is only stable as long as the stock market is stable"[108].

On May 7th 1873, the Neue Freie Presse, alongside the Wiener Zeitung one of the most eminent Austrian daily newspapers, published an explicit warning:

> "We have pointed out repeatedly that the general public is indulged
> in an illusion concerning the nature and the laws governing cash cer-
> tificates. [...] One should not ignore the fact that cash certificates
> are currently issued by so called banks whose solvency is question-
> able from one day to another."[109]

Indeed, some highly leveraged banks suffering directly from losses on their own securities holdings are known to have started to struggle with their deteriorating financial position as soon as May 5th 1873. On this date, the supervisory council of the Franco-Hungarian Bank, a Budapest-based credit institution, itself an off-spring of the Viennese Franco-Austrian Bank, felt the need to publicly call upon its shareholders for a further payment on its stocks – despite the fact that it had just recently decided in favor of the distribution of superdividends[110]. This bold move by the Franco-Hungarian Bank, which had participated in the foundation and IPOs of at least six of its Transleithanian homologues, triggered first doubts about certain banks' solvency. However, generalized public uncertainty definitely surpassed a critical level when rumors solidified that two Viennese investment banks, the Börsen- und Creditbank and the Commissionsbank, had effectively suspended payments on May 7th 1873[111]. Eventually, on May 9th 1873 one of the largest stock market brokers, the Commissionshaus Petschek, defaulted on its repos loans and the stock market ground to a halt[112].

Reacting to these events, creditors of Austro-Hungarian credit institutions initiated heavy withdrawals of their funding[113]. The above cited final report

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average interest rate for certificates with a maturity of only nine days amounted to 5% per annum. Yield curves are discussed in detail in the longer version of this paper.

[107]Ludwig Ritter von Stein, 'Natur und Recht der Cassenscheine', *Tresor - Revue, Statistik und Archiv für Volkswirtschaft und Finanzwesen*, 33/24.12.1872 (1872), 463-65 at 464.

[108]Ibid., at 465.

[109]Neue Freie Presse, 'Das Recht der Cassenscheine', 07.05.1873, 1873i p.10.

[110]Sommaruga (ed.), 'Der Oesterreichische Oekonomist (Oeconomist)', at 292.

[111]Ibid.

[112]Pressburger, *Oesterreichische Notenbank, 1816-1966: Geschichte des Oesterreichischen Noteninstituts* at 1131; Presse, 'Wiener Börse vom 9.Mai'.

[113]Reports on heavy targeted cash withdrawals from particular banks were abundant in the daily press. Some examples include Morgen-Post, 'Neuestes - Zur Börsenkrise', 12.05.1873, 1873b p.4; Fremdenblatt, 'Zur Börsenkrise', 15.05.1873, 1873a p.10; Neue Freie Presse, 'Von der Börse', 16.05.1873, 1873g p.4; Deutsche Zeitung, 'Die insolventen Banken', 17.05.1873, 1873 p.10; Volksblatt für Stadt und Land, 'Von der Börse', 21.05.1873, 1873 p.6; Neue Frem-denblatt, 'Neue Opfer der Börsenkrisis', 29.05.1873, 1873b p.3; Illustriertes Wiener Extrablatt, 'Wieder eine Bank-Kalamität', 30.05.1873, 1873 p.3; Morgen-Post, 'Die Katastrophe bei der Industrial-Bank', 30.05.1873, 1873a p.3.

of the Austrian House of Representatives' economic committee explained the rationale behind the occurring banks runs in the following way:

> "The insolvency of a foremost investment bank, which had issued cash certificates and was now preparing for the liquidation of its assets, strongly suggested that people who had invested in cash certificates could definitely not count on their full redemption and in the best case might hope for a proportional indemnity of their claims. Yet, the failure of this foremost investment bank, which at year-end 1872, with 2 million Gulden equity capital, had disclosed a circulation of 8 million Gulden cash certificates, led immediately to the drastic revelation that in the case of bankruptcy any funds that had been deposited in exchange for cash certificates would be irretrievably lost up to the last penny."[114]

Figure 19: Monthly changes in total deposits* of Austro-Hungarian banks (April 1872 - April 1874)
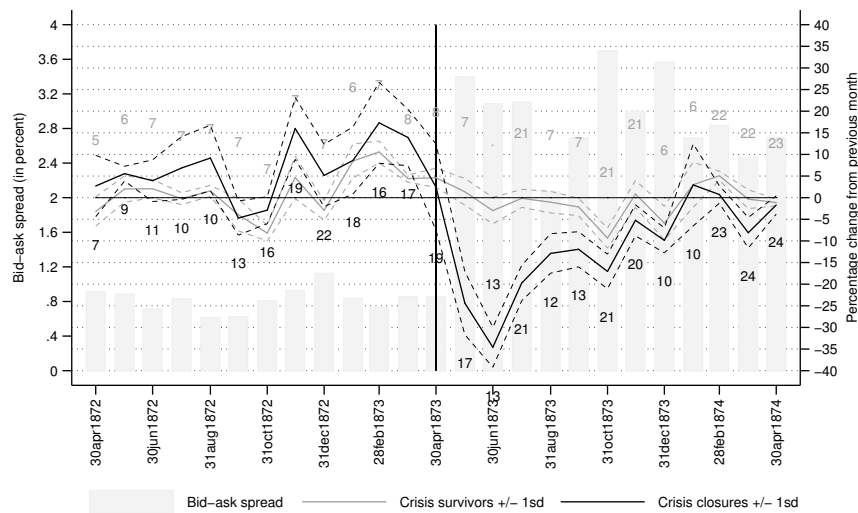
Source: own calculations; Tresor and Wiener Zeitung

Average calculated from available subsample of banks, N indicated for each data point.
Individual bank-level rates weighted by total deposits.
*Total deposits equal the sum of retail deposits and cash certificates.

