

# Contingent Capital and Bank Risk-Taking among British Banks before World War I<sup>1</sup>

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## ABSTRACT

The recent financial turmoil highlights the incentive of highly leveraged financial institutions to take excessive risk, given the protection of limited liability. During the nineteenth and early twentieth century, many banks operated under liability rules which obligated shareholders to bear larger costs of bank insolvency in the form of contingent, or even unlimited liability. This paper examines the empirical relationship between the size of banks' contingent liability and their risk-taking behavior using data on British banks from 1878-1912. We find that banks with more contingent liability appear to have taken less risk. We also find evidence that the risk-reducing effects of contingent liability were larger for banks with higher leverage, suggesting that contingent capital mitigated moral hazard problem at banks.

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## 1. Introduction

From the enactment of the first commercial banking codes in the nineteenth century to the adoption of the Basel and Basel II accords in recent years, to the anticipated implementation of Basel III, policy makers have argued that holding increased amounts of capital promotes bank “soundness and stability” (Basel Committee on Banking Supervision 1988, 2004).<sup>4</sup> Capital has several stability-enhancing properties. First, unlike debt, equity provides a buffer against a shortfall in cash flow: if earnings fall, dividends can be suspended without catastrophic consequences, freeing up funds to pay depositors and other creditors.<sup>5</sup> Second, if a bank is forced to close, capital serves as a reserve that can be called upon to liquidate unpaid debts. Third, greater holdings of capital can encourage banks to undertake less risk: because the capital may be partially or completely wiped out if the firm fails, banks have an incentive not to take risks that might put them out of business.<sup>6</sup> Fourth, because banks know more about their operations than their investors (information asymmetry), the decision to hold more capital—i.e., to subject owners to a greater loss in case of failure—can signal to depositors and investors that the bank will undertake less risk than it otherwise might.<sup>7</sup>

Although the stabilizing role of bank capital is widely recognized by economists and policy-makers, establishing a regulatory framework that ensures that banks have sufficient

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<sup>4</sup> Bank capital (or lack thereof) played an important role in making the banking system vulnerable to systemic shocks during the recent financial crisis. See Demirguc-Kunt, Detragiache, and Merrouche (2010).

<sup>5</sup> Debt service cannot be so easily suspended. This is especially important, given that banks are among the most highly leveraged firms in the world: the average debt-to-equity ratio in US agriculture is about one; the average in manufacturing is about two; the average in banking is over nine. Troy (2004).

<sup>6</sup> This presupposes that the incentives of bank managers shareholders are aligned (i.e., assuming no principal-agent problem). Glassman and Rhodes (1980). The incentive effect can be even more powerful when shareholder liability is not limited (Grossman 2001a).

<sup>7</sup> Finally, banks hold capital because government regulations force them to do so. Such government regulation is typically justified on the grounds that it promotes soundness and stability in the banking sector: that is, for all the reasons cited above.

capital to weather large shocks has proven difficult. The value of bank capital changes over time and is notoriously difficult to measure given the inherent opacity of bank assets. The historical experience suggests that the difficulty in measuring bank capital may create an environment in which regulators are tempted to grant forbearance to insolvent banks (e.g., the US Saving and Loans Crisis in the 1980s and Japan's decade-long banking crisis in the 1990s).<sup>8</sup> It has also been emphasized that bank capital regulation may be circumvented because of the strong influence of political capture (Barth, Caprio, and Levine, 2006).

The earliest national banking codes, enacted in Canada, England, Finland, Japan, Sweden, and the United States, established minimum capital requirements ranging from just over £5000 to as much as £100,000. Even before governments began to mandate explicit minimum capital requirements, law, custom, and market forces led to alternative means for providing sufficient levels of capital as an additional protection for bank creditors, primarily through extended shareholder liability.<sup>9</sup>

The oldest and most well-known system of extended liability is unlimited liability, under which partners bear unlimited liability for the obligations of a failed firm. In England and Sweden, banks that issued currency during the nineteenth century were typically subject to unlimited liability.<sup>10</sup> In the United States, state law often mandated that banks chartered under their authority be subject to "double" liability: that is, in case of the bank's failure, shareholders would be liable for twice the amount they had originally paid for their shares; some states mandated "triple" liability.<sup>11</sup>

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<sup>8</sup> See, for example, Kane (1989) on the S&L crisis and Fukao (2003) on the Japanese experience.

<sup>9</sup> See Berger, Herring, and Szegő (1995) on market capital requirements.

<sup>10</sup> By contrast, in countries in which government-sponsored central banks maintained a monopoly on note issue, banks were frequently incorporated with the same liability rules as governed non-financial corporations. Grossman (2001b).

<sup>11</sup> Technically, shareholders of such a bank were liable to pay in an additional amount equal to the par value of their shares (shareholders subject to triple liability would be liable for an additional payment equal to twice the

Theory predicts that extended liability will reduce the opportunity to shift risk to debt holders (e.g., depositors), since bank owners under such a regime are obligated by law to shoulder failure costs that are potentially well in excess of the initial equity contributed. Figure 1 illustrates shareholder payoffs under a variety of liability rules. In all cases, there is no upward limit on shareholder returns: positive returns on investment projects (i.e., higher firm value) lead to higher share value without limit. Under unlimited liability, the negative returns to shareholders are also unlimited, implying that the shareholders give equal weight to both tails of asset returns when evaluating investment decision.<sup>12</sup> Under limited liability, negative returns to shareholders are limited to the amount of paid-in capital, thereby altering the bank's risk preference: if bank returns are normally distributed (with a mean of zero), bank owners operating under limited liability can increase their expected return by engaging in higher-risk projects (i.e., those with a higher variance). Such risk-shifting incentives are mitigated by contingent liability, since it raises the size of the potential negative payoff to shareholders. Thus, banks operating with larger amounts of contingent liability should give greater weight to the extremes of the tails of the returns—hence, avoiding high-variance (i.e., high-risk) projects. Esty (1998) and Grossman (2001a) demonstrate that such strict liability rules historically played an important role in reducing moral hazard problem in the US banking sector.

In this paper, we consider another mechanism for imposing contingent liability upon bank shareholders which was common in Britain during the late nineteenth and early twentieth century: uncalled capital. Under this system, firms issued equity with a nominal value, all or part of which might have been required to be paid in by subscribers at the time of

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par value of their shares). To the extent that the market value differed from the par value and the purchase price, the terms “double liability” and “triple liability” are misnomers. Grossman (2001a).

<sup>12</sup> In practice, however, shareholders' liability is limited to their wealth—even under unlimited liability.

the initial offering. Shares which were only partly paid carried with them a contingent liability for the unpaid portion and could be called in by the firm at the management's discretion. As in the case of unlimited and double liability, such extended liability should induce bank shareholders to become more risk averse.<sup>13</sup> Even in the absence of an actual capital call, the threat of such a call might render shares with uncalled liability less liquid which, in turn, would give shareholders additional incentive to monitor managers for excessive risk-taking. The goal of this paper is to determine whether greater levels of uncalled capital, in fact, reduced bank risk-taking.

Examining the consequences of uncalled liability fills a substantial gap in the scholarly literature. Despite the recent and intense interest in unlimited liability,<sup>14</sup> double liability,<sup>15</sup> and contingent capital<sup>16</sup>--in part, as a result of the subprime crisis and its aftershocks—there has been little systematic empirical work specifically examining the historical experience with unpaid capital.<sup>17</sup> Contingent liability also offers advantages over other forms of extended liability, particularly in terms of the tractability of empirical analysis. Unlike unlimited liability, although similar to double and triple liability, the extent of liability with uncalled capital is explicitly stated; in the case of unlimited liability, the contingent liability could well exceed the total wealth of some shareholders, as it famously did during the failure of the City

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<sup>13</sup> Although unlimited liability and double liability superficially resemble the extended liability provisions of uncalled capital, in fact, there are important differences. Both limited liability and double liability formally come into play only if the institution in question is being wound up. Shareholders in both types of firms can be solicited for additional funds--either to bolster a foundering firm or to promote growth of a healthy one—however, they are under no obligation to do so. On the other hand, those owning shares with unpaid capital are obligated to meet capital calls under all circumstances, whether or not the firm is in liquidation. Because calling up uncalled capital of an on-going concern is much simpler than calling upon unlimited or double liability in the case of bankruptcy—which involves a court procedure—it is, in a sense, a less rare occurrence and one which shareholders are therefore more likely to anticipate

<sup>14</sup> Halpern et al (1980), Easterbrook and Fischel (1985), Carr and Mathewson (1988), Hansmann and Kraakman (1991, 1992a, 1992b), Grossman (1995), Hickson and Turner (2003a, 2003b, 2005), Acheson and Turner (2006).

<sup>15</sup> Macey and Miller (1992, 1993), Jackson (1993), Wilson and Kane (1996), Esty (1998), and Grossman (2001a, 2007).

<sup>16</sup> Kashyap, Rajan, and Stein (2008), Flannery (2009).

