The Functions of Australian Banks' Branch Networks:

The Diversification of Risks and Spatial Allocation of Capital

Andrew J. Seltzer
Royal Holloway, University of London; London School of Economics; Centre for Economic History, ANU; and IZA

I wish to thank David Choa and David Varney for research assistance and David Merrett for introducing me to the Union Bank data. I have also benefited from comments by Jeff Frank, Diana Weinhold, two anonymous referees, and participants at seminars at Australian National University; Royal Holloway, University of London; and the Economic and Business Historical Society Conference. I particularly wish to thank the staff at the ANZ Archive (Trevor Hart, Peggy Kennedy, and Tony Miller); Funding for this project has been received from an Arthur Cole Grant in Aid and a University of London Central Research Grant. Any errors that remain are entirely mine.

The Functions of Australian Banks' Branch Networks:

The Diversification of Risks and Spatial Allocation of Capital

Abstract

This paper examines the consequences of branch banking for the Australian economy. There is little evidence to show that branching increased the stability of Australian banking. During the 1893 crisis, banks with more extensive branch networks, particularly those that had rapidly expanded their networks during the long boom of 1866-89, were more likely to suspend payments. However, it is shown that branching increased the availability of capital and provision of banking services in rural areas. This occurred because, unlike unit banks, which were tied to a specific location, branch banks could internally reallocate capital from urban to rural regions at low cost.

I. Introduction

A well-functioning banking system is a necessary precondition for sustained economic growth. Banks are essential for matching borrowers and lenders, transforming risks and maturity, moving capital across regions, and providing information about risks and returns. It has been argued that banks are the single most important financial institution in early stages of economic development (White 1998). In Australia trading banks were by far the largest and most important financial intermediary prior to the World War Two.[1] They also provided the main mechanism for the transfer of domestic and English capital into the colonies' nascent pastoral and mining industries (Butlin 1987; Dyster and Meredith 1990).

This paper examines the consequences of branch banking for the early development of the Australian economy, focusing particularly on whether, relative to a unit banking system, extensive branching increased the stability of the banking system and contributed to the development of the rural economy. From the time of initial settlement, Australia imposed few restrictions on the extent of branch networks. Individual banks were allowed to maintain a network of branches and agencies within and across the antipodean colonies. By the early 1890s, Australia had one of the most developed branch banking systems in the world, with more banking offices per capita than any other country (Butlin 1986; Vamplew 1987, series POP25; Australia 1931; Grossman 1994). A. E. Webster commented in 1893, 'The antipodes, but for the prior claim of Scotland, might almost be said to be the home of branch banking. In no [other] quarter of the world is such enterprise in this direction exhibited' (Webster

1893, p. 24). Initially, all branches were primarily located in the population centres; however, during the latter part of the nineteenth century the banks increasingly followed the gold miners and pastoralists into rural areas. By the late-nineteenth century most banking offices were in rural areas, despite the fact that the colonies were becoming increasingly urbanized.

The relative efficiency of branch and unit banking has been an extensively analyzed topic (Calomiris 1993; Calem and Nakamura 1990; Carlson 2004; Chapman and Westerfield 1942; Sprague 1902). Branch banking has the inherent disadvantage of greater agency problems. Directors of unit banks typically possess intimate knowledge of their local economy. On the other hand, branch banks, particularly in the Australian environment where the branch network was spread out over a vast, but sparsely populated area, must appoint local managers who are not residual claimants of their own efforts. Economists have offered several reasons why branch banking may yield benefits that more than offset the added agency costs. This paper focuses on two reasons that may have been pertinent to Australia: greater stability of the banking system as a result of portfolio diversification across regions and greater provision of services to rural areas as a result of branch specialization.[2]

Most recent literature on the merits of branch banking argues that its superiority is primarily due to the fact that branching leads to more diversified asset portfolios (Calomiris 1990 and 1993; Carlson 2004; Grossman 1994; Hughes, et. al. 1996; Pope

[1]In 1901 trading banks possessed total assets of £116.6 million while savings banks only possessed £32.9 million. The total assets of other financial intermediaries such as building societies, life offices, and friendly societies were smaller still (Pope 1987; Butlin 1987).

[2]In addition economists have argued that branch banking was better suited to funding large-scale industrial firms (Giedeman 2005), that it led to competition between banks at multiple locations (Calem and Nakamura 1990), that it reduced the safe level of reserve ratios that banks needed to maintain

1987; and White 1983). The asset portfolio of a banking office, whether a branch or unit bank, is mainly comprised of loans made in the local area. Such a portfolio faces inherent risks due to localized shocks. Unlike a unit bank, a branch bank can diversify these risks geographically, as localized shocks are imperfectly correlated across regions. Thus, branch banking increases the stability of the system by reducing the variability of individual banks' asset portfolios. Other authors have argued that the reduction of the variability of the returns on a given class of assets leads branch banks to invest more heavily in riskier assets, and thus branching may not result in an overall less risky portfolio (Hughes, et. al. 1996; Carlson 2004). Butlin (1961) and Merrett (1985) argue that in nineteenth century Australia this second effect dominated the first, and banks which most rapidly expanded their branch network during the long boom also ignored basic prudency standards with regard to their asset portfolios.[3]

An alternative argument of the superiority of branch banking is based on the lower cost of internally transferring capital between branches relative to raising capital on the external market. If the costs of borrowing from the external market exceed the returns on loans, then a unit bank is constrained by the amount of local capital it can raise through deposits and by its ability to find suitable local borrowers. On the other hand, for a branch bank these constraints apply to the entire network, but individual branches within the network could specialize in either deposits or advances (Anonymous 1900; Anonymous 1893; Baxter 1883; Chapman and Westerfield 1942; Moffatt 1915). By reallocating capital between branches across regions, a branch bank

(Calomiris 1993 and Chapman and Westerfield 1942), and that it provided greater convenience to customers who transacted at multiple locations (Chapman and Westerfield 1942).

[3] The long boom, which occurred between 1866 and 1889, was a period of unprecedented economic growth in Australia. Real GDP (1911-12 prices) increased from £55.5 million to £184.8 million. Real per capita GDP increased by 30 percent over the period (Vamplew 1987, series ANA46, ANA79,

could more efficiently match borrowers and savers than could a unit bank, which depended on its local customer base. The ability to reallocate capital across regions may have been particularly important for small, isolated communities that had relatively few potential depositors. In the Australian context, these communities typically required capital to develop large-scale mining, timber, or pastoral industries, but could generate few deposits until these industries had been established for several years. At the turn of the twentieth century, the primary sector accounted for approximately one third of Australian GDP, nearly three times the contribution of manufacturing. A high proportion of the primary and secondary sector was large-scale operations in industries such as mining, forestry, livestock, and their manufacturing derivatives (Vamplew 1987, series ANA50-ANA54).

In this paper I examine both the portfolio diversification and branch specialization hypotheses in the Australian context. I use data on the assets and branch networks of all Australian trading banks from Butlin, Hall and White (1971); Butlin (1986); and Mackay (1931) to examine whether branching increased the probability of banks' survival after the end of the long boom and reduced the probability that they suspended payments during the panic of 1893. I then present a simple, but formal model showing why branch banks are better than unit banks at transferring capital between capital-surplus regions (typically urban) to capital-deficit regions (typically rural). Finally, I use unpublished data from the *Annual Reports* of the Union Bank of Australia (UBA) on the deposits and loans held by individual branches to examine the extent to which the branches of this bank were specialized. The evidence indicates that branch specialization provides a better explanation for the advantages of branch

POP25). The long boom ended abruptly with the crash of a speculative bubble in the property market and was followed by the deep and protracted depression of the 1890s.

banking to the Australian economy than diversification. Contrary to the predictions of the diversification model, banks that maintained extensive branch networks, and particularly those that rapidly expanded their networks during the long boom, were more likely to suspend payments during the banking panic of 1893. On the other hand, the UBA data indicate considerable specialization by individual branches. Typically, newer branches and those in rural regions issued more advances than they collected in deposits, whereas the reverse was true for more established and urban branches. It is also shown that a large proportion of the UBA's branches in 1900 and 1930 could not have been profitably operated as unit banks.

The outline for the remainder of this paper is as follows. After the introduction, the second section provides a short overview of branch banking in Australia. The third section examines portfolio diversification and the effects of branch growth during the long boom on the performance of trading banks during the 1893 crisis. The fourth section examines branch specialization, developing a simple theoretical model and examining the loans and advances of the individual branches of the UBA. The fifth section concludes.