Figure 19 displays the mean monthly percentage changes in total deposits (retail deposits and cash certificates) for a subsample of Austro-Hungarian banks between April 1872 and April 1874. The fact that Figure 19 relies on banks' voluntary data submissions (there was no official record of monthly changes in deposits or cash certificates) should be problematic for any type of generalized statistical inference because the subsample varies in number and composition

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[114]The report describes the fate of the Wiener Wechslerbank which officially filed for bankruptcy on June 9th 1873 after having attempted to stem runs for several weeks, c.f. Volkswirtschaftlicher Ausschuss des österreichischen Abgeordnetenhauses, 'Bericht des volkswirtschaftlichen Ausschusses über den Antrag des Abgeordneten Lienbacher und Genossen, betreffend die Krisis von 1873', at 34.
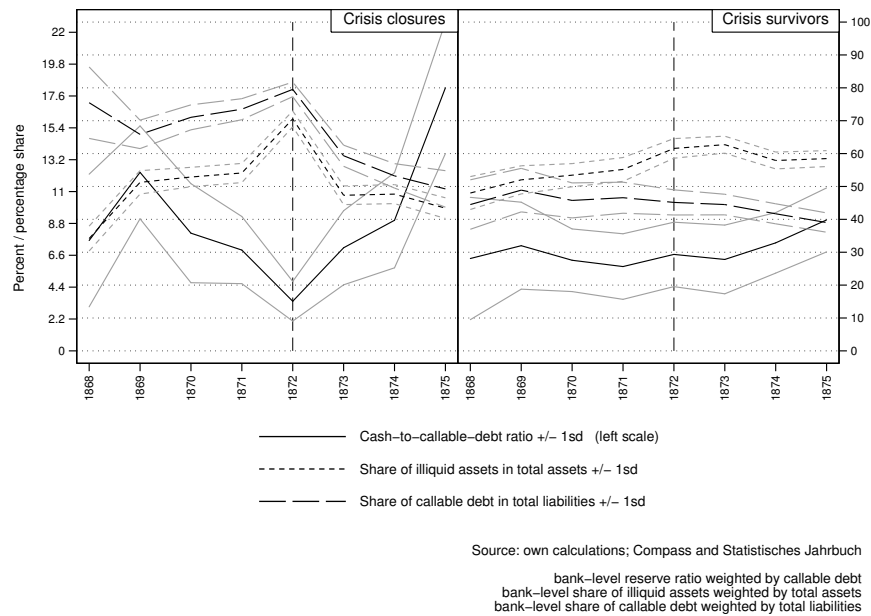
from call date to call date, depending on whether credit institutions published their financial data at the end of the month. Specifically, one might expect financial intermediaries with particularly high withdrawal rates to stop publishing their data or to submit falsified accounts in order to avoid "adding fuel to the fire". Similarly, an ex ante selection into the sample may have occurred. For example, in the absence of deposit guarantee schemes, only very solid banks are likely to publish the outstanding amount of their retail deposits in the first place. Both behavioral patterns would make it impossible to gauge the dimension of occurring bank runs, let alone conducting any analysis on the groups of targeted banks, since they would imply a considerable upward bias in deposit growth rates.

Against the background of these non-negligible caveats, Figure 19 tells a surprisingly clear-cut story. Contrary to what could be expected, the published data allows for the construction of an almost black and white opposition between Gründerkrach failures and survivors. The mean monthly percentage changes in total deposits of credit institutions which survived at least until the end of 1874 resembles a random walk with no longer term consistent deviations above or below zero growth rates. In contrast, judging by their respective month-on-month deposit growth rates, banks that had to close their doors definitely between May 8$^{\text{th}}$ 1873 and December 31$^{\text{st}}$ 1874 went through a clearly different, boom-and-bust type of cycle. On average, this latter group of credit institutions had to cope with an almost 50% loss of their total deposits in only 60 days after the stock market crash (-20% from April to May and -35% from the end of May until the end of June 1873). Mean comparison tests clearly reject the null of equality (at the 0.1%-level) between surviving and failing banks, even after accounting for potentially unequal variances across groups. Hence, in the months leading up to the Gründerkrach, banks which failed had significantly higher positive deposit growth rates, whereas in the months after the onset of the crisis they suffered from significantly higher withdrawal rates than surviving credit institutions. Taking into account that the data could suffer from upward bias, one may hypothesize that this contrast between failing and surviving banks was even more pronounced than is observable in Figure 19. An interesting feature of Figure 19 is certainly that depositors seemingly targeted institutions which can be identified as failures only post-hoc. Figure 19 conveys the impression that bank creditors harbored well defined priors concerning the asset allocation and quality of the financial intermediary they had chosen.

