MY WORD IS MY BOND:
REPUTATION AS COLLATERAL IN NINETEENTH CENTURY ENGLISH PROVINCIAL BANKING

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'Quaerenda pecunia primum est. Virtus post nummos.'

First, build up your capital. Reputation comes after wealth.

Horace, *Epistulae*.

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ABSTRACT

There are few real-world economic transactions that do not involve an element of trust, yet in textbook economics trust is not prominently discussed. In that world, perfectly informed and computationally endowed agents reach optimal, enforceable decisions in continuously harmonising exchanges. Trust is therefore linked to deviations from the textbook ideal: incomplete information, costly enforcement, and computational limitations faced by agents. Trust can then be thought of as an algorithm, in other words, a way of resolving uncertainty in a complex world. In this sense trust may be seen as a form of expectation concerning the behaviour of other agents whose actions and intentions cannot be (fully) observed. This paper pursues this approach by "running the algorithm backwards" and trying to establish what factors led a 19th century provincial English bank to trust different loan applicants. Using a data-set of some 200 loan decisions, and knowing the size of collateral (if any) requested, we develop a method to estimate the probability that the bank attached to each borrower's promise to repay (i.e., the trust the bank had towards the borrower), adjusting for stages in the business cycle. We then regress this estimated probability on a variety of observable borrower characteristics. We find that trust is not correlated with *a priori* expected variables, such as borrower's assets or frequency of interaction. This suggests that trust was built up in other interactions, possibly through social or religious networks, and that the banking relationship reflected information available to bank directors other than what was purely pertinent to the borrowers' economic conditions. This has strong implications for the allocation of credit to industry in 19th century England.

Introduction

The nineteenth century saw the rise and fall of the small, provincial joint-stock bank (JSB) as the leading commercial banking institution in the UK, at first replacing the private bank after the reforms of the 1820s and later being in its turn overtaken and eventually absorbed by the national JSBs from the 1880s onward. The JSB's competitive advantage relative to private bankers is easily identified. By raising capital from a larger number of investors, JSBs achieved economies of scope in portfolio selection and were able to offer more credible guarantees at all times, and particularly when financial crises threatened the liquidity of intermediaries with narrower asset bases. But while their greater size gave them a stability seldom achieved by most private bankers, the JSBs were open to another sort of threat precisely because of their size. Specifically, the private banks survived by having very close, long standing relationships with clients whose activities they financed and followed over years: for them the classic problem of informational asymmetries between lenders and borrowers probably came as close to disappearing as possible. For JSBs, and even more so for the national banks that replaced them at the end of the 1800s, size meant inevitably a slackening in the close relationship with clients, simply because a bigger portfolio meant less detailed contact with, and information about, each individual borrower. Since screening and monitoring tasks are not obviously characterised by scale economies, whatever economies of scope the JSBs were able to achieve due to size could only turn into tangible competitive advantage if their benefits were not offset by higher default rates brought about by less thorough knowledge of their borrowers.

Modelling their lending decisions is therefore interesting, since the archives show that the JSBs did, in the main, get it right. However, this paper reaches beyond that particular historical context because the JSBs provide an opportunity to study the decision making process of a lender that is no longer wholly dependent upon the personal relationships of the

private banker, and yet has not quite adopted the routinised procedures of national banks. In particular, a method of estimating the probability of default attached by the directors of a particular JSB to their borrowers' promise to repay has been developed. This probability, or rather one minus this probability, can be viewed as their measure of trust for each borrower. The novelty in the method used here is that interest rate differentials are not used as all borrowers were charged the same premium above current bank rate, so that their relative trustworthiness from the bank's point of view, has to be reconstructed with an inductive process.

The JSB used for this exercise is the Sheffield Union Bank, a middle-sized industrial bank active in the coal and steel industry of South Yorkshire from the 1840s until it became part of the Midland Bank (now HSBC Bank) in 1901 (Crick and Wadsworth, 1936: 235). Over an arc of 30 years (1855-85) detailed information has been obtained for advances, collateral and terms of repayment for some 200 applications (26% of all credit applications in those years) made by some 120 firms.[1] For each of these an attempt is made to calculate how much the bank trusted the applicant, that is, the probability that the bank attributed to that particular borrower's defaulting on that particular advance is computed. It will then be shown that this probability is not obviously correlated to measurable borrower characteristics, which suggest that bank directors obtained information concerning borrowers' 'soundness', 'virtue', 'trustworthiness' and 'reputation' through other channels than formal credit assessment. What were these other channels, and what were the signals by which 'reputation' was established? Did the possession of 'reputation' influence bankers to the extent that some borrowers received greater access to credit, and on more favourable terms, than those without

[1] The remaining advances were not accompanied in the archives by all the information required for the calculations undertaken here, most specifically the value of collateral was not recorded.

such ranking? It is not possible to fully answer these questions at present, but some hypotheses may be put forth which can be tested in future work on other bank records.

In the remainder of this paper the background of the JSB, in general, and the Sheffield Union in particular, will be considered and the criteria by which this lender decided when to extend credit. There will then be a consideration of the analytical framework by which the bank's trust for each borrower is computed. This measure of trust will be applied to the Sheffield Union's records in order to calculate how much the bank trusted individual credit applicants. This estimated degree of trust will then be regressed on a number of borrower and sector specific characteristics in order to test whether the variations in the trust measure computed (in the order of eight times from the least to the most trusted customers) can be explained in conventional terms, such as length of relationship with the bank or good credit history. There will be a consideration of recent literature on trust and reputation throughout. The paper will conclude by arguing that these measures do not explain the variation in estimated trust levels, so that different decisions made by the bank's directors have to be explained in terms of other information flowing to them. In this way, the JSBs appear still closer to the personal bankers than to their more routine-driven successors. Finally, a proposed methodology for calculating the value of reputation is put forward.

Section 1: Setting the Stage

During the nineteenth century both private bankers and JSBs operated in England and Wales. Private banks were small-scale in operation, consisting of an individual or a few partners, and did not have the right to issue shares. JSBs were formed after the liberalising legislation of 1826, which allowed banks with more than six partners and freely transferable shares to be established beyond a 65-mile radius of London. In allowing the formation of

institutions with the potential to call upon large capital resources the government intended to stabilize to the banking system after the crisis 1824/5.

The markets responded enthusiastically to the reform, as 117 JSBs were established in fewer than 20 years, while the number of private banks decreased from 554 in 1825 to 311 in 1842 (Crick and Wadsworth, 1936: 21; Thomas, 1934: 656-62). Overall, 141 joint-stock banks were established under the 1826 Act and of these only 19 failed or closed before the new banking legislation of 1844, a failure rate considerably below that of private banks (Cottrell and Newton, 1999). The stability of joint-stock institutions was a decisive factor in attracting depositors, which reinforced their advantage over their private competitors.

However, JSBs were not usually what may be termed substantial corporations. Rather, the typical JSB before 1880 was a local lender with business concentrated in a particular town or city and its immediate neighbourhood. A local base reduced information and governance costs as well as reflecting prevailing parochial attitudes. Branch networks developed slowly - in 1857, the average number of offices per JSB was only 6.7 (2.1 for private banks) (Nishimura, 1971: 80). Although spearheaded by a few, ambitious bank boards, branching confronted considerable managerial and informational difficulties so that extra-regional banks only really developed after 1860. In 1874 only two banks had major branch networks: the London & County with 149 offices and agencies, and the National & Provincial with 138, while the average JSB still only had 10.5 branches (Newton and Cottrell, 1998). It was only after the merger movements from the 1880s that the development of an extensive branch banking system with large, centralised head offices in London occurred.

1.1: Sheffield and the Sheffield Union Bank

Most JSBs operated only within limited geographical areas and that was certainly valid the four JSBs banks active in Sheffield in the mid-nineteenth century; the Sheffield & Hallamshire Bank, the Sheffield Union Banking Company, the Sheffield Banking Company and the Sheffield & Rotherham Bank. Well-established industry in Sheffield and its environs provided both private and joint stock banks with a business base. Iron, steel, and coal, as well as the secondary metal trades, dominated the area and their output grew during the first half of the century as both domestic and foreign demand for their products increased. In 1850 the majority of firms in all sectors were small and tended to rely on the 'plough-back' of profits to expand operations; very few large-scale factories had become established in any sector. After 1850, the pressure of increased demand for the metals and goods manufactured in the Sheffield region resulted in an increase in the scale of some firms in the heavy industries and also led to the adoption of new technologies by which large-scale production of steel and steel goods could be undertaken. This, in turn, led to an increase in the requirements of finance for these branches of industry. Thus, by 1885 a complex structure had developed whereby some large joint stock concerns in heavy industry, requiring large capital outlays, existed alongside small, family run firms requiring only small amounts of capital investments. This structural and technological change provided a new basis for the extension of banking in the area. By 1850 a number of banking institutions, or their branches, existed in Sheffield suggesting that the local capital market was extremely competitive, something that was reinforced during the third quarter of the nineteenth century as more banks with head offices elsewhere also opened branches in Sheffield (Newton, 1994).