II. Branch Banking in Australia

Like most post-settlement economic institutions, the Australian banking system was modelled on its British counterpart. Banks faced few or no restrictions on maintaining networks of branches and agencies.[4] Between 1817 and 1914, 58 trading banks were opened in Australia. As a consequence of failures and mergers, the maximum number

[4]The only restrictions on branching were cross-colony restrictions in the charters of some banks.

open at any point in time was 31, which occurred in 1890. Figure 1 shows the number of trading banks and banking offices in Australia between 1817 and 1929. Because the colonies were sparsely settled, the number of offices initially grew very slowly. From the 1850s the number of branches grew rapidly, particularly in Victoria, where Melbourne was emerging as the financial center of the colonies. In 1859 there were 178 branches in Australia, with 96 in Victoria alone. The long boom witnessed an acceleration of branch growth, and between 1866 and 1890 both the number of branches and the value of assets held by trading banks increased more than seven-fold. With the exception of the depression of the 1890s, branch growth continued uninterrupted until the 1930s. By 1914 there were 2,050 branches and by 1930 there were 3,481, an average of 387 per bank (Butlin 1986; Australia 1908, 1930, and 1931).

Although all Australian banks were allowed to open branches, the extent to which they actually did so varied considerably. In 1914, the largest bank (the Bank of New South Wales) operated 284 branches, whereas the smallest (Bathurst Bank) operated only one. The largest six banks operated over 56 percent of the nation's branches. Over time the industry consolidated though a series of mergers and by 1970 there were only 11 banks remaining, all but two of which operated at least 150 branches (White 1973).

During the early years of settlement, almost all branches were located in the major population centers. However, beginning in the 1870s, the majority of new branches were set up away from the cities. At the turn of the twentieth century, 78 percent of Victorian branches were in rural areas, whereas 54.9 percent of the population lived in

cities of at least 5,000 and 43.1 percent lived in Melbourne alone (Hill 1982).[5] The proportion of branches in rural areas remained high throughout the century. In 1946 69.1 percent of branches throughout Australia were in rural areas (White 1973). It was common for small rural towns to have several branches operated by different banks. For example, in 1920 the Australian Bank of Commerce, the Bank of New South Wales, the Commercial Banking Company of Sydney, the London Bank of Australia, and the Union Bank of Australia all operated branches in Hay, New South Wales, a town with a population of approximately 2,500 (International Banking Directory). As a consequence of the large number of branches in rural towns, the ratio of population to banking offices was considerably lower in Australia than the rest of the world (Butlin 1986; Vamplew 1987, series POP25; Australia 1931; Grossman 1994). By comparison, the United States had about a third the number of banking offices per capita as Australia. Rural areas accounted for a higher proportion of the American population, 43.5 percent in 1940, but a lower proportion of banking offices, 51.9 percent in 1940 (Board of Governors 1941 and United States 1997, Series A57 and A69).

Prior to the 1890s, trading bank failures were relatively uncommon in Australia, with annual average failure rates of 0.67, 0.95, 0.71, and 2.16 percent of trading banks in the 1850s, 1860s, 1870s, and 1880s respectively (Butlin 1986). However, at the end of the long-boom in 1890, Australia suffered the worst crisis ever to occur in a branch banking system. Banks had invested heavily in the property market during the long-boom. The property market collapsed dramatically in 1891, resulting in a substantial

[5] I do not have comparable figures for other states or for Australia until 1946. However, it is likely that the proportion of branches in rural areas in other states was higher than for Victoria. Victoria was the most urbanized state, with 54.92 percent of the population living in towns of over 5000 in 1907. In

shock to the banks' portfolios. Over 40 building societies and land banks in Melbourne and Sydney alone failed between July 1891 and March 1892 (Butlin 1961). Worse was yet to come. In April 1892 the Bank of South Australia with its 20 branches and £3.8 million assets, became the largest Australian bank to fail. Between 1890 and 1893 7 of the colonies' 31 trading banks permanently closed their doors. In January 1893 the Federal Bank of Australia went into liquidation, precipitating widespread runs on deposits at other banks. In April and May 1893 over half of the colonies' trading banks, including 9 of the 12 largest, suspended payments for periods between 30 and 128 days (Mackay 1931; Butlin, et. al. 1971). The banks that suspended payments collectively held 61.5 percent of all assets of Australian trading banks. The crisis was national in scope, but had particularly severe effects on urban property markets and agriculture.

III. Branching and Portfolio Diversification

Perhaps the most common argument in favor of branch banking is that branching facilitates risk-pooling by allowing for the geographic diversification of assets (Calomiris 1990 and 1993; White 1983; Alston, et. al. 1994; Carlson 2004; Grossman 1994). Individual loans held by a bank could go bad for a variety of reasons – such as drought, pestilence, adverse price shocks, death. Banks reduce their exposure to these risks by holding a diversified portfolio of assets. Part of this diversification is geographic, which reduces the impact of localized shocks on the overall portfolio. Within regions, particularly in rural areas, borrowers are often fairly homogeneous and exposed to the same shocks. Thus, a single localized shock could precipitate mass

---

New South Wales, Queensland, South Australia, Western Australia, and Tasmania this figure was 49.2, 50.2, 54.2, 29.9, and 41.7 percent respectively (Australia, 1908).

default within a community. Although the banks normally insisted upon collateral for their loans, they would often get back only a small proportion of the book value if foreclosure was necessary. A unit bank, with its localized loan pool, could easily be wiped out by such a shock; however, a branch bank that was diversified across regions would have a better chance of survival because a geographically diverse set of assets would be less likely to go bad simultaneously. This argument can be extended to general, but asymmetric shocks. A branch bank is far less likely than a unit bank to have a high proportion of its assets held in sectors of the economy that are severely impacted by such a crisis. This effect may have been particularly relevant for Australia, which has the highest variability of rainfall of any continent and most regions of the country periodically suffered serious droughts (Shann 1930). Moreover, Australian regions tended to be highly specialized in a limited number of primary products and thus were highly exposed to variation in world commodity prices.

More recent scholarship has argued that the relationship between geographic diversification and risk is far from unambiguous. This is because branching has multiple effects on a bank's portfolio, which work in opposite directions. Much of the literature has primarily focussed upon what might be termed the 'covariance effect', whereby the risk inherent to a given type of asset will be reduced through diversification because the covariance on the returns of different types of assets is less than one (Calomiris 1990 and 1993; White 1983). However, there is also a 'composition effect' whereby branch banks may adjust their asset portfolios and hold inherently higher risk assets than unit banks (Carlson 2004; Grossman 1994). In addition, branching over a wider area also makes it more difficult to monitor local mangers and thus increases the scope for managerial opportunism in loan decisions.

Finally, the growth of branch networks may be a result of optimism about future business conditions. If that optimism is irrational, or at least unwarranted *ex post*, then banks with larger networks are likely to have worse asset portfolios and hence be more likely to fail. Given that these effects work in opposite directions, it is perhaps unsurprising that the international evidence on branch banking and bank failures has been somewhat mixed (Calomiris 1990 and 1993; White 1983; Alston, et. al. 1994; Carlson 2004; Grossman 1994).

Australian contemporaries differed in their views on whether the extensive branch networks operated by the larger banks increased the stability of the banking system. A. E. Webster stated in a lecture to the Bankers' Institute of Australia, 'The funds of the banks possessing branches could be far more usefully and remuneratively employed and yet kept in a far more liquid condition than was formerly the case with the [unit] banks, who were always liable to find their funds locked up in "dead loans"' (Webster 1893, p. 1440). Conversely, from the 1870s onwards, other Australian commentators expressed concern about the effects of the growth of branch networks on the composition of portfolios held by the banks. An article in the *Australasian Insurance and Banking Record* likened the proliferation of branches to rival gas companies laying separate pipes to the same destination (AIBR 1887). Another article claimed, 'In some country towns branch banks are as plentiful as publichouses. This did not tend to increase the confidence of depositors, and, as a matter of fact, greatly helped to destroy the trust that people at one time had in some of the institutions' (Black 1893, p. 324).

