Monetary conditions and bank loan risk taking:

Evidence from the North and South Wales Bank, 1881-1894*

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Abstract

I investigate the effects of the monetary rate, the interest rate set by the Central Bank, on bank risk taking by examining a sample of loan contracts secured by shares and extended by the North and South Wales Bank between 1881 and 1894. Collateralization by shares allows me to construct a measure of ex ante risk taking for each loan: the collateral value to loan amount ratio. Exploiting the fact that Britain was on the Gold Standard at that period in time allows me to address possible endogeneity issues.

I use the number of gold rushes in a year as an instrumental variable for the monetary rate, by arguing that an unexpected windfall in the gold supply serves as an exogenous shock to the money supply, translating to a cut in the monetary rate. Results are consistent with theories indicating that low Central Bank interest rates can induce bank loan risk taking in the search for yields, as I find that collateral value to loan ratios are lowered following a cut in the monetary rate. I also find that low monetary rates corresponded with, on average, lower loan prices.

Keywords: Monetary policy, Credit risk, Bank lending, Gold Standard, Instrumental variable analysis.

JEL Classifications: C26, C58, E52, G21, N23

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1. Introduction

The recent financial crisis affected credit markets severely and many scholars have investigated what caused such turmoil (for an overview see Goodhart (2008)). One explanation that has been given was that low interest rates before the crisis led banks to take on excessive risk in the search for yields, a phenomenon also referred to as the bank risk taking channel of monetary policy (Rajan (2006)). Various studies have suggested the existence of such a channel, arguing that low levels of Central Bank interest rates (referred to as "the monetary rate") could induce excess bank risk taking (see amongst others Rajan (2006), Blanchard (2009), Calomiris (2009)).[1] Empirically identifying the bank risk taking channel is important as the behavior of banks can crucially affect financial stability. However, this analysis is econometrically challenging. First, disentangling a true causal relationship between the monetary rate and bank risk taking is challenging, as the monetary rate is often endogenous to the state of the economy. Second, comprehensive data on loan pricing, borrower characteristics as well as risk taking measures are needed, which currently are often kept confidential by banks. It is especially difficult to assess what the role of collateral is within this risk taking channel of monetary policy, due to the fact that collateral values are often not "real time" values and therefore are less informative when constructing measures of risk taking.

This study adds to the existing literature by empirically assessing the existence of a bank risk taking channel of monetary policy, addressing both of the above raised issues. I examine a unique hand-collected and detailed sample of loan contracts secured by shares, extended by the North and South Wales bank in the period 1881-1894, and I construct a precise measure of collateral value for each loan, using the market prices of the shares serving as collateral. Using such market based collateral values, I create a measure of *ex ante* risk taking using the

[1] Referred to as "the monetary rate".

collateral value to loan amount ratio. In addition, the period 1881-1894 provides me with an adequate setting to address the possible endogeneneity of the monetary rate. At this time Britain's monetary system was characterized by the *Gold Standard*[2]. The Gold Standard was a fixed exchange rate regime in which the currencies of participating countries could all be converted into gold at a predefined fixed price (see Bordo and Schwartz (1984); Mckinnon (1993)). Central banks were required to keep a level of gold to currency reserves in order to make it possible to fulfill the demand of exchanging currencies into gold and keep the exchange rate fixed (Sayers (1976)). The structure of the Gold Standard left little room for Central banks to control monetary policy: this implies that monetary policy in the nineteenth century was in principle "more exogenous" than today. Despite the fact that the Gold Standard had all the features of a fixed exchange rate regime, many scholars have argued that there was room for Central banks to influence the money supply (among others, Morys (2012)). Dutton (1982), for instance, argues that "*given that London was the world financial center and that sterling was a reserve asset, the Bank of England could have a significant effect on money supplies abroad via its open market operations and manipulations of the Bank rate*", which is consistent with the notion that the Bank of England did not always adhere to the "rules of the Gold Standard" and sterilized gold inflows.[3] This evidence suggests that the monetary rate, even under the Gold Standard, could have been endogenous to economic conditions.

I therefore use the number of yearly gold rushes as an instrumental variable for the monetary rate. I argue that the number of gold rushes can serve as a proxy for a windfall in the gold supply, exogenously increasing the money supply. This is a good instrument as gold rushes happened largely by chance due to accidental findings. As a result, they can be seen as an exogenous positive shock to the world money supply. I find that the number of gold rushes

[2] For an excellent overview of the Gold Standard in history see Bordo and Schwartz (1984): "A retrospective on the classical old Standard 1821-1931".

[3] For an overview of the rules of the game see Mckinnon (1993).

indeed is a strong instrument for the British monetary rate. My results furthermore indicate that there is a negative relationship between the monetary rate and bank risk taking, implying that under a low monetary rate period the bank takes on additional risk compared to high rate periods, *ceteris paribus*. The economic significance of this finding is quite large, since a one standard deviation decrease in the monetary rate results in a decrease of the collateral value to loan ratio of *33.7%* compared to its mean value.

In addition, capital markets seem to have worked in my sample period as a low monetary rate corresponded with, *on average*, lower loan prices in terms of interest rates charged, *ceteris paribus*. This implies that after a cut in the monetary rate bank risk increased but prices were lowered. This study adds to the existing literature on the bank risk taking channel of monetary policy by addressing endogeneity of the monetary rate using a unique instrumental variable that exploits the historical setting of this paper. Moreover, unique data on real time market values of collateral make it possible to create a very informative measure of ex ante bank risk taking something existing studies have not been able to address up to now. The data also allow me to identify borrowers with multiple loans over time, as loans were often rolled over, which makes it possible to account for borrower fixed effects and changing requirements of collateral for a given loan over time. This is a particularly important feature of the data, as borrower fixed effects have been proven to be of importance within the literature on bank credit. Furthermore I examine the bank risk taking channel of monetary policy in a *historical* perspective. Many scholars that have investigated the effect of the monetary rate on bank risk taking focus on the period around the recent crisis. To the best of my knowledge no study has shown that the existence of such a channel is not only a recent phenomenon, but was present more than a century ago. I provide new evidence that more than a decade ago, the monetary rate, affected bank risk taking as well as loan pricing. In addition, this paper provides historical evidence on micro level bank lending in Britain under the Gold Standard by studying unique loan books of the North and South Wales bank. It therefore contributes directly to the literature on historical bank lending in Britain. To the best of my knowledge, there are very few studies that look at actual loan books of that time period. Notable exceptions are studies by Temin and Voth (2006; 2008) that look at the loan books of Hoare's bank.

This paper proceeds as follows. Section 2 will discuss the existing literature and the testable hypothesis based upon this existing literature. Section 3 will discuss the historical background of this study, namely that of bank lending in nineteenth century Britain for the North and South Wales Bank. Section 4 will describe the identification strategy/ model and testable hypothesis, while Section 5 addresses the data and variable description. Finally Section 6 will provide the results and Section 7 will conclude.

2. Related literature and hypothesis development

The main objective of this paper is to identify whether there is support for the existence of the so-called bank risk taking channel of monetary policy. Various scholars indicate that a low monetary rate can induce banks to increase credit availability and take on excessive risk, compared to periods that are characterized by a high monetary rate. This rationale is based upon the notion that by increasing the money supply as a result of a cut in the monetary rate, banks are inclined to lower lending standards and take on extra risk due to this excessive credit availability (see amongst others Allen and Rogoff (2011), Rajan (2010), Calomiris (2009)).