There were four main JSB's located in Sheffield. All had localised spheres of activity but none the less built up growing businesses as both volumes of deposits and advances

increased during the period. The Sheffield Union's advances increased three fold but the banks' deposits grew even more substantially by five times.

Table 1.1 shows the business of the Sheffield Union Bank in more detail and illustrates the extent to which the bank was involved in providing advances, the majority of which went to industry. The banks' main source of funds was deposits, potentially subject to short notice withdrawal. In order to match such liabilities, lending to industry tended to take the form of short-term advances and this resulted in long- and medium-term credit being provided by the renewal of short-term advances, usually in the form of rolling overdrafts.

Table 1.1: Sheffield Union Balance Sheets, 1850-1880

(£ 000's)							
Assets	**1850**	**1855**	**1860**	**1865**	**1870**	**1875**	**1880**
Cash & Bills in Hand	51	52	57				
Balances due to Bank	79	174	208	328	402	711	650
Bank Premises & Fixtures				4	4	5	15
Total	131	226	266	332	405	716	666
Liabilities	**1850**	**1855**	**1860**	**1865**	**1870**	**1875**	**1880**
Capital	41	61	82	83	120	180	180
Deposits & Balances due by Bank	86	151	161	213	248	463	446
Profits & Loss	3	8	11	8	15	23	14
Surplus Fund	1	6	10	18	23	50	25
Fund for bad debts			3	10			
Total	131	226	266	332	405	712	666
Ratio advances & bills: deposits	151.87	149.53	165.36	154.05	162.30	153.53	145.73

Sources: HSBC Group Archives, [HSBCGA]: Sheffield Union Banking Company [SUB], Board Directors Minutes [BDM], AD 2,3,4, and 5. Balance sheets were provided with details of the banks Annual General Meeting, held in July.[2]

[2] We are very grateful for the help and assistance of Edwin Green and Sara Kinsey, Archivists at HSBC Holdings.

1.2: Credit assessment in the nineteenth century

The heyday of the JSBs came in a society that was increasingly urban and industrial, where the social glue of long term relations between economic agents was being dissolved by increasing factor mobility and where business was becoming more impersonal in the sense that ever fewer producers actually knew the ultimate consumers of their products. In such a setting, any economic actor faced with a time consistency problem, such as issuing credit, had to find new ways of securing compatible behaviour on the part of other players whose motives and actions could only be partially observed, if at all. Even if complete contracts could be written, enforcement remained costly, so it is not surprising that individuals routinely involved in time inconsistent decisions had to develop means of reducing the likelihood of ever having to enforce contracts on delinquent parties. In the case of the JSBs, this involved careful screening procedures, the posting of bonds (collateral) and the concentration of decision-making authority in the hands of a small group of individuals (the Directors) whose incentives were consistent with the bank's. The JSBs can therefore be pictured as a pyramid where authority was vested in the apex, and where the function of the administrative structure (clerks, cashiers, branch managers) was first to collect information to be relayed up to the Board of Directors and second to implement the decisions taken by the Board. Outside the apex, discretionary powers appear to have been sharply constrained (Newton, 1996).

The Board's decision can be modelled as moving through two nodal points. Upon receipt of an application for a given sum of credit for a certain term, the Board would first consider the personal reputation of the applicant and his business (although a few women did apply for credit from Sheffield Union, the vast majority were men) and decide whether a collateral was required for that particular advance. If the Board felt no collateral needed posting, the advance was accepted (as will be argued below, this in effect meant that the

Board estimated the applicant's probability of default to be below a critical value). These advances are indicated in the bank books as either being the customers 'own responsibility' or they were backed by guarantees, that is by the signature of the borrowers himself or of a family member/business partner. Guarantees did not give the bank a legal title to property owned by the borrower/guarantor, so they could be viewed as constituting no more than an expression of trust by the bank in the word of the borrower and/or the guarantor.

If, on the other hand, collateral was required the Board had to assess whether the assets offered to that end by the applicant could be considered adequate given their expectation concerning the probability of the applicant's actually repaying. It should be emphasised that applicants had a reasonably shrewd idea of whether the Board was likely to require collateral, although they did not always get the amount right. Thus no cases are found where a borrower put in application for an advance offering some collateral while the Board felt that no collateral was necessary, though cases are found where the Board specifically replied that the collateral was insufficient. If the assets offered were considered adequate the Board approved the advance pending the handing over of deeds or title to the security. At all stages of this process the Board drew upon the knowledge of the applicant's branch manager, though the latter was not involved in the final decision.

However objective and measurable some of the criteria used in reaching a final decision may have been, inevitably the Board had to exercise a high degree of 'judgement'. This is true even for the contemporary banker. A recent textbook on corporate finance states that 'Like all financial decisions, credit allocation involves a strong dose of judgement' (Brealey and Myers, 1996: 860). In making such judgements, the JSBs could resort to particular informational channels. Unlike their successors the 'national' banks, but like their predecessor the private bankers, JSBs still had a local base and their managements (the banks directors) consisted of individuals who, as a rule, were deeply involved in local social,

business and political networks. There were some professional bankers on JSB boards but it was more common to find the occupations of directors representing the major trades and industries of an area (Newton, 1996; idem, forthcoming). Likewise, the local sphere of activity of these banks meant that those applying for credit were based in the district and were linked to local businesses by a mesh of relationships as customers and suppliers, neighbours and relatives, or trade, craft and even sports club memberships. Personal participation in local society by bank directors would not only allow members of the banks' management to draw upon their experience of local business and current business conditions, it would also allow them to utilise the local business networks in which they participated as a source of knowledge and information (Galassi, 1996; Newton, forthcoming).

What type of information would the local banker find useful when utilising their own knowledge and that obtained from business networks? To a degree personal wealth, thus ownership of substantive property, size and success of a business, ability to undertake certain leisure pursuits, membership of particular institutions and generally a certain lifestyle would matter. These tangible actions were not, however, necessarily unambiguous signals because substantial lifestyles can be maintained by running down assets, not an activity bank directors wish to encourage in their clients (at least not unless it resulted in a straight asset transfer to the bank). Besides the outward manifestation of wealth, on which banks could lay claim by requiring collateral, a borrower's reputation also played a role. This was somewhat harder to measure but nevertheless a crucial consideration to those doing business with, or providing credit to, an individual or firm. If a 'bad' reputation is understood as a recognised tendency to defect from co-operative engagements, the possessor of such a reputation will find it more difficult to enter into profitable trades because other players will have to build into their payoff matrix higher monitoring costs, and therefore the number of mutually profitable transactions will shrink (Ridley, 1996: 80-2; Kitcher, 1993). Reputation was thus important

given the ability of the local business community to detect opportunistic behaviour amongst its members. The business community and its associated networks could operate as a monitoring mechanism that provided a strong disincentive for potential defaulters who faced losing the trust, reputation and connections so vital to business success. As Carnevali found in the case of regional Italian banks, 'peer monitoring adds another element to the reduction of moral hazard' (Carnevali, 1996: 88). Conversely, a 'good' business reputation, as demonstrated by being held trustworthy by members of the business community, was a valuable asset. Authors in the field of sociology and organisational behaviour concur with this viewpoint, suggesting that social interaction between economic actors leads to the emergence of trust and the development of social sanctions, such as withdrawal of reputation and prestige or ostracism from the community, in order to control opportunism (Granovetter, 1985; Dore, 1983; Powell, 1990; Uzzi, 1997). Axelrod has also emphasised the importance of the 'shadow of the future' in economic transactions (1984).