Subsequent historians have also concluded that branch growth during the long boom led banks to undertake poor quality, high-risk investments. S. J. Butlin wrote, 'In the long boom deposits were to be had by banks prepared to open branches in small towns without assessing costs closely. So too, advances could be expanded rapidly by a bank not too restrictive as to security or length of loan. [M]any of [the colonial banks] built up large business in deposits and advances, and did so rapidly, by being not merely brash but rash' (Butlin 1961, p. 191). Merrett (1995) also argues that the rapid expansion of branch networks during the long boom was associated with a decline in basic prudency standards. During this time banks allowed the quality of their assets to decline, neglected prudency standards in order to attract deposits, increased their activity in high-risk sectors such as property, and expanded their branch network at such a rate that they were forced to promote less qualified staff to the level of branch manager.

Ultimately, whether the growth in branches during the long boom reduced or increased the vulnerability of Australian banking is an empirical question. To analyze this question, I examine the relationship between branching and three outcome variables: 1) failure between the end of the long boom and the 1893 panic (FAILED), 2) being forced to suspend payments in the 1893 panic (CLOSED), and 3) the number of days for which payments were suspended in 1893 (DAYS CLOSED). The covariance effect implies that more diversified banks should have been more able to survive the downturn and panic, whereas the composition and irrational optimism effects imply the reverse. I measure branching and geographic diversification in three ways: the number of Australian branches maintained in 1892 (BRANCHES); the percent of branches outside the colony where the bank operated the most branches

(HOME COLONY); and the number of Australian colonies in which they operated at least one branch (COLONIES). The latter two measures of geographic diversification follow Merrett (1985), who argues that one of the problems facing Australian banks circa 1890 was excessive concentration of branches in the banks' home colonies. Table 1 shows the values of each of these variables for the 22 banks open in March 1893 and how each of the banks fared during the 1893 crisis.

To examine the impact of expansion of the branch networks during the long boom on later outcomes, Figure 2 shows the growth of assets and branch numbers between 1866 and 1890 for all banks operating during this period. Figure 2 also shows whether each bank failed prior to 1893 (FAILED), closed during the 1893 panic (CLOSED), or remained open throughout 1893 (OPEN). Finally, figure 2 shows an OLS regression of branch growth (ΔBRANCH) on asset growth (ΔASSET). The regression yields (standard errors in parentheses):

$$\Delta BRANCH = \underset{(0.242)}{-.1531} + \underset{(1.139)}{10.47}\Delta ASSET \qquad R^2 = .742,\ F=84.29,\ N=29$$

Virtually all banks expanded both in terms of assets and branches during the long boom. The correlation between asset and branch growth is high, but imperfect, implying that some banks pursued a branch-intensive approach to expansion (those above the OLS best fit line), while others focused relatively more on increasing their overall assets (those below the line). Figure 2 shows that rapid expansion of branch networks was associated with worse outcomes for individual banks and thus probably decreased the overall stability of the system. Banks that failed prior to 1893 were

generally small both in terms of assets and number of branches.[6] Among the larger banks, those that pursued a branch-intensive expansion strategy were much more likely to suspend payments during the 1893 panic. Each of the three large banks that remained open throughout the panic had been relatively conservative about opening branches during the long boom, whereas only one of those that closed had been similarly conservative.

As another test of whether geographic diversification protected banks in 1893, I have run a series of logistic regressions on CLOSED and OLS regressions on DAYS CLOSED. In addition to controlling for the three measures of the branch networks, the regressions also control for portfolio diversification and incumbency advantages, proxied by the year in which the bank was founded (YEAR FOUNDED). Butlin (1961) and Merrett (1985) argue that many of the banks founded during the long boom were excessively optimistic in their lending policies and regarded expansion of business to be more important than maintaining standards of prudent banking. In addition to excessive optimism, they may have needed to take on riskier loans simply because the established banks had ongoing relationships with the better customers. For these reasons, one would expect that the older banks would have been less likely to suspend payments and those that were forced to suspend payments would have been shut for shorter periods of time. Thus, the coefficient on YEAR FOUNDED is expected to be be positive. If geographic diversification served to lessen the riskiness of the banks' portfolios then one would expect a negative coefficient on the branching variables.

[6]Fourteen banks failed between 1866 and 1893. Six of these operated at least 10 branches at the time of failure. The largest bank to fail was the Bank of South Australia which operated 28 branches and had

Table 2 shows the regression results. Because of the relatively small number of observations (22 banks), some caution is necessary in interpreting table 2. However, the main results on the variables of interest are fairly consistent across specification. There is strong evidence that the older banks were better able to survive the panic. On the other hand, there is no evidence to suggest that more extensively branched banks were better able to survive the panic. In each case the coefficient on the branching variable is *positive*, although only the coefficient on BRANCHES in the logit regression is significant at the 10 percent level.

IV. Branch Specialization

An alternative argument for the superiority of branch banking is that it allowed for specialization and exchange among branches of the same bank. The crux of this argument is that branch banks could reallocate resources from capital surplus regions to capital deficit regions far more efficiently than could unit banks. If customers were attracted by the convenience of a local branch and distant loans were costly to monitor, a unit bank would be restricted to conducting business in its immediate area. On the other hand, a branch bank could, at very low cost, move capital from one region with surplus deposits to another region with a deposit shortage. A related argument is that 'bankless towns' were likely to arise under unit banking. In the early-twentieth century United States, which operated a unit banking system, many small towns did not have sufficient business to support an independent bank. These towns suffered significant commercial disadvantages as a result (Chapman and Westerfield 1942).

---

assets of £3.8 million in 1890, ranking 12th and 14th respectively among all trading banks.

Contemporary commentators argued that Australian banks' extensive branch networks played an essential role in reallocation of capital between regions. One noted that: 'There are places where [a branch] receives more deposits than it makes in loans. In other localities the … deposits are smaller while there is a greater demand for loans. A bank with branches all over the country can thus send the surplus money gathered up in one branch to be loaned at another' (Anonymous 1893, p. 225). This reallocation of capital was viewed as beneficial to the banks, as noted by A. E. Webster:

> 'Creditor branches' might [separately]… seem to be a loss to the bank, for they may obtain such a plentiful supply of money on deposit, the [cost of] which … may appear to be more than the amount earned by the branch. [T]his apparent loss may be in reality the bank's gain; … [transferring] this capital … may earn [at a 'debtor branch'] such good returns as to provide a sufficient profit for both branches (Webster 1893, p. 1442).

Others argued that the reallocation of capital by transfers between branches had been essential to providing rural areas access to financial markets and to the development of these areas. For example, one wrote:

> By [opening numerous branches] the banks have vastly increased the services they render to the community. Branches have been established … even in the remotest bush townships. … In the absence of the system, it is hard to conceive how, in our sparsely populated country, banking could have been of such signal service as it has undoubtedly been to the squatter, selector, minor, and storekeeper, who have been so instrumental in opening up the country (Anonymous 1900, p. 375).

1. *A Simple model of branch specialization*

To more formally examine the relative efficiency of branch and unit banks, I consider a simple model of profit maximization for a small, isolated rural region under unit and branch banking. The two efficiency criteria considered are the ability of a bank to transform deposits into loans and whether they are able to provide banking services to small towns. In isolated regions there are high 'convenience costs' to using a distant bank. For the purpose of simplicity it is assumed that these costs are sufficiently high to rule out 'commuting'. Likewise, it is assumed to be prohibitively costly for banks based outside the region to monitor local borrowers. Thus all deposits and loans must be made through local institutions. Finally, it is assumed that a bank's capital can only be raised through deposits and can only be utilized as loans.[7] Under these assumptions both a unit bank and a branch would be viable if:

$$\pi = i_L L_j - i_D D_j - \alpha \geq 0 \qquad 1.$$

Where:

i_L – expected return on loans. This is a continuous variable equal to the interest rate charged by the bank (adjusted by the probability of default and administrative costs of the loan).
i_D – interest rate paid on deposits. Assumed to be constant.
L_j – amount of loans
D_j – amount of deposits
α – fixed wage and capital costs, assumed to be exogenous to the banking system.
π – total profits
j – denotes values of loans (deposits) issued (collected) by bank j

[7]These assumptions are based on the experience of small unit banks in rural parts of the United States. These banks specialized almost exclusively in local loans and investments and were extremely reluctant to raise capital by borrowing from other banks. Inter-bank borrowing in the United States, comprised only 1.06 percent, 3.04 percent, and 0.07 percent respectively of the capital raised through deposits in 1913, 1929, and 1938, respectively (Chapman and Westerfield 1942).