Some indicate the existence of a *bank lending channel* of monetary policy (see for instance Kashyap and Stein (2000), Bernanke and Blinder (1992) and Bernanke and Blinder (1988)). Such a channel indicates that a change in the monetary rate (or a change in the stance of monetary policy) can change the supply of loans that are available to banks, which in turn affects the amount of loans these banks can extend to their customers. In the case of a cut in the monetary rate this would coincide with an increase in the amount of loanable funds by banks. Jimenez et al. (2012) find that a tight monetary regime and bad economic conditions reduce loan granting. The *bank risk taking channel* of monetary policy takes this notion of an increase in monetary funds following a rate cut a step further. It argues that not only the quantity, i.e. supply of funds increases, but that also the quality of these funds is affected in the sense that banks tend to extend this extra available money in the form of loans to borrowers by softening lending standards and taking on extra risk in the search for yields (Rajan 2006). In this study I add to the existing literature by focusing on the effect that the monetary rate has on three specific *ex ante* loan characteristics: The collateral value to loan amount ratio (that serves as a variable of *bank risk taking*), the interest rate charged on the loan (*loan price*) and the size of the loan indicated by the loan amount extended (*quantity*). In line with the above mentioned studies I therefore hypothesize that low monetary rates will induce more bank risk taking which ultimately results in a *lower* collateral value to loan ratio asked. When the collateral value to loan ratio is low the bank is more exposed to risk in case the borrower defaults. Furthermore I derive from these studies that if the financial market during my sample period worked changes in the monetary rate must have affected the interest rate charged on loans in a similar way. I therefore hypothesize that the monetary rate will affect interest rates on bank loans in a positive way, suggesting that a low monetary rate results in a *lower* interest rate charged to borrowers. In addition I argue that due to the increase in the availability of monetary funds when the monetary stance loosens (i.e. a low rate) banks on average make *larger* loans in terms of loan size, as measured by the loan amount extended, compared to periods where the monetary rate tightens, *ceteris paribus*.

The current literature has focused on several measures of bank risk taking and its relationship to the monetary rate (see for instance Dell' Arricia et al. (2013), Ioannidou et al. (2013) and Jimenez et al. (2013)). This study adds to this literature by using a unique dataset of micro level bank lending. Of the recent studies that focus on a more contemporary period, namely around 2007 when the crisis started, few have focused on detailed micro level loan data that includes market values of collateral[4]. In this sense my study adds the existing body of research by examining detailed, hand collected loan level data with not only information on the loan characteristics but also that of the borrowers and the collateral. In this respect it is most closely related to Ioannidou et al. (2013), who look at micro level loan data of Bolivian banks and find evidence that a low monetary rate can induce banks to take on more *ex-ante* as well as *ex-post* risk, by extending more loans to borrowers that have a weak history of past repayment and have a higher ex-post probability to default. Another study that focuses on micro level loan data is that of Jimenez et al. (2013) who find that banks grant more risky loans when the monetary rate is low and loosen their lending standards.

In this study I focus on an *ex ante* measure of bank risk: The collateral value to loan ratio.[5] As the loans employed in this study are all collateralized with shares, which are very liquid assets, it is possible to construct market based values of collateral using asset prices. This makes the valuation discrepancy of the collateral between the borrower and lender fairly small, if not non-existent. In case of default, it is also easier to attribute a value to the collateral that can be seized by the lender.[6] Contemporary data lack real time values of collateral, which makes information on collateral less informative. This study therefore adds to the existing empirical literature by not only including real time collateral values when assessing the effect of monetary policy on bank risk taking, but in addition can disentangle this effect as clean as possible by using a unique instrument for the endogenous monetary rate.

[4] A possibility is the difficult nature of such data: banks are often not willing to make such data public or available for research, with the exception of Ioannidou et al. (2013). However they *do not* have only loans that have *shares* as collateral.

[5] I do not observe ex post measures of default. I do observe renewals and repayments but it is not directly indicated whether a borrower defaulted. More on this can be found under section 5.

[6] In contrast to Ioannidou et al. (2013) who also have collateral values, but indicate that market valuations and actual values that the lender can obtain in case of default do not coincide due to weak court enforcement.

3. Historical Background

This paper examines the loan books of the North and South Wales Bank over the period 1881-1894. In this section I briefly discuss the positioning of the North and South Wales within the British banking sector and I will elaborate on the features of the monetary system at that time. Furthermore, I will indicate the benefits of this setting in determining the possible existence of a bank risk taking channel of monetary policy.

3.1 The North and South Wales Bank

Britain during the period 1881-1894 was the largest and most developed capital markets in the world. Besides being known for its active stock market, there also was a well developed banking sector. At the turn of the 19th century the banking sector was characterized by a merger wave, where there was a transition from local banks to provincial banks and ultimately to large joint stock banks. In the period 1881-1894 the sector was characterized by many local provincial banks that served provincial areas (see amongst others Braggion et al. (2012)). The North and South Wales Bank was one of many of such provincial banks and it was established in Liverpool, England in 1836 extending its branch system eventually throughout Wales.[7] From its start it operated in a very enterprising manner by taking over existing bank branches in order to expand. This phenomenon of entering a new market that was more distant from the headquarter by taking over existing branches rather than opening a new branch was not uncommon as many other banks at that time penetrated geographically more distant markets by taking over existing branches (Braggion et al. (2013)). The bank was a "classic" commercial bank in the sense that it both held deposits and extended credit at the same time. It was comparable to banks as we know nowadays in the sense that it wanted to maximize profits. In terms of size it was one of the larger banks in Britain at that time and its shares were quoted on the London Stock Exchange. In 1885 its assets were worth 6.7

[7] This bank was characterized by a branch network, similar to many other banks operating in Wales and Britain at that time (Braggion et al. 2012).

million pounds, which made it Britain's 13th largest bank.[8] In terms of size it was therefore 1.6 times larger than the average bank at that time.

3.2 The monetary system from 1881-1894

During this period in time Britain's monetary system was characterized by the Gold Standard. The Gold Standard was fixed exchange rate regime: that participating countries were obliged to convert the local currency to a pre-determined amount of gold. Central banks kept also gold reserves to sustain the pre-specified exchange rate.

A feature of such a mechanism is that central banks lost control over monetary policy, as interest rates converged to the worldwide average (Bordo and Rockoff (1996)).[9] However various scholars have indicated that many countries under the Gold Standard did not always follow the "rules of the game" and in fact did manipulate the monetary rate in the short run (or for short period of time) to achieve various economic policy goals (Dutton (1984)). This evidence suggests that under the Gold Standard the monetary rate was not completely exogenous from local economic conditions. However, the fact that Britain adhered to the Gold Standard in this period does uniquely allow for the creation of an instrumental variable that can be used for the monetary rate, in order to be able to address endogeneity issues while assessing the relationship between the monetary rate and bank risk taking: the number of gold rushes.

[8] Putting this into perspective: The largest bank at that time, the Liverpool bank, had an asset value of £71 million whereas the smallest bank, the Hove banking company only had assets of £13267.