To be sure, Figure 19 does not allow for the conclusion that banks were forced to close down *because* they were targeted by funding withdrawals. Yet, given their important dimensions, withdrawals are likely to have played a decisive role. On the one hand, targeted bank runs may have been directly responsible for banks' suspension of payments. On the other hand, even if they cannot be immediately matched to bank failures, mass withdrawals certainly would have had the power to make liquidity-related balance sheet constraints binding. According to Figure 19, moments characterized by an increase in withdrawals actually coincided with peaks in liquidity squeezes. Each time withdrawal rates intensified, the market's bid ask spread shot up as one would expect under "cash-in-the-market" pricing in the context of fire-sale executions of repossessed collateral. This tight connection between targeted withdrawals

and market illiquidity is best understood in the light of the pronounced liquidity mismatch emerging on some Austro-Hungarian bank balance sheets on the eve of the crisis. At the end of 1872, credit institutions which fall into the post-hoc category of Gründerkrach closures on average displayed considerably higher ratios of illiquid assets, were financed more extensively by callable debt and exhibited lower cash reserves than surviving banks (c.f. Figure 20). In other words, the group of credit institutions that was targeted by bank runs consisted of exactly those banks which were more vulnerable to sudden funding withdrawals in the first place. The pressure exerted by depositors appears to represent a plausible mechanism through which failing banks lost control over the timing of collateral liquidation. Reacting to targeted funding withdrawals on the spot, these credit institutions quickly ran out of cash reserves and sought to execute large masses of repossessed repo collateral in order to honor their short-term financial liabilities. Due to depressed market prices, collateral sales led to large residual claims on borrowers which lenders were forced to write off, thereby cutting deeply into their equity.

Figure 20: Asset liquidity, callable debt and reserves of Austro-Hungarian banks (1868-1875)

Source: own calculations; Compass and Statistisches Jahrbuch

bank–level reserve ratio weighted by callable debt
bank–level share of illiquid assets weighted by total assets
bank–level share of callable debt weighted by total liabilities

In this process, banks not only suffered from idiosyncratic losses due to already depressed asset prices; they were also likely to push market prices even further down the demand curve. This in turn opened a trade-off very similar to the one discussed by Oehmke (2014) (c.f. Section 3.2). Credit institutions which were not targeted (yet) and kept on benefitting from some room for maneuver in terms of collateral liquidation now faced a tough choice too. They could either hold onto repossessed collateral and hope for merely temporary price effects; or, if anticipating a permanent depression of asset prices, they had the option to proceed to the liquidation of the securities Kostgeschäft borrowers had pledged

to them. As a corollary, through this form of contagion funding withdrawals not only affected directly targeted banks, they also played a role in the decisions of financial intermediaries which could still count on their creditors' trust. The minutes from the Bodencreditanstalt's (BCA) supervisory board and board of directors meetings provide an illustration of how banks perceived this trade-off in practice. The BCA was a large Austrian mortgage bank financed by domestic and international capital which had become particularly unfaithful to its original business focus during the Gründerboom. Justifying its policy stance during the first weeks of the crisis, the directorate reported to the supervisory board on May 21st 1873, with a decent tone of self-praise:

> "The big credit institutions cooperated during this [last] time and contributed their part to achieve the so necessary alleviation without fostering rotten and bogus practices, in order to revive and strengthen trust. For this purpose, we did not implement a single collateral liquidation, although we certainly placed margin calls on our Kostgeschäft and trading account debtors; this way of proceeding was seemingly in our own interest, because we were able to avert otherwise inevitable damages due to canny and sober-minded waiting."[115]

Unfortunately for the BCA, in the long run these perseverance tactics did not turn out to be that canny after all. Five months later, on October 8th 1873, the BCA's managing director ruefully reported to the board of directors:

> "[In May 1873], the losses amounted to a little bit more than one million Gulden and seemed to be manageable in view of the bank's large reserves; yet, today the stock market reports already provides very strong evidence to what extent the situation has changed since then; had the collateral executions been implemented at an earlier time, they could have resulted in a more favorable position; however, this was not possible, because banks which implemented collateral liquidations were stigmatized by the public, and even officially asked to refrain from executions in the hope that the crisis would be alleviated by this measure. Since then the recovery that was hoped for has not occurred, because the acute emergency situation evolved into a sluggish crisis which led to much higher losses."[116]

Although the BCA benefitted from the luxury to be able to postpone collateral sales in May 1873[117], its directorate seems to have underestimated the consequences of other market participants' reaction. It simply did not reckon with a permanent price slump of repossessed collateral caused by exiting lenders and investors. The bank's stocks, hitherto fairly unimpressed by the turmoil in

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[115] BCA's supervisory council meeting on May 21st 1873, Creditanstalt archives.

[116] BCA's board of directors meeting on October 8th 1873, Creditanstalt archives.