The possession of a 'good' reputation and the consequent ability to inspire trust were especially important in banking transactions. By providing clear signals that they were likely to repay, potential borrowers increased the likelihood of obtaining credit and reduced the cost and inconvenience of accepting claims upon their property to secure the debt. The economic advantages of building up a good reputation were therefore apparent. From the perspective of the banker, accurately assessing reputations and trustworthiness reduced costs. Resorting to external measures, such as legal contracts or law courts, in order to enforce agreements was expensive and therefore banks could reduce transaction costs by screening out applicants with undesirable reputations. Yet the screening had to be quite accurate. Losing business because of a false negative would help one's competitors if they could capture the refused would-be borrower, while accepting a false positive meant opening oneself to financial losses.

George Rae, a mid-nineteenth century banker, provides some insight into the opinion of his contemporaries concerning lending policy. He advised the banker: 'The leading subject of your daily education as a banker will be to learn whom to trust' (Rae, 1885: 6). In assessing the likelihood of repayment by the potential customers, Rae clearly believed that the banker not only had to assess information as regards to the wealth of the client but also their reliability and trustworthiness. It appears that the nineteenth century banking practitioner was seeking to provide credit to the borrowing customer who had both the means and the inclination to repay, whatever the circumstances, and looking to 'filter out' those who were 'untrustworthy' and/or with limited means.

These factors were also crucial in deciding how much collateral security it was necessary to obtain from the customer in order to protect the bank by enabling its management to reclaim funds in the case of default. On the matter of security, George Rae advised: 'Reject as a banking security everything that is not readily convertible into money' but ultimately he counselled that the only way to ensure that an advance was 'safe' was 'never to make an advance without security' (Rae, 1885: 37).

In reality, Rae's strictures about procuring security were honoured more in the breach than in the observance by bankers in the nineteenth century.[3] Indeed, surveys of the archives of JSBs have shown that they frequently lent funds to customers who provided security below the value of the credit granted or no security at all. A study of those banks formed between 1826 and 1844 revealed that 30 per cent of credit examined was extended without the formal deposit of collateral security (Newton, forthcoming). Likewise, a survey of

[3] Even Rae himself did not follow this advice. In 1839, after three years at the North of Scotland Bank, Rae became inspector of branches at the North and South Wales Bank and proceeded to rise in rank to become managing director in 1865, a position in which he controlled bank policy. Reference to the Board of Directors minute books of the bank will find instances of credit granted on illiquid security or

English bank lending between 1860 and 1914 found that 'somewhere over half of the industrial overdrafts made in the provinces did not involve the formal deposit of securities - they were either wholly unsecured or relied on the signing of personal guarantees' (Capie and Collins, 1996: 35; idem, 1999: 42). Upon what basis did some clients receive credit under such conditions? Capie and Collins (1999: 42n) emphasise that the issue of trust was central to the common practice of English banks in the nineteenth century of granting credit unsecured by any formal collateral. How such trust generated?

Zucker has emphasised the collective experience of actors and their shared implicit knowledge in the development of trust. In doing so she has identified three different types of trust. Firstly, process-based trust, which develops from long-term stable relationships as a result of institutional processes rather than personal relationships. In these circumstances the participants presume that past 'good' behaviour, or a positive reputation, will be replicated. Secondly, characteristic-based trust is identified, whereby reliance on the assumption that certain characteristics, such as family background, religion or ethnicity, can be used as good justifications for trust. Finally, she identifies institutionally-based trust, which exists when trust is linked to formal structures in society, independent of the preferences and actions of individuals (Zucker, 1986).

In their empirical research of trust in buyer-supplier relations Lane and Bachmann found that 'process-based' trust, that built from stable relationships, was encouraged by 'the degree of physical proximity of firms and the longevity of business relations' and knowledge sharing but also 'the establishment of reputation by firms' (Lane and Bachmann, 1996: 381). Close proximity was likely to increase the contact between actors in economic relationships and also increase the likelihood of informal contact, both of which would enhance process-

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no security at all. See HSBC Group Archives, BDM, North & South Wales Bank; Collins and Hudson, 'Provincial Bank Lending', pp. 77-8; and Crick and Wadsworth, pp. 167-194 and pp. 425-35.

based trust. Such definitions of trust and research findings are relevant here. The bank-customer relationships considered in this study took place in a specific geographical area (South Yorkshire, England) during a period when restrictions upon travel ensured a relatively parochial environment. It is fairly safe to say that the actors in this environment originated from a relatively concentrated geographical area and this would have provided them with common social and cultural experiences. Such a parochial sphere of activity also related to the business environment. In the case of the banks that existed during this period, lending to customers that resided outside the town in which it operated, or outside its immediate environs, was not undertaken: their sphere of operations was very narrow (Newton, 1996). In such an environment it is likely that process-based trust, relationship-based trust and characteristic-based trust would flourish.[4]

The length of relationship between actors is considered important by many in the development of trust. Lane and Bachmann assert that long-term relationships increase the amount of contact between two parties and, if this contact were positive, it would be likely to increase trust (1996: 381). In banking, the length of a relationship with the customer is important in the generation of trust but it is also crucial for its role in information gathering and screening. The longer the relationship between bank and customer, the more information about the customer may have been accumulated and a better assessment of their creditworthiness made (Galassi, 1996; Newton, forthcoming). As a result, an information advantage is created. It is possible that existing customers of the bank with a good reputation, particularly a history of repaying advances on time, may have been granted credit more freely and on better terms than applicants with no history at the bank (Capie and Collins, 1996). In an examination of corporate finance, Mayer emphasises that long-term, positive

[4] Unfortunately, kinship, religious or ethnic ties are hard to uncover and are not revealed in the records consulted for this paper. The results found here suggest, however, that characteristic-based trust may have been a key factor in lending decisions. This therefore remains a topic for future research.

bank/industry relationships may reduce moral hazard, arguing that such relationships form a commitment which can replace long-term, more costly written contracts (Mayer, 1988). In a broader context, Williamson asserts that repeated transaction with the same partners can be a source of significant economic advantage (Williamson, 1981). Indeed, a long history of economic interaction may reduce behavioural uncertainly and promote 'honest' interaction: individuals are less likely to 'take advantage' of those with whom they have had long and stable past interaction (Dyer, 1997).

Thus longevity of relationships, geographical proximity between firms and social networks were/are important factors in the production of trust and reputation. Is it fair to presume that were customers of JSBs in the nineteenth century who possessed a highly trustworthy reputation not only had greater access to credit, but access under favourable conditions? The next section addresses this question.

Section 2: An Analytical Framework

The purpose of this section is to quantify in so far as possible what 'trust' meant to borrowers from English banks in the nineteenth century. The question is interesting because the records obviously show that seemingly identical borrowers were being asked to post strikingly different securities for their advances implying that, in the view of the bank's management, they posed a worse risk than others considered more 'trustworthy,' 'sound', or 'virtuous.' Reputation was therefore an asset, and trust was the benefit that those who had the asset could draw from it. By using the bank's marginal equilibrium condition, a computable formulation is derived for the implicit trust that the bank's management felt towards individual clients.

Before modelling the borrower/bank interaction, it is important to establish the principal/agent relationship within the bank. It is convenient to see the bank as a two-tiered

organisation consisting of principals (stockholders) and agents (directors). While in practice these may at times have been the same individuals, not all stockholders were directors, and their functions are analytically distinct. Principals post assets to back the funds raised by the bank, set 'broad' policy criteria, namely the *ex ante* target return (*a*) on loanable funds, and act as residual claimants. Directors take *a* as given and set 'detailed' policy in consequence, specifically defining solvency criteria and acceptable securitizable assets, choosing interest rates and other charges, assessing individual applicants and ultimately deciding whether to lend. Delegation is needed because principals may have a competitive advantage in raising funds but may simply not have the time to gather information on each borrower, so that delegation becomes the solution to foregoing profitable lending opportunities (scale diseconomies intervene).

The agents, backed by the paid up capital posted by the principals, raise funds on the money market at rate *r*, which is competitively set given Bank Rate. As part of bank policy, agents set the rate to be charged borrowers, and it is assumed that this is done by adding a mark-up *m* to market rate *r*. This uniform rate r^* $(= r + m)$ is charged all clients whose applications are accepted.

Why would heterogeneous borrowers be charged a uniform rate? Although in textbook finance the bank would differentiate among borrowers with varying risk profiles by marginal adjustments in the lending rate, Stiglitz and Weiss (1981) have convincingly argued that as a sorting device the interest rate may actually reduce the bank's expected income. A rate increase may well select against safe but relatively less remunerative projects, shifting the bank's portfolio towards riskier investments. In addition, higher rates might discourage honest but risk averse borrowers and select for dishonest or risk loving customers. Because clients' relative degree of risk aversion may be difficult to asses *ex ante*, and because in any event borrowers certainly posses better information on the risk characteristics of their

investment than the bank, the latter will find it extremely costly to predict with any accuracy what the impact of marginal adjustments in the rate will be upon its portfolio. The direction of the change will however be clear: the portfolio becomes on balance riskier. Rate changes are therefore not a desirable sorting device.