<sup>17</sup> See, however, Nanjo and Kasuya (2009).

of Glasgow Bank in 1879. Further, unlike double or triple liability, the extent of uncalled liability varied from firm to firm, allowing a more systematic assessment of its effects. Finally, given recent interest shown by policy makers in extended liability, the historical examination may yield insight for current-day policy.<sup>18</sup>

Our work also ties in with an extensive literature on the importance of liability structure. The Coase Theorem (1960) argues that in the absence of transactions costs as long as property rights—or, in this case, liability obligations—are clearly assigned, the market can effectively price their effects and thereby render liability structure irrelevant. Grossman’s (1995) case study of American Express, an unlimited liability company, shows that its shares were just as actively traded—and not viewed as excessively risky in comparison with those of limited liability companies—suggesting that the liability structure did not have important effects on market outcomes. Similarly, Acheson and Turner (2008b) do not find any discernible difference in the liquidity of shares of limited liability and extended liability banks in the nineteenth century Britain. Our study differs from previous work in that it looks in detail at the balance sheet characteristics of banks under different liability rules and assess whether liability structure had effects on banks’ risk taking behavior.<sup>19</sup>

Briefly, we find that, on average, banks with larger amounts of contingent liability tended to be more conservative. That is, they held less risky assets and their loan portfolios grew more slowly than banks with less uncalled capital. Notably, these effects are larger for banks with smaller amounts of paid-in capital at stake, suggesting that contingent capital mitigated the moral hazard problem at banks that were less well-positioned to weather negative shocks to the value of their assets. Our results are analogous to those of Esty (1998)

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<sup>18</sup> See, for example, Ashcraft (2004) on the Federal Reserve’s “source of strength” doctrine.

<sup>19</sup> Unlike Acheson and Turner (2008b), we do not focus specifically on the liquidity of bank shares.

and Grossman (2001a) who find that double liability rules in the US worked to restrain excessive risk-taking by banks. We also infer from these results that liability structure indeed “mattered” in the pre-war British banking sector.<sup>20</sup>

## 2. The evolution of contingent liability in law and practice

The first joint stock bank in Britain was the Bank of England, which was established in 1694.<sup>21</sup> Prior to that, banking services had been rendered by a number of different agents, including scriveners, goldsmiths, moneylenders, and participants in the daily meetings of London merchants, although none had received any charter, sanction, or official recognition from the government. In 1708, during the War of Spanish Succession, in return for a fresh loan to the government, a new charter was granted which, among its other provisions, prohibited associations of more than six individuals from carrying on a banking business in England and Wales.<sup>22</sup> Thus, for the next 118 years, all banks with the exception of the Bank of England were partnerships with unlimited liability.

Banking crises in the early nineteenth century brought home to policy makers the fragility of a banking system composed primarily of small banks. This realization, combined with the declining importance of the Bank of England in funding government expenditures, led to the passage of a series of laws which gradually eroded the Bank’s monopoly on joint stock banking (Broz and Grossman 2004, Grossman 2010). An 1826 law allowed the

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<sup>20</sup> One way in which our results can be reconciled with those of Acheson and Turner (2008b) is to argue that *at the equilibrium*, banks with extended liability might have made deliberate choices to invest in less risky assets, thereby reducing the probability of liability calls and raising the attractiveness of their shares.

<sup>21</sup> This section deals almost exclusively with the liability laws affecting banks. Hunt (1936) and Cook (1950) discuss the development of corporation law more broadly.

<sup>22</sup> The 1742 charter specifically enunciated the Bank’s “privilege of exclusive banking.” Crick and Wadsworth (1936: 11), Thomas (1934: 15).

establishment of note-issuing joint stock banks outside of a 65-mile radius of London. By 1833, joint stock banks without note-issuing privileges were allowed within the 65-mile exclusion zone. Although these laws were viewed as something of a watershed at the time in that they allowed the formation of banking corporations, their provisions were quite modest: no minimum capital requirements were specified, nor were banking corporations granted limited liability.

Two pieces of legislation in 1844 further changed the character of English banking, both regularizing the mechanism for creating joint stock banks and setting limits upon bank activities in order to reduce the riskiness of their operations.<sup>23</sup> The better known of these was the Bank Charter Act (also known as Peel's Act, after the Prime Minister, Sir Robert Peel) which, among other things, began the process—continued over several decades--of centralizing the banknote issue within the Bank of England. Because banknotes are highly liquid, and subject to over-issue, by gradually removing the privilege of note issue from commercial banks, the law reduced their exposure to banknote-related risk. And, when banks were eventually allowed to incorporate with limited liability, remaining note-issues were exempted from the limited liability provision.

The second piece of legislation was the Joint Stock Banking Act. This law established England's first banking code and specified a detailed set of regulations governing the establishment and management of joint stock banks. Minimum share denominations were to be £100, in order to encourage shareholding by the wealthy individuals who would be able to afford future capital calls. The law also introduced minimum capital requirements: banks had to have £100,000 in subscribed capital, half of which had to be paid up before they could begin operation.

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<sup>23</sup> The text of both laws is reprinted in Gregory (1929).

In some sense, the notion of “uncalled capital” in an unlimited liability bank is counterintuitive: if liability is joint and several, then individual partners can be sued for the debts of the partnership as a whole and liability will not be limited to the amount of uncalled capital. Nonetheless, uncalled capital may have served an important role: the unlimited liability of partners would only be relevant in the case of a liquidation of the firm; uncalled capital could be called in under much less dire conditions.

The provisions of the Joint Stock Banking Act were severe relative to existing law: no new joint stock bank was established during the subsequent five years and only seven were formed during the 13 years following its enactment, compared with well over 100 established during the previous 13-year period. The 1857 Joint Stock Banking Companies Act repealed the code of 1844, essentially subjecting banks to the new joint stock company law (which had been enacted the previous year), aside from its limited liability provisions. Legislation in the following year granted joint stock banks the right to incorporate with limited liability. Consolidating legislation enacted in 1862 made limited liability readily available for banks and also eliminated the £100 minimum share denomination.

The changes in banking law led to the rapid growth of limited liability banking, both through the establishment of new institutions and the conversion of unlimited liability banks into limited liability institutions. Nonetheless, many of the larger, well-established joint stock banks were reluctant to incorporate under limited liability (Crick and Wadsworth 1936: 32-33). By 1870, there were approximately 80 joint stock banks in England and Wales, with total market capitalization of £52 million (about 4.5% of British GDP). At the end of 1913, there were less than 45 joint stock banks in England and Wales, with a combined market capitalization of about £160 million (about 5.9% of British GDP).

The failure of the unlimited City of Glasgow Bank in 1878 again raised the question of the advisability of limited liability banking.<sup>24</sup> One of the reactions was the passage of the Companies Act of 1879, which instituted the principle of “Reserved Liability.”<sup>25</sup> Section 5 of the Act allowed banks, both limited and unlimited, to divide their uncalled capital into two parts, one to be callable at the discretion of the directors and a second as “reserved liability,” only to be called up in the event that the firm was wound up.<sup>26</sup> Under the terms of the Act, unlimited liability banks were allowed to increase their nominal capital, as long as the entire increase was allocated to reserved liability. Both limited and unlimited banks could reclassify a portion of their uncalled capital as reserve liability. Many banks took advantage of this in the subsequent decade (Gregory 1936 I: 206ff).<sup>27</sup>

The greatest risk to shareholders with contingent liability was that part or all of the uncalled capital could be called. If the firm’s liquidation was handled by the bankruptcy court, shareholders became parties to the case and could be compelled to pay the uncalled capital by the court. Uncalled liability, along with high share denomination, was seen as ensuring that shares remained in the hands of the well-to-do, who would be willing and able to monitor the activities of managers and cautious in how the business was run. According to Jefferys (1938 [1977]: 174-5):

The very existence of a large uncalled portion on each share was a direct incentive to interest in the activities of the company. If there was any doubt about the honest

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<sup>24</sup> This development had a parallel with developments among non-banking firms following the Overend, Gurney crisis of 1866. The 1867 Companies Act allowed companies to reduce their capital and share values, thereby reducing the proportion of unpaid capital. Few older companies took advantage of this provision, although newer companies tended to issue shares of lower denomination with a small unpaid portion. Jefferys (1946: 46).

<sup>25</sup> Crick and Wadsworth (1936: 33), Gregory (1936 I: 204ff). Another important part of this Act (section 7) mandated periodic independent audits.

<sup>26</sup> Our results are qualitatively similar if we treat reserved liability independently of uncalled liability, although they are less statistically robust than the results with total uncalled liability, suggesting that total uncalled liability mattered more than reserve liability.

<sup>27</sup> As joint stock banking matured, a further important trend that may have affected bank risk-taking was the development and growing acceptance of “conservative” banking principles (Kennedy 1987, Collins 1989).

running of the concern, or the promises of the prospectus not being fulfilled, the shareholders attempted to use legal methods to absolve them of the necessity of paying up their shares.

And, in fact, two shareholders in Overend, Gurney sued—unsuccessfully—to have their names removed from the roster of shareholders in the wake of capital calls made on their shares after the firm’s failure due to gross mismanagement (Campbell 1895: 879ff.).