[117] The BCA's main funding source were covered bonds, rather than sight deposits. This particular funding situation, together with latent bail-out expectations due to the tight business connections with the Austrian state, shielded the BCA from outright bank runs. The long version of this paper provides more contextual details on the BCA.

Figure 21: Market-to-book ratio* of bank stocks decomposed by failure type (12/1867 - 12/1874)
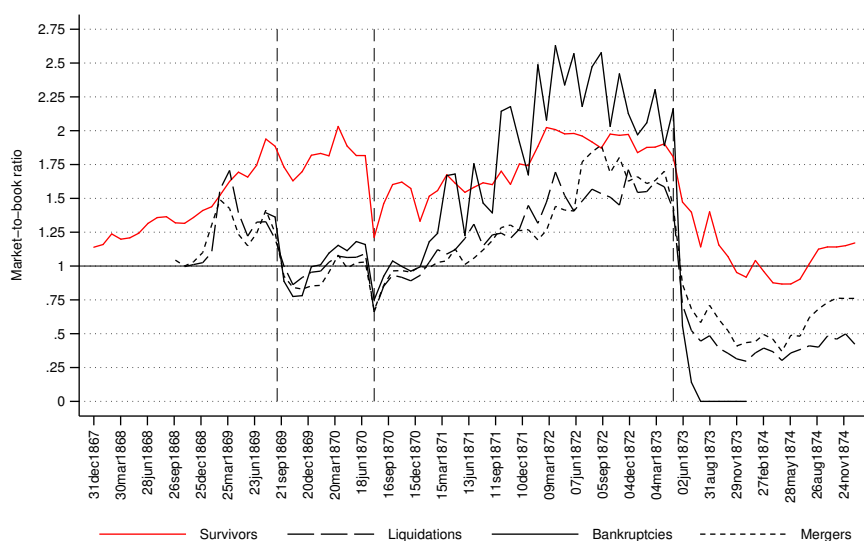
Source: own calculations; Compass, Coursblatt des Gremiums der k.k. Börse–Sensale and Wiener Zeitung

*End–of month quotes; par values adjusted to account for not paid up capital and fluctuations in silver prices where necessary.

Austria-Hungary, suddenly came under pressure when international shareholders realized the dimension of previously unacknowledged losses in October 1873 and started to dump their stocks in Frankfurt and Berlin[118]. Due to its large exposure to worthless collateral from defaulting Kostgeschäft borrowers, the bank almost failed to honor its credit commitments in the autumn of 1873[119]. Even though the BCA survived because it was one of the only two credit institutions bailed out by the Austrian government[120], its fate illustrates the possibility of strategic interactions forcing credit institutions to walk the tightrope between a "wait-and-see" strategy and a "rush to the exit". Moreover, the preceding quote also suggests that this trade-off was further compounded by banks having higher order interests to avoid collateral liquidations. Credit institutions which got caught executing repossessed securities were apparently thought to signal their deteriorating financial situation to the market. Public "stigmatization" in response to these signals may have taken the form of targeted withdrawals, with potential negative feedback loops between funding pressure and asset liquidations. In addition, it would have manifested itself in the confidence with which investors held onto these banks' stocks. These relationships are difficult to pin down causally, because any precise data on the timing of specific banks' collateral liquidation is lacking. However, banks closing down in the aftermath of the Gründerkrach, that is, exactly those institutions which were targeted by depositors and displayed pronounced liquidity mismatches, were also the ones that

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[118]BCA's board of directors meeting on October 8th 1873, Creditanstalt archives.

[119]In the BCA's board of governors meeting on October 8th 1873, managing director Hopfen suggested a capital loss of 4 million Gulden due to defaults by Kostgeschäft borrowers. c.f. also Pressburger, *Oesterreichische Notenbank, 1816-1966: Geschichte des Oesterreichischen Noteninstituts* at 1165.

[120]c.f. Steiner, *Die Entwicklung des Mobilbankwesens in Österreich* at 255.

permanently lost their shareholders' trust immediately following Black Friday (c.f. Figure 21).

8   Conclusion

Following in the footsteps of Gorton and Metrick (2012), recent contributions to the field of financial economics have concentrated on explaining the advent of borrower demise in the repo (repurchase agreements) market. Inspired by the failure of Lehman Brothers, a US investment bank which was forced to suspend payments and face bankruptcy when its short-term repo funding suddenly dried up in autumn 2008, economists have attempted to pin down necessary and / or sufficient conditions for repo runs to occur. Less attention has been paid to possible channels to financial distress on the lending side of repo markets. The present paper addressed this question from a historical perspective by focusing on the Austro-Hungarian Gründerkrach of 1873, an episode of financial turmoil which entailed both a severe stock market crash and a fully-blown banking crisis. Contemporary sources on the Gründerkrach accorded a decisive role in establishing the link between stock market crash and banking sector distress to an early version of repo loans, which credit institutions granted to stock-market agents. Building on these historical accounts and bringing to bear a large array of new bank-level and stock market data, this study provided a theoretically and empirically grounded explanation for the wave of bank failures in the months following Black Friday on May 9$^{\text{th}}$ 1873.