The alternative is asking for security, *s*. This may be preferable on some grounds, although it involves its own distinct set of undesirable outcomes from the bank's point of view. In the first place, the evaluation of collateral at the time the advance is agreed may vary significantly from its realisable value, net of transaction and possibly litigation costs, should the bank need to seize it. Secondly, again the borrower has better information on *s* than the bank. Furthermore, evaluating collateral is not costless, and since the bank will charge the cost back to the client this may discourage some marginal borrowers from seeking credit, resulting in foregone lending opportunities. The advantages of having borrowers post security, however, are that, first, it provides a deterrent to default in a way that higher interest rates cannot (a dishonest borrower will agree to pay high rates if he intends to default anyway), and therefore, secondly, involves no skewing of the bank's portfolio structure (Coco, 2000). *Ex ante,* adjusting the collateral to reflect the borrower's risk profile does not therefore diminish the bank's expected income.

The directors thus have two decision variables, the mark-up and the broader policy issue of what guidelines (in assessing borrowers and collateral) to adopt.[5] In deciding the mark-up, they aim to achieve target return *a*. In addition, to cover administrative and bookkeeping costs, the directors charge a fixed commission per advance, *c*.

If that is at least broadly correct, what of the bank/borrower relationship? Assume that a group of heterogeneous borrowers apply for an advance of mean value *x* from the bank, and

[5] We are assuming that the bank can raise practically unlimited funds at *r*, so the amount of credit provided is limited only by demand.

offer collateral with current market value of v. Collateral means, in this case, tangible property (buildings, goods) or financial assets. The bank directors evaluate each application in turn and decide whether the offered security is adequate. In this case adequate means that the expected realisable value of v, net of litigation costs if the borrower defaults, will repay the bank for the default. The directors therefore were likely to have applied a discount factor q to v ($q \leq 1$) such that $qv=s$. If the security offered by the j^{th} applicant is considered inadequate by this criterion, the directors refuse the advance and no further interaction ensues. For simplicity, but without loss of generality, the assumption is made that all advances are for the same period.

As already outlined, however, a substantial portion of borrowers in the English capital market in the nineteenth century did not post collateral. These people borrowed in effect on the strength of their own signature (or their guarantors'), that is, on their reputation alone. Since reputation is the key issue of this paper, it will now be considered in more detail. By reputation, we mean the expectation by other agents in the economy that individual (or firm) j will not defect from co-operative games, whether repeated or unique. Because these expectations imply a reduction in the number of margins over which interacting agents need to exercise monitoring when engaged in a game with j, and since monitoring is costly, reputation reduces transaction costs and increases the net benefit available to both parties in the transaction.

Reputation is therefore a valuable asset, but what its value is exactly may be difficult to quantify. One approach may be to see it purely as an opportunistic cost-benefit analysis by the actor concerned, who by implication stands ready to defect if the net discounted benefits should become negative, for example because of a change in the time horizon. Dasgupta (1988) pointed out that, since intentions are unobservable and that purely strategic considerations rather than intrinsic characteristics may motivate co-operative behaviour,

reputation depends on sustained co-operation. Even one lapse may lead other players to a drastic revision of the distribution of probabilities associated with the actor's inferred preference structure (and therefore of the net benefits available to the actor in future transactions). Though insightful in a general way, the problem with this approach is that future benefits from current co-operative engagement are difficult for actors to quantify, so that it is problematic to define with any precision where the margin at which their behaviour 'switches' lies. The approach is therefore ultimately untestable (non-falsifiable).

As an alternative, reputation may be analysed as a form of capital accumulated over repeated interactions in time. Rather than integrating forward, actors are presented as integrating backward over time and seeking to obtain a stream of current benefits (trust) from past co-operative behaviour. The probability of defection then hinges on the payoff structure of the current game: given a large enough payoff net of sanctions, jettisoning the accumulated asset may be individually rational.

It is not possible to test this approach in a single paper. Rather, the intention of this paper is to begin to quantify the value of the probability of defection as estimated by the lender and to relate it to borrower characteristics, so as to determine what the intangible assets that Victorian English businessmen needed to accumulate were. The advantage of seeing trust as a probability is that its value is necessarily implicit (in this case) in the lender's equilibrium condition, and can therefore be calculated provided adequate information exists on other parameters.

In this way the paper differs from recent literature on trust and reputation by economists (Glaeser *et al.* 2000, Clark and Sefton 2001, Alesina and La Ferrara 2001) which focus on calculating how frequently players choose co-operative strategies depending upon payoff structures, recent experience and group membership. Strictly, these studies do not measure trust but rather the probability of mutual engagement given a set of parameters. On

the other hand, it is possible to measure trust in the sense of computing the probability that a lender attributed to a given borrower's course of action (repay or not repay). That is the next step.

Let p_j be the probability of default by the j^{th} borrower as estimated by the bank. Bank directors would set the expected revenue from the advance (interest and capital weighed by the probability that the borrower will repay plus realisable collateral weighed by the probability that he will not) net of costs to be at least equal to what they have 'pay' back to their principals, *a*. At the margin, then,

$$(1-p_j)(1+r^*)x_j + p_j q_j v_j - (1+r)x_j + c \geq a \qquad [1]$$

which implies

$$\left(\frac{s}{x}\right)_j \geq \frac{1+r+\frac{a-c}{x}-(1-p_j)(1+r^*)}{p_j} \qquad [2]$$

This simple formula may be considered as a summary of the criteria that directors had implicitly in mind when assessing borrowers. Recall that the model considers the directors as having only two decision variables, m and s. The former is general, in the sense that it is set once as the standard mark-up above market rates charged by the bank. Having set m, directors treat it as a constraint and evaluate s_j (that is, estimate q_j given v_j offered by the borrower) in order to achieve target return a. In other words, given parameters a and m, and given the market rate r, 'all' that is left for the agents to do is evaluate p_j, the probability that j will default. A minimum value of $(s/x)_j$ follows the evaluation of p_j, and the only other step to be taken is checking whether the proffered collateral matches this minimum value

Before continuing, it is important to be clear that return on equity a is an *ex ante* target set by the bank's principals, not a *realised* return. Any shortfall in realised revenue [$^{o}S(1+r^*)x+Ss$, once p has collapsed to either 1 or 0] will reduce a. This means that [2] constitutes a guide to *ex ante* behaviour, not a description of *ex post* outcome, which is appropriate in this case since it is an attempt to evaluate trust, which is essentially a non-collapsed probability.

Second, [2] is an inequality, and it would seem reasonable to presume that the bank's ability to ask for collateral in excess of the minimum would depend on its competitive position. For the remainder of this paper it is assumed that the bank cannot capture differential rents from different borrowers by forcing them to post s/x in excess of the minimum as defined by [2]. In other words, it is assumed that the bank remained close to the locus of minima outlined in Figure 1, so that if there is any rent captured it is the same for all borrowers (that is, it is built into parameter a).