Even in the absence of liquidation or an actual capital call, uncalled liability could impose substantial costs upon shareholders, particularly in the liquidity of shares and in their usefulness as collateral. Testifying in the aftermath of the Overend, Gurney crisis, banker and statistician William Newmarch presented the example of a company founded with £50 shares, the management of which subsequently realized that it only required £25 to be paid in:

There is then an uncalled margin of £25, which hangs over the heads of the persons who are on the register of the company, and looking at the events of the last nine or ten months, the practical result is, that shares in the kind of companies mentioned have become almost entirely unmarketable, and for the very obvious reason that the buyer, while he will be perfectly content to embark in a concern where £25 is paid up, where only £5 or £10 more can in any way be called up, he is exceedingly unwilling to embark in a concern where the uncalled liability is represented by £25 per share. (Parliament (1867: Q. 525))

I should think that at this moment there is between 20 and 30 millions of actually paid-up money, which is more or less in a state of suspended animation, in consequence of the unmarketable character of the shares. (Q. 528)

This view was reinforced by Manchester merchant and Salford mayor, Henry Pochin:

I think that [overhanging liability] is a great public damage; the shares of many companies are incapable of being negotiated in any form, the property being as far as paid-up capital is concerned, just as unavailable as if it were at the bottom of the sea. It cannot be dealt with; it cannot be sold in the market. No banker will look at it, and the consequences are very serious and very considerable, having regard to what I believe to be the real value of those shares (Q. 2298)

He argued that bankers would not take securities with uncalled liability as collateral for loans, since if the borrowers defaulted, the bank would have to seize the contingent liability, which might outweigh the value of the shares (Q. 2311).<sup>28</sup>

Uncalled liability was also useful for companies attempting to raise capital under less dire circumstances. Rather than calling in capital, the management employed uncalled capital in two ways: (1) as collateral for bank loans or for debentures to be sold in securities markets; and (2) by issuing new shares with lower amounts of paid-up capital. *The Shareholder Guardian* (August 12, 1864) complained that: “The pernicious practice has grown up whenever additional working capital is required, of not making calls on the existing shares but of issuing new ones and requiring a small payment to be made on them” (quoted in Jefferys (1938 [1977]: 181).<sup>29</sup>

### 3. Data

Bank balance sheet data on banks of England and Wales from 1877-1912 were gathered from the *Economist* banking supplement,<sup>30</sup> share data were taken from the *Investor’s Monthly Manual (IMM)*, which published comprehensive tables on securities traded on British—and some foreign--exchanges.<sup>31</sup> The *IMM* did not include separate tables for stocks and bonds, and so distinguishing debt from equity is not a straightforward exercise.<sup>32</sup> Annual

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<sup>28</sup> He further noted that those who held such shares felt compelled to leave funds that could otherwise be used in profitable endeavors lying idle in the bank as insurance against calls (Q. 2301).

<sup>29</sup> We intend to take up the consequences of this form of raising additional capital in future work.

<sup>30</sup> The *Economist* banking supplement began reporting consistent bank balance sheet data in October 1877. Our analysis starts in 1878 to allow a one year lag to avoid endogeneity problems. Our results are unaffected if the analysis begins in 1883, after most banks had adopted limited liability. We restricted our sample to banks in England and Wales because Scottish and Irish banks operated under a different legal framework.

<sup>31</sup> Grossman (2002: 124-126, 144) presents a more complete description of *IMM* data.

<sup>32</sup> Fixed income securities were sometimes distinguishable by the title of the issue (which might, for example, include a maturity or an interest rate) or by listing the nominal amount of the issue rather than the number of shares in the column titled “number of shares or amount of stock” (i.e., £100,000 versus 100,000) or by the designation “stock” rather than an amount in the column devoted to the nominal amount of the share. It is

data on ordinary shares were gathered from the December issue of the *IMM*, including the number of shares outstanding, the nominal amount of each share, and the amount paid-in on each share. We also collected monthly data on share prices from this source so as to compute the volatility of share prices. Information was not collected on shares for which any of this information was omitted in the *IMM*.<sup>33</sup>

At the time of establishment, company promoters declared the nominal amount of the firm's capital, the number of shares into which it would be divided, and the portion of each share that would be paid-in by subscribers.<sup>34</sup> For example, a firm might be established with £1,000,000 capital divided into 10,000 shares of £100 each, with £50 pounds per share paid-in. Upon issue, subscribers would pay £50, with another £50 payable (i.e., uncalled capital) at the discretion of the directors.<sup>35</sup>

During the late nineteenth and early twentieth century there were no statutory requirements as regards share denominations or proportion of shares paid up. These were, rather, determined by the organizers at the outset. Frequently, organizers stated how much they intended to call up of a firm's nominal capital in the firm's prospectus, although it is unlikely that these intentions were legally binding. The proportion of capital paid up varied for a variety of reasons, including common practice within an industry and current opinion as to what share characteristics were conducive to promoting financial stability (Jefferys 1946: 46-48).

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possible that some securities that carried the designation "stock" in the amount column were, in fact, fully paid £100 shares and so the data presented in this section may not represent all fully paid shares. We are grateful to John Turner for clarifying the *IMM* nomenclature.

<sup>33</sup> A missing latest price suggests that the share was not actively traded in the month.

<sup>34</sup> These were considered among the most crucial decisions made by company promoters. Jefferys (1946: 45) notes that by "the eighties and nineties these considerations were no longer to the fore."

<sup>35</sup> Under the Joint Stock Bank Act of 1844, a nominal share amount of £100 with £50 paid in would have been common. These minimum share denomination and paid-in requirements were eliminated in 1862.

Figure 2 presents data on the extent of uncalled capital, as measured by the ratio of uncalled to paid-in capital, in banks, insurance companies, mining companies, and land, mortgage, and finance companies during 1870-1913, as well as an average for all firms listed on the London Stock Exchange. The data for calculating the ratios, as well as the sector classifications, are taken from the *IMM*. The ratio is weighted by firm size: that is, the ratio is the sum of all uncalled capital in the sector divided by the sum of total nominal capital.<sup>36</sup> Figure 2 illustrates the relatively high amount of uncalled capital maintained by banks, insurance, and land, mortgage, and financial companies relative to the market as a whole. The high proportion of uncalled capital can be seen as a market-imposed requirement to engender confidence in sectors where leverage was high and the physical assets were either meager or inaccessible to creditors. Insurance companies, which like banks had large potential liabilities, had not been permitted to register as limited liability firms until 1862.

Figure 2 can be interpreted as suggesting that the introduction of reserved liability in 1880 increased in the relative amount of uncalled capital. In the course of establishing reserved liability, many banks raised the nominal value of their capital without changing the paid-in amount. During the entire period, changes in paid-in capital that were not associated with a stock split or with a change in the nominal capital of a firm were no more common in banking than in any other industry, occurring in about 2 percent of company-year observations.<sup>37</sup>

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<sup>36</sup> Mining is included because, like the three financial sectors, the amount of uncalled capital was high relative to the average of the entire market.

<sup>37</sup> It is impossible to determine from our data precisely how often capital was called, since such calls may have been partially disguised by stock splits or by the issuance of new shares. Nonetheless, we estimate capital calls by years in which the change in uncalled capital was equal and opposite to the change in the amount of paid-in capital. By this measure, the number of capital calls was not great—about 2.2 percent of bank-year observations—and fell by 0.13 calls per year.

#### 4. Methodology

Our working hypothesis is that the more capital bank owners have at stake, the greater their incentive to avoid risk.<sup>38</sup> Shareholders in banks operating under unlimited liability—which we capture with a dummy variable—have the greatest potential loss (all of their personal assets) and should, in theory, be the most risk-averse.<sup>39</sup> Shareholders in banks operating under limited liability have at stake the total amount of equity capital, measured by the ratio of market value of capital to total assets: the smaller the capital-to-asset ratio, the greater incentive for risk-taking.<sup>40</sup> Finally, bank owners also have contingent liability, which we measure in two ways: (1) by the amount of uncalled capital relative to the book value of subscribed capital; and (2) by the amount of uncalled capital relative to the value of paid-in capital.<sup>41</sup>

We measure bank risk—our dependent variable—in four ways. First, following Saunders, Strock, and Travlos (1990) and Esty (1998), among others, we use the volatility of share prices. More specifically, we compute the standard deviation of monthly changes in share prices for a given year for each bank, which we match up with annual data on bank

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<sup>38</sup> If the interests of managers and shareholders are not aligned, there may be principal-agent problems (Glassman and Rhoades 1980). Such incentive incompatibility contributed to the 1878 failure of the City of Glasgow Bank. Most British banks required directors to hold a minimal number of shares, potentially mitigating this problem (Acheson and Turner 2008a:244).

<sup>39</sup> Unlimited liability companies are not, of course, completely unlimited, but are limited by the wealth of their shareholders, which is not known with precision by the market at any moment. Dropping unlimited liability companies from our analysis does not substantively alter our results. The results are not reported to conserve space but are available from the authors upon request.

<sup>40</sup> We also use the ratio of paid-in capital (in book value) to assets to measure capital-to-asset ratio as a robustness check, as well as the level of capital and reserves. The results are qualitatively similar, and thus not reported to conserve space.