This paper situated repos in the wider context of banks' business models during the stock market boom leading up to the crisis of 1873. Repos played an essential role in the investment banking business conducted by Austro-Hungarian banks during the Gründerzeit. Repurchase agreements allowed credit institutions to raise the attractiveness of IPOs to investors in the stock exchange by supporting the liquidity of emitted shares through generous lending schemes. In this sense, repos represented a flexible alternative to outright securities purchases by underwriting banks aiming to achieve ex post IPO share price stabilization. The study offers a detailed narrative approach to trace the channels leading to bank distress during the Austro-Hungarian Gründerkrach by tracking how a reversal of investor sentiment slowly snowballed into an outright "run on repo". Insights from the legal environment, financial constraints and strategic trade-offs between repo lenders show that distress likely occurred in the context of forced collateral liquidation following severe liquidity mismatches on banks' balance sheets.

More formally, the impact repo loans had on lenders' demise was examined by drawing on Cox proportional hazard regressions. The paper's econometric results testify to a strong and robust negative relationship between banks' repo exposure and their survival performance. These findings question the received wisdom that the Gründerkrach banking crisis derived mainly from a bursting real estate bubble which subsequently compromised the financial health of credit institutions. The paper's results also directly challenge the still prevailing misconception that repos only constitute a product of the recent past by

underlining the crucial role these financial instruments played in 19th century financial markets and crises.

9 Appendix

9.1 Descriptive reasons for failure

Although the result of a voluntary decision taken by the qualified majority of shareholders, there are good reasons to believe that liquidations during the Gründerkrach were in fact simply one pf several possible management reactions to bank distress. The general assembly's decision to liquidate mostly sprang from the desire to avoid outright bankruptcy due to further losses that would have been incurred by staying in business. The advantage of a quick decision to liquidate in response to losses was at least twofold. First, the quicker a bank entered liquidation, the more likely it was to be able to minimize cuts into its equity following from hasty asset liquidations in response to creditors calling in their money. Liquidation allowed for more orderly asset sales because payments to creditors on an ongoing basis could be suspended. Second, in contrast to bankruptcy, liquidation enabled shareholders to retain the power over how and when bank assets were to be sold.

This interpretation of liquidations as a response to distress rather than an unforced decision to suspend business for "benign" reasons is confirmed by the summaries of final general assemblies published in the Compass. Table 4 below conveys a systematic summary of the available information on bank failures contained in the reports of the Compass. Out of the 70 liquidating banks for which reports are available in the Compass, only 6 mentioned bad future business perspectives as one of their main motivations for liquidation. All others cited their dismal financial position, for example losses from defaulting loans as well as securities holdings and withdrawals of funding, as their main reason for liquidation. The summary in Table 4 also provides qualitative data on reasons for 8 out of the 18 mergers which took place following the Gründerkrach. In only one of these cases did the target institution apparently give up the independence of its business activities for merely "benign" reasons. The Austro-Ottomanische Bank merged into the Imperial Ottoman Bank on June 30th 1874 because the Ottoman Empire had founded the latter to take over the entire state-financing business. Since the introduction of Ottoman government bonds in central Europe had previously been its most important banking arm, the Austro-Ottomanische Bank saw its future business perspectives eroding and agreed to a take-over by the Imperial Bank. In all other cases, shareholders seemingly rescued their stakes in a stumbling bank by agreeing to merge with another more solid institution.

Table 4: Reasons for bank closures as recorded by the Compass (1870-1880)

Bank	Date of closure	Type of closure	Reasons for closure
Oesterreichisch-niederlaendische Bank	02.05.1870	merger	losses due to stock market crisis of 1869; bad future business perspectives
Allgemeine Agrar-Bank	02.05.1870	merger	losses due to stock market crisis of 1869; bad future business perspectives
Wiener Bank	03.05.1870	merger	losses due to stock market crisis of 1869; bad future business perspectives
Oesterreichische Disconto-Bank	10.05.1870	merger	losses due to stock market crisis of 1869; bad future business perspectives
Generalbank für Industrie, Handel und Gewerbe	24.01.1871	merger	losses due to Franco-Prussian War; bad future business perspectives
Oesterreichische Volksbank	25.01.1871	merger	losses due to Franco-Prussian War; bad future business perspectives
Oesterreichische Centralbank	20.01.1872	liquidation	business partner went bankrupt; losses by branches; held own shares
Laibacher Gewerbebank	11.05.1872	liquidation	
Pest-Ofener Gewerbebankverein	28.01.1873	merger	
Veszprimer Credit-Anstalt für Handel und Gewerbe	16.03.1873	merger	
Raaber Credit- und Pfandleih-Anstalt	21.03.1873	bankruptcy	
Wiener Commissionsbank	07.05.1873	bankruptcy	losses from investment banking business
Boersen-und Credit-Bank	07.05.1873	liquidation	losses due to Kostgeschäft; defaulting loans; withdrawal of funding
Szegediner Credit- und Pfandleih-Anstalt	10.05.1873	bankruptcy	fraud
Oedenburger Credit-Bank	25.05.1873	bankruptcy	losses from investment banking business
Oedenburger Handels- und Gewerbe-Bank	25.05.1873	bankruptcy	losses from investment banking business
Nieder-Oesterreichische Bank	31.05.1873	bankruptcy	withdrawal of funding; losses due to Kostgeschäft
Wiener Wechslerbank	09.06.1873	bankruptcy	stock market crash made it impossible to borrow money against securities or sell them; defaulting loans; withdrawal of funding
Oedenburger Allgemein Bank	15.06.1873	liquidation	
Allgemeine Gewerbebank	18.06.1873	bankruptcy	withdrawal of funding; losses on securities holdings; defaulting debtors
Allgemeine Credit- und Handelsbank in Pilsen	20.06.1873	liquidation	fraud; withdrawal of deposits; defaulting interbank loans; losses from securities holdings