Third, [2] above is well behaved in all arguments (note in fact that $\partial(s/x)/\partial p > 0$, and $\partial^2(s/x)/\partial p^2 < 0$ for all values of p). However, s/x can never be negative, though it can be 0, so there exist positive values of p for which the directors will ask for no security, consistent with observation. Let p^* represent a value of p small enough that $(s/x)_j=0$. Then

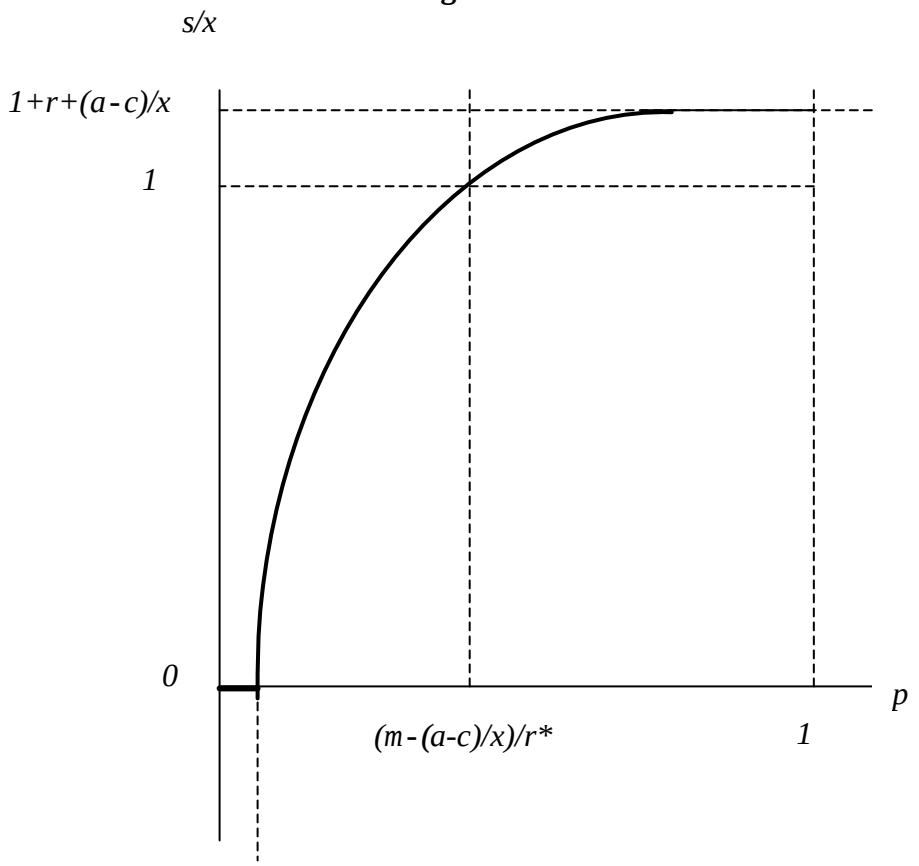
$$p^* = \frac{m - \dfrac{a-c}{x}}{1+r^*} \qquad [3]$$

For any $p \pounds p^*$, the function lies flat on the horizontal axis (see Figure 1), so that p^* constitutes a break, and the derivatives above hold only, in this context, for $p>p^*$. Note that p^* varies inversely with a: as the target return on capital set by stockholders increases for a given

mark-up, their agents will reduce the threshold of the probability of default below which they ask for no security.

The curve in Figure 1 is, it must be emphasised, a locus of minima: the value of collateral to credit required by the bank will be set *at least* at the value there indicated, and not below, though it may be above.

Figure 1



In order to complete this part of the task, the terms of [1] are rearranged so as to solve for p_j. In effect, if [2] was the algorithm that the bank directors used to decide whether collateral was required and if so how much for the j^{th} applicant, solving [1] for p_j involves running the algorithm backward. Given that it is *not* possible to observe p_j, but it *is* possible

to observe $(s/x)_j$, the probability of default for credit j may be calculated by substituting the known parameters into the following expression:

$$p_j = \frac{\frac{a-c}{x} - m}{\left(\frac{s}{x}\right)_j - 1 - r^*} \qquad [4]$$

The next section of the paper outlines the sources and methodology adopted in computing p, and presents some descriptive statistics of the results obtained.

Section 3: Measuring Trust.

Most of the parameters necessary to compute the implicit value of p as set by [4] are very straightforward. The Bank Rate is known (Mitchell and Deane, 1962), as are the mark-up and commission charged by the bank. Really the only difficulties arise with a, the target return stipulated by the stockholders, and with s/x, the discounted collateral to credit ratio. This latter is considerably more troublesome than the former, therefore the simpler problem is examined first.

Parameter a is the target that stockholders in the bank wish to achieve in terms of return to their assets. Note however that a is not a profit rate, that is, it is not a return per pound of invested assets. Rather it is the revenue net of costs that each advance must contribute to overall profits. Assume that A is the total equity held by stockholders in the bank, and R is their desired rate of return on A. If X is the total value of the bank's income earning portfolio, then each advance of value x must yield (net) $(AR)(x/X)$ for the full

portfolio to yield *AR*. That is the target return a. The problem remains that only the profits made by the bank on its portfolio *ex post* are know, not what they intended to make *ex ante*, and it on the *ex ante* values used to calculate trust for individual customers. However, the ratio of profits to advance portfolio was reasonably constant (see Table 1.1) at around 3.5% over 30 years, which interestingly is also the mean value for the Bank Rate over the same years. This suggests the stockholders found this level of return reasonably satisfactory over the long term, which is another way of saying that it met their target. It is therefore not unrealistic to use that figure as a reasonably good approximation of a.

The discounted collateral to advance ratio is less easily computed. While the minutes of the directors' meetings record the book value of collateral for advance applications (accepted or rejected), that is obviously v, not s. Therefore it is necessary to estimate the value of q for each category of collateral, which is rather troublesome as no more than summary descriptions of the physical or financial assets being offered to the bank as security are available. It seems certain that the discount factors applied to individual assets varied from case to case: directors, precisely because they were so intimately involved in the business life of the town, had a great deal of very specific information not only on people but on companies, factories, works, sites, buildings, possibly even individual workshops, which it is virtually impossible for the historian to obtain. To them, a specific iron and steel works might be a more desirable form of security than another (say because of better location) which might however be identified with identical language in the minutes, in the same way as Saks Fifth Avenue and a pawn shop on the Lower East Side might both be described as jewellery shops.

It is necessary to accept that it is not possible to reconstruct the level of specific information possessed by the Directors, and instead the analysis must opt for less accurate but more tractable ways of estimating q. To that end, the collateral recorded in the minutes of the

Sheffield Union Bank have been divided into three groups. The first includes all advances issued on the strength of guarantees or IOUs alone. For all of them, their value as collateral is zero. As has already discussed, if guarantees are given there are no assets to seize in case of default, and guarantees, although legally binding, were easy to circumvent in the nineteenth century.[6] In the second group all physical assets are included, such as land, property, factory works, buildings, stocks of goods or machinery, which, following Rae, may be considered consider illiquid security. In the third category all financial assets, shares, uncalled capital, bonds or cash deposits are grouped, which may be considered highly liquid. It is then necessary to apply uniform discount coefficient q to each of these latter groups, distinguishing between q_h if the discount is high (assets are illiquid) and q_l if it is low (assets are liquid). The next step is to define what is high and what is low.

One way to estimate q_h is to actually study cases where the bank had to seize the collateral and sell it to make good a default. Working on the reasonable assumption that Directors, in assessing the suitability of collateral offered by applicants would base their decision on their experience in such cases, it is reasonable to reconstruct a general discount factor they were likely to have applied when illiquid assets were being considered.

Firstly, it should be emphasised that, in the case of the Sheffield Union, the number of customers whose businesses failed was relatively low and therefore the bank's screening mechanisms appear to have been relatively successful. On the few occasions that companies were forced to liquidate, the board minutes record the process by which the bank attempted to

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[6] For example, in the case of Holme v Brunskill (1877), it was held that any variation to the underlying contract made without the consent of the guarantor would result in the release of the guarantee. The only exception would be where the variation was self-evidently insubstantial or non-prejudicial. In the case of Swire v Redman (1876), the court held that if the creditor entered into a binding agreement to give additional time for the debtor to pay then the guarantor was released. Many thanks to Malcolm Dowden for providing this information and clarifying the legal status of guarantees.

recover money owing to them from the failed customer. This process was involved and time-consuming. For example, the Albion Steel & Wire Company went into liquidation in 1876[7] owing the bank £28,838, for which the bank held security of a mortgage on the company works worth £56,000, but by 1884 the debt had still not been fully recovered. In 1882 the bank, having failed to sell the Albion works as a going concern in its entirety, was forced to break the company in different parts.[8] By 1884 the bank was still selling off premises and machinery of the original company in a piecemeal fashion. In September 1884 one of Albion's boilers was sold for £95 but the bank was left holding five remaining boilers.[9] In November of the same year the bank sold plots of land, including associated buildings, that had been part of the Albion works for 1s 4d/sq.yard.[10] Therefore, more than eight years after the Albion Steel & Wire Company had failed, the bank was still trying to liquidate the assets it held as collateral security to cover the debt of £28,000. Moreover, during this period it had been necessary for the bank to spend money on the works in order to maintain the company as a going concern, presumably in an attempt to maximise its potential realizable value. It was only in 1883 that the directors resolved that 'no more money is to be spent on the property'.[11] This case demonstrates that the actual value of the company works was far less in reality than it had been on paper due to the illiquid and depreciating nature of its assets. The price of £56,000 originally placed on the works was a very far cry from what could be recovered by the bank. Indeed, the bank was eventually forced to write off much of the debt into the bad debts account.