<sup>41</sup> There is no correct method for specifying the denominator in a measure of contingent capital. We focus our attention the ratios of uncalled liability to subscribed capital and to paid-in capital, which seem to have been the focus of market participants at the time. One could also measure uncalled capital relative to market capitalization, since as market valuations increased a given amount of uncalled would have decreased in importance to shareholders. We have experimented with this measure, although the results are generally not significant.

liability characteristics.<sup>42</sup> This measure has several limitations. First, some banks are privately owned, and thus their shares are not traded; we drop these banks from our sample. Second, even when banks are publicly traded, shares are not transacted every month, presumably because these shares are not especially liquid. Following Esty (1998), we screen out bank-year observations in which fewer than 11 prices are observed (out of 12 months).<sup>43</sup> After dropping the 580 observations for the reasons discussed above, we are left with 2636 bank-year observations that contain information on capital-to-asset ratio, liability status (limited or unlimited), and the amount of contingent capital.<sup>44</sup>

Another potential problem with this measure is that contingent liability makes shares riskier, since compared with limited liability, equity holders with contingent liability face wider range of returns for a given asset risk (Esty 1998). Hence, given this direct positive effects of contingent liability on share price volatility, even if contingent liability reduces asset risk (which in turn reduces the volatility of share price returns), the net effect of these competing mechanisms is theoretically ambiguous.

Because of the limitation of share price volatility, we also use three alternative measures of risk-taking from bank balance sheets: the ratio of loans to total assets, the ratio of cash to total assets, and the rate of growth of assets. Our assumption is that loans are riskier and less liquid—and that cash is less risky and more liquid--than other balance sheet assets,

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<sup>42</sup> One possible objection to this procedure is the assumption that the true volatility of prices can be captured only with 12 observations. As a check, we compute standard deviation based on 24 month of share price data to construct bi-annual panel. The results are qualitatively similar.

<sup>43</sup> The results are qualitatively similar without this screen or with a less stringent screen (e.g., dropping bank-year observations in which fewer than 10 prices are observed). We also limited analysis to the largest 25 percent, 50 percent, and 75 percent of all banks (by size or number of shareholders) in order to eliminate the possibility that the share prices of less frequently traded banks were more likely to be subject to manipulation. This did not substantially alter our results.

<sup>44</sup> Because the data are panel, we adjust standard errors by using STATA's cluster option.

primarily securities.<sup>45</sup> Banks with substantial contingent liabilities should have a smaller proportion of their assets in loans and a larger proportion of their assets in cash than limited liability banks if the risk-reducing incentive of contingent liability is strong. We also measure risk-taking by the rate at which a bank's assets expand in a given year under the theory that, all other things being equal, banks that engage in riskier activities will grow more rapidly than banks behaving in a more conservative manner (Calomiris 1990, Grossman 2001a, 2007).

Descriptive statistics are presented in Table A1.

With these four measures of risk as dependent variables, we estimate the following regression equation:

$$Risk_{it} = \beta_0 + \beta_1 Capital_{it} + \beta_2 Unlimited_{it} + \beta_3 Contingent\ Liability_{it} + \varepsilon_{it}$$

Since all three factors reduce the incentive for banks to take risk, we expect the coefficients on each of these variables to be negative. All specifications include year specific effects.<sup>46</sup>

Standard errors are clustered by banks.

In addition to this basic specification, we control for bank size (measured by log of assets, the number of branches, and establishment year, to be sure that the factors that are correlated with bank risk are not driving our results. Table A2 show the structure of correlations among these variables. It is noteworthy that uncalled liability is positively correlated with both bank size and the number of branches and negatively correlated with establishment year, indicating that large and old banks with diversified branch network is more likely to issue shares with uncalled liabilities. Controlling for these factors, thus, is

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<sup>45</sup> We also attempted to use the fraction of the asset portfolio in cash and government securities, however, the *IMM* doesn't provide data on government securities holdings until relatively late in the period, rendering this approach impractical.

<sup>46</sup> As a first pass at the data, we ran several specifications with bank fixed effects, but the results are all insignificant largely due to the fact that the independent variables do not have rich within-bank variation. As a result, we focus only on the results without bank fixed effects but with year fixed effects.

likely to be important in order to estimate the independent effects of uncalled liability as there are likely to be important difference among banks of different size (i.e., it might just be the case that large (or old) banks were more likely to adopt conservative asset portfolio in order to preserve their reputational capital).

When data are available, we also insert regional dummy variables to control for bank location. It is likely that the geographical factors (e.g., industrial structure, growth opportunities, intensity of bank competition, etc.) affect bank risk, and thus omitting them may cause bias in the estimated effects of uncalled liability on risk-taking.

## 5. Results

The results based on share price volatility are presented in Table 1. Columns 1-6 use the ratio of uncalled capital to paid-up capital as our measure of contingent liability, and columns 7-12 employ the ratio of uncalled capital to subscribed (nominal) capital.

As predicted, share price volatility is typically negatively correlated with the capital-to-asset ratio (i.e., share price volatility is larger for more highly leveraged banks). Although this result is consistent with the view that a bank with higher capital-to-asset ratio makes more prudent decisions, it might also be driven in part by a simple mechanism that higher leverage causes greater share price volatility. The coefficients on contingent liability and unlimited liability, however, are for the most part not statistically significant. This result contrasts with that of Esty (1998), which shows that the strict liability rule is correlated with lower share price volatility. Our results suggest that in the case of British banks during the late nineteenth and early twentieth century, the risk-reducing effects of a strict liability rule might not have been large enough to offset its direct positive effects on share price volatility.

The results based on loan-to-asset ratio are displayed in Table 2. Column 1 shows that the loan-to-assets ratio is strongly negatively correlated with the amount of contingent liability, measured as the ratio of uncalled liability to subscribed capital. A similar correlation is present when we employ the ratio of uncalled liability to paid-in capital as our measure of uncalled liability (column 7). These results are statistically robust even when we control for the capital-to-assets ratio and a dummy variable for unlimited liability (columns 2), bank size (column 3), the number of branches (column 4) and establishment year (column 5). When we include location dummies, the results turn insignificant (column 6) as the standard error rises, although the point estimate is similar. When contingent liabilities are measured in relation to paid-in capital, the estimated coefficients on contingent liability are not significant in some specifications (columns 9-12), however they are qualitatively similar.

The estimated risk-reducing effects of contingent liability are economically important: based on columns 1-6, comparing a bank with no contingent liability (i.e., (amount-par)/amount=0) with a bank with equal amounts of contingent and paid-up capital ((amount-par)/amount=0.5), the latter's loan-to-asset ratio is, on average, 6 – 8.5 percentage points less than that of the former. Taken as a group, these results suggest that extension of bank owners' liability beyond the paid-in amount played an important role in restraining banks from excessive risk-taking.

Interestingly, the loan-to-asset ratio is positively correlated with the capital-to-asset ratio, suggesting that well-capitalized banks seem to have taken more risk than poorly capitalized banks. One possible explanation is that markets demanded higher capital-to-asset ratios from banks holding more opaque assets (i.e., loans). The coefficient on unlimited

liability is not significantly different from zero, although its signs are generally negative, as expected.

The results using the cash-to-asset ratio as the dependent variable are displayed in Table 3. When measured by the ratio of uncalled capital to paid-in capital, contingent liability is positively correlated with cash-to-asset ratio (column 7); these results are generally robust. Hence, the balance sheet of banks with contingent liability tended to be less risky and more liquid. Interestingly, the cash-to-asset ratio is negatively correlated with the capital-to-asset ratio and unlimited liability status in some specifications. Again, it might be the case that markets demand higher capital-to-asset ratio and unlimited liability from a bank with illiquid balance sheet.

Table 4 shows the results for asset growth. In two specification (columns 5 and 6), contingent liability is negatively correlated with asset growth, however, this result is not robust. Nonetheless, the results strongly indicate that the other forms of risk capital made banks more cautious as suggested by the negative coefficients on capital-to-asset ratio and unlimited liability.

### **Nonlinearity**

In addition to estimating the average effects of contingent capital on bank risk-taking, we also examine the interactive effects of these measures. Theory predicts that the effects of unlimited liability and contingent liability are heterogeneous, depending on how leveraged a bank is. On the one hand, when leverage is high and insolvency more likely, a bank with no extended liability has strong incentives to take risk which can be effectively shifted onto debt holders. With large extended liability that could adversely affect personal wealth of bank

equity holders in case of insolvency, however, such risk-shifting incentives are attenuated. On the other hand, when leverage is low and insolvency is unlikely, extended liability is unlikely to be demanded and thus less relevant to the bank's choice of asset risk. Hence, the effects of extended liability on bank risk-taking depend crucially on capital-to-asset ratio.

Econometrically, we look at the interaction of contingent capital and unlimited liability with the capital-to-asset ratio. These interactions capture the possibility that extended liability is less relevant when banks are more adequately capitalized. We therefore expect both to have positive and statistically significant coefficients.

Another important dimension of nonlinearity is the interaction of bank size with uncalled liability. The basic interpretation of our main results is that a stricter liability rule creates an incentive for bank shareholders to be more concerned about asset risk. However, when a bank is large and owned by many small shareholders, they might face serious free-rider problems since each shareholder cannot fully appropriate the economic benefit of her monitoring efforts. Since bank size and co-ordination costs of shareholder monitoring are likely to be positively correlated, we expect that the effects of extended liability should depend on bank size as well. To capture this possible nonlinearity, we interact firm size with contingent liability, which should have a positive coefficient.

The results are presented in Table 5. As expected, the interaction of bank size with contingent liability is positive and significant, suggesting that the marginal impact of strict liability rules was smaller for larger banks. The results thus provide some evidence that the strength of corporate governance might have been an important intervening factor that could have affected the efficacy of uncalled capital as an instrument for risk control. As expected, the coefficient on the interaction of capital-to-asset ratio and contingent liability is positive

and significant while that on (un-interacted) contingent liability remains negative. Thus, the risk-reducing effects of contingent liability seem to be highly nonlinear, depending upon a bank's leverage (i.e., the amount of extended liability matters more when the capital-to-assets ratio is low).