Since a unit bank must raise and utilize its capital locally, deposits and loans must be at levels such that:

$$L_j \leq (1 - R)D_k \quad \text{and} \quad D_j \leq D_k \tag{2.}$$

Where:

R is the reserve ratio[8],
k denotes loans (deposits) locally available in region k

Solving this for L_k and D_k, it can be seen that a unit bank will be viable if:

$$D_k \geq \frac{\alpha}{i_L(1-R)-i_D} \quad \text{and} \quad L_k \geq \frac{\alpha(1-R)}{i_L(1-R)-i_D} \tag{3.}$$

or, alternatively:

$$MIN(L_R, [1-R]D_k \geq \frac{\alpha(1-R)}{i_L(1-R)-i_D} \tag{3a.}$$

Branch banks face a different constraint because deposits received by one branch can be profitably used as loans or investments by another branch. In practice, banks could productively utilize both deposits and loans generated by any branch based in Australia or New Zealand. Most Australian banks faced on-going capital shortages, which they made up for by operating offices in London that collected deposits at a higher interest rate than paid in Australia and did not issue loans.[9] Thus the individual branch within a network only faces the constraint that both deposits and loans are nonnegative and that $L_j \leq L_k$ and $D_j \leq D_k$. Under this framework, the returns on loans

[8]As with the fixed costs, I assume that the reserve holdings are the same under branch and unit banking and relaxing this assumption strengthens the case for branch banking. Generally, branch banks had considerably lower reserve to liability ratios than unit banks (Calomiris 1993; Carlson 2004).

will be (i_L - i_D(1/1-R))L_k/2 and the returns on deposits will be (i_L(1-R)- i_D)D_k/2. Thus a branch bank will be viable if:

$$\pi = \frac{[i_L - i_D(1/1-R)]L_k + (i_L(1-R) - i_D)D_k}{2} - \alpha > 0 \qquad 4.$$

or, alternatively:

$$L_k + (1-R)D_k \geq \frac{2\alpha(1-R)}{i_L(1-R)-i_D} \qquad 4a.$$

To illustrate the difference between a branch and a unit bank, consider the case where reserves are zero. Viability requires: $MIN(L_k, D_k) \geq \frac{\alpha}{i_L - i_D}$ for a unit bank and $L_k + D_k \geq \frac{2\alpha}{i_L - i_D}$ for a branch.[10] It is evident from casual inspection that the viability constraint for a branch is less restrictive than that for a unit bank. This is also illustrated in figure 3. The curves denoted U reflect isoprofit lines for a unit bank and the curves denoted B reflect isoprofit lines for a branch in towns with different combinations of loans and deposits (D_k and L_k). The curves U_0 and B_0 reflect the combinations of loans and deposits for which a unit bank and a branch office respectively will be viable. Figure 3 illustrates two sources of greater efficiency of a branch banking system. First, the area above U_0 is larger than the area above B_0. It is

[9]In 1892 10 of the largest Australian banks collected an average of approximately 28 percent of their deposits in London (Mackay 1931).

[10]Even with the possibility of inter-bank borrowing in a unit banking system, there are still likely to be gains from specialization under branch banking. Suppose that if L_k>(1-R)D_k a rural unit bank can borrow B from a city bank at interest rate i_B. The rural unit bank's objective function becomes: $\pi = i_L L - i_D D - i_B B - \alpha$ whereas a rural branch could obtain additional capital by utilizing excess deposits from other branches and thus would have the objective function: $\pi = i_L L_k - i_D(D_k + B) - \alpha$. The interest rate i_B will be greater than the rate i_D because the city bank must cover the costs associated with administration, monitoring, and default. Under this framework, a region could support a branch, but not a unit bank if $(i_B - i_D)B > i_L L_k - i_D D_k - \alpha$. Individual loans would be viable under branching but not under unit banking if $i_B \geq i_L > i_D$. Put differently, loans with relatively high default probabilities would be viable if financed by low interest deposits, but not if financed by higher interest inter-bank borrowing.

thus possible for a location to have enough business to support a branch, but not a unit bank. A town with available deposits and loans between B_0 and U_0 will be bankless under a unit banking system, but capable of supporting at least one branch. Secondly, viable points above and to the left of the locus AA will have an excess supply of capital (deposits exceed loans) whereas viable points below and to the right of the locus AA will have an excess demand for capital.[11] In a branch banking system, the excess deposits at one branch can be channeled into loans at another branch, whereas in a unit banking system they will remain idle. Suppose local supply and demand for capital are at point P in figure 3, thus desired deposits exceed desired loans. A unit bank will be unable to productively use the excess deposits and thus will not accept them, producing the outcome at Q. On the other hand, a branch bank will channel the excess deposits into another branch, thus P is a viable outcome. Under branch banking, P lies on a higher isoprofit line than Q and thus is more efficient.

This framework provides an explanation for the considerably larger number of banking offices per capita and the greater concentration of offices in rural regions in Australia, where branching was not restricted, than in the United States, where it was restricted. It also provides an explanation for greater competition between banks in rural regions. Under unit banking the number of offices that a town can support is a function of the minimum of deposits or loans, whereas under branch banking it is a function of the sum. Consequently, a branch banking system may be able to support more banking offices in a particular location, and thus the extent of local monopoly power is likely to be lower.

[11]The locus AA is the set of points above U_0 and B_0 where L=(1-R)D.

2. Evidence of Branch Specialization at the Union Bank of Australia

The model from the previous section yields several testable predictions. In a bank with multiple branches, individual branches can be expected to specialize to some extent in either the collection of deposits or issuing loans. This specialization is likely to be geographically driven. Areas with a higher urban population would be more likely to be relatively specialized in collecting deposits, whereas areas with low population density and those dominated by the primary sector would have been relatively more specialized in issuing loans. Finally, the model implies that some branches could only survive as a specialized part of a larger branch network.

This section tests these predictions of the model using unpublished micro-data covering branch-level loans and deposits at the Union Bank of Australia (UBA) from 1900 and 1930, a London-domiciled trading bank which conducted the vast majority of its business in the Antipodes. During the period of this study, the UBA was one of the largest and most successful banks in Australia, ranking third in the value of its assets in 1890 as shown in table 1. The UBA was fundamentally more conservative than its competitors in terms of its asset portfolio and approach to expansion during the long boom (Butlin 1961 and Merrett 1985).[12] Despite this conservatism, at the end of the long boom most of the UBA's branches were in rural areas.[13]

The main source of data are the *Annual Reports* of the UBA's branches (U/218, U/219, U/220, U/221, U/222). The *Annual Reports* contain the values of each

[12]This can be seen in figure 2, as the UBA is the second furthest below the OLS best-fit line. By 1890 the UBA had virtually stopped opening new branches, although it did acquire 20 branches after absorbing the Bank of South Australia in 1892 (Butlin 1986).

branch's advances, deposits, and accounting profits over the preceding year. The ANZ Group Archive contains the *Annual Reports* for the years 1900-30 for Victoria, Queensland, Tasmania, and Western Australia; 1900-17 and 1925-30 for New South Wales; and 1900-10 and 1927-35 for South Australia. I have collected data on deposits and advances for each branch of the bank in 1900 and 1930. A second source of data from the ANZ Group Archive are the personnel records contained in the *Register of Officers* (U/271/1, U/271/2, U/272/3). These records contain the wages, position, and branch location for all employees at the bank between 1888 and 1899. These records are used to estimate the wage costs of operating a branch.

As an indicator of specialization, I have calculated the ratio of advances to deposits for each branch (ADV/DEP). Across all of the UBA's Australian branches in 1930 the ratio of total advances to total deposits was 0.96. However, the UBA's London office almost exclusively specialized in collecting deposits, and thus it is likely that the bank's overall reserve ratio was considerably higher than the 4 percent implied by the advance-deposit ratio. The ratio of total advances to deposits hides considerable variation across the branches, and a substantial number of branches specialized primarily in either loans or deposits. In 1930 37.9 percent of branches have a value of ADV/DEP either below 0.4 or above 2.5. Figure 4 shows the distribution of ADV/DEP in 1900 and 1930, along with a normal distribution with the same mean and variance, to act as a benchmark. It can be seen that most branches specialized in either loans or deposits, at least to some degree. The overall picture is similar for 1900, although the variance of the distribution is slightly larger, implying a greater level of specialization. Over 55 percent of branches had values either under 0.4 or

[13]In 1900 only 15.5 percent of its branches were in the capital cities and 21.4 percent were in other cities with populations of at least 10,000. In 1930 these figures were 14.9 and 9.3 percent.

over 2.5. In general, urban branches specialized in collecting deposits while rural branches specialized in issuing loans. In 1900 (1930) the average value of ADV/DEP was 1.07 (1.42) for rural branches and 0.52 (0.82) for urban branches. The correlation between the 1900 and 1930 values of ADV/DEP across branches is 0.60, suggesting that values that were either significantly above or below one were due to the underlying characteristics of the branch, not short-term shocks to advances or deposits.