[9] The mechanism can be illustrated in the following way: If the Bank of England (BofE) would deviate from the world average rate, by lowering interest rates in Britain, investors would have sold pounds for gold to the BofE, and invested in other countries to obtain higher interest rates. Hence this coincides with a gold *outflow*. By buying these pounds and selling gold, the BofE effectively reduced the supply of money, raising back the British interest rates to the world average.

3.3 The Gold Standard and exogenous gold rushes

Gold rushes are often indicated as periods in which there is a feverish migration of workers to an area that has had a dramatic discovery of gold deposits. The finding of gold deposits in history was often by chance.

This implied that gold rushes occurred accidentally, whenever large deposits of gold were found. Various studies have backed the exogeneity of gold rushes, considering the discovery of large gold carrying areas as events that happened by chance. For instance Schumpeter (1939) in his "Business Cycles" and Tinbergen (1950) conclude that mineral discoveries are unexpected windfalls that by no means are an explanatory reaction to economic conditions.[10] Moreover, the available anecdotal evidence on the discovery of large mining fields suggests that chance played a major role in this process. George Walker, a self proclaimed discoverer of the Transvaal Gold mines in South Africa stated that "*he stumbled on an outcrop while taking a stroll on the Langlaagte farm on a Sunday morning in February 1886. Examining it, he recognized it as conglomerate, panned it and found it to be rich in gold.*"[11] Also the discovery of gold at the archipel of Tierra del Fuego was found by chance as the French steamship Arctique ran aground on the northern coast of Cape Virgenes. Those that came for its rescue, found gold within the ground of the archipelago.

In addition to these chance discoveries of gold, it did not appear that mineral discoveries were related to the price of these minerals (Eichengreen and Mclean (1994) and Blainey (1970)). I therefore argue that fluctuations in supply reflected a random shift unrelated to the monetary standard. A contrasting view however, is offered by Blainey (1970), who suggests that for Australian gold discoveries, the discovery of mining fields was sensitive to (local) economic conditions. Morrissey and Burt (1973) however indicate that Blainey's work can be criticized

[10] Schumpeter, "Business Cycles" (1939), p. 1, 176 and 311.Tinbergen, "The dynamics of business cycles", (1950), p. 156.
[11] From: http://www.heritageportal.co.za/article/greatest-discovery-them-all, on the history of the South African Witwatersrand gold fields.

as they indicate that the pattern of mineral discovery was random, and that the findings were most likely driven by the application of an incorrect statistical method.[12]

I therefore propose to use the number of gold rushes as an instrumental variable for the monetary rate, as it can be seen as an exogenous shock to the money supply unrelated to economic conditions, which in turn can isolate the exogenous part of the monetary rate that can induce bank risk taking.

The historical setting of this paper is therefore interesting for two reasons: 1) It can provide an instrumental variable to address endogeneity problems while examining the presence of a possible bank risk taking channel of monetary policy and 2) It can test whether such a channel was already present in the nineteenth century, as existing literature only provides evidence of this channel using contemporary data and suggesting this is a recent phenomenon.

4. Identification strategy

Identifying a bank risk taking channel of monetary policy is a difficult task for two reasons. First, detailed loan data on loan pricing, borrower characteristics as well as risk taking measures are needed, which nowadays are often kept private by banks. Second, disentangling a true causal relationship between the monetary rate and bank risk taking is challenging, as the monetary rate is often endogenous to the state of the economy. As I have unique hand-collected detailed loan level data I can address issue 1) by creating a measure of bank risk taking using market values of collateral. Specifically I want to quantify the impact of the monetary rate on bank risk taking measured by the collateral value to loan ratio, loan pricing indicated by the interest and loan quantities, captured by the loan amount. In order to do this I will estimate the following 3 models separately:

[12] Furthermore, even if Blainey is correct in his statement that economic conditions and the process of discoveries are related it remains still a question which economic conditions matter. From his story, the local economic conditions of where the mines were actually discovered played a large role. As the gold rushes used in this paper did not take place in Britain itself (Britain at that time was no gold producing country), it is therefore highly doubtful that the exclusion restriction is violated.

1. $CV/Loanamount_{ijt} = \propto + \beta * Monetary\ Rate_{t-1} + \gamma * Controls_{it-1} + \delta * Borrower\ FE_j + \varepsilon_{ijt}$
2. $Interest\ Rate_{ijt} = \propto + \beta * Monetary\ Rate_{t-1} + \gamma * Controls_{it-1} + \delta * Borrower\ FE_j + \varepsilon_{ijt}$
3. $Ln\ Amount_{ijt} = \propto + \beta * Monetary\ Rate_{t-1} + \gamma * Controls_{it-1} + \delta * Borrower\ FE_j + \varepsilon_{ijt}$

The *CV/Loanamount* is a measure of bank risk taking for loan *i* of borrower *j* at time *t*. The *Interest Rate* is a measure of the price of the loan *i* of borrower *j* at time *t*. The *Ln Amount* is the natural logarithm of the loan amount, which is a measure of loan size, for loan *i* of borrower *j* at time *t*. The main coefficient of interest is that on the *Monetary Rate*, which is the average monthly monetary rate in the month *t-1*, a month *prior* to the initiation of loan *i*. As my dataset indicates distinct borrowers, I am able to filter out any time invariant borrower specific effects by including borrower fixed effects, which enter each specification in the form of *Borrower* FE_j.[13] In order to control for any time specific effects, I include several control variables. First, I add a yearly measure of the state of the economy using *Real GDP*, which is the natural logarithm of the Real GDP in year *t-1*, the year *prior* to the initiation of loan *i*. Second, I add a variable *D/A ratio*, which is the deposit to asset ratio of the North and South Wales bank to capture any *overall* bank risk taking in a given year *t-1*, the year *prior* to the initiation of loan *i*.[14] The main coefficient of interest is that of β, which captures any quantitative effect of the monetary rate on bank risk taking, loan pricing and loan quantities in model 1, 2 and 3 respectively. A drawback of this identification strategy is that it does not account for any problems relating to the possible endogeneity of the monetary rate. This can be especially an issue given the fact that various scholars have indicated that the Bank of England indeed manipulated its bank rate (Dutton (1984)). I address this concern for this by proposing the number of gold rushes as an instrument for the monetary rate.

[13] A borrower could have had multiple loans in time.
[14] I do not include loan characteristics as explanatory variables on the right hand side of these models, as I assume that parameters such as bank risk, interest rate, loan amount and duration are jointly determined. As a robustness test I have included these parameters in each model, but they do not alter the conclusions I draw on my main variable of interest, the monetary rate.

4.1 Instrumental variable

In order to address endogeneity issues I construct the following instrumental variable for the monetary rate: I compute the number of gold rushes in a year based upon the largest gold rushes between 1880-1894. This variable captures an exogenous shock to the money supply through the monetary rate, as a gold rush exogenously increases the gold supply.

In a first step I test whether the number of gold rushes satisfies all requirements to be an appropriate candidate as an instrumental variable for the monetary rate. The first stage model I estimate is:

$$Monetary\ Rate_{t-1} = \propto + \beta * Gold\ Rushes_{t-1} + \gamma * Controls_{it-1} + \ \delta * Borrower\ FE_j + \varepsilon_{ijt}$$

The *Gold Rushes* variable is a measure of an exogenous shock to the gold supply that enters the money market through a cut in the monetary rate. It is constructed by calculating the number of gold rushes in year *t-1*, a year prior to the initiation of loan *i*.