The results are again qualitatively important. Based on column 1, for a bank with a relatively high capital-to-asset ratio (say 0.35, one standard deviation above the average), the impact of an increase in the ratio of contingent to subscribed capital from 0 to 0.5 (i.e., switching from limited liability to double liability) is only  $0.5*(-0.474 + 0.35*1.273) = -0.015$  (and statistically insignificant), while for a bank with low capital-to-asset ratio (say 0.15, one standard deviation below the average) the effect of the same change in contingent capital is  $0.5*(-0.474 + 0.15*1.273) = -0.14$ .<sup>47</sup> This is consistent with the view that contingent liability keeps bankers from shifting risk to debt holders when their bank is near insolvency.

When the interaction of the capital-to-assets ratio with unlimited liability is included (column 2), the coefficient on (un-interacted) unlimited liability becomes larger (i.e., more negative) and statistically significant (in Table 4) while the coefficient on the interaction of the capital-to-assets ratio with unlimited liability is positive. These results suggest that when banks are fully solvent with high capital-to-assets ratio, unlimited liability is irrelevant, whereas it plays an important role in reducing bank asset risk when capital asset ratio is low. Again the effects are economically important. Based on column 2, for a well capitalized bank (capital-to-asset ratio = 0.35), the effect of converting from limited to unlimited liability is only  $-0.201 + 0.35*0.555 = -0.007$ , whereas for a poorly capitalized bank (capital-to-asset ratio = 0.15), the effect is  $-0.201 + 0.15*0.555 = -0.118$ .

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<sup>47</sup> We obtain similar calculation if we use the coefficient estimates on columns 3-8.

In sum, the risk-reducing effects of strict liability rules are larger among highly leveraged banks, since contingent capital and unlimited liability are irrelevant to risk-attitude of banks when the capital-to-assets ratio is so large that banks are unlikely to become insolvent (i.e., bank owners are unlikely to be called to provide contingent capital if banks are adequately capitalized).

## 6. Conclusion

Does imposing more strict liability rules make banks behave more prudently? This paper exploits pre-World War I data, when British banks operated with varying levels of extended liability, to address this question. Our results suggest that banks which operated under more strict liability rules—particularly more highly leveraged banks—undertook less risk than counterparts operating with lower levels of contingent liability. These results are consistent with both the predictions of economic theory as well as the findings of an empirical literature that focuses on the consequences of double liability in the United States. They are at odds with the Coase (1960) Theorem view that liability structure will be rendered irrelevant due to the market’s ability to price and trade it. In short, liability structure “mattered.”

Although our interest is primarily historical, our results may have an important implication for current day policy makers: namely that extending bank shareholders’ liability—or by converting creditors into equity holders via contingent convertible bonds (Cocos)—can protect taxpayers by directly reducing their share of bank resolution costs and, more importantly, by altering the risk-shifting incentives of banks.

Our results also suggest an agenda for research on British economic history. Although we document that liability rules had important effects on bank risk, it is not clear *how* bank

equity holders controlled managerial agency problems. In particular, the period in question is characterized by democratization of the British equity markets (Rutterford et al., 2001 and Acheson and Turner, 2011), which is likely to have led to more dispersed ownership structure and exacerbate agency problems. Thus, collecting the data on corporate governance structure and matching them to the data on liability structure is one fruitful step to opening up the “black box.” Additionally, if the institution of extended liability functioned well as a device to mitigate the moral hazard problem in the British banking sector before WWI, what led to its decline and eventual demise? It might also be fruitful to probe the factors underlying the evolution of liability rules, as well the factors—e.g., convention, market—that determined individual firms’ contingent capital choices.

## Bibliography

Acheson, Graeme G. and John D. Turner (2006). "The Impact of Limited Liability on Ownership and Control: Irish Banking, 1877-1914." *Economic History Review* **59**(2): 320-346.

Acheson, Graeme G. and John D. Turner (2008a). "The Death Blow to Unlimited Liability in Victorian Britain: The City of Glasgow Failure." *Explorations in Economic History* **45**(3): 235-253.

Acheson, Graeme G. and John D. Turner (2008b). "The Secondary Market for Bank Shares in Nineteenth-Century Britain." *Financial History Review* **15**(2):123-151.

Acheson, Graeme G. and John D. Turner (2011). "Investor Behaviour in a Nascent Capital Market: Scottish Bank Shareholders in the Nineteenth Century." *Economic History Review* **64**(1): 188-213.

Barth, James R., Gerard Caprio, Jr., and Ross Levine. (2006) *Rethinking Bank Regulation: Till Angels Govern*. Cambridge, MA: Cambridge University Press.

Basel Committee on Banking Supervision (1988). "International convergence of capital measurement and capital standards."

Basel Committee on Banking Supervision (2004). "Basel II: International Convergence of Capital Measurement and Capital Standards: a Revised Framework."

Berger, Allen N., Richard J. Herring, and Giorgio Szegő (1995). "The Role of Capital in Financial Institutions." *Journal of Banking and Finance* **19**(3-4): 393-430.

Broz, J. Lawrence and Richard S. Grossman (2004). "Paying for Privilege: The Political Economy of Bank of England Charters, 1694-1844." *Explorations in Economic History* **41**(1): 48-72.

Calomiris, Charles W. (1990). "Is Deposit Insurance Necessary? A Historical Perspective," *Journal of Economic History* **50**: 283-29.

Campbell, Robert (1895). *Ruling Cases, volume 6: Contract*. London: Stevens and Sons, Ltd.

Carr, Jack L. and G. Frank Mathewson (1988). "Unlimited Liability as a Barrier to Entry." *Journal of Political Economy* **96**(4): 766-784.

Coase, R.H. (1960). "The Problem of Social Cost." *Journal of Law and Economics* **3**: 1-44.

Collins, Michael (1989). "The Banking Crisis of 1878." *Economic History Review* **42**(4): 504-27.

Cooke, C.A. (1950). *Corporation Trust and Company*. Manchester: Manchester University Press.

Crick, W. F. and J. E. Wadsworth (1936). *A Hundred Years of Joint Stock Banking*. London: Hodder and Stoughton.

Demirgüç-Kunt, Asli, Enrica Detragiache, and Ouarda Merrouche (2010). "Bank Capital: Lessons from the Financial Crisis" World Bank Policy Research Working Paper 5473.

Easterbrook, Frank H. and Daniel R. Fischel (1985). "Limited Liability and the Corporation." *University of Chicago Law Review* **52**: 89-117.

Esty, Benjamin C. (1998). "The Impact of Contingent Liability on Commercial Bank Risk Taking." *Journal of Financial Economics* **47**(2): 189-218.

Flannery, Mark J. (2009). "Stabilizing Large Financial Institutions with Contingent Capital Certificates" working paper.

Fukao, Mitsuhiro. (2003). "Financial Sector Profitability and Double Gearing." In: Blomstrom, M., Corbett, J., Hayashi, F., Kashyap, A. (Eds.), *Structural Impediments to Growth in Japan*. University of Chicago Press, Chicago, IL, pp.9-35.

Glassman, Cynthia A. and Stephen A. Rhoades (1980). "Owner vs. Manager Control Effects on Bank Performance." *Review of Economics and Statistics* **62**(2): 263-270.

Gregory, T.E. (1929). *Select Statutes, Documents and Reports relating to British Banking: 1832-1928*. London: Oxford University Press.

Grossman, Peter Z. (1995). "The Market for Shares of Companies with Unlimited Liability: The Case of American Express." *Journal of Legal Studies* **24**(1): 63-85.

Grossman, Richard S. (2001a). "Double Liability and Bank Risk Taking." *Journal of Money, Credit and Banking* **33**(2): 143-59.

Grossman, Richard S. (2001b). "Charters, Corporations, and Codes: Entry Restriction in Modern Banking Law." *Financial History Review* **8**(2): 1-15.

Grossman, Richard S. (2002). "New Indices of British Equity Prices, 1870-1913." *Journal of Economic History* **62**(1): 121-146.

Grossman, Richard S. (2007). "Fear and Greed: The Evolution of Double Liability in American Banking, 1865-1930." *Explorations in Economic History* **44**(1): 59-80.

Grossman, Richard S. (2010). *Unsettled Account: The Evolution of Banking in the Industrialized World since 1800*. Princeton: Princeton University Press.

Halpern, Paul, Michael J. Trebilcock, and Stuart Turnbull (1980). "An Economic Analysis of Limited Liability in Corporation Law." *University of Toronto Law Journal* **30**: 119-150.

Hansmann, Henry and Reinier Kraakman (1991). "Toward Unlimited Shareholder Liability for Corporate Torts." *Yale Law Journal* **100**(7): 1879-1934.

Hansmann, Henry and Reinier Kraakman (1992). "Do the Capital Markets Compel Limited Liability? A Response to Professor Grundfest." *Yale Law Journal* **102**(2): 427-436.

Hansmann, Henry and Reinier Kraakman (1992). "A Procedural Focus on Unlimited Shareholder Liability." *Harvard Law Review* **106**(2): 446-460.