To examine the nature of specialization and the extent to which it reallocated capital from urban to rural regions, I have run a series of regressions on ADV/DEP for 1900 and 1930. The regressions take the form:[14]

$$5.\ \mathrm{Ln}[1+\mathrm{ADV/DEP}_i] = a + b_1\,\mathrm{AGE}_i + b_2\,\mathrm{AGESQUARED}_i + b_3\,\mathrm{RURAL}_i + b_4\,\mathrm{AGE}_i * \mathrm{RURAL}_i + b_5\,\mathrm{DISTRICTPOPULATION}_i + \sum_6^{11} b_j \mathrm{STATE}_i + e_i$$

where:

AGE – age of the branch
AGE SQUARED – age of the branch squared
RURAL – Dummy, one if located in a town of less than 10,000[15]
AGE * RURAL – Interaction of age and rural
DISTRICT POPULATION – Population (in 1000s) of the region serviced by the branch, available for rural regions only in 1930
STATE – Dummy variables for New South Wales, Queensland, South Australia, Western Australia, and Tasmania, omitted state is Victoria
i – denotes branch i

The expected signs of the coefficients on the independent variables are as follows. The age variables (AGE, AGE SQUARED, AGE*RURAL) are proxies for the

[14]The transformation of the dependent variable proved necessary because 1) ADV/DEP is bounded at zero 2) and the residuals from similar regressions on ADV/DEP (unlogged) are highly skewed left and mesokurtic.

economic maturity of the region. Their net combined effect is expected to be negative because less established regions would likely have had a shortage of local depositors relative to borrowers; whereas the reverse would have been true of older, more established regions. If branch specialization was important for reallocation of capital and rural development, one would expect a positive coefficient on RURAL. Rural regions are likely to have been able to raise relatively little capital from deposits, but able to support considerable advances to large-scale primary industry. Similarly, older and larger rural regions may have more potential depositors than newer and smaller regions and thus the coefficients on AGE*RURAL and DISTRICT POPULATION are both expected to be negative. Finally, state dummies are included as a control for variation across locations and I do not have prior expectations on the signs of their coefficients.

The regression results are shown in table 3. The results are generally in accordance with the predictions of the model and indicate that intra-bank transfers resulted in considerable reallocation of capital from urban to rural areas. The regressions are all strongly significant and explain between 25.6 percent and 47.9 percent of variation in the dependent variable for 1900 and 1930 respectively. The net effect of age is given by [b_1AGE + b_2AGE SQUARED] for urban regions and [(b_1+b_4)AGE + b_2AGE SQUARED] for rural regions. Evaluating the 1900 regression results at the mean value of AGE, the net effect of age is approximately zero for rural branches founded after 1870, negative for rural branches founded before 1870, and positive for urban branches. For 1930 the net effect of age is negative for both urban and rural branches. The strongest result in table 3 is that rural branches tended to specialize in issuing

[15]The data on town population are from Australia (1908 and 1930).

loans while urban branches tended to specialize in taking deposits. The coefficient on RURAL is positive and strongly significant in both 1900 and 1930. The magnitude of the effect of RURAL is considerably larger than the magnitude of the combined effects of the other independent variables. The coefficient on AGE*RURAL is negative, indicating that older rural areas were less specialized in advances. Finally, in the 1930 specification restricted to rural branches, there is weak evidence that branches in less populated areas were more specialized in issuing loans.

The model also implies that some regions that could support a branch would not have been capable of supporting a unit bank. This can be examined using a simple counterfactual exercise. Recall that deposits and loans could take any non-negative values at a branch; however, at a unit bank they are constrained such that $L_j \leq (1 - R)D_k$ and that viability required $i_L L_j - i_D D_j - \alpha \geq 0$. Under the counterfactual assumption that each branch operated as a unit bank, the branch would be viable if and only if $\pi = i_L L^* - i_D D^* - \alpha \geq 0$, where $L^*=MIN(L_k, [1-R]D_k)$ and $D^*=MIN([L_k/1-R], D_k)$. The counterfactual values L* and D* are thus the values of deposits collected and loans issued, assuming that all capital was generated internally by the branch. As an alternative counterfactual, I assume that when local deposits fell short of potential loans that the bank could borrow capital on the external market at i_B, a rate between i_L and i_D.

The *Annual Reports* provide L_j and D_j for all branches, which for a branch bank is equal to L_k and D_k. It is possible to estimate plausible values for i_L and i_D. The gross return on loans issued by the Melbourne branch typically averaged about 8 percent at the turn of the century (Butlin 1961). This implies a net return of 6 to 8 percent,

allowing for a downward adjustment of up to 2 basis point for default and administrative costs. According to Butlin, the interest paid on deposits averaged about 3 percent (Butlin 1961). As a robustness check of this exercise, I examine a counterfactual in which there exists a perfectly elastic external supply of credit at a borrowing rate of 5 percent. The fixed costs, α, can be broken down into two components, wages and costs associated with maintaining the office (construction and furnishing the building, provision of housing for the manager, maintenance costs, correspondence with the head office, inspection costs, etc.). It is possible to obtain a reasonable estimate for the wage bill for a small country branch using the UBA's employment records. Such a branch would have had only two staff: a manager and an accountant/teller. Employees at smaller branches were typically paid slightly less than staff at larger branches of a similar rank (Seltzer and Merrett 2000). As a conservative estimate of the wage costs of a small branch, I use the 5th percentile of the earnings distribution for managers and accountant/tellers; in 1899 these were £200 and £120, respectively, implying a real salary cost of £331.85 and £594.29, in 1900 and 1930 prices, respectively.[16] The actual wage costs are likely to have been somewhat higher, which would imply a higher proportion of branches would not have been viable. I have not been able to find any records of non-wage costs; thus, I have assumed that they fall between £100 and £2000 annually, with lower levels in that range being more plausible for a smaller branch.

For the purpose of this analysis I assume that i_L takes on values of either 6 or 8 percent, non-wage costs takes on values between £100 and £2000, and the reserve

[16] Prices are deflated using Vamplew (1987) series, PC31.

ratio was zero.[17] Table 3 shows the proportion of the UBA's branches that would not have been viable under different assumptions about i_L, α, and i_B. It is evident that despite the assumptions of zero reserves, wage costs near the bottom of the distribution, and low (or no) administrative and default costs, a fairly high proportion of branches would not have been viable as unit banks. A sizable majority of branches that would not have been viable as unit banks were in rural regions, confirming the previous evidence that branch banking increased access to banking services in these regions. For example, using the 1930 figures with the assumptions that i_L=.6 and α=750, 40 percent of rural branches would not have been viable as unit banks, compared to 19.6 percent of urban branches.

VI. Conclusions

Most recent literature comparing unit and branch banking has focussed on whether branching increases the stability of banking systems. Branch banking has been viewed by some authors as superior to unit banking because branch banks can diversify their loan portfolio across regions, and thus are partly insured against localized shocks. However, there also exists a literature that argues that that branch banks compensate for geographic diversification by holding inherently riskier assets, and thus do not have overall lower levels of risk. To test whether extensive branching increased the stability of the Australian financial system, I have examined the relationship between the extent of branching and the effect of the banking crisis of 1893 for the 22 Australian trading banks open in March 1893. The evidence confirms the conclusions

[17] The assumption of no reserves is made for the purpose of simplicity of calculation. Increasing the reserve ratio would reduce the returns of the branch (in equation 1) and thus reduce the proportion of branches that were viable.

of Butlin (1961); Merrett (1985); and Pope (1987) who argued that more extensively branched banks acquired a more inherently risky portfolio of assets during the long boom of 1866-89. Banks with a more extensive branch network, and particularly those that expanded rapidly during the long boom, were more likely to suspend payments in 1893.