In order to be a valid instrument the coefficient β should indicate that a positive shock to the gold supply enters the money market through a cut in the monetary rate. Hence I expect this coefficient to be *negative* and statistically significant. In addition I test whether the data suggest that the monetary rate indeed is endogenous, implying that an instrumental variable is the correct strategy of identification. Then in a second step I take the estimated values for the monetary rate and estimate the models 1-3 as specified under section 4.

5. Data and Variable definition

For my main dataset I manually collect unique information on detailed individual loan data. For this I rely on the loan books of the North and South Wales bank as main historical data source. The loan books cover the period 1881-1894 and contain the administration of the loan extension and renewal process for a specific type of loans, namely those that most likely served for the purpose of buying stock. These loans were often extended to brokers, who invested in securities with the provided credit in their name or in the name of a customer, but also to non-broker individuals. All loans were backed by securities, which were traded on the Liverpool Stock Exchange or the London Stock Exchange. For these securities I observe both the names as well as the total amount of shares pledged. Often loans were renewed, making it possible to track a loan over time per borrower and to separate both the 316 initial loans at origination as well as their renewals in empirical tests. Typically the loan books were all organized in a similar fashion over the years and kept track of customer and loan details such as maturity of the loan as well as address and name of the borrower. A description of the data extracted from these loan books can be found in figure 1.

I supplement my loan dataset with annual data constructed from several sources:

- Collateral prices (From the digitized Investor's Monthly Manual files)
- North and South Wales Bank Data (From the HSBC Archives)
- Macro data (From the digitized Investor's Monthly Manual files and Measuringworth.com)
- Gold rush data (From Encyclopaedia Britannica and Blainey (1970))

5.1 Collateral prices

Monthly share prices data from the Investor's Monthly Manual files is used to calculate collateral values at each point in time (either at the time of initial loan origination or at the time of renewal of the loan) for each loan. Because I observe the names and total amounts of shares pledged as collateral from the loan books I compute a measure of collateral value by multiplying the number of shares k pledged at time t with the corresponding end of the month share price for share k and summing over all shares pledged for each loan i. Subsequently I calculate a measure of ex ante risk taking, the collateral value over loan amount- ratio for borrower j at time t (at time of either initial loan origination or time of renewal) as follows:

$$Collateral\ Value(CV_{ijt})/Loan\ amount_{ijt} = \frac{\sum_{k=1}^{k=j} No. of\ shares\ k_t * price\ of\ share\ k_t}{Loan\ amount_{ijt}}$$

5.2 North and South Wales Bank data

Bank data for the North and South Wales Bank are obtained from the HSBC historical archives. I manually collect yearly deposit and assets data from the banks' balance sheets for the period 1880-1894. This information enables me to construct a measure of balance sheet risk. Specifically, I construct this measure by dividing the amount of yearly deposits by the banks' total assets one year prior to the year of loan origination.

5.3 Macro data

Monetary rates data is obtained from the Bank of England historical files from the Investor's Monthly Manual. I use the average monthly Bank of England monetary rate in the month prior to origination of the loan as a proxy for the central bank's monthly monetary rate. This average monthly monetary rate is calculated by taking the equally weighted average of the weekly Bank of England monetary rates in a certain month.

Yearly real GDP data, one year prior to loan origination, comes from the Measuring Worth website and is measured in year 2008 pounds per capita.

5.4 Gold rushes

Gold rush data is used to construct an instrumental variable for the Bank of England's monetary rates. I obtain information on the dates of the largest gold rushes in the world between 1880-1894 from Encyclopaedia Britannica. I amend this list with significant gold rushes in the same period as mentioned by Blainey (1970). My final list of gold rushes contains six rushes, of which two occur in South-Africa, one in British-Columbia and the remaining ones in Chile and Argentine, Colorado and Australia respectively. Based upon these rushes, that can be considered to induce an exogenous shock to the money supply, an instrumental variable for monetary rates is created. This instrument is constructed by summing up the number of gold rushes in the year prior to initial loan origination. A complete overview of gold rushes and their respective time periods is presented in Figure 3.

A summary of the variable description and the descriptive statistics for each variable can be found in figure 1 and 2 respectively. An example of a loan book can be found in appendix A.

6. Results

6.1 OLS regression results: Initial sample

I present the OLS regression results for the 3 models described in section 4 in table 1 under column 1 to 3 for the measures of bank risk taking, loan pricing and quantity respectively. In these columns I focus solely on the 316 initial loans in my sample and do not incorporate any information on renewals. The models all include borrower fixed effects, as one borrower could have had more than one loan, to control for the time invariant characteristics of borrowers. In addition standard errors are clustered on month, as the monetary rate is available on a monthly frequency. The results in column 1 of table 1 suggest that there is possible evidence for the presence of a risk taking channel of monetary policy. The coefficient on the main variable of interest, the monetary rate, is positive in the specification under column 1, indicating that when the monetary rate is *low*, the collateral value to loan amount ratio is also *low* in line with studies that suggest that low rates induce more risk taking (amongst others Rajan (2006), Ioannidou et al. (2013) and Dell'Arricia (2013)). It is difficult however to make statements on the causation between both variables, as the results are not statistically significant. The sign and magnitude of the monetary rate variable in this specification does suggest that low monetary rates go in line with low levels of collateral value to loan amount ratios. From column 2 in the same table, the results indicate that there is a *positive* relationship between the monetary rate and the interest rates charged on loans. The coefficient of 0.569 indicates that a decrease of the monetary rate by 1%, leads to a decrease of 0.569% on the loan interest rate. This indicates that the financial market at the time worked, and that the monetary rate did feed through into the customer lending market. It needs to be noted however that the coefficient on the monetary rate variable is smaller than 1. This actually implies that loan interest rates did go down when the monetary rate decreased, but not *more* than the decrease in the monetary rate, suggesting that the bank followed a rather prudent strategy on its loan pricing. Also for the results on loan quantity in column 3, the hypothesis from section 3 is confirmed as the sign on the monetary rate is *negative*. This implies that when the money supply is *increased*, i.e. the monetary rate is *low* the loan amount extended is *on average larger*. This result needs to be interpreted with caution as it is not statistically significant. The sign and magnitude of the monetary rate coefficient do suggest however that during periods of low monetary rates, average loan amounts are larger.

6.2 OLS regression results: Renewals included

In columns 4 to 6 in table 1, I re-estimate the same models as in columns 1 to 3, however in the sample size I look the loan information of renewals (if any) for each loan. In this way I can see whether the behavior of a loan over time alters my conclusions from section 6.1. Results for the effect of the monetary rate on the interest rate in column 5 remain unchanged. Results do change for the bank risk taking variable in column 4 and indicate that there is a *positive* relationship between the monetary rate and the interest rates charged on loans. The coefficient on the monetary rate becomes much smaller and the sign switches to negative compared to a positive sign under column 1. This coefficient is not statistically significant. In column 6, the sign on the monetary rate indicates that during periods of low monetary rates the average loan amount is *smaller* compared to high rate periods, although not statistically significant. The OLS results presented in table 1 do not address the issue of a possible endogenous monetary rate variable. I therefore re-estimate these models using an instrumental variable approach, whereby I instrument the monetary rate with the number of yearly gold rushes.