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7 HSBCGA, SU, BDM, Vol. III, 5 Oct. 1876, f.157.

8 For example, in November 1882 the Sheffield Union attempted a sale by auction of the freehold sections of the works which had themselves been divided into lots. ibid., Vol. IV, 16 Nov., 1882, f. 248.

9 ibid., Vol. IV, 18 Sept., 1884, f. 430.

10 ibid., Vol. IV, 13 Nov., 1884, f. 444-46.

11 ibid., Vol. IV, 6 Sept. 1883, f. 326.

Admittedly, the Albion Steel & Wire Company went into liquidation during a recession that lasted into the early 1880s. The works were also relatively large and therefore not attractive for sale in a period of contraction. That the bank encountered difficulties in selling the assets is unsurprising. However, other examples illustrate similar problems encountered by the Sheffield Union in realising smaller collateral in different circumstances.

In July 1882 Joseph Armstrong & Co were declared bankrupt.[12] The bank were owed £9,000 for which it held the company works and machinery as collateral security, valued at approximately £20,000 in 1877.[13] The machinery had been valued at nearly £11,575 in 1877 yet in 1883 the bank sold most of it for £1,250,[14] less than 11 per cent of the original book value estimate. Even with the sale of the remaining machinery, the full value of these assets could not even come close to being realized. In addition, it was necessary for the bank to undertake expenditure in order to maintain the works.[15] The Sheffield Union encountered similar problems with assets seized following the collapse of the Railway Spring Company in 1879. The bank sold the various works of the company that had been held as collateral security (a process taking 3 years) for 47 per cent of the original valuation.[16] This sale appears to have been reasonably successful for the bank, probably due to the fact that the works being sold were relatively small and therefore more liquid than large-scale premises. Yet these examples clearly demonstrate that illiquid collateral security such as works, machinery and land did not provide the bank with assets that had a realizable value commensurate with their 'book' value (*v* in the formulation).

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12 ibid., Vol. IV, 31 Aug., 1882, f. 233.

13 ibid., Vol. III, 5 Jan., 1877, f. 182. These valuations were for the company as a going concern.

14 Ibid. Vol. IV, June 1883, f.

15 ibid., Vol. IV, 20 Sept., 1883, f. 329. The caretaker of the works informed the board that 'he must have some coke, oil and waste or the engines will soon be past getting into order.' The Board sanctioned the purchase of these products in order to keep the concern in good working order and, presumably, a more marketable asset.

Evidently the 'real' value of security accepted by the bank was far less than the book value, as presented by the company in applying for credit.[17] Indeed, the acceptance of 'illiquid' forms of collateral by the bank appears to have been undesirable – it is unlikely that they wished to come into possession of a company and all the associated problems of its operation. Members of the board had a bank to run and usually had businesses of their own to consider. Yet company works were frequently accepted as a form of collateral security by the Sheffield Union. An explanation could be that, rather than attempting to calculate an accurate future realizable value of such an asset, the bank directors may have been more interested in the value or importance of the asset to the borrower. By holding the deeds of a company's works the bank was, in effect, holding the livelihood of its customer or the ultimate sanction in the event of default. The threat of repossessing works and machinery may therefore be viewed just as much as a deterrent to default as it could be viewed as a form of collateral security.

Given this evidence, it is justifiable to estimate a realizable value of illiquid asset (land, property, machinery) at one fifth of its original book value (q_h=0.8). This discount may appear excessively high, but it really is not. Consider that in the case of the Armstrong & Co bankruptcy, the bank sold assets for 1/10 of their book value, and even in the relatively easy case of the Railway Spring Company in 1879, the PDV of the sale of the seized collateral was still less than 40% of their book value, and that is without taking legal and other costs into consideration.

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16 See Vol. III, 26 July 1877, f. 230; Vol. IV, 12 Feb. 1880, f. 55 and 18 Jan. 1883, f. 262.

17 There was also likely to be some inflation of the price of an asset by a company when applying for credit in order to ensure a successful outcome. However, this would have been offset by the experience of the bankers in assessing such securities and the fact that the bank would often hire relevant experts and undertake the valuation of property themselves.

In contrast, relatively liquid assets such as shares would have had a much higher realizable value, and this can be estimated as 90 per cent of their value (q_l=0.1) when taking into consideration the transaction costs necessary to dispose of them. This parameter is in a sense arbitrary, but the results obtained seem reasonably convincing. In any event, doubling q_l appears to make no difference to the distribution of the estimated p.

It is now possible to use [4] to compute the probability that the bank estimated any given customer had of defaulting on a particular advance. This value is, arguably, a measure of trust between lender and borrower. Initially some summary statistics classifying credit applications by type of collateral and by outcome (accepted or rejected) may be reported. A simple econometric analysis of the computed p for accepted advances will be conducted in the next section. Before turning to the tables, however, a word of caution is necessary. The estimate of p as given by [4] only is meaningful for *approved* credit applications. This is because if the bank turned down an application it was, in effect, indicating that it expected the borrower to have a probability of default higher than was implied by the proffered security. Therefore, as the bank's algorithm is run backward using the q-adjusted value of v as recorded in the board minutes, what is computed is a value of p which the bank felt was too low for that particular customer. Indeed, that was why the bank refused the advance. Consequently the descriptive statistics of the computed values of p reported in Tables 3.1 and 3.2 are placed in brackets when they include data from applications that were rejected, because in that case the value computed by the formula does not reflect the expectations of the bank with respect to that particular customer.

Table 3.1: Computed values of *p* for credit applications classified by outcome.

	Credit Applications (N)	Years with Bank at Transaction Date	Credit (£)	Collateral (£)	Collateral to Credit Ratio	Collateral to Credit Ratio - Adjusted	Implied *p*
REJECTED	**26**						
Applicants: 25							
Mean		3.33	1837.96	1824.37	1.223	0.379	(0.0262)
SD		5.51	3960.21	3999.06	1.145	0.590	(0.0338)
Mode		0.00	200.00	500	1	0	(0.0142)
Median		0.00	500.00	500	0.848	0.150	(0.0164)
SE		1.08	776.66	784.28	0.22	0.12	(0.0066)
Skewness coefficient		1.81	1.01	0.99	0.72	1.16	(0.87)
ACCEPTED/REJECTED	**20**						
Applicants: 6							
Mean		5.11	2305.26	2375.53	1.074	0.103	(0.0163)
SD		6.67	1925.98	4366.43	1.442	0.155	(0.0035)
Mode		4.00	2000.00	2000	0.5	0	(0.0142)
Median		3.00	2000.00	1200	0.6	0	(0.0142)
SE		1.49	430.66	976.36	0.32	0.03	(0.0008)
Applicants: 6	**14**						
Mean of accepted only		5.23	2646.15	2985.38	1.286	0.112	0.0164
SD of accepted only		6.73	2116.84	5180.17	1.718	0.162	0.0037
Mode of accepted only		0.00	2000.00	2000	0.5	0	0.0142
Median of accepted only		3.00	2000.00	1600	0.6	0	0.0143
SE of accepted only		1.80	565.75	1384.46	0.46	0.04	0.0010
Applicants: 6	**6**						
Mean of rejected only		4.83	1566.67	1054.17	0.615	0.084	(0.0159)
SD of rejected only		7.14	1281.67	1082.87	0.161	0.154	(0.0033)
Mode of rejected only		4.00	N/A	N/A	N/A	0	(0.0142)
Median of rejected only		2.50	1400.00	712.5	0.578	0	(0.0142)
SE of rejected only		2.91	523.24	442.08	0.07	0.06	(0.0014)
ACCEPTED	**148**						
Applicants: 92							
Mean		4.15	1215.61	1538.64	1.902	0.415	0.0247
SD		6.33	2683.98	2623.47	2.455	0.904	0.0228
Mode		0.00	1000.00	1000	1	0	0.0142
Median		1.00	600.00	550	1	0	0.0142
SE		0.52	220.62	215.65	0.20	0.07	0.0019
SAMPLE	**194**						
Mean		4.11	1402.68	1665.89	1.757	0.408	(0.0241)
SD		6.23	2835.73	3034.97	2.282	1.009	(0.0236)
Mode		0	1000	1000	1	0	(0.0142)
Median		1	600	800	1	0	(0.0143)
SE		0.45	203.59	217.90	0.16	0.07	(0.0017)