An alternative hypothesis, namely that branching facilitated specialization across regions, provides a more compelling explanation for the importance of branch banking to Australian economic development. The intuition behind this hypothesis is that a branch bank can transfer capital at very low cost from regions where potential deposits exceed available loans to regions where potential loans exceed available deposits. On the other hand, because unit banks need to interact with intermediaries to make similar capital transfers, they could only do so at high cost. Using a simple model, I show that, all else equal, branch banking will lead to a more efficient allocation of capital between regions than unit banking except under the specific (and unrealistic) scenario that desired loans exactly equal desired deposits (less reserves) in every region. Moreover, the model implies that some regions, particularly small rural regions with primary industry, may be capable of supporting a branch but not a unit bank. Evidence from the *Annual Reports* of the branches of the Union Bank of Australia confirms these predictions of the model. A large proportion of branches maintained advance to deposit ratios that would have been unprofitable for a unit bank. Moreover, the ratio systematically varied across regions, with branches in small towns and rural areas issuing considerably more advances than they collected in deposits and branches in urban areas collected more deposits than they issued in loans.

Bibliography

Alston, L. J., Grove, W. C., and Wheelock, D. C. (1994). Why do banks fail? Evidence from the 1920s. *Explorations in Economic History*, 31 (4): 409-31.

Anonymous (1893). Branches or no branches? *The Bankers' Magazine and Journal*, 7 (4): 225-26.

Anonymous (1900). Branch banks. *Journal of the Institute of Bankers of New South Wales*, 9: 375.

Australia, Commonwealth Bureau of Census and Statistics (1931). *Australian Financial Statistics*, Private finance: (A) cheque-paying banks, Table 67 (Canberra).

ANZ Group Archive, Melbourne.

Australia, Commonwealth Bureau of Census and Statistics (1908 and 1930). *Official Yearbook of the Commonwealth of Australia* (Melbourne: McCarron, Bird and Co.).

The Australasian Insurance & Banking Record (various years) (Melbourne: McCarron, Bird & Co.)

Baxter, A. B. (1883). *Banking in Australasia* (Blades, East & Blades).

Black, R. J. (1893). The banking crisis and its lessons. *The Australian Economist*, 3: 319-34.

Board of Governors of the Federal Reserve (1941). *Banking Studies* (Baltimore: Waverly Press).

Butlin, M. W. (1987). Capital markets. In R. Maddock and I. W. McLean, eds. *The Australian Economy in the Long Run* (Sydney: Cambridge University Press).

Butlin, S. J. (1961). *ANZ: Australia and New Zealand Bank* (Croydon: Longmans).

Butlin, S. J. Hall, A. R., White, R.C. (1971). Australian banking and monetary statistics, 1817-1945. Reserve Bank of Australia, Occasional Paper No. 4A, Sydney.

Butlin, S. J. (1986). *The Australian Monetary System 1851-1914* (Sydney: Ambassador Press).

Calem, P. S. and Nakamura, L. I. (1990). Branch banking and the geography of bank pricing. *Review of Economics and Statistics*, 80, 4: 600-10.

Carlson, M. A. (2004). Are branch banks better survivors? Evidence from the Depression era. *Economic Inquiry*, 42 (1): 111-26.

Calomiris, C. W. (1990). Is deposit insurance necessary? A historical perspective. *Journal of Economic History*, 50 (2): 283-95.

Calomiris, C. W. (1993). Regulation, industrial structure, and instability in U.S. banking: an historical perspective. In M. Klausner and L. J. White, eds. *Structural Change in Banking* (Homewood, Ill : Business One Irwin), pp. 19-116.

Chapman, J. M. and Westerfield, R. B. (1942). *Branch Banking: Its Historical and Theoretical Position in America and Abroad* (New York: Harper & Brothers Publishers).

Dyster, B. and Meredith, D. (1990). *Australia in the International Economy* (Melbourne: Cambridge University Press).

Giedeman, D. C. (2005). Branch banking restrictions and finance constraints in early-twentieth-century America. *Journal of Economic History*, 65 (1): 129-51.

Grossman, R. S. (1994). The shoe that didn't drop: explaining banking stability during the Great Depression. *Journal of Economic History*, 54 (3): 654-82.

Hill, J. (1982). *From Subservience to Strike, Industrial Relations in the Banking Industry* (St. Lucia: University of Queensland Press).

Hughes, J. P., Lang, W. Mester, L. J. and Moon, C-G. (1996). Efficient banking under interstate branching. *Journal of Money, Credit and Banking*, 28 (4): 1045-71.

International Banking Directory (1920) (New York: The Bankers Publishing Co.).

Mackay, A. L. G. (1931). *The Australian Banking and Credit System* (London: P. S. King & Son).

Merrett, D. T. (1985). Australian banking practice and the crisis of 1893. *Australian Economic History Review*, 29 (1): 60-85.

Moffatt, W. (1915). The management of branch banks. *The Australian Insurance and Banking Record*: 512-13.

Pope, D. H. (1987). Bankers and banking business. Australian National University Working Paper Series, No. 85.

Seltzer, A. J. and Merrett, D. T. (2000). Personnel practices at the Union Bank of Australia: panel evidence from the 1887-1900 entry cohorts. *Journal of Labor Economics*, 18 (4): 573-613.

Shann, E. O. G. (1930). *An Economic History of Australia* (London: Cambridge University Press).

Sprague, O. M. W. (1902). Branch banking in the United States. *Quarterly Journal of Economics*, 17 (2): 242-60.

United States Bureau of the Census (1997). *Historical Statistics of the United States on CD-ROM: Colonial Times to 1970* (New York: Cambridge University Press).

Vamplew, W., ed. (1987). *Australians: Historical Statistics* (New South Wales: Fairfax, Syme & Weldon Associates).

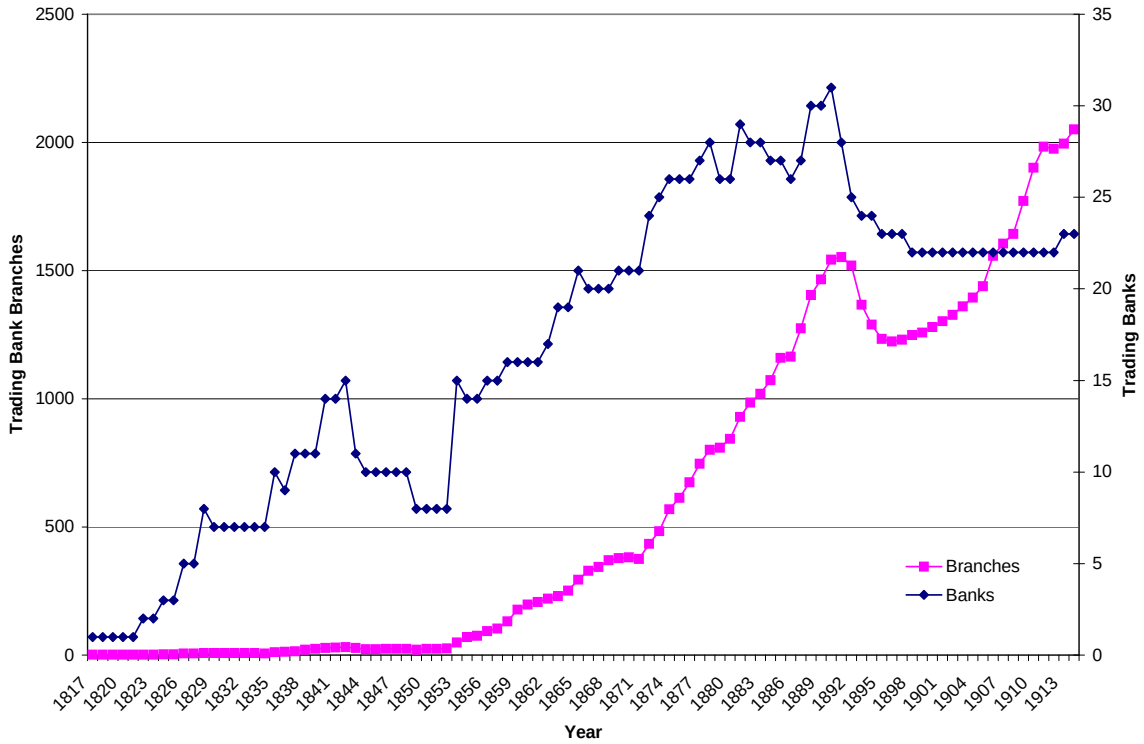
Webster, A. E. (1893). The advantages or otherwise of the establishment of branches by banks. *The Bankers' Magazine of Australasia*, 6: 1438-45 and 7: 22-31.