6.3 Instrumental variable: Gold Rushes

In table 2 the first stage regression results of the bank risk taking model are presented whereby the *number of gold rushes* is the main variable of interest to explain variation in the *monetary rate*. As hypothesized in section 4 I indeed find evidence that an *increase* in the number of gold rushes leads to a *decrease* in the monetary rate. Furthermore the F-test is larger than 10 in both column 1 and 2 with a value of 60 and 42 respectively, indicating that this is a suitable instrument for the monetary rate. In addition, the test for exogeneity of the variables is rejected, implying that the monetary rate is indeed endogenous; hence using an instrumental variable for the monetary rate is the appropriate way to proceed.[15]

In an additional specification, which can be found in table 2b, I test whether gold rushes had a direct impact on share prices. The results indicate that this was not the case, as the returns on a monthly market index did not significantly increase as a consequence of a goldrush.

6.4 IV regression results: Initial sample

Columns 1 to 3 in table 3 present the instrumental variable results for the initial sample (no renewals included). The results in column 1 suggest a strong significant and *positive* relationship between the monetary rate and bank risk taking. This implies that a decrease in the monetary rate leads to a lower collateral value to loan ratio which is indeed evidence in favor of the existence of a bank risk taking channel of monetary policy. These results confirm previous suggestions that were made based upon OLS results. The *economic significance* is quite large, since a one standard deviation decrease in the monetary rate results in a decrease

[15] Due to space limitations I only report the first stage for full specification of the bank risk taking model. For all other models the results show that the number of gold rushes is indeed a suitable instrument, with F-statistics larger than 10.

of the collateral value to loan ratio of *33.7%* compared to its mean value. Column 2 presents the results for the effect of the monetary rate on the interest rate charged on loans. They suggest that a cut in the monetary rate leads on average to *lowe*r loan prices. This indicates that the market worked, in the sense that the monetary rate did affect bank loan prices. Also here, the *economic significance* is quite large, since a one standard deviation decrease in the monetary rate results in a decrease of the interest rate on the loan of *23%* compared to its mean value. In line with the OLS results, it needs to be noted that the coefficient on the monetary rate variable is smaller than 1. This actually implies that loan interest rates did go down when the monetary rate decreased, but not *more* than the decrease in the monetary rate, suggesting that the bank followed a rather prudent strategy on its loan pricing. Combining this with the fact that the bank charged on average less collateral compared to the loan amount when the monetary rate was low, this can indicate that banks attracted more risky borrowers but also priced this risk in terms of the interest rate charged, thereby not fully passing on a cut in the monetary rate through to its customers.

The results on the loan *quantity*, the loan amount, are somewhat surprising. The coefficient on the monetary rate is positive which indicates that a decrease in the monetary rate leads to on average *smaller* loans. This finding is not supported by existing lines of theory, as it would have been expected that when the monetary rate goes down, banks on average expand their loan amounts. One explanation is that the bank lent out money to more risky borrowers, and did price them for this as the coefficient on the interest variable in column 2 suggests. In addition they also adjusted the loan amount by extending smaller loans. The economic significance of this finding is relatively small, as a one standard deviation decrease in the monetary rate results in a decrease of the loan amount of *4%* compared to its mean value.

6.5 IV regression results: Renewals included

Columns 4 to 6 in table 3 present the instrumental variable results for the full sample including the information on loan renewals. The results are, except for those in column 5 for the loan price, not statistically significant and should therefore be interpreted with caution. In column 4, that presents results for the effect of the monetary rate on the CV/Loan Amount ratio, the coefficients on the monetary rate variable is small and negative, indicating that there is no support for a bank risk taking channel of monetary policy. A possible explanation is that loans behave as somewhat “sticky loans”. Only when a borrower applies for the initial loan market conditions and the monetary rate will be taken into account, whereas for renewals these conditions do not play a role in adjusting the collateral value to loan amount ratio. It could be the case that a borrower pledges the required collateral at the loan initiation and leaves it there over the course of the loan, even if a lower amount of collateral would have sufficed for the bank. But, as the coefficient on the monetary rate is insignificant it is difficult to make a causal interpretation.

The findings in column 5 indicate that there is a *positive* relationship between the monetary rate and loan prices, suggesting that a cut in the monetary rate leads on average to *lowe*r loan prices. The results in column 6 suggest that for the loan renewals, loans are smaller when the monetary rate goes down. Again, also here this result is not statistically significant, which makes it difficult to interpret it as a form of causation.

6.6. An additional measure of risk: Loans with an CV/Loan Amount ratio <1

Table 4 re-estimates columns 1 and 4 from table 3 but looks more closely at those loans that have a collateral value to loan amount ratio that is smaller than 1. This sample of loans is particularly interesting, as in case of default the bank is not fully covered. The dependent variable, Risky Dummy, is a dummy indicator that equals one when the loan has a CV/Loan

Amount that is smaller than 1. These loans are particularly risky, as they cannot be fully recovered by the bank in case of default.

Results in column 1, which looks at the initial loans only, indicate that there is still a bank risk taking channel of monetary policy present, as the coefficient on the monetary rate is negative and statistically significant. This suggests that a decrease in the monetary rate spurs the granting of loans that are more risky in the sense that they have a CV/Loan Amount ratio that is smaller than 1. This result is also economically significant, as a 1 standard deviation decrease in the monetary rate leads to a *32%* increase in the probability of granting a loan with a CV/Loan Amount that is smaller than 1.

This result is similar when taking into account the renewals, as can be seen in column 2, although it loses economic significance. However, the *negative* relationship between the monetary rate and the risky dummy does support the presence of a bank risk taking channel of monetary policy.

6.7 Robustness Test: The absence of year fixed effects

As the instrumental variable employed in this paper is constructed on a yearly level, I am not able to include year fixed effects to control for any time varying characteristics. To address this issue I do include various control variables on a yearly level (Real GDP and D/A ratio) that capture the overall state of the economy and the bank. To address this issue further I demean my main dependent variable of interest, the collateral value to loan amount ratio. The procedure is as follows: From each observation of this measure of risk taking a yearly average is deducted to control for a time varying effect. Results can be found in table 5. The main coefficient on the monetary rate remains the same as in column 1 and 4 of table 3, again indicating that the exclusion of year fixed effects is not too much of concern for the results presented here.

6.8 Ex post measure of risk: Paid off loans

In table 6 the present the results of the effect of the monetary rate on an "ex-post" measure of bank risk taking. As dependent variable I create a dummy indicator that equals 1 when the loan is ever being repaid over time.[16] The results suggest that when the monetary rate goes down, loans are being issued that are less likely to be repaid in time. This is a confirmation of the bank risk taking channel of monetary policy, suggesting that the bank extends loans to risky borrowers when the monetary rate is low and that these borrowers are more likely to not repay their loan.

Conclusion

This paper provides evidence on the existence of the so-called bank risk taking channel of monetary policy, which indicates that a cut in the monetary rate can lead to increased risk taking by banks as they search for yields. It is empirically difficult to assess such a relationship as rich data is needed on loan characteristics and due to the fact that the monetary rate is often endogenous to economic conditions. This study looks at a unique hand collected dataset of loans from the British North and South Wales during the Gold Standard. The loans were all collateralized by shares which makes it possible to create a valuable measure of risk taking: The collateral value to loan amount ratio, using market prices. Features of the Gold Standard make it possible to address the issue of endogeneity by using an instrumental variable approach where the number of gold rushes serves as an instrument for the monetary rate. The findings indicate that a bank risk taking channel of monetary policy was already present more than a hundred years ago, which up to now has only been seen as a recent phenomenon.