Hickson, Charles R. and John D. Turner (2003). "Shareholder Liability Regimes in Nineteenth-Century English Banking: The Impact Upon the Market for Shares." *European Review of Economic History* **7**(1): 99-125.

Hickson, Charles R and John D Turner (2003). "The Trading of Unlimited Liability Bank Shares in Nineteenth-Century Ireland: The Bagehot Hypothesis." *Journal of Economic History* **63**(4): 931-58.

Hickson, Charles R, John D Turner, and Claire McCann (2005). "Much Ado About Nothing: The Limitation of Liability and the Market for 19th Century Irish Bank Stock." *Explorations in Economic History* **42**(3): 459-76.

Hunt, Bishop Carleton (1936). *The Development of the Business Corporation in England, 1800-1867*. Cambridge: Harvard University Press.

Jackson, Howell E. (1993). "Losses From National Bank Failures During the Great Depression: A Response to Professors Macey and Miller." *Wake Forest Law Review* **28**: 919-932.

Jefferys, J.B. (1938 [1977]). *Business Organization in Great Britain, 1856-1914*. New York: Arno Press.

Jefferys, J.B. (1946). "The Denomination and Character of Shares, 1855-1885." *Economic History Review* **16**(1): 45-55.

Kane, Edward J. (1989) *The S&L Insurance Mess: How Did it Happen?* Washington, DC: Urban Institute Press.

Kashyap, Anil, Raghuram Rajan, and Jeremy Stein (2008). "Rethinking Capital Regulation " Federal Reserve Bank of Kansas City symposium on "Maintaining Stability in a Changing Financial System," Jackson Hole, WY (August 21-23, 2008).

Kennedy, William P. (1987). *Industrial Structure, Capital Markets, and the Origins of British Economic Decline*. Cambridge: Cambridge University Press.

Macey, Jonathan R. and Geoffrey P. Miller (1992). "Double Liability of Bank Shareholders: History and Implications." *Wake Forest Law Review* **27**: 31-62.

Macey, Jonathan R. and Geoffrey P. Miller (1993). "Double Liability of Bank Shareholders: A Look at the New Data." *Wake Forest Law Review* **28**: 933-941.

Nanjo, Takashi and Makoto Kasuya (2009). "Part-Paid Stock, Corporate Finance, and Investment: Economic Consequences of the Part-Paid Stock System and Supplementary Installments in the Early 1930s of Japan." IMES Discussion Paper Series 2009-E-22.

Parliament (1867). *Report from the Select Committee on Limited Liability Acts*.

Parliament (1877). *Report from the Select Committee on the Companies Acts, 1862 and 1867*.

Rutterford, Janette, David R. Green, Josephine Maltby, and Alastair Owens (2011). "Who Comprised the Nation of Shareholders? Gender and Investment in Great Britain, c. 1870–1935." *Economic History Review* **64**(1): 157-187.

Saunders, Anthony, Elizabeth Strock, and Nickolaos G. Travlos (1990). "Ownership Structure, Deregulation, and Bank Risk Taking." *Journal of Finance* **45**(2): 643-54.

Thomas, Samuel Evelyn (1934). *The Rise and Growth of Joint Stock Banking*. London: Sir I. Pitman and Sons, Ltd.

Troy, Leo (2004). *Almanac of business and industrial financial ratios*. Englewood Cliffs, NJ: Prentice-Hall

Figure 1: Shareholder payoff under different liability rules

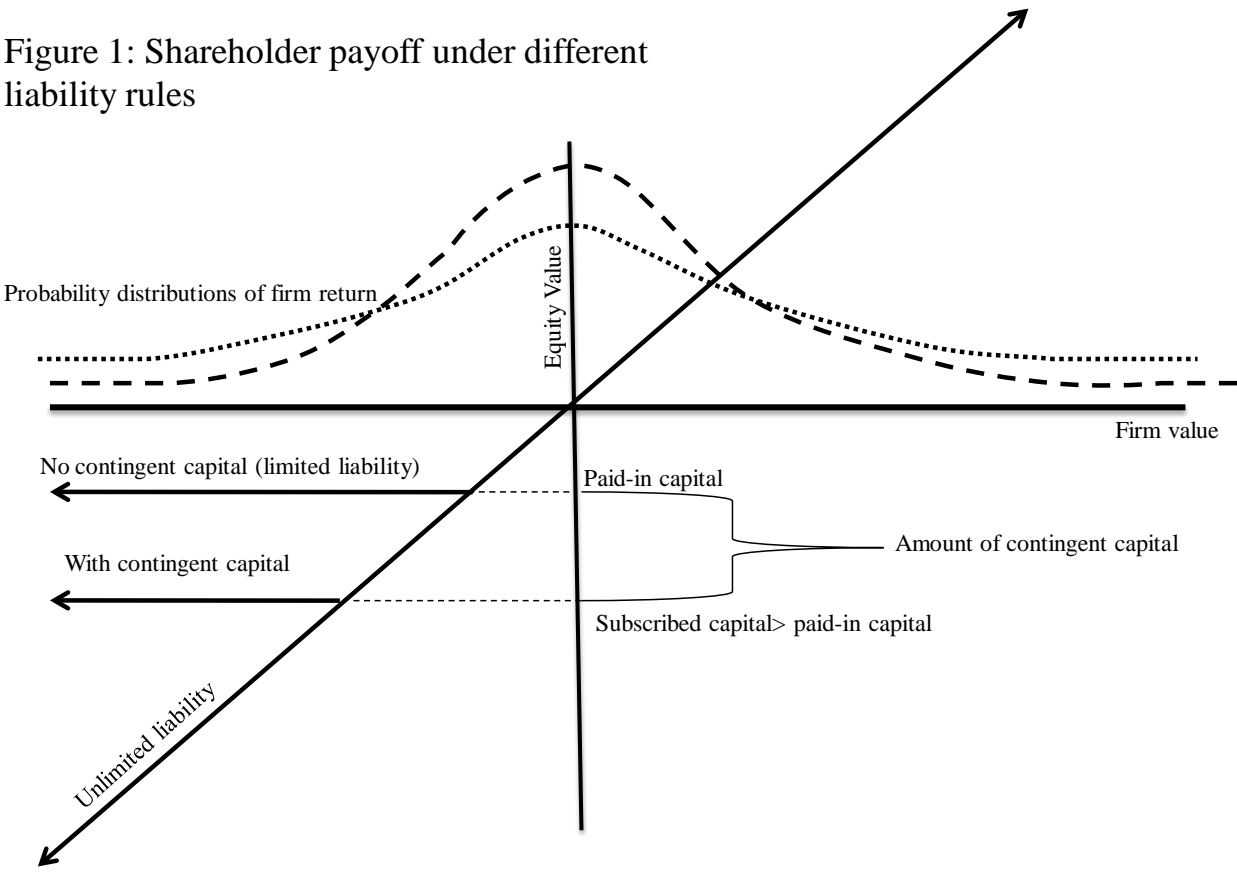
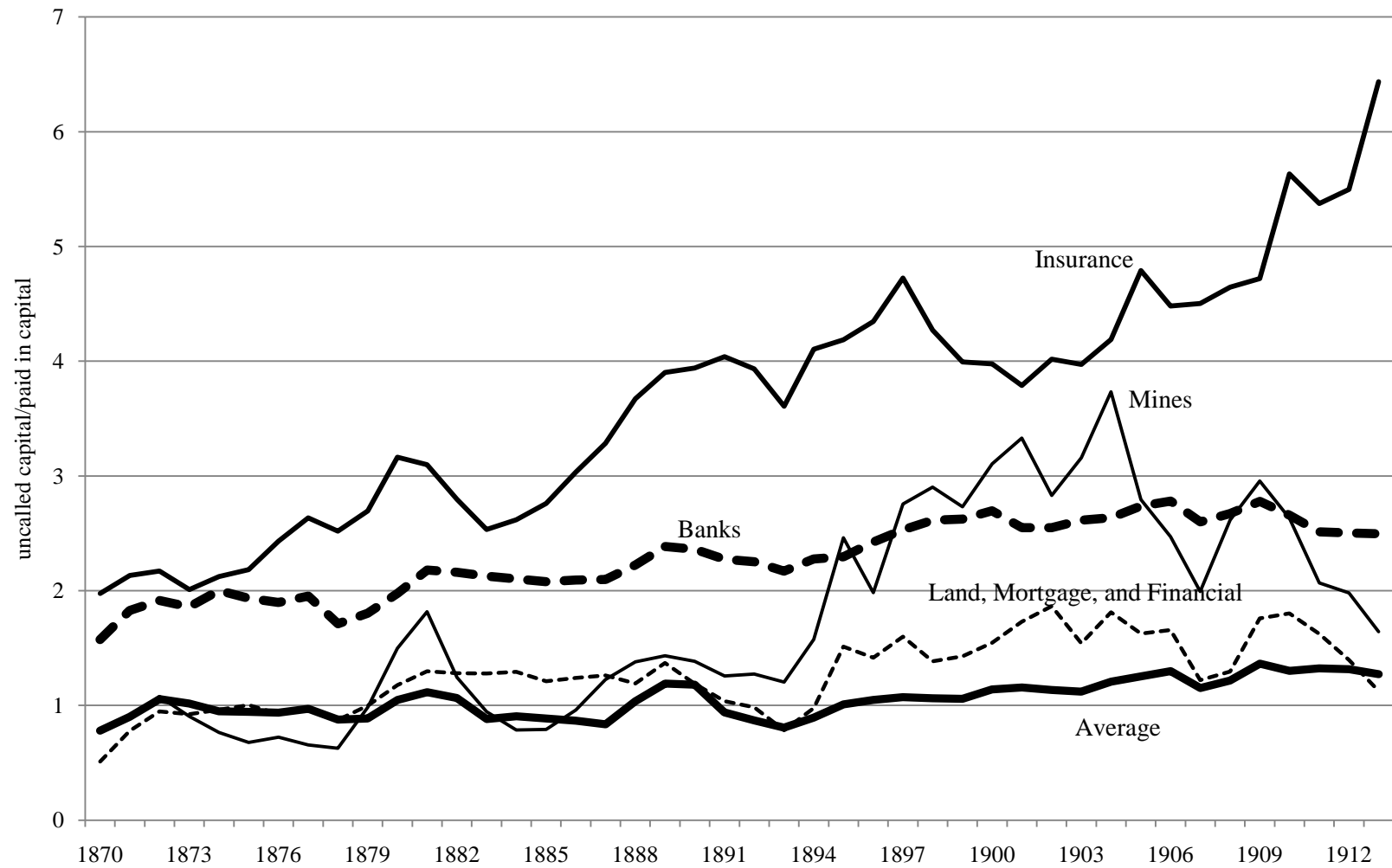