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Industrie- und Commercial-bank fuer Ober-Oesterreich und Salzburg	25.06.1873	bankruptcy	losses due to failure of other credit institutions; defaulting loans; withdrawal of funding; unable to sell securities to satisfy liquidity needs
Wiener Maklerbank	30.06.1873	liquidation	losses from investment banking business; losses due to Kost-geschäft; collateral and securities cannot be sold due to market conditions
Werschetzer Handels- und Gewer-bebank	01.07.1873	bankruptcy	
Alfölder (niederungarische) Bau- und Hypothekar-Creditanstalt	01.07.1873	liquidation	capital was not paid up
Munkacser Credit- und Pfandlei-hanstalt	01.07.1873	liquidation	
Neusatzer Spar- und Credit-Anstalt	01.07.1873	liquidation	
Credit-Institut für Handel und Gewerbe in Stuhlweissenberg	01.07.1873	liquidation	
Budapester Spar- und Credit-Anstalt	01.07.1873	liquidation	capital was not paid up; bad future business perspectives
Oesterreichische Boersen- und Wechslerbank	02.07.1873	liquidation	losses due to failure of other credit institutions
Bank für den Wiener Börsen-verkehr	03.07.1873	liquidation	losses due to commission business and Kostgeschäft; held own shares
Wiener Boden-Credit-Gesellschaft	04.07.1873	merger	losses due to failure of other credit institutions; defaulting loans
Boersen- und Arbitrage-Maklerbank	05.07.1873	liquidation	losses due to investment banking business and Kostgeschäft; defaulting loans
Ungarische Maklerbank	06.07.1873	liquidation	losses due to failure of other credit institutions
Oesterreichische Industrialbank	10.07.1873	liquidation	withdrawal of funding, losses from securities holdings and commission business; losses from Kostgeschäft
Schlesischer Bankverein	21.07.1873	liquidation	unable to sell any shares to the public
Westungarische Escomte- und Credit-Bank in Pressburg	22.07.1873	liquidation	defaulting debtors on the stock exchange
Credit-Bank in St. Poelten	25.07.1873	liquidation	
Oesterreichischer Vorschuss-Cassen-Verein	26.07.1873	liquidation	losses due to failure of other credit institutions
Raten- und Renten-Bank	26.07.1873	liquidation	losses from investment banking business
Wiener Cassen-Verein	28.07.1873	liquidation	losses due to failure of other credit institutions; defaulting loans
Pester Volksbank	29.07.1873	liquidation	losses from Kostgeschäft
Bank fuer Handel und Gewerbe des Riesengebirges in Trautenau	01.08.1873	liquidation	

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Allgemeine Vorschussbank	11.08.1873	liquidation	
Wiener Effectenbank	14.08.1873	liquidation	losses from investment banking business; large scale losses on securities holdings; defaulting loans
Wiener Agentur- und Credit-Bank	20.08.1873	liquidation	losses from investment banking business
Lemberger Bank	25.08.1873	liquidation	losses due to failure of other credit institutions
Temesvarer Gewerbebank	31.08.1873	bankruptcy	losses on repossessed collateral
Allgemeine Triesterbank	11.09.1873	liquidation	
Bank in Stadt Steier	16.09.1873	liquidation	
Temesvarer Commercial- und Hypotheken-Bank	16.09.1873	bankruptcy	withdrawal of funding precipated suspension of payments
Spar- und Lombard-Verein	20.09.1873	liquidation	losses due to failure of other credit institutions
Pressburger allgemeine Credit-Bank	28.09.1873	liquidation	defaulting debtors on the stock exchange
Szegediner Escompte- und Spar-Anstalt	04.10.1873	liquidation	
Allgemeine steierische Creditbank	05.10.1873	bankruptcy	defaulting loans; losses from Kostgeschäft
Triester Bodencredit- und Sparverein	13.10.1873	liquidation	
Italisch-oesterreichische Bank	14.10.1873	merger	losses due to Kostgeschäft; losses due to connections with stock market; defaulting loans
Wiener Capitalisten-Vereins-Bank	18.10.1873	liquidation	forced liquidation by other bank holding majority of stocks; bad future business perspectives
Provinzialbank in Wien	30.10.1873	liquidation	unable to sell any shares to the public
Pester-Bank	02.11.1873	liquidation	losses due to Kostgeschäft; defaulting loans; losses due to failure of other credit institutions; losses from securities holdings; losses on discount loans
Oedenburger Escompte-Bank	06.11.1873	bankruptcy	
Bürgerlicher Spar- und Credit-Verein	09.11.1873	liquidation	
Prager Wechslerbank	10.11.1873	liquidation	liquidation of large securities holdings resulted in losses
Wiener Commerzial-Bank	20.11.1873	liquidation	losses from investment banking business; held own shares; attempts to merge failed; losses due to Kostgeschäft
Oesterreichisch-ungarische Escompte- und Creditbank	22.11.1873	liquidation	strong speculative orientation; withdrawal of funding; held own shares; losses from commission business