White, E. N. (1983). *The Regulation and Reform of the American Banking System, 1900-29* (Princeton: Princeton University Press).

White, E. N. (1998). Were banks special intermediaries in late nineteenth century America? *Federal Reserve Bank of St. Louis Review*: 13-32.

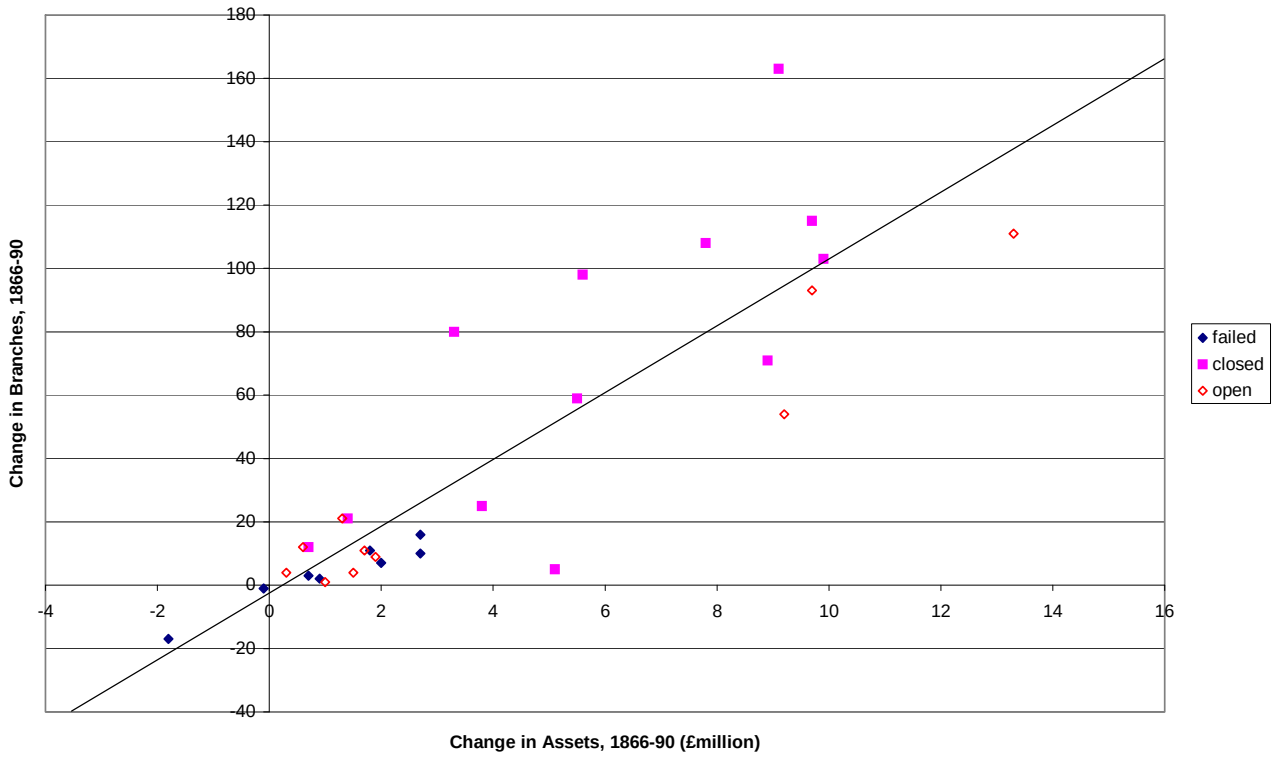
White, R. C. (1973). *Australian Banking and Monetary Statistics, 1945-1970* (Sydney: Reserve Bank of Australia).

Figure 1
Number of Banks and Branches in Australia, 1817-1914



Source: Butlin (1986).

Figure 2
Branch and Asset Growth During the Long Boom and Impact of the 1893 Panic



Sources: Butlin, Hall and White (1971); Butlin (1986); and Mackay (1931).

Figure 3
Isoprofit Curves Under Branch and Unit Banking

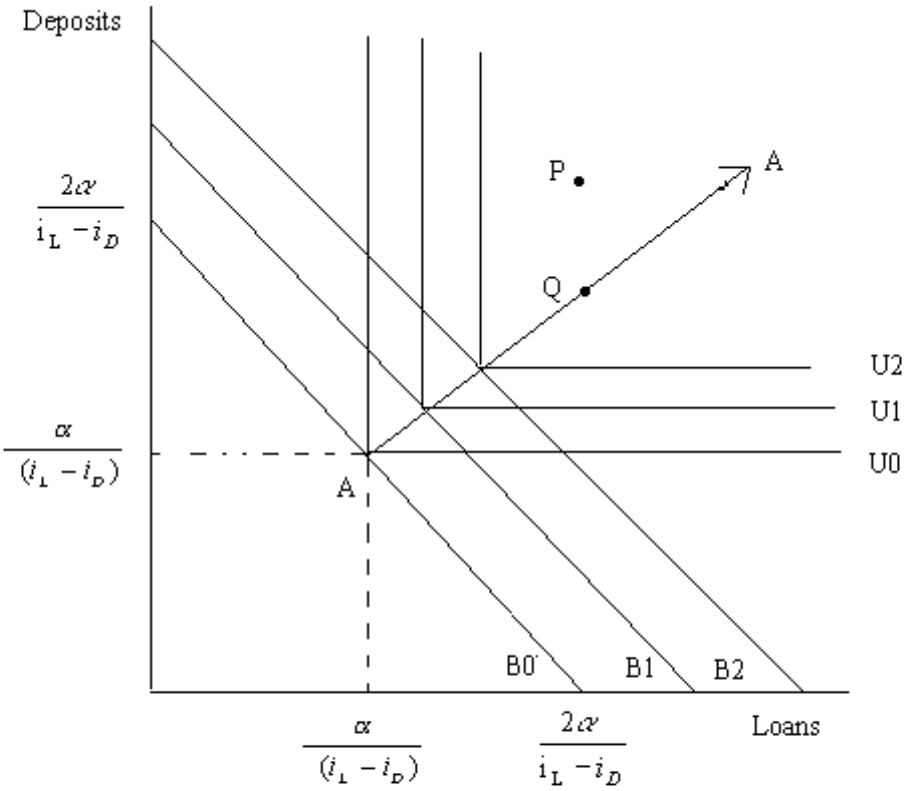
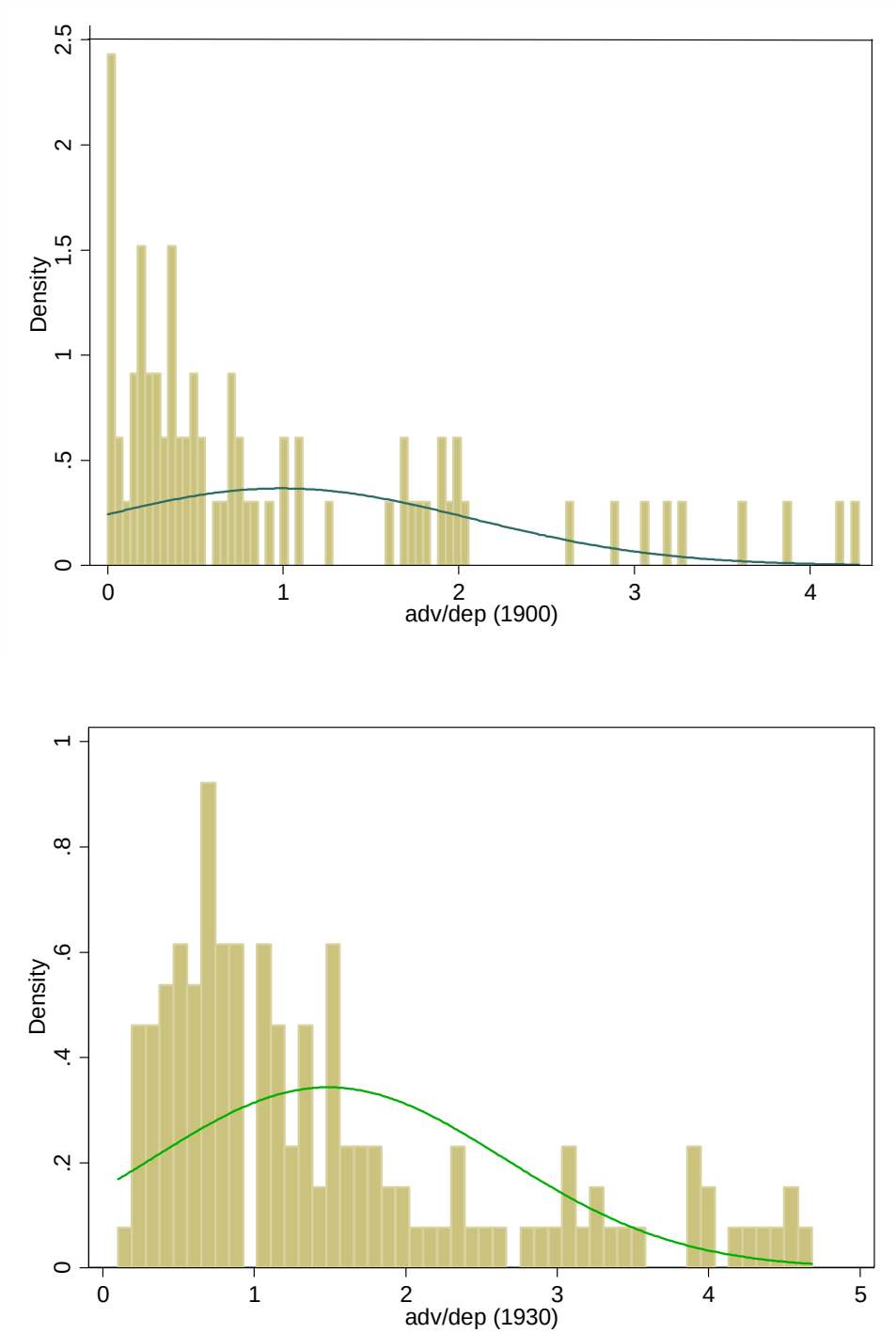