Figure 2: Ratio of uncalled to paid-in capital, selected sectors, 1870-1913  
(weighted by firm size)



Source: Authors' calculations.

Table 1: Standard Deviation of Share Price Return

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES												
(amount-par)/amount	0.00263 (0.00772)	0.00230 (0.00693)	0.00531 (0.00703)	0.00548 (0.00707)	0.0105 (0.0115)	0.00266 (0.0166)						
(amount-par)/par							0.00139 (0.000928)	0.00112 (0.000930)	0.00133 (0.000912)	0.00134 (0.000913)	0.00191* (0.00114)	0.000725 (0.00244)
Capital-to-Assets Ratio		-0.0528*** (0.0167)	-0.0627*** (0.0192)	-0.0630*** (0.0195)	-0.0395** (0.0193)	-0.00737 (0.0233)		-0.0498*** (0.0175)	-0.0603*** (0.0193)	-0.0607*** (0.0196)	-0.0334** (0.0164)	-0.00711 (0.0230)
Unlimited Liability		-0.00474 (0.00879)	-0.00426 (0.00900)	-0.00427 (0.00911)	-0.00354 (0.0106)	-0.00959 (0.00845)		-0.00427 (0.00880)	-0.00386 (0.00899)	-0.00389 (0.00910)	-0.00331 (0.0105)	-0.00890 (0.00854)
ln(Assets)			-0.00215** (0.00106)	-0.00202* (0.00119)	-0.000704 (0.00143)	-0.00177 (0.00230)			-0.00240** (0.00102)	-0.00225* (0.00115)	-0.000952 (0.00132)	-0.00233 (0.00324)
Number of Branches				-3.33e-06 (1.18e-05)	3.71e-07 (1.30e-05)	-6.58e-06 (1.29e-05)				-4.11e-06 (1.20e-05)	4.02e-07 (1.37e-05)	-3.20e-06 (1.81e-05)
Establishment Year					5.72e-05** (2.66e-05)	-4.65e-05 (2.83e-05)					6.10e-05** (2.92e-05)	-4.93e-05 (3.12e-05)
Constant	0.0629*** (0.0236)	0.0721*** (0.0237)	0.107*** (0.0294)	0.105*** (0.0292)	-0.0451 (0.0576)	0.146** (0.0688)	0.0602** (0.0231)	0.0695*** (0.0234)	0.110*** (0.0291)	0.108*** (0.0289)	-0.0484 (0.0597)	0.157* (0.0857)
Location dummy	no	no	no	no	no	yes	no	no	no	no	no	yes
Observations	2,103	2,103	2,103	2,096	1,681	1,681	2,103	2,103	2,103	2,096	1,681	1,681
R-squared	0.049	0.059	0.061	0.061	0.052	0.099	0.052	0.061	0.063	0.063	0.057	0.100

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 2: Loans-to-Assets Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES												
(amount-par)/amount	-0.177*** (0.0549)	-0.177*** (0.0578)	-0.152** (0.0588)	-0.150*** (0.0567)	-0.118* (0.0680)	-0.125 (0.0804)						
(amount-par)/par							-0.0118** (0.00485)	-0.0105** (0.00517)	-0.00703 (0.00488)	-0.00700 (0.00476)	-0.00647 (0.00535)	-0.0106 (0.00680)
Capital-to-Assets Ratio		0.316** (0.121)	0.257* (0.141)	0.251* (0.137)	0.351** (0.170)	0.121 (0.134)		0.281** (0.124)	0.203 (0.147)	0.200 (0.143)	0.292 (0.181)	0.118 (0.133)
Unlimited Liability		-0.0337 (0.0363)	-0.0229 (0.0330)	-0.0247 (0.0333)	-0.0219 (0.0343)	0.00126 (0.0235)		-0.0229 (0.0341)	-0.0108 (0.0303)	-0.0124 (0.0306)	-0.0149 (0.0319)	0.00524 (0.0214)
ln(Assets)			-0.0242** (0.0111)	-0.0190 (0.0137)	-0.0143 (0.0164)	-0.00188 (0.0269)			-0.0305*** (0.0113)	-0.0257* (0.0144)	-0.0216 (0.0178)	-0.000923 (0.0270)
Number of Branches				-0.000176 (0.000151)	-0.000180 (0.000152)	-6.69e-05 (0.000137)				-0.000149 (0.000153)	-0.000129 (0.000152)	-9.63e-05 (0.000151)
Establishment Year					-7.79e-05 (0.000298)	0.000434 (0.000508)					-1.81e-05 (0.000297)	0.000394 (0.000500)
Constant	0.708*** (0.0451)	0.653*** (0.0534)	1.040*** (0.187)	0.981*** (0.213)	1.012 (0.655)	0.104 (1.159)	0.621*** (0.0243)	0.568*** (0.0367)	1.065*** (0.201)	1.012*** (0.230)	0.969 (0.687)	0.122 (1.173)
Location dummy	no	no	no	no	no	yes	no	no	no	no	no	yes
Observations	2,630	2,630	2,630	2,622	2,090	2,090	2,621	2,621	2,621	2,613	2,081	2,081
R-squared	0.130	0.171	0.208	0.214	0.212	0.584	0.122	0.154	0.209	0.213	0.220	0.577

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 3: Cash-to-Assets Ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
VARIABLES												
(amount-par)/amount	0.0318 (0.0290)	0.0294 (0.0299)	-0.00124 (0.0247)	-0.00112 (0.0248)	-0.00305 (0.0299)	0.00517 (0.0321)						
(amount-par)/par							0.00584** (0.00227)	0.00537** (0.00229)	0.00258 (0.00198)	0.00258 (0.00197)	0.00367* (0.00198)	0.00432* (0.00245)
Capital-to-Assets Ratio		-0.0979** (0.0409)	-0.0359 (0.0372)	-0.0366 (0.0369)	-0.0283 (0.0395)	0.0316 (0.0532)		-0.0882** (0.0408)	-0.0331 (0.0369)	-0.0340 (0.0367)	-0.0183 (0.0379)	0.0376 (0.0544)
Unlimited Liability		-0.0122 (0.0117)	-0.0236** (0.00927)	-0.0242** (0.00936)	-0.0198* (0.0105)	-0.00322 (0.0105)		-0.0116 (0.0110)	-0.0213** (0.00902)	-0.0219** (0.00907)	-0.0164 (0.0101)	0.00243 (0.0101)
ln(Assets)			0.0231*** (0.00349)	0.0230*** (0.00486)	0.0228*** (0.00596)	0.0178*** (0.00612)			0.0223*** (0.00340)	0.0223*** (0.00479)	0.0218*** (0.00586)	0.0155** (0.00610)
Number of Branches				2.40e-06 (7.04e-05)	1.74e-05 (7.61e-05)	1.66e-05 (7.82e-05)				-1.89e-06 (7.05e-05)	1.63e-05 (7.57e-05)	3.42e-05 (7.93e-05)
Establishment Year					5.26e-05 (0.000204)	0.000159 (0.000184)					6.50e-05 (0.000201)	0.000155 (0.000182)
Constant	0.177*** (0.0260)	0.196*** (0.0284)	-0.169** (0.0653)	-0.168** (0.0770)	-0.273 (0.395)	-0.392 (0.343)	0.181*** (0.0166)	0.198*** (0.0190)	-0.164*** (0.0602)	-0.165** (0.0719)	-0.296 (0.388)	-0.371 (0.343)
Location dummy	no	no	no	no	no	yes	no	no	no	no	no	yes
Observations	2,460	2,460	2,460	2,453	1,946	1,946	2,460	2,460	2,460	2,453	1,946	1,946
R-squared	0.037	0.051	0.173	0.173	0.168	0.366	0.053	0.065	0.177	0.177	0.175	0.372