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Crédit foncier fuer das Koenigreich Boehmen	29.11.1873	merger	
Galizische Landesbank	29.11.1873	liquidation	
Wiener Spar- und Credit-Bank	29.11.1873	liquidation	losses from Kostgeschäft; held own shares as Kostgeschäft collateral
Boehmische Hypothekar-Renten-Bank	06.12.1873	liquidation	
Erste Raten-Bank in Prag	06.12.1873	liquidation	
Pester Vereins-Bank	07.12.1873	liquidation	withdrawal of funding; liquidity shortage; bad future business perspectives
Allgemeine Escompte-Anstalt	17.12.1873	liquidation	losses due to failure of other credit institutions
Zwittauer Commercialbank	18.12.1873	liquidation	
Universalbank	23.12.1873	liquidation	stocks not admitted to Viennese stock exchange; losses from securities holdings (consequence of insolvent debtors in Kostgeschäft)
Wiener Boersen-Bank	23.12.1873	liquidation	losses from brokerage, investment banking
Oesterreichischer Spar-Verein	30.12.1873	liquidation	withdrawals of deposits; unable to obtain sufficient price for collateral in order to meet deposit withdrawals; losses from securities holdings; defaulting loans
Mährische Pfandleih-Gesellschaft	30.12.1873	merger	
Papaer Handels- und Gewerbe-Bank	31.12.1873	liquidation	defaulting loans
Südungarisches Boden-Credit-Institut in Szegedin	31.12.1873	liquidation	
Trenchiner Credit-Anstalt	31.12.1873	liquidation	
Nordwestboehmische Vereins-Bank	04.01.1874	liquidation	losses from investment banking business and Kostgeschäft
Mährische Boden-Credit-Anstalt	04.01.1874	merger	losses due to failure of other credit institutions
Erste Banater Handels- und Gewerbebank in Temesvar	05.01.1874	liquidation	
Szegediner Verkehrs-Bank	11.01.1874	liquidation	
Westungarische Hypotheken-Bank in Oedenburg	29.01.1874	liquidation	
Inneroesterreichische Boden-Credit-Anstalt	20.02.1874	liquidation	stocks not admitted to Viennese stock exchange
Boehmischer Sparverein	26.02.1874	liquidation	deposited collateral lost value and generated losses for bank; losses from securities holdings; defaulting loans
Carlsbader Bank	10.03.1874	liquidation	losses from investment banking business

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Industrie- und Boden-Credit-Bank	16.03.1874	liquidation	losses from securities holdings; held own shares
Hód-Mezö-Vásárhelyer Oekonomie-, Gewerbe- und Handelsbank	19.03.1874	bankruptcy	
Austro-Tuerkische Credit-Anstalt	24.03.1874	liquidation	unable to obtain sufficient price for collateral in order to meet deposit withdrawals; held own shares; losses from securities holdings; losses from investment banking activities
Boehmischer Bankverein	27.03.1874	liquidation	
Leopoldstädter Bank	31.03.1874	liquidation	losses from securities holdings, Kostgeschäft and commission business; held own shares
Prager Wechselstuben-Gesellschaft	31.03.1874	liquidation	
Wiener Credit-Bank	01.04.1874	liquidation	
Franz- und Josefstäder Spar- und Credit-Verein	01.04.1874	merger	
Saazer Bank	15.04.1874	liquidation	defaulting debtors on the stock exchange
Erstes Unter-Theiß-Credit-Institut in Török-Becse	15.04.1874	liquidation	
Budweiser Bank	26.04.1874	liquidation	losses from securities holdings; losses from commission business
Oesterreichische allgemeine Bank	13.05.1874	liquidation	losses due to collateral repossession; withdrawal of deposits; held own shares; losses from securities holdings; losses due to Kostgeschäft; defaulting loans
Prager Boersen-Bank	21.05.1874	liquidation	
Mariahilfer Spar- und Escompte-Gesellschaft	28.05.1874	liquidation	bad future business perspectives
Pester Wechselstuben Gesellschaft	07.06.1874	merger	
Genossenschaftsbank von Julius Heinisch Leopold Loewy & Comp	15.06.1874	merger	defaulting loans
Mährische Hypotheken-Bank	20.06.1874	merger	losses from securities holdings
Oesterreichische Sparbank	22.06.1874	liquidation	losses due to Kostgeschäft and commission business; held own shares; losses from securities holdings
Austro-Ottomanische Bank	30.06.1874	merger	bad future business perspectives
Wiener Escompte- und Depositen-Casse	04.07.1874	merger	
Landwirtschaftliche Credit-Actienbank in Lissa a. d. Elbe	07.07.1874	bankruptcy	losses from securities holdings; losses from investment banking business
Credit-Anstalt in Kuttenberg	16.07.1874	bankruptcy	withdrawal of funding