Figure 4
Distribution of the Advance/Deposit Ratio at UBA Branches, 1900 and 1930



Note: There were a handfull of very small branches which had advance-deposit ratios over 5. These outliers were excluded from the graph in order to better illustrate the underlying distribution.

Sources: Union Bank of Australia, Annual Reports, U/218, U/219, U/220, U/221, U/222.

Table 1
Characteristics of Australian Trading Banks Open in March 1893

Bank	Closed in 1893	Branches	Colonies	Home Colony	Assets
Commercial Bank of Australia	YES, 30 Days	104	6	21.2	10.0
English, Scottish & Australian	YES, 128 Days	107	5	59.8	7.2
Australian Joint Stock Bank	YES, 59 Days	203	2	9.85	10.9
London Chartered Bank of Aus.	YES, 106 Days	67	3	41.8	7.5
Standard Bank of Australia	YES, 105 Days	2	1	0	NA
National Bank of Australia	YES, 56 Days	159	4	42.8	9.8
Colonial Bank of Australia	YES, 65 Days	84	1	0	4.7
Bank of Victoria	YES, 40 Days	68	1	0	6.6
Queensland National Bank	YES, 79 Days	66	2	1.5	8.9
Bank of North Queensland	YES, 65 Days	14	2	7.1	0.7
Com. Banking Co. of Sydney	YES, 33 Days	151	2	8.6	11.9
City of Melbourne Bank	YES, 33 Days	5	1	0	5.1
Royal Bank of Queensland	YES, 82 Days	21	1	0	1.4
Bank of Australasia.	NO	120	5	50.0	13.8
Union Bank of Australia	NO	88	6	71.6	12.9
Bank of New South Wales	NO	163	5	39.9	18.1
City Bank of Sydney	NO	21	1	0	2.3
Royal Bank of Australia	NO	1	1	0	1.0
Bank of Adelaide	NO	20	1	0	1.6
Com. Bank of Tasmania	NO	14	1	0	2.1
National Bank of Tasmania	NO	16	1	0	0.6
Western Australia Bank	NO	10	1	0	0.4

Notes: Branches = Number of branches operated in Australia in 1892.
Colonies = Number of colonies operating at least one branch in 1892.
Assets = Total assets in 1890 in £ million.
Home Colony = Percent of branches outside the colony with the head office.

Sources: Data for Branches, Home State, and States are from Butlin (1986). Data for Closed and Days Closed are from Mackay (1931). Data for Assets are from Butlin, Hall and White (1971).

Table2
Regression Analysis on the Determinates of Closure During the 1893 Panic

Dependent Variable	DAYS CLOSED	DAYS CLOSED	DAYS CLOSED	CLOSED	CLOSED	CLOSED
Year Founded	.692	.825*	.864*	.042*	.042*	.1359**
	(.378)	(.409)	(.416)	(.024)	(.025)	(.067)
States	2.995			.146		
	(5.03)			(2.85)		
Outside HS		51.80			.924	
		(39.93)			(2.18)	
Branches			.209			.051*
			(.153)			(.028)
Regression Type	OLS	OLS	OLS	LOGIT	LOGIT	LOGIT
Adjusted R^2	.040	.102	.110	.152	.148	.407
F-Statistic	1.44	2.19	2.30			
Chi-Square				3.62	3.53	11.51***
% Correct				68.2	72.7	77.3
Sample Size	22	22	22	22	22	22

Notes: The Cox-Snell R^2 is reported for logit regressions. Standard errors in parentheses. * = significance at the 10% level. ** = significance at the 5% level. *** = significance at the 1% level.

Table 3
Determinants of the Advance/Deposit Ratio

Dependent Variable	Ln (1+ADV/DEP30)	Ln(1+ADV/DEP30) Rural branches only	Ln(1+ADV/DEP00)
NSW	.366**	.398**	.00325
	(.112)	(.139)	(.178)
QLD	-.178	-.228	-.294
	(.158)	(.210)	(.216)
SA	-.162	-.124	-.119
	(.160)	(.196)	(.187)
WA	.397**	.341*	-.804**
	(.136)	(.158)	(0.200)
TAS	-.185	.489	-0.043
	(.352)	(.590)	(.469)
AGE	-.0265**	-.0582**	0.045*
	(.008)	(.009)	(0.022)
AGE SQUARED	.000255**	.000521**	-0.00065*
	(.00008)	(.0001)	(0.0003)
RURAL	.731**		1.002**
	(.197)		(.294)
AGE*RURAL	-.01355**		-0.0313*
	(.005)		(.012)
DISTRICT POPULATION		-.0000011*	
		(.0000005)	
CONSTANT	1.10**	2.059**	0.044
	(.199)	(.158)	(.328)
F	16.531**	14.445**	4.09**
Adjusted R^2	.466	.379	.256
N	160	117	81

Notes: DISTRICT POPULATION is available only for rural and small city branches in 1930.
Standard errors in parentheses. * = significance at 5% level. ** = significance at 1% level.

Table 4
Viability of UBA Branches as Unit Banks

Non-Wage costs	100	250	500	750	1000	1500	2000
1900 (i_L-i_D)=.03	47.6 (39.8)	65.5 (51.8)	72.6 (67.5)	79.8 (75.9)	81.0 (79.5)	88.1 (86.8)	90.5 (88.0)
1900 (i_L-i_D)=.05	29.8 (21.7)	40.5 (30.1)	59.5 (43.4)	66.7 (53.0)	71.4 (62.7)	79.8 (68.7)	83.3 (80.7)
1930 (i_L-i_D)=.03	30.4 (20.5)	35.4 (24.2)	44.1 (32.9)	49.7 (41.0)	56.5 (51.6)	72.1 (64.6)	82.6 (77.6)
1930 (i_L-i_D)=.05	18.1 (6.8)	22.4 (12.4)	28.0 (14.9)	34.8 (20.5)	39.1 (23.0)	47.8 (31.7)	55.9 (41.0)

Notes: The top figure is the percentage of branches fail to satisfy $.03(L^*-D^*) - \alpha > 0$ or $.05(L^*-D^*) - \alpha > 0$. This is the percentage of branches that would not be viable as unit banks if all capital had to be raised locally as deposits.

The figure in parentheses is the percentage of branches that fail to satisfy $[.03(L^*-D^*) - \alpha] + .01(L-D) > 0$ or $[.05(L^*-D^*) - \alpha] + .03(L-D) > 0$ if $L>D$. This is the percentage of branches that would not be viable as unit banks if there existed a perfectly elastic supply of credit at a 5 percent interest rate.