Table 3.2: Computed Values of *p* for Credit Applications Classified by Collateral

	Credit Applications	Years with Bank at Transaction Date	Credit (£)	Collateral (£)	Collateral to Credit Ratio	Collateral to Credit Ratio - Adjusted	Implied *p*
GUARANTEES ONLY	**110**						
of which approved %	**86.4**						
Mean		3.91	956.55	789.42	0.998	0	(0.01419)
SD		5.79	987.89	705.71	0.569	0	(0.00026)
Mode		0	1000	1000	1	0	(0.01422)
Median		1	600	500	0.841	0	(0.01422)
SE		0.55	94.19	67.29	0.05	0	(0.00002)
GUARANTEES AND PHYSICAL/ FINANCIAL ASSETS	**9**						
of which approved %	**66.7**						
Mean		4.11	1722.22	1892.78	1.377	0.262	(0.03150)
SD		3.52	889.91	1103.73	1.346	0.291	(0.04192)
Mode		4	2000	N/A	N/A	N/A	N/A
Median		4	2000	1935	1	0.16	(0.01678)
SE		1.17	296.64	367.91	0.45	0.10	(0.01397)
PHYISICAL/ FINANCIAL ASSETS ONLY	**73**						
of which approved %	**78.1**						
Mean		4.81	2058.90	2966.58	2.887	0.921	(0.03689)
SD		7.18	4393.13	4155.01	3.219	1.142	(0.03455)
Mode		0	200	550	1	0.2	(0.09554)
Median		0	550	1200	1.429	0.5	(0.02283)
SE		0.84	514.18	486.31	0.38	0.13	(0.00404)
SAMPLE	**192**						
of which approved %	**82.3**						
Mean		4.20	1409.053	1682.542	1.778	0.505	(0.02405)
SD		6.27	2864.167	3063.242	2.301	0.650	(0.02360)
Mode		0	500	1000	1	0	(0.01422)
Median		1	600	800	1	0	(0.01432)
SE		0.45	206.70	221.07	0.17	0.07	(0.00170)

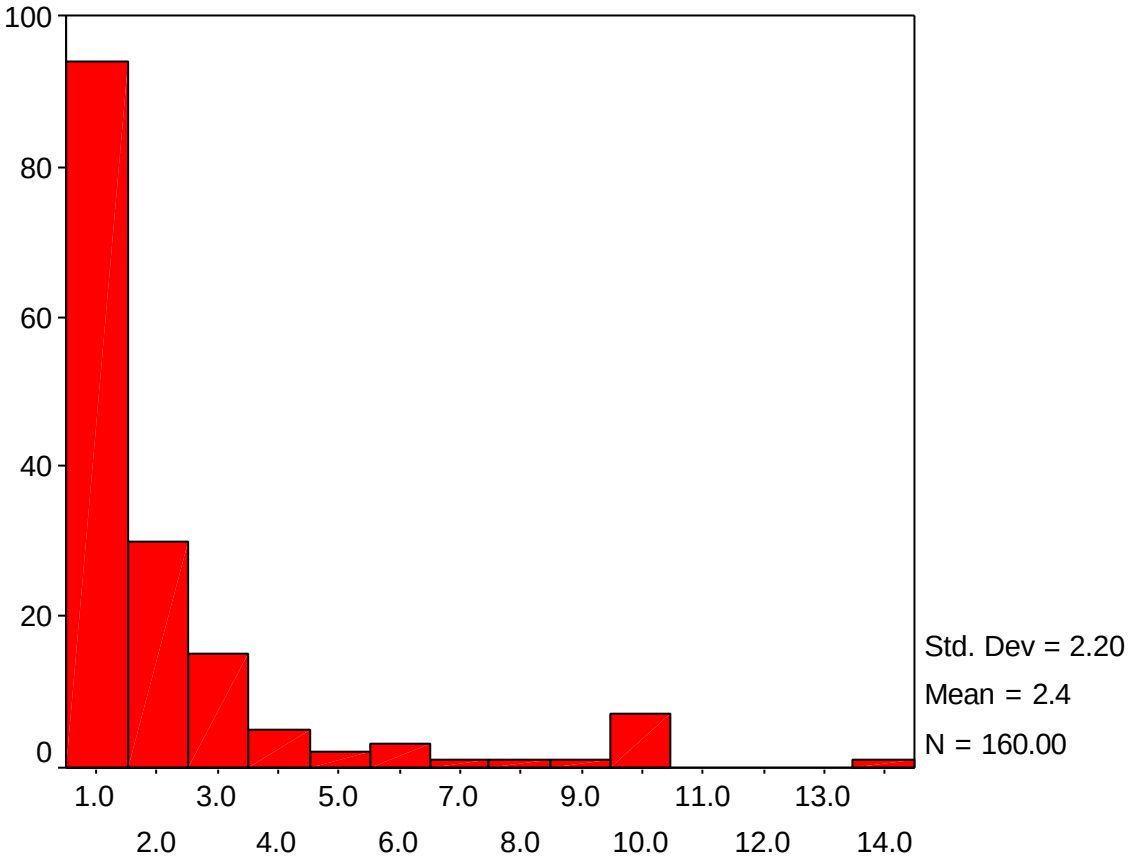
Note: the total number of applications differs between Table 3.1 and 3.2 because for two credit applications the Board minutes report the value of collateral but not its kind.

Perhaps the most striking feature of the tables is how little difference alternative classification criteria make. Successful applications are not put in by customers who had been significantly longer with the bank, nor are the computed values of p dramatically different. In fact, within-class variation far outstrips inter-class variation. This is interesting as it suggests that the bank was very effective at filtering out customers who did not meet certain criteria, so that the sample of advances is remarkably homogeneous. On the other hand, this raises a troubling issue for the methodology utilised, which is that the structure of the computation of p might be flattening existing differences among applicants, so that the estimates of p are excessively uniform. In principle it has not been possible to ascertain what, if any, bias the calculation should be introducing in the estimated variable. However, in this case a histogram of the computed p can be drawn in order detect bias in the distribution. If the methodology had unnecessarily reduced the range of the estimated variable, the expectation would be to find a distribution centred around a particular value with very small tails. If, on the other, the estimates are a reasonably faithful rendition of the probability which the bank estimated any given customer had of defaulting on their advance, it could be expected that p would follow a non-normal, positively skewed distribution, possibly Poisson. This is because it is logical that the portfolio structure of a lender with large short-term liabilities would include a high proportion of low risk assets, and a declining proportion of higher risk ones.

The latter is exactly what is revealed in the histogram (Figure 2, skewness coefficient 1.37). While it important to remember that not all of these advances were held at the same time by the bank, so that this distribution does not represent the structure of the bank's portfolio at a moment in time, it remains undeniable that the skewness is consistent with what can be reasonably expected of the portfolio of a lender of this kind. It is therefore reasonably to assume that that, while the blanket method of estimating q by classes of collateral may not always be an accurate rendition of the information available to the bank directors, there is no

prima facie evidence to suggest that the methodology has introduced systematic errors in the estimates.

Figure 2: Histogram of computed *p*.



Computed *p*, %.

Section 4: An explanation of trust.

There is enough variability in the computed values of *p* to warrant an attempt at explaining them econometrically. Regrettably the dataset for borrowers whose applications were accepted by the Sheffield Union, and for whom is has therefore been able to compute a probability of default, is far from complete. In addition, some variables that have been obtained cannot be used because they have gone into computing the estimates of *p*, so that regressing *p* on these variables would reveal no more than the parameters that have been

adopted. However, despite limited additional information for each of these 160 separate advances and 98 borrowers, the results of the regressions are intriguing if only in a negative way.

Two kinds of variables are necessary in order to explain variations in the computed *p* values. Initially what might be termed conjunctural variables are required to see whether the business cycle affected the bank's estimate of the probability of default for a given borrower. Ideally, this would already have been factored out of the estimates of *p* if the *q*s had been such as to allow cyclical fluctuations of asset values to be taken into account. Unfortunately the blanket measures that it was necessary to use for the discount coefficient are simply too crude to permit this, and it therefore seems opportune to use some index of business conditions in Sheffield in order to see whether the bank's estimates of *p* varied pro-cyclically. To that end the price of common iron bars and the price of a ton of coal at Yorkshire pitmouths have been utilised (Mitchell, 1988: 763; Mitchell, 1984: 277-8). As Sheffield's economy was, as already outlined, one tied into the coal, iron and steel industry, variations in these prices should give us an accurate reading of the business cycle in the town. These variables are used both as absolute values and as first differences.