[16] Please note that I only observe whether a loan has been paid back. In some cases a loan is being transferred to a new book, and I am not able to trace whether it is going to be paid back or it defaulted. Hence my measure of repayment might underestimate the true number of loans that were being repaid.

References

Allen, F., Rogoff, K., *"Asset Prices, Financial Stability and Monetary Policy"*, 2010, Paper presented at Swedish Riksbank Workshop on Housing Markets, Monetary Policy and Financial Stability.

Bernanke, B. S., Blinder, A.S., "*Credit, Money, and Aggregate Demand"*, American Economic Review P&P, vol.78, no.2, 1988, pp.435-439.

Bernanke, B. S., Blinder, A.S., *"The Federal Funds Rate and the Channels of Monetary Transmission",* American Economic Review, vol.82, 1992, pp.901-921.

Bordo, M, Rockoff, H., *"The Gold Standard as a 'Good Housekeeping Seal of Approval"*, The Journal of Economic History, vol.56, no.2, 1996, pp.389-428.

Bordo, Michael D., Schwartz, Anna A., *"A retrospective on the Classical Gold Standard, 1821-1931"*, 1984, Chicago: University of Chicago Press.

Braggion, Fabio, Dwarkasing, Narly and Lyndon Moore, *"Increasing Market Concentration in British banking, 1885 to 1925"*, book chapter, forthcoming in "Institutions, Innovation, and Industrialization: Essays in Economic History and Development", John Nye, Avner Greif, and Lynne Kiesling (eds.), 2013, Princeton University Press.

Braggion, F., Dwarkasing, N. and Moore, L., *"From Competition to Cartel: Bank Mergers in the U.K. 1885 to 1925"*, working paper, 2012.

Blainey, Geoffrey, *"A Theory of Mineral Discovery: Australia in the Nineteenth Century"*, The Economic History Review, vol.23, no.2, 1970, pp.298-313.

Blanchard, Olivier, *"The Crisis: Basic mechanisms and appropriate policies"*, IMF working paper, 2009.

Calomiris, C. W., *"The Subprime Turmoil: What's Old, What's New and What's Next?"*, Journal of Structured Finance, 15, 2009, pp.6-52.

Dell'Ariccia, Giovanni, Igan, Deniz and Luc Laeven, *"Credit Booms and Lending Standards: Evidence from the Subprime Mortgage Market"*, Journal of Money, Credit and Banking, vol.44, no.2-3, 2012, pp.367-384.

Dell'Ariccia, G., Laeven, L. and G. A. Suarez, *"Bank Leverage and Monetary Policy's Risk-Taking Channel: Evidence from the United States"*, International Monetary Fund, 2013, Washington DC.

Dutton, John, *"The Bank of England and the Rules of the Game under the International Gold Standard: New Evidence",* book chapter in "A retrospective on the Classical Gold Standard, 1821-1931", M. Bordo and A. Schwartz (eds), 1984, Chicago: University of Chicago Press.

Eichengreen, B, Mclean, I.W., *" The supply of gold under the pre 1914 gold standard"*, The economic history review, vol.47, no.2, 1994, pp.288-309.

Goodhart, Charles A.E., *"The background to the 2007 financial crisis"*, International economics and economic policy, vol.4, no.4, 2008, pp.331-346.

Ioannidou, Vasso, Ongena, Steven and Jose-Luis Peydro, *"Monetary Policy, Risk-Taking and Pricing: Evidence from a Quasi-Natural Experiment"*, European Banking Center Discussion Paper No. 2009-04S, 2013.

Jiménez, G., Ongena, S., Peydró, J-L, and J. Saurina, *"Credit Supply and Monetary Policy: Identifying the Bank Balance-Sheet Channel with Loan Applications"*, American Economic Review, vol.102, 2012, pp.2301-2326.

Kashyap, A. K., Stein, J.C., *"What Do A Million Observations on Banks Say About the Transmission of Monetary Policy?"*, American Economic Review, vol.90, pp.407-428.

McKinnon, Ronald I., *"The rules of the game: International Money in Historical Perspective"*, Journal of Economic Literature, vol.31, No.1, 1993, pp.1-44.

Morys, M., *"Discount rate policy under the Classical Gold Standard: Core versus periphery (1870s-1914)"*, Explorations in Economic History, vol.50, no.2, pp.205-226.

Morrissey, M., Burt, R., *"A theory of mineral discovery: A note"*, The economic history review, vol.26, no.3, 1973, pp.497-505.

Rajan, R. G., *"Has Finance Made the World Riskier?"*, European Financial Management vol.12, 2006, pp.499-533.

Rajan, R.G., *"Fault Lines"*, 2010, Princeton University Press, Princeton NJ.

Sayers, Richard S., *"The Bank of England 1891-1944"*, 1976, Cambridge University Press.

Schumpeter, J.A., *"Business Cycles"*, 1939, New York.

Temin, Peter, Voth, Hans-Joachim, *"Credit rationing and crowding out during the industrial revolution: evidence from Hoare's Bank, 1702 –1862"*, Explorations in Economic History, vol.42, no.3, 2005, pp.325 – 348.

Temin, Peter, Voth, Hans-Joachim, *"Interest Rate Restrictions in a Natural Experiment: Loan Allocation and the Change in the Usury Laws in 1714"*, Economic Journal, vol.118, no.528, 2008, pp.743-758.

The Investor Monthly Manual (IMM), electronically available at:http://icf.som.yale.edu/imm/

Tinbergen, J., Polak, J.J., *"The dynamics of business cycles"*, 1950, Chicago.

Variable description

Customer Characteristics	Description
1. Name	Customers first and last name
Loan Characteristics	
2. Date of initiation$_{it}$	When the loan was granted (D/M/Y)
3. Ln Loan amount$_{it}$	Natural logarithm of the amount in £
4. Interest rate$_{it}$	%
5. Securities pledged for the loan$_{it}$ (Collateral)	The name of each security pledged
6. Number of each security pledged$_{t}$	No. of shares of each security
7. Renewed$_{it}$	Whether the loan was a renewal
8. Collateral value/Loan amount$_{it}$	Calculated as: No. of shares * price of each share/Loan amount[17]
Macro economic Characteristics	
9. Monetary rate$_{t-1}$	Average monthly Bank of England rate, at t-1, 1 month before the loan origination
10. Ln Real GDP$_{t-1}$	Natural logarithm of the Real GDP in the year prior to loan initiation in year 2008 pounds per capita
Bank characteristic	
11. D/A ratio$_{t-1}$	Deposits to Assets ratio of the N&SW bank in the year prior to loan initiation

Figure 1. Variable description

Descriptive statistics

	#
Borrowers	68
Loans	316
Loans (incl renewals)	2367

Summary statistics	Number of obs	Average	Minimum	Maximum	St.dev
Interest rate (%)	2367	3.50	1.5	6.5	0.88
Collateral Value /Loan amount [18]	2367	1.17	0.05	2.74	0.85
Amount (£)	2367	4840	44	49000	6071
Real GDP	2367	3723	3528	3911	117
D/A ratio	2367	0.86	0.82	0.88	0.02
Monetary rate	2367	3.30	2	6	1.08
Gold Rushes	2367	0.93	0	2	0.61