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Oesterreichische Interventions-Bank	06.08.1874	liquidation	losses from securities holdings and Kostgeschäft; held own shares as Kostgeschäft collateral; defaulting loans
Pester Pfandleih-Anstalt	10.08.1874	liquidation	losses from commissions business
Wiener Spar- und Credit-Casse fuer Gewerbe und Handel	18.09.1874	liquidation	losses due to Kostgeschäft
Actien-Gesellschaft für den Hypothekar-Credit	14.11.1874	liquidation	
Oesterreichische Immobiliar-Credit-Anstalt	31.12.1874	liquidation	
Gratzer Bankverein	28.02.1875	liquidation	bank complained about high taxes compared to very low profits; losses from securities holdings
Ofner allgemein bürgerliche Spar-cassa	22.03.1875	liquidation	defaulting loans; bad future business perspectives
Vorschuss-Escompte-Anstalt in Klattau	12.05.1875	bankruptcy	
K K privilegirte oesterreichische Vereinsbank	28.05.1875	merger	losses due to Kostgeschäft; losses from securities holdings; defaulting loans
Wiener Wechselstuben-Gesellschaft	17.08.1875	liquidation	losses due to Kostgeschäft; losses from securities holdings
Wiener Lombardverein	06.12.1875	liquidation	
Oesterreichische Hypothekar-Credit- und Vorschussbank	10.02.1876	liquidation	losses from securities holdings; defaulting loans
Indo-Aegyptische Bank	12.02.1876	liquidation	bad future business perspectives
Warnsdorfer Escompte-Gesellschaft	16.02.1876	bankruptcy	
Wiener Vororte-Bank	02.03.1876	liquidation	losses on real estate; held own shares
Oesterreichische Hypothekar-Rentenbank	06.03.1876	liquidation	losses from securities holdings and investment banking activities; defaulting loans
Disconto- und Wechsler-Gesellschaft	13.03.1876	liquidation	losses from securities holdings
Allgemeine Pest-Leopoldstädter Sparcasse	31.03.1876	merger	fraud; withdrawal of funding; defaulting loans
Ungarisches Beamten- Credit- und Versicherungs-Institut	09.04.1876	liquidation	withdrawal of funding
Bruenner Bank	20.04.1876	merger	
Boehmische Handels- Gewerbe-und Realitäten-Bank	04.05.1876	merger	
Steinamangerer Escompte-Gesellschaft	18.06.1876	liquidation	
K K priv Wiener Handelsbank fuer den Producten- und Waaren-verkehr	24.06.1876	liquidation	

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Salzburger Bank	24.06.1876	liquidation	illiquid assets could not be sold; withdrawal of funding
Franko-ungarische Bank	26.06.1876	liquidation	losses from securities holdings and investment banking business; defaulting loans
Ober-ungarische Creditanstalt als Producten- Commissions- und Wechselgesellschaft	01.07.1876	liquidation	
Ofen-Alt-Ofner Volksbank als Selbsthilfs-Verein	04.11.1876	liquidation	
Austro-Aegyptische Bank	20.11.1876	liquidation	
Ofner Commercial- und Gewerbe-bank	05.03.1877	liquidation	defaulting loans
Oesterreichische Bank-Gesellschaft	14.03.1877	liquidation	
Erste ober-ungarische Gewerbe- und Creditbank	31.03.1877	merger	
Eperieser Spar- und Creditverein	31.03.1877	merger	
Neusohler Bankverein	18.04.1877	liquidation	
Allgemeine boehmische Bank	07.05.1877	liquidation	
Franco-Oesterreichische Bank	15.05.1877	liquidation	losses from consortial and under-writing business
Oesterreichisch-orientalische Bank	24.05.1877	liquidation	
Teplitzer Bank	04.06.1877	liquidation	losses from securities holdings and investment banking business
Länderbanken-Verein	19.07.1877	liquidation	losses from securities holdings; defaulting loans
Triester Bank-Verein	21.08.1877	liquidation	losses from securities holdings and investment banking business
Prager Bank-Verein	12.11.1877	liquidation	losses from syndicates
Boehmische Volksbank	20.01.1878	liquidation	
Anglo-Hungarian Bank	28.01.1878	liquidation	losses from securities holdings and investment banking business
Papaer Volksbank	09.04.1878	bankruptcy	
Wiener Hypotheken-Casse	29.05.1878	liquidation	defaulting loans
Slavonische Commercial- und Es-comptebank	01.06.1878	bankruptcy	
Komorner Handels- und Gewerbe-Creditanstalt	12.06.1878	liquidation	
Nord-ungarische Hypotheken- und Industriebank	01.07.1878	liquidation	

Table 4 – continued from previous page

Bank	Date of closure	Type of closure	Reasons for closure
Bacser erste Handels- und Gewer-bebank	01.07.1878	liquidation	
K K priv mährische Bank fuer In-dustrie und Handel	27.07.1878	merger	
Baranyaer Comitats Spar- und Creditbank	13.11.1878	liquidation	defaulting loans
Mezöberenyer Volksbank	16.02.1879	liquidation	

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