The second set of variables that can potentially explain different values in computed *p* are individual specific. These consist of variables reflecting the past history of the credit applicant with the bank and are meant to proxy how well the applicant was known to the lender. They are the number of years the applicant is known to have banked with Sheffield Union at the time of the transaction, and whether the applicant had previously received an advance from the bank. This latter variable has been tried both as a (0,1) dummy and as a step variable (0 if there are no previous advances, 1 if there is one, 2 if there are more than 1).

In addition to these two groups being utilised in order to capture the relationship between the economy and the borrowers and the bank and the borrowers, a time trend has

also been used to see whether the bank was became more or less cautious over time. Finally the amount of the credit applied for has been included. Although this variable does contribute to the estimate of p, it is important to remember that it only enters this estimate as the denominator of the collateral to credit ratio, and even then its impact on that ratio is mediated by the discount coefficient q. This should therefore not create spurious correlations. The variable is meant to capture any possible scale effects in credit allocation.

There appears to be no clear reason to prefer a particular functional form of the regression to another. Both a linear and a log-linear regression have been tried, with non-parametric forms being rejected as the distribution of p definitely suggests a log. Only the log-linear results are reported here as the linear results were simply unenlightening.

Table 4.1: Log-linear Regression Results on Dependent Variable 'Computed *p*'.

Constant	-3.88***	-4.05***	-4.206***	-3.8***	-3.94***	-4.05***	-4.23***	-4.21***
	(-10.79)	(13.95)	(28.32)	(-18.51)	(-50.17)	(-14.14)	(-30.14)	(31.15)
Customer's years with bank at transaction date	0.0037	.0043	.0043	.0072	.0099			
	(0.43)	(.503)	(.509)	(.554)	(1.23)			
Previous credit dummy (0,1)	-.121	-.13	-.121	-.12	-.085	-.113	-.105	-.107
	(-1.148)	(-1.238)	(-1.167)	(-1.15)	(-.799)	(-1.16)	(-.108)	(-1.11)
Previous credit dummy (step)	-.75					-.37	-.084	
	(-.45)					(-.43)	(-.984)	
Price of iron bars	-.0965	-.0505		-.195		-.0502		
	(-1.085)	(-.754)		(-2)**		(-.759)		
Price of coal	.0037	.0022		.0046		.002		
	(.948)	(.658)		(1.72)*		(.534)		
d(price of iron bars)	.109		-.073		-.085		-.072	
	(.3)		(-.227)		(-.265)		(-.228)	
d(price of coal)	.206		.104		.032		.106	
	(.611)		(.329)		(.103)		(..344)	
Time trend	.0086	.011	.015			.124	-.105	.016**
	(.909)	(1.26)	(2.176)**			(1.484)	(-1.08)	(2.53)
Credit size	-.0000003	-.0000005	-.0000005					
	(-.195)	(-.268)	(-.277)					
R^2	.0502	.0455	.0426	.0348	.0105	.0436	.0406	.0398
Adj-R^2	.0001	.0081	.0051	.0099	-.0151	.0189	.0158	.0276
SER	.57	.568	.569	.568	.575	.565	.566	.562
SSR	49.13	49.37	49.52	49.92	51.18	49.47	49.63	49.67
Log-likelihood	-132.57	-132.99	-135.21	-133.86	-135.85	-133.13	-133.38	-133.44
F	.998	1.216	1.135	1.399	.411	1.785	1.638	3.256

t statistics in brackets.

(*): significant at 10%
(**): significant at 5%
(***): significant at 1%

Overall, the observed variables have poor, if any, explanatory power for the computed *p*. The only possible exception is the time trend, which alone of all variables reaches significance twice, both times with a positive sign suggesting that the Sheffield Union Bank was becoming more cautious in its lending policies over time. This may be in part a reflection

of the crisis in the coal and steel sector in the 1870s, however looking for a structural break with a Chow test failed to yield significant results.

What can be inferred from these results? Seemingly the important determinants of the probability of default as estimated by the bank are unobserved. While it may appear surprising that the length of the relationship between borrower and lender and the credit history of the borrower have no impact on the computed *p*, on reflection these results are actually giving a very strong message. This is that in this case trust could be characteristic-based, to use Zucker's expression. Sheffield Union directors do not appear to have been too concerned with the actions of their customers as evidence of trustworthiness. They appear instead to have focussed on other criteria, which are not observable, but about which it is possible can speculate. It is not impossible to imagine that such elements as religious affiliation, membership in particular social organisations or clubs, political allegiance or kinship links may have counted for more than a good credit history. Social networks, the regressions suggest, may have been more important as allocative devices in the credit market than anything a particular individual could do to acquire the trust of the banking fraternity.

The conclusion that trust was bestowed on grounds of group identity, rather than individual action, has substantial evidence in its favour. Glaeser *et al*. (2000) and Alesina and La Ferrara (2001) have found that when players belonged to the same group, significantly higher propensities to engage in co-operative behaviour were observed. Further research is therefore required in order to define these groups, which implies shedding light on the background of the directors and as many of the successful (and unsuccessful) applicants as possible. If the results presented here are indicating what has been inferred from them, there would be an expectation that a great deal of intersecting points between applicants with low computed *p* and bank directors would be found. However, that is the subject of another paper.

An alternative explanation could be that the unobservable factors are a more tangible form of assessment utilised by the bank directors. It is clear from the minutes that the directors were able to undertake fairly accurate assessments of a company's profitability from inspecting balance sheet, order books, etc. The information collected by directors and branch managers was very rarely recorded in the minute books and therefore the assessments based upon such data, in addition to the inherent knowledge of local industry possessed the bank's board from running their own industrial concerns, is also unobservable. This conclusion also has evidence in its favour. In a previous study based upon archival research and qualitative analysis, admittedly for a later period (the turn of the nineteenth and twentieth centuries), Newton concluded that bankers, although assessing reputation, put tangible economic factors before intangible criteria when assessing their borrowing customers: 'although reputation and trust played an important role, they were only pieces in the process of gathering information concerning a borrowing customer's ability to, and likelihood of, repaying credit' (2000: 197).

What is clear from these findings is that factors others than those which have been observed influenced the lending policies of the Sheffield Union Bank during this period.

5. Conclusion

Speaking of œonclusions is at this stage premature to say the least. However, an attempt has been made to develop a simple method of computing trust starting from observed variables and working backwards to the implicit decision made by the actor whose turn it was to move first in the game. The game in question here is that played between the potential borrowing customer and the bank, with the bank attempting to assess the likelihood fo the potential borrower to repay. In attempting to predict borrower actions, the analysis has focused upon the importance placed by the bank on a customer's reputation, with the aim of providing a quantitative or money value on this 'asset'.

The starting point of the analysis was that a number of well-specified variables would correlate with an estimate of trust, notably the credit/collateral ratio, the type of collateral utilised and the length of relationship between the bank and the customer. In addition, the external business environment was also taken into consideration. The aim has been to provide a measurement of trust, or *p*, yet the observable factors taken into consideration in the calculations appear to have been of only minimal importance in the banks assessment of trustworthiness. The implication is, therefore, that unobservable factors were more important in the bank's measurement of reputation than those variables that it was possible for the historian to observe. These unobservable elements are likely to have included kinship and religious ties and social positioning. Indeed, from the somewhat negative findings it appears that membership of an unobservable group, and exhibiting behaviour that reflected the norms of such a group, was more important than individual actions, even if such actions included a long-term, reliable credit history with the bank. Alternatively, or addition to group membership, more tangible pieces of economic information, such as a company's balance sheets or order books, payment of suppliers etc., are further variables observable to the nineteenth century bank directors but not to the historian.

Although not offering a precise measurement of reputation, this work highlights that the possession of the asset *p* (in terms of belonging to a social grouping or possessing a 'good' business reputation as displayed in company performance) was crucial in gaining access to bank credit in the nineteenth century. Thus, intangible assets clearly had very tangible results. The importance of studying reputation and trust has therefore been validated, even if it has not been possible to clarify its monetary value.

These conclusions conform most closely with Zucker's model of characteristic-based trust, which emphasises the necessity of research into the religious, political, social and familial affiliation of bank directors and their customers. From the first, tentative conclusions

it is clear that further research is needed in order to fully quantify the value of reputation and place it in a broader social context.

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