Figure 2. Summary statistics

[17] For the price of each share, the average between the monthly highest and lowest quotation as published in the IMM is taken, 1 month prior to the loan initiation

[18] Collateral value/ loan amount is the number of shares of the securities pledged as collateral * price per share scaled by the total loan amount extended. In order to remove errors from incorrect entered data this variable is winsorized at 10%

Gold rushes 1880-1894:

Gold rush	Year	Location
Barberton	1883	South Africa
Wit Watersrand & Transvaal	1886	South Africa
Cayoosh	1884	British Columbia
Tierra del Fuego	1884	Chile & Argentine
Cripple Creek	1891	Colorado
Calgoorlie	1893	Australia

Figure 3. Gold rushes

Table 1. OLS specifications: Monetary rates and bank risk taking, loan pricing and loan amounts

	Initial Loans			Renewals		
	(1)	(2)	(3)	(4)	(5)	(6)
	CV/Loan Amount	Interest Rate	Amount	CV/Loan Amount	Interest Rate	Amount
Monetary Rate	0.048	0.569***	-0.039	-0.001	0.581***	0.016
	(0.046)	(0.079)	(0.051)	(0.014)	(0.043)	(0.0184)
Real GDP	-2.810**	-1.467	-2.887**	1.042*	-1.773**	-3.667***
	(1.198)	(1.691)	(1.166)	(0.591)	(0.794)	(0.617)
D/A ratio	9.443**	4.181	7.835*	3.864**	5.842*	-5.403***
	(3.818)	(6.099)	(4.288)	(1.519)	(3.468)	(1.662)
Constant	26.24**	15.40	36.06***	-14.60**	17.32**	56.50***
	(12.98)	(16.35)	(11.99)	(6.084)	(8.576)	(6.629)
N	316	316	316	2051	2051	2051
adj. R-sq	0.185	0.503	0.465	0.506	0.627	0.494
Borrower F.E.	YES	YES	YES	YES	YES	YES

CV/Loanamount is is the value of the collateral on the day of the loan initiation (no. of shares * price) scaled by the amount, winsorized at a 10% level. Interest rate (%) is the loan interest rate at time t, initiation date of the loan. Amount, is the natural logarithm of the amount of the loan (£) at time t, initiation date of the loan. Monetary rate (%) is the Bank of England rate at t-1, 1 month prior to the loan date. Real GDP (£) is the natural logarithm of the real gdp at t-1, 1 year prior to the year of the loan initiation. D/A ratio is the Deposits of the bank at t-1 scaled by the total Assets of the bank at t-1, 1 year prior to the year of the loan initiation. OLS regression with Borrower Fixed Effects included and standard errors in parentheses, clustered on month. Loan renewals are not included in the initial loans sample (columns 1 to 3), but are included in column 4 to 6.

Table 2: First stage results Monetary rates and Bank risk taking:

	Initial Loans	Renewals
	(1)	(2)
	Monetary Rate	Monetary Rate
Gold Rushes	-1.109***	-1.317***
	(0.168)	(0.062)
Real GDP	7.393***	6.997***
	(1.796)	(0.828)
D/A ratio	0.402	9.262***
	(5.678)	(2.233)
Constant	-83.495***	-86.265***
	(20.768)	(9.704)
N	316	2051
adj. R-sq	0.133	0.301
F-Stat	60.13	42.61
Reject exogeneity	YES	YES
Borrower F.E.	YES	YES

First stage model: $\text{Monetaryrate}_{t-1} = \alpha_i + \beta_{t-1}\text{GoldRushes} + \gamma_{t-1}\text{ Controls} + \varepsilon_{ijt}$. Gold Rushes is the total number of goldrushes in the world in the year before the loan initiation. All other variables are defined as in figure 1, the variable description. Standard errors in parentheses and clustered on month. First stage results for the models with Interest rate and Amount as dependent variable are not reported, but yield the same results on the Gold Rushes variable.

Table 2b: The effect of gold rushes on share prices

	(1)
	Marketreturn
Gold Rushes	-0.0003
	(0.0027)
Constant	0.0036
	(0.0035)
N	1565

Marketreturn is a monthly index that captures the overall performance of the market in year t, with t>1884. Gold Rushes is the total number of goldrushes in the world in year t,with t>1884. OLS regression with standard errors in parentheses and clustered on month.

Table 3. Monetary rates and bank risk taking, loan pricing and loan amounts: 2SLS IV results

	Initial Loans			Renewals		
	(1)	(2)	(3)	(4)	(5)	(6)
	CV/Loan Amount	Interest Rate	Amount	CV/Loan Amount	Interest Rate	Amount
Monetary Rate	0.389**	0.801***	0.302**	-0.008	0.762***	0.014
	(0.157)	(0.157)	(0.153)	(0.037)	(0.082)	(0.043)
Real GDP	-2.913**	-1.538	-2.990**	1.026*	-1.363	-3.671***
	(1.167)	(1.757)	(1.411)	(0.566)	(0.922)	(0.625)
D/A ratio	10.30**	4.764	8.692	3.907***	4.742	-5.392***
	(4.885)	(5.707)	(5.588)	(1.479)	(3.499)	(1.669)
Constant	25.59**	14.96	35.42**	-14.43**	12.86	56.55***
	(12.43)	(17.34)	(13.77)	(5.840)	(9.910)	(6.723)
N	316	316	316	2051	2051	2051
adj. R-sq	0.025	0.418	0.378	0.506	0.583	0.494
Borrower F.E.	YES	YES	YES	YES	YES	YES

CV/Loanamount is the value of the collateral on the day of the loan initiation (no. of shares * price) scaled by the amount, winsorized at a 10% level. Interest rate (%) is the loan interest rate at time t, initiation date of the loan. Amount, is the natural logarithm of the amount of the loan (£) at time t, initiation date of the loan. Monetary rate (%) is the Bank of England rate at t-1, 1 month prior to the loan date. Real GDP (£) is the natural logarithm of the real gdp at t-1, 1 year prior to the year of the loan initiation. D/A ratio is the Deposits of the bank at t-1 scaled by the total Assets of the bank at t-1, 1 year prior to the year of the loan initiation. 2SLS instrumental variable regression with Borrower Fixed Effects included and standard errors in parentheses, clustered on month. Loan renewals are not included in the initial loans sample (columns 1 to 3), but are included in column 4 to 6.

Table 4. An additional test of risk taking: Loans with an CV/Loan Amount ratio <1

	Intial Loans	Renewals
	(1)	(2)
	Risk Dummy	Risk Dummy
Monetary Rate	-0.183**	-0.012
	(0.092)	(0.016)
Real GDP	1.737**	0.816***
	(0.737)	(0.237)
D/A ratio	-2.297	0.539
	(2.543)	(0.660)
Constant	-17.68**	-9.757***
	(8.084)	(2.485)
N	316	2367
adj. R-sq	0.069	0.499
Borrower F.E.	Yes	Yes

The dependent variable, Risky Dummy, is a dummy indicator that equals 1 when the CV/Loan Amount ratio is <1. Monetary rate (%) is the Bank of England rate at t-1, 1 month prior to the loan date. Real GDP (£) is the natural logarithm of the real gdp at t-1, 1 year prior to the year of the loan initiation. D/A ratio is the Deposits of the bank at t-1 scaled by the total Assets of the bank at t-1, 1 year prior to the year of the loan initiation. 2SLS instrumental variable regression with Borrower Fixed Effects included and standard errors in parentheses, clustered on month. Loan renewals are not included in the initial loans sample (columns 1 to 3), but are included in column 2.