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 4: Asset Growth

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(amount-par)/amount	0.0126 (0.0148)	0.00936 (0.0152)	0.0110 (0.0155)	0.00507 (0.0153)	-0.0287* (0.0164)	-0.0254* (0.0145)						
(amount-par)/par							0.00141 (0.00141)	0.00107 (0.00143)	0.00118 (0.00149)	0.000938 (0.00144)	-0.00148 (0.00117)	-0.00131 (0.00142)
Capital-to-Assets Ratio		-0.0455* (0.0237)	-0.0492** (0.0234)	-0.0409* (0.0235)	-0.0580*** (0.0204)	-0.00443 (0.0437)		-0.0400 (0.0246)	-0.0424* (0.0242)	-0.0366 (0.0242)	-0.0529*** (0.0200)	-0.00585 (0.0431)
Unlimited Liability		-0.0188** (0.00802)	-0.0182** (0.00799)	-0.0174** (0.00794)	-0.0159* (0.00840)	-0.00938 (0.00842)		-0.0186** (0.00790)	-0.0182** (0.00787)	-0.0170** (0.00782)	-0.0133 (0.00801)	-0.00679 (0.00822)
ln(Assets)			-0.00151 (0.00224)	-0.00620** (0.00261)	-0.00226 (0.00272)	-0.00768** (0.00375)			-0.000899 (0.00233)	-0.00564** (0.00279)	-0.000760 (0.00274)	-0.00769* (0.00393)
Number of Branches				0.000154*** (3.73e-05)	0.000114*** (3.41e-05)	6.23e-05 (3.93e-05)				0.000147*** (3.73e-05)	9.95e-05*** (3.45e-05)	5.75e-05 (4.15e-05)
Establishment Year					5.48e-05 (0.000109)	-3.87e-05 (9.57e-05)					5.07e-05 (0.000108)	-4.67e-05 (0.000101)
Constant	0.0257* (0.0132)	0.0356** (0.0144)	0.0597 (0.0372)	0.109*** (0.0392)	-0.0263 (0.188)	0.175 (0.170)	0.0235* (0.0123)	0.0320** (0.0140)	0.0464 (0.0369)	0.101** (0.0406)	-0.0573 (0.188)	0.175 (0.182)
Location dummy	no	no	no	no	no	yes	no	no	no	no	no	yes
Observations	2,525	2,525	2,525	2,520	2,020	2,020	2,517	2,517	2,517	2,512	2,012	2,012
R-squared	0.055	0.059	0.060	0.070	0.072	0.120	0.057	0.061	0.061	0.070	0.071	0.118

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table 5: Interaction Effects (Loans-to-Assets Ratio)

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(amount-par)/amount	-0.474*** (0.128)	-0.179*** (0.0578)	-0.506*** (0.123)	-0.458*** (0.144)	-0.452*** (0.139)	-1.778*** (0.666)	-1.964*** (0.716)	-1.334 (1.029)
Capital-to-Assets Ratio	-0.521* (0.283)	0.289** (0.124)	-0.636** (0.267)	-0.618** (0.283)	-0.606** (0.275)	-0.673** (0.279)	-0.667 (0.420)	-0.701 (0.430)
Unlimited Liability	-0.0322 (0.0361)	-0.201** (0.0900)	-0.251*** (0.0858)	-0.221*** (0.0791)	-0.226*** (0.0784)	-0.221*** (0.0811)	-0.218** (0.0900)	-0.166** (0.0649)
Capital-to-Assets Ratio * (amount-par)/amount	1.237*** (0.424)		1.355*** (0.402)	1.253*** (0.467)	1.228*** (0.451)	1.311*** (0.444)	1.387** (0.612)	1.192* (0.665)
Capital-to-Assets Ratio * Unlimited Liability		0.555** (0.234)	0.724*** (0.210)	0.658*** (0.195)	0.671*** (0.194)	0.670*** (0.203)	0.645*** (0.228)	0.548*** (0.164)
ln(Assets)				-0.0228** (0.0106)	-0.0190 (0.0128)	-0.0857*** (0.0301)	-0.0912*** (0.0341)	-0.0456 (0.0428)
ln(Assets) * (amount-par)/amount						0.0890** (0.0414)	0.1000** (0.0429)	0.0595 (0.0570)
Number of Branches					-0.000127 (0.000137)	-0.000139 (0.000132)	-0.000146 (0.000131)	-5.74e-05 (0.000127)
Establishment Year							-0.000132 (0.000284)	0.000362 (0.000439)
Constant	0.858*** (0.0926)	0.660*** (0.0540)	0.886*** (0.0898)	1.231*** (0.158)	1.187*** (0.184)	2.184*** (0.472)	2.499*** (0.790)	1.099 (1.073)
Location dummy	no	no	no	no	no	no	no	yes
Observations	2,630	2,630	2,630	2,630	2,622	2,622	2,090	2,090
R-squared	0.192	0.176	0.201	0.234	0.238	0.251	0.248	0.599

Standard errors in parentheses

\*\*\* p&lt;0.01, \*\* p&lt;0.05, \* p&lt;0.1

Table A1: Summary Statistics

<i>Variable</i>		<i>Mean</i>	<i>Std. Dev.</i>	<i>Min</i>	<i>Max</i>	<i>Observations</i>
SD of Stock Return	overall	0.028	0.048	0.000	0.658	N = 2103
	between		0.018	0.000	0.108	n = 118
	within		0.046	-0.062	0.646	T = 17.822
Loan-to-Asset Ratio	overall	0.660	0.153	0.119	1.000	N = 2631
	between		0.146	0.227	0.961	n = 143
	within		0.078	0.095	1.164	T-bar = 18.3986
Cash-to-Asset Ratio	overall	0.157	0.080	0.000	1.758	N = 2461
	between		0.074	0.020	0.597	n = 140
	within		0.049	-0.124	1.715	T-bar = 17.5786
Asset Growth	overall	0.035	0.085	-0.588	0.689	N = 2526
	between		0.051	-0.141	0.223	n = 140
	within		0.078	-0.449	0.640	T = 18.0429
(amount - par)/amount	overall	0.696	0.167	0.000	1.000	N = 2636
	between		0.177	0.000	1.000	n = 143
	within		0.077	-0.115	0.930	T-bar = 18.4336
(amount - par)/par	overall	3.126	1.959	0.000	24.000	N = 2627
	between		1.918	0.000	10.429	n = 142
	within		0.780	-4.303	21.445	T-bar = 18.5
Unlimited Liability	overall	0.046	0.208	0.000	1.000	N = 2636
	between		0.115	0.000	1.000	n = 143
	within		0.190	-0.500	1.017	T-bar = 18.4336
Capital-toAsset Ratio	overall	0.257	0.102	0.018	1.558	N = 2636
	between		0.121	0.032	1.081	n = 143
	within		0.057	-0.251	0.940	T-bar = 18.4336
ln(Asset)	overall	14.823	1.368	8.961	18.468	N = 2636
	between		1.509	9.568	17.981	n = 143
	within		0.346	13.220	16.123	T-bar = 18.4336
Branch	overall	39.60868	76.38624	0	768	N = 2627

Establishment Year	between		70.31374	0	519.2143	n = 142
	within		35.25864	-197.606	402.8944	T-bar = 18.5
	overall	1832.196	29.078	1685	1884	N = 2098
Year	between		29.135	1685	1884	n = 102
	within		0.000	1832.196	1832.196	T-bar = 20.5686
	overall	1892.541	9.097	1878	1912	N = 2636
	between		6.637	1878	1911	n = 143
	within		7.599	1875.541	1909.541	T-bar = 18.4336

Table A2: Correlation coefficient with p-value for statistical significance

	SD of Stock Return	Loan-to-Asset Ratio	Cash-to-Asset Ratio	Asset Growth	(amount - par)/amount	(amount - par)/par	Unlimited Liability	Capital-to Asset Ratio	ln(Asset)	Branches	Establishment Year
SD of Stock Return	1										
Loan-to-Asset Ratio	0.0267 0.2208	1									
Cash-to-Asset Ratio	0.0172 0.4469	-0.4026 0	1								
Asset Growth	-0.0109 0.6228	-0.0838 0	0.0835 0	1							
(amount - par)/amount	-0.007 0.75	-0.2131 0	0.0676 0.0008	0.0266 0.1811	1						
(amount - par)/par	0.0505 0.0206	-0.1683 0	0.1428 0	0.0341 0.0874	0.7915 0	1					
Unlimited Liability	0.0406 0.0628	0.0837 0	-0.0517 0.0103	-0.0512 0.0101	-0.1863 0	-0.1171 0	1				
Capital-to Asset Ratio	-0.0695 0.0014	0.2798 0	-0.1545 0	-0.0526 0.0082	-0.0414 0.0336	-0.1122 0	0.0922 0	1			
ln(Asset)	-0.0296 0.1745	-0.3363 0	0.3964 0	-0.0137 0.4924	0.1303 0	0.1889 0	-0.0339 0.0822	-0.2678 0	1		
Branches	-0.0252 0.249	-0.3046 0	0.2719 0	0.0675 0.0007	0.1507 0	0.1452 0	-0.0667 0.0006	-0.2761 0	0.6474 0	1	
Establishment Year	0.0415 0.0887	0.0534 0.0146	-0.0509 0.0246	0.0115 0.6054	-0.0792 0.0003	-0.0874 0.0001	0.0114 0.6026	0.0202 0.3553	-0.207 0	-0.1948 0	1