Table 5. Robustness test: CV/Loan Amount adjusted for a yearly trend (initial loans only)

	Initial loans	Renewals
	(1)	(2)
	CV/Loan Amount	CV/Loan Amount
Monetary Rate	0.355**	-0.0156
	(0.157)	(0.0354)
Real GDP	-1.399	2.258***
	(1.122)	(0.549)
D/A ratio	5.451	-0.332
	(4.718)	(1.458)
Constant	10.76	-26.49***
	(12.08)	(5.598)
N	316	2051
adj. R-sq	0.033	0.505
Borrower F.E.	YES	YES

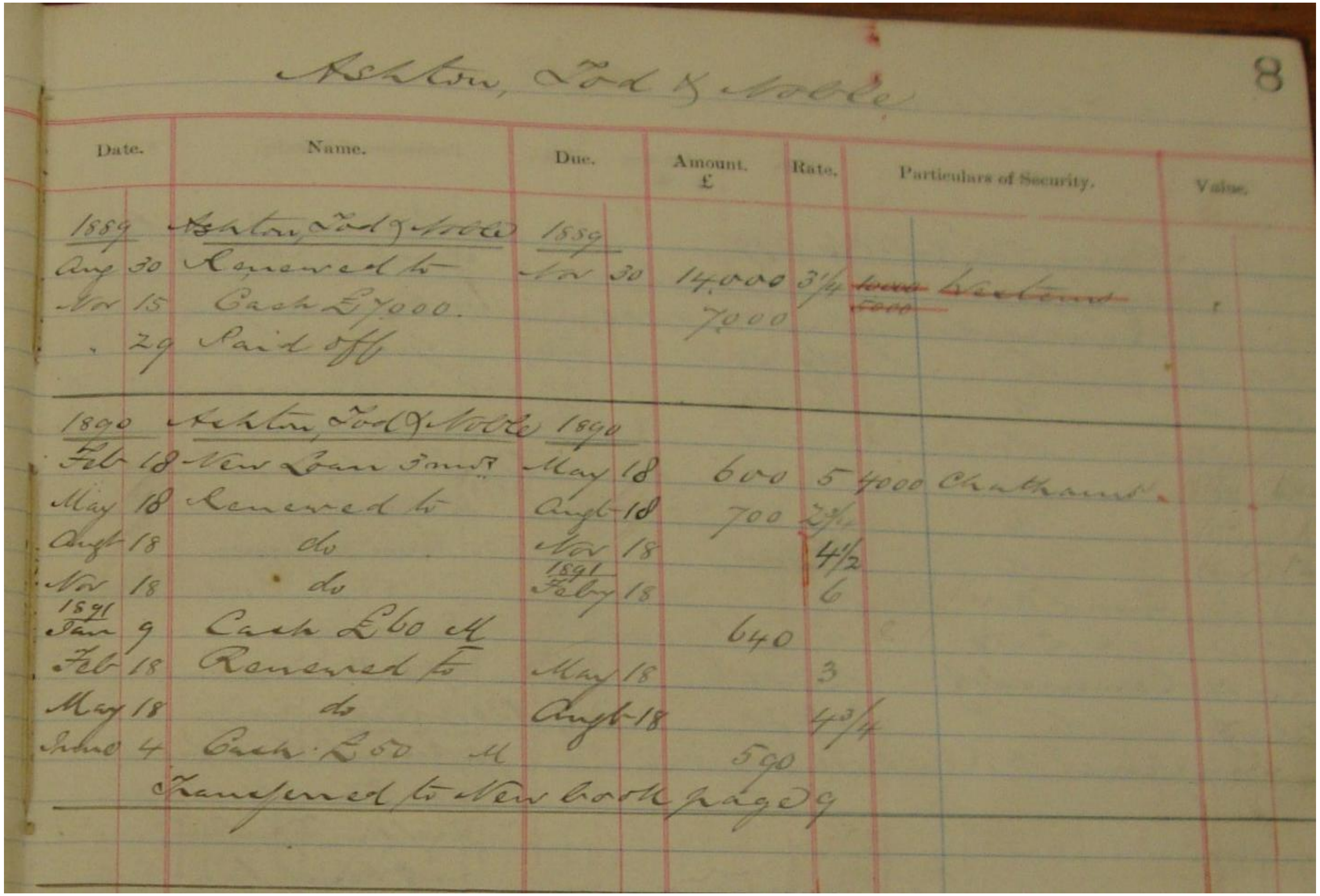
CV/Loanamount is the value of the collateral on the day of the loan initiation (no. of shares * price) scaled by the amount, winsorized at a 10% level. This measure of risk taking is demeaned, which implies that for each observation a yearly average of the CV/Loanamount is deducted, to address a possible yearly time trend. Monetary rate (%) is the Bank of England rate at t-1, 1 month prior to the loan date. Real GDP (£) is the natural logarithm of the real gdp at t-1, 1 year prior to the year of the loan initiation. D/A ratio is the Deposits of the bank at t-1 scaled by the total Assets of the bank at t-1, 1 year prior to the year of the loan initiation. 2SLS instrumental variable regression with Borrower Fixed Effects included and standard errors in parentheses, clustered on month. Loan renewals are not included in the initial loans sample (columns 1), but are included in column 2.

.**Table 6. Ex post measure of risk: Paid off loans**

	(1)
	Ex post
Monetary Rate	0.162***
	(0.0339)
Real GDP	1.871***
	(0.474)
D/A ratio	-4.199***
	(1.529)
Constant	-18.85***
	(5.036)
N	2367
adj. R-sq	0.363
Borrower F.E.	YES

Ex post is a dummy indicator that equals 1 if the loan is being repaid. Monetary rate (%) is the Bank of England rate at t-1, 1 month prior to the loan date. Real GDP (£) is the natural logarithm of the real gdp at t-1, 1 year prior to the year of the loan initiation. D/A ratio is the Deposits of the bank at t-1 scaled by the total Assets of the bank at t-1, 1 year prior to the year of the loan initiation. 2SLS instrumental variable regression with Borrower Fixed Effects included and clustered on month and standard errors in parentheses.

Appendix A: Example of a page from a loan book



Ashton, Tod & Noble 8

Date.	Name.	Due.	Amount. £	Rate.	Particulars of Security.	Value.
1889	Ashton, Tod & Noble	1889				
Aug 30	Renewed to	Nov 30	14,000	3¼	~~[illegible]~~	
Nov 15	Cash £7000.		7000			
" 29	Paid off					
1890	Ashton, Tod & Noble	1890				
Feb 18	New Loan 3 mos	May 18	600	5	4000 Chatham	
May 18	Renewed to	Augt 18	700	2¾		
Augt 18	do	Nov 18		4½		
Nov 18	do	1891 Feby 18		6		
1891 Jan 9	Cash £60 M		640			
Feb 18	Renewed to	May 18		3		
May 18	do	Augt 18		4¾		
June 4	Cash £50 M		590			
	Transferred to New book